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Economic Analysis of Processing Date Growing:
The Case Study of Bam Township, Iran

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Abstract

Iran is the world's leading producer accounting for about 30% of world Dates supply. Dates production is the single most important economic activity (monoculture) and income resource of rural households in the Persian Gulf Region. The purposes of this study are to economic analyzed of Date growing in Bam province and to determine it's profitable for producers. Data were collected by survey from 142 farmers by using random sampling. In economical analysis, cost and net profit of Date production were calculated. According to results of this study, average size of the Date orchards was 0.98 ha. Average date production ha^{-1} and $tree^{-1}$ were determined to be 9612.33 kg and 43.7 kg. Average Date price that received by the farmers was determined to be 0.633 \$ kg^{-1}. Total cost ha^{-1} of date production was calculated to be 4178.43 \$ ha^{-1}. Net profit obtained ha^{-1} and $tree^{-1}$ from Dates were determined to be 1872.17\$ and 6.09 \$, respectively.

Keywords: Date, orchard, monoculture, economic analysis

Introduction

The Egypt is the largest producer of the Dates in the world, followed by Iran, Saudi Arabia, Algeria and Pakistan. Ecological and geographical conditions in Iran allow for high quality Dates in large quantities all over the Southern and central regions. Date is a product which is of high importance in social-economic plan of Iran so that it has supplied near 14% of world's date with annual output of 1066000 tons, worth approximately U.S. \$ 544410, and it is allocated the second place in the world by Iran in terms of date production, FAO (2012). Among the dates produced in Iran, Mazafati variety is considered as the most important economic variety after Estameran and Shahani varieties, Hashempour (2001). Bam Township is one of the most important poles of producing Mazafati date in Iran. It is allocated the first Mazafati producer with annual output of 90313 tons, SIAA[1] (2011).

An orchard Date is a long-term including establishment and maturity period investment and careful planning is essential to ensure economic success, Hashempour (2001).

The producer would like to know the results of his economic activity by working out detailed cost-benefit analysis of the investment in project, Syed (2009). Although the technical aspects of Date production have been studied extensively, quantitative studies related to the economics of such orchards are limited in literature. Therefore there is still a need for further study; especially at the local level.

In this study, economic analysis of Date growing in Bam, Kerman was performed. In economic analysis, cost and net profit of Date production were calculated. Further, factor analysis was performed for determining factors affecting the profitability of Date growing.

Materials and Methods

In the present study, the data was gathered using library studies, survey research, questionnaires (personal interview). The statistical population included the producers of Bam Mazafati date and the sample was selecting through stratified random sampling. The selection of stratifies was based on the level of Mazafati date cultivation in Bam. The data was gathered

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[1]Statistic of Iran Agriculture Administration

using questionnaire and personal visit. The sample has been selected using stratified random sampling including 142 orchardists of Bam Township in 2013.

The general cost items of Date production were classified as variable costs and fixed costs, Engindeniz (2007). The variable costs associated with Date production were all inputs that directly relate to the production and covered labor and machine costs, material costs (fertilizer, pesticide, etc.). In this study, variable costs were calculated by using current inputs and labor wages. In this study, variable costs were calculated by using current inputs and labor wages.

Fixed costs are named as indirect costs or supplementary costs, Abdpourdallal (1995). In this study, Date growing was analyzed as an independent production branch. Therefore, interest and depreciation costs of farmers' machines and buildings were not calculated. Fixed costs included interest cost, administrative costs and annual depreciation costs of Date orchards, rent equivalent of land, and keeper fee. Interest costs estimated to be interest on total variable costs and it was calculated by charging a simple interest rate of 12 % (saving deposits interest rates on US $), Abdpourdallal (1995). Administrative costs were estimated to be 3 % of the total variable costs. Annual depreciation cost was estimated using the straight-line method. Rent equivalent of land was estimated to be 5 % of land value, Engindeniz et al. (2007).

Also in this study, factor analysis was performed for determining factors affecting the net profit obtained from Date growing. Many statistical methods are used to study the relation between independent and dependent variables. Factor analysis is different; it is used to study the patterns of relationship among many dependent variables, with the goal of discovering something about the nature of the independent variables that affect them, even though those independent variables were not measured directly. Thus answers obtained by factor analysis are necessarily more hypothetical and tentative than is true when independent variables are observed directly. The main applications of factor analytic techniques are: (1) to reduce the number of variables and (2) to detect structure in the relationships between variables, that is to classify variables, Hair et al. (1992).

The clearer the true factor structure, the smaller the sample size needed to discover it. But it would be very difficult to discover even a very clear and simple factor structure with fewer than about 50 cases, and 100 or more cases would be much preferable for a less clear structure. The rules about number of variables are very different for factor analysis than for regression. In factor analysis it is perfectly okay to have many more variables than cases. In fact, generally speaking the more variables the better, so long as the variables remain relevant to the underlying factors, Hair et al. (1992).

In this study, 12 dependent variables were determined for factor analysis as follow. Data of variables was obtained from 142 orchards:

X_1: Date orchard size (ha), X_2: Number of tree, X_3: Date production (kg), X_4: Labor cost ($), X_5: Fertilizer cost ($), X_6: Pesticide cost ($), X_7: Irrigation(m^3), X_8: Fragmentation, X_9: Price of Dates ($ kg^{-1}), X_{10}: Transport cost, X_{11}: Education level of farmers, X_{12}: Capital ($).

All the results of this study are given to be average of 142 orchards.

Results and Discussions

Yield

According to results of this study, average size of the Date orchards was 0.98 ha. Average yield obtained from Date orchards was determined to be 9612.33 kg ha^{-1} and 43.72 kg tree^{-1}.

Production costs

Costs of Date growing include establishment and production costs. Establishment costs are spreading to fifteen years. Date trees typically do not produce fruit until the fifteenth year or later. Establishment costs cover all the expenses that is relating with the period of the trees having productive capacity. These are generally related with the costs of labor, machines and sapling (maintenance, etc). Average establishment costs of fifteen years were determined to be 1600 $. Production costs consist of both variable and fixed cost. The variable or operating costs included costs on irrigation, fertilizer and other cultural practices. Results of the variable cost, fixed cost, gross production value and Net profit are given in Table 1.

Table 1: Production costs of Date growing and obtained net profit ($ ha^{-1})

	Items	Total ($)
1.Variable costs	Plowing	28.92
	Fertilizing	36.13
	Fertilizer	193.95
	Irrigation	544.43
	Pesticide	25.1
	Pesticide application	27.62
	Hoeing	13.87
	Pruning and Pollination	70.56
	pollens	9.67
	consumption rope	20.85
	Harvesting, packing and transport	1140.55
	total	2111.65
2. Fixed costs	Interest on total variable costs (12 %)	241.39
	Administrative costs (3 %)	60.34
	Rent equivalent of land	324.7
	Annual depreciation costs (*)	1432.35
	Keeper fee	8
	total	2066.78
3.Total costs (1+2)		4178.43
4.Gross production value		6050.6
5.Net profit (4-3)		1872.17

(*) The economic life of Date plantations was estimated at 30 years.

According to table 1 average production cost ha^{-1} was determined to be 4178.43$. Variable costs and fixed costs formed 50.53 % and 49.46 % of total costs. In addition, labor, fertilizer, Irrigation and pesticide costs were 55.38 %, 9.18 %, 25.7 % and 1.18 % of total variable costs, respectively. The portion of labor costs on Date is extremely high (Table 1). Labor is used for maintenance, harvestings, classification and transport.

Also in this study, cost to produce 1 kg of Date was calculated to be $ 0.20 (4178.43 $/ 9612.33 kg = 0.43$).

Marketing and prices

In this study, average Date price that received by the farmers was calculated to be 0.633 $ kg^{-*1}. It was determined that Date price varied between 0.2 $ kg^{-1} – 1.16 $ kg^{-1}.

Gross production value and net profit

Gross production value obtained ha^{-1} from Dates was calculated to be 6050.6 $ in this study. If total production costs were subtracted from gross production value, average net profit obtained ha^{-1} from Dates can be calculated to be 1872.17 $ (Table 1).

According to results of this study, there are average 307 trees in one hectare. Thus, average net profit tree^{-1} was calculated to be 6.09 $ (1872.17 $).

Analysis of factors affecting the profitability

Results of the factors analysis is given in Tables 2 and 3.

Table 2: The results of factor analysis

Factor	Eigen value	Variance	Cumulative variance
1	5.6	46.7	46.72
2	1.19	9.9	56.71
3	1.11	9.2	65.99
Bartlett's Test		Chi square: 1.13	Sig: 0.0000
KMO		0.843	

Table 3: Rotation results of factor analysis

Variables	Factor 1	Factor 2	Factor 3
Date orchard size	0.911		
Number of tree	0.931		
Date production	0.915		
Labor cost	0.557		
Fertilizer cost		0.682	
Pesticide cost	0.733		
Irrigation	0.839		
Fragmentation			0.587
Price of Dates			
Transport cost			-0.66
Education level of farmers			
Capital	0.918		

According to the results of factor analysis, 3 factors which have a high eigenvalue (more than 1) were determined (Table 2). The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. The ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables. If a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors.

Factor 1, 2 and 3 accounted for 46.7 %, 9.9 % and 9.2 % of the variance. These factors as cumulative accounted for 65.99 % of the variance.

According to rotation results of factor analysis, Date orchard size, Number of tree, Date production, Labor cost, Pesticide cost, Irrigation and Capital form Factor 1 and this factor was named to be "input use and technical factor". Fertilizer cost form Factor 2 and this factor was named to be "Fertilizer factor". Also fragmentation and transport cost form Factor 3 and this factor was named to be "freight factor".
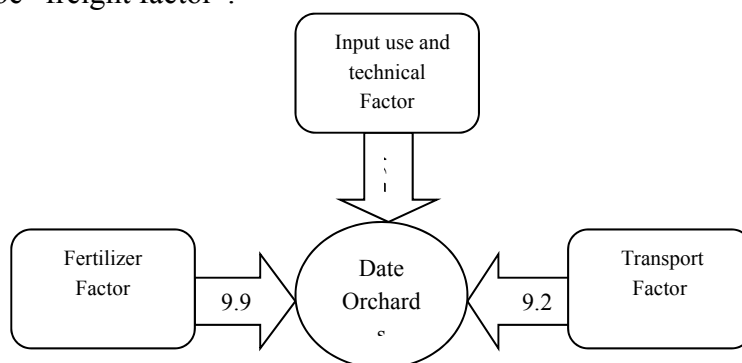
Figure 1: Factor analysis.

Conclusions

In Date production, success depends on how well the farmer can manage the crop and make the right decisions at the right time. In addition, total supply, consumer demand, pricing, perish ability of the product, and market structures are other factors that contribute to a farmer's ability to sell his/her product. Therefore, production and market risks both affect the profitability and economic viability of Dates. Date growing is popular for the small farmers of the region, especially where production space or farm equipment is limited. But, there are problems associated with Date production and marketing according to farmers. Problems during production are increase of input prices, ineffective of pesticides, increase of irrigation costs, lack of technical information of farmers, Increase of credit interest, variations of climate conditions, and rapidly spread of insect and diseases. Problems during marketing are increase of transporting costs, decrease of Date prices, distance of wholesale markets, legal deductions in wholesale markets, and irregular payments in wholesale markets and there is not a sales cooperative in region.

Understanding the causes of problems can give some idea of the type of research that is needed to improve the production of Date. Some suggestions can be given to improve the production of Date in the region. For example; farmers should be informed about Integrated Pest Management, contracting farming system should be developed, irrigation cooperatives should be improved, farmers should be informed about crop insurance, sales cooperatives should be established, credit limits should be increased and interest of credit should be decreased, and organic Date production should be encouraged.

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Survey the Income Gap Between the Two Approaches Produce Greenhouse Traditional and Semi Modern Management of the City of Isfahan – Iran

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Abstract

The purpose of this study, Evaluation of greenhouse production income gap between traditional management and semi modern approaches of the city Isfahan - Iran. The results showed that the production of greenhouse crops in the area where both methods of economic management, But they have a huge income gap. So that the annual net income generated in the traditional way at 5.62$ per Dekar, In semi modern per Dekar was 12.16$ .Comparison shows that the income gap greenhouse production units in semi modern compared to traditional manufacturing units in the regions 36/18 percent is more economical.

Keywords: Greenhouse production, income gap, management approach, Isfahan.

Introduction

Development of the agricultural sector and increasing resource productivity in this sector requires a permanent increase of knowledge and Productivity managers' skills and agricultural producers. Farmers in role of production manager, without familiarity and adoption of modern methods and without having a logical management cannot successfully engage in economic activity. Variety of situations and economic and social requirements, Combined with a variety of thematic and regional territory, Due to the nature and quality of the reference, totality have brought rise and evolution of different approaches in the development and promotion of rural communities. Generally, Management system approach in Agricultural unit scan include planning, organizing, technical, financial management, accounting, representation, guidance and leadership, supervision and control, entrepreneurship, logistics, supply of Production entities, budget, waste management, Property types in Agricultural implements and machinery, packing products, sales and marketing that resulting in better outcomes in agricultural management unit. See more results from matching such a system approaches in agricultural unit Created gaps in performance and earnings. In the city of Isfahan Development trends of greenhouse plants are very different and these differences are more obvious in the structure term. Development trends of greenhouse plants with traditional structures and half modern together and Concentration of some of these structures in greenhouse plants units are representing different management practices in this city and it's possible that in future in terms of management strategies create uneven process of homogeneous development in greenhouse area and face farmers with administrative and economic challenges. In this regard, Sharif (2001) during research after examining the advantages and disadvantages of greenhouse cultivation estimates that the major problems in most of greenhouses are lack of proper management. Also Cetin and Vardar (2008) in economic analysis of tomato production greenhouse in Industrial way in Turkey, with estimate input costs and requirement energy to produce this product, found the difference in performance of various greenhouse units is due to different approaches in the process of production management. Results of Abdpour Dallal (2003) also show that greenhouse producer of strawberry and ornamental flowers in two regions of Turkey despite being in a close geographical, in terms of social and economic structure, performance of the agricultural units toward the farmer household characteristics, management factors and use of produced resources have been possessed with different functions. According to the system approach in the management of greenhouse units and compare the effectiveness of system approach to the

function of greenhouse units in the study area, this research intends to examine the income gap in greenhouse production between the two approaches traditional management and half modern management in the city of Isfahan-Iran and offers appropriate solutions in greenhouse production income gaps between the two approaches.

Materials and Methods

The present research is type of quantitative research, in terms of purpose is applied research component and in terms of required data collection, is type of descriptive and non-experimental research method that was conducted in survey method. Greenhouse units in the region of Shahreza and Falavarjan and suburbs of Isfahan forms the research for this study

The sample size of this study using (equation 1) which sampling methods were selected totally random among the research community.

$$n = \frac{N \times z^2 \times \sigma^2}{d^2(N-1) + (z^2 \times \sigma^2)}$$ [1]

According to (equation 1) total sample size in this study was determined equal 153 manufacturer greenhouse vegetables and distribution of greenhouse units in research areas were considered 44 unites in Shahreza, 52 unit in suburbs of Isfahan and 57 unit in Falavarjan. According to collected data management system approach in greenhouse units was identified and by these approaches agriculture units was classified and their economic and social structure were studied. Economic analysis of agricultural units, according to revenues from product sales and production costs, including Fixed and variable costs in these agricultural units was calculated. In this regard, gross profit and net profit and other indicators of profitability of greenhouse units were studied, calculated and were evaluated. Based on available technological differences in area including differences in the structure type and skeleton of the scheme (welded, bolt and nut, wood) greenhouse height, greenhouse space, equipment type(use or non-use of flood irrigation channels, optional pesticides, environmental control devices,co2 Measuring device, thermometer, hygrometer, insect control lace, densitometer, PH meter, photometry, blue and yellow cards, EC meter) type of organic fertilizer consumption, value of greenhouse and value of equipment groups of greenhouse vegetable manufacturer units in the study area was done by using Spss software and Cluster. In grouping 152 greenhouse vegetable manufacturer unit in terms of technological differences, 104 units were placed in traditional group and 48unit in half modern group.

Results and Discussion

The information and data of this research has been analyzed from eco-social approaches and divided into three regions and two prospects. The research results are presented below:
Economic analysis in researched regions:
In this level, information and data had been analyzed and presented in the sheets below:

Table 2. Survey the social characteristics of the two approaches traditional and semi modern management in units green house

Variables	Semi modern(48)	Traditional(104)
Age of farmer(years)	39.92	44.81
Production experience(years)	5.56	5.46
Level of education(years)	3.79	3.41
The term of the green house (day)	267	267.46
The average acreage per unit area(dekar)	4766.67	4841.34

The manager of traditional divisions is usually at age and considering that the previous method of agriculture do not have any place in optimization of greenhouses but their experience in green housing is consider to be of great importance and also according to recent results the number of highly educated technicians in semi modern's in comparison to traditional ones are very high.

Economic analysis in researched regions

In this stage, we focus our priority data which we gathered from accomplishments of vegetables producing divisions at the pointed regions and these two approaches: traditional and semi modern. The purpose of this economic analysis is to raise the possibility of succession in vegetable production procedure.

Table 3. Determination net profit in the units green house ($)

Variables	Shahreza(44)	suburbs of Isfahan(52)	Falavarjan(57)	Total
Income	4876390.3	3557432.5	1932955.3	10366778.1
Variable costs	1693957.8	1271665.4	1046548.2	4012171.4
Fixed costs	233334.4	234260.4	183837.1	2084582714
Finance of the units green house	10625326.5	5149795	1064433.6	651432.09
Net profit per unit	2949101.1	2051506.6	702569.9	5703174.5
Net profit per dekar	10.49	7.54	2.52	7.45

According to the results the net profit of each dekar at Shahreza is 10.49$, Isfahan suburb is 7.54$, and at Falavarjan is 2.52 $. According to the achieved result from the sheets net profit of greenhouse divisions at Isfahan in each dekar is 7.45 $. In comparison of these three Falavarjan section had the least of net profit and a huge gap of income is obvious.

Table 4. Determination net profit of the two approaches traditional and semi modern management in units green house ($)

Variables	Traditional(104)	Semi modern(48)
Income	5274392.1	4924375.9
Variable costs	2078526.1	1862873.4
Fixed costs	361689.3	279148.9
Finance of the units green house	5153859.9	9658217.1
Net profit per unit	2834176.6	2782353.5
Net profit per dekar	5.62	12.16

The net profit of each dekar in traditional divisions is 5.62$ and at semi modern's is 12.16 $. The gap income of these two approaches is 6.54 $.

Reviewing the average comparison between economic variables

Because of independency of selected divisions and also the existence of these divisions in both traditionalist and semi modern's, to compare an average and identifying the difference of divisions for normally distributed variables the T test has been used. The results are shown in sheets below .

Table 5. Reviewing the average comparison between economic variables

Variables	t-test for Equality of Means						
	t	df	sig	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						lower	upper
Fixed costs	-5.348	104.71	.000	-0.55145	0.10311	-0.75590	-0.34699
Variable costs	-7.608	150	.000	-0.91903	0.12080	-1.15771	-0.68034
Income	-8.023	129.18	.000	-1.02520	0.12778	-1.27802	-0.77238
Net profit	-5.401	113.45	.000	-1.08804	0.20147	-1.48717	-0.68891
Finance	-10.894	150	.000	-1.13007	0.15880	-2.04385	-1.41628
Total costs	-7.491	150	.000	-0.85192	0.11373	-1.07664	-0.62719

The table shows the result of research on greenhouse divisions point that there is a significant differences of 99% in average variable cost, fixed cost, profit, assets and total cost of greenhouse divisions.

Due to the result of analysis of economic data's of 152 greenhouse vegetable divisions, production in both approaches of traditional and semi modern are economical but these two managing system has a huge gap of income in-between that could have happened for the cause of inefficient equipment and instruments of the greenhouse, the low technical knowledge of production procedure, increasing of production cost in comparison to selling price, price volatility, low power producers Capital, depreciation costs and staffing, attributed to the production in semi modern divisions in comparison to traditional one's is 36.18% more economic.

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The Challenges of a Common Market Albania – Kosovo for Agricultural Products

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Abstract

Both Albania and Kosovo have too small market, the latest being very important in terms of effectiveness, lower prices and competitiveness with foreign markets. History, tradition, customs, language and political will is bringing both countries and their markets together, sharing also the typicality of a dominating rural and agricultural sector. Despite the political willingness for removing any tariff and non – tariff barriers in trade, there has been a trade crisis between the two countries especially due to custom reference prices for key agricultural products, like potatoes, grapevine and dairy products. The research presented here shows the results of an analysis of this 'common' agricultural market, key products and draws some conclusions and recommendations for the policy–makers of both countries that are in the process of establishing such common market.

Keywords: Common market, agricultural trade, tariff and non-tariff barriers

Introduction

International economic integration (IEI) is one aspect of 'international economics', which has grown in importance since the middle of the twentieth century (El-Agra, 2011). IEI has been also referred to as 'regional integration', 'regional trading agreements' (RTAs), 'preferential trading agreements' (PTAs) and 'trading blocks'. More specifically, IEI is concerned with (a) the discriminatory removal of all trade impediments between at least two participating nations, and with (b) the establishment of certain elements of cooperation and coordination between them. Different forms of IEI can be envisaged and many have actually been implemented, like free trade areas (FTAs or PTAs), custom unions (CUs), common markets (CMs), complete economic unions or economic unions (EcUs) and complete political unions (Pus).

The governments of Albania and Kosovo have stated a willingness to integrate their respective economies. In fact, since 2000, the relationships between the two countries have increased both in the volume of trade as well as in the regulatory context. However, the economic inter-penetration remains relatively small compared to the possibilities and needs of the respective economies. Although there was has been an increased trade circulation, this has been associated with various trade barriers, which have limited their free circulation, as in the case of exporting potatoes from Kosovo to Albania, and even trade conflicts due to the application of technical non – tariff obstacles (or hidden barriers), as in the case of milk, meat, etc.

Material and Methods

Although there have been a large number of political statements or opinions in newspaper projects, during our literature review we did not found any economic analyses of the impact of such economic integration between Albanian and Kosovo. Phase 1 of the research was used to review all existing data, reports, studies on the economy and agriculture of these two countries. Moreover, the author has reviewed in detail the international experience in economic integration, particularly in Europe (El–Agraa, 1988; El-Agra, 2011; Smith, 1977; Sundelius and Wiklund, 1979; but also in Africa (Adedeji, 2002; El–Agraa, 2004; Robson 1997) in the western hemisphere (El-Agra, 2011), in Asia–Pacific (El–Agraa 1988a, b; El–Agraa 2010a,b) and in the Middle East (El-Agra, 2011). Phase 2 was designed as a data collection and in-depth face-to-face interviews with various stakeholders and experts.

Results and Discussions

There are 502 Albanian businesses in Kosovo, mainly in construction and finance and 386 Kosovar businesses in Albania, mainly micro and small businesses. Economic relations between Albanian and Kosovo are characterized by trade exchanges, export – import but not other forms of cooperation, like common or direct investments. The import of Albania from Kosovo accounts for about 1 % of total imports while exports accounts for 8,15 % of the total. In the case of Kosovo, importation from Albania accounts for about 4 % of the total while export 10,8 % of its total exports.

Import-export between the two countries

The economic relations between Albania and Kosovo are concentrated on the exchange of goods. Their structure reflects the poor offer of both countries, with a restricted range or a high percentage of final products.

Starting from 2000 and until June 2012, Kosovo has exported to Albania goods totalling 136 million EUR and has imported three times more, 386 million EUR. However, if analyse imports, the highest volume of 2000, with 3,4 million EUR was not exceeded for five years consecutively, until 2005. Our analyses conclude that this is due to both lack of offer and weak connections between the two economies. Meanwhile, exportation from Kosovo to Albania in later years has increased steadily. A strong impetus was the building of the highway Durres – Kukes – Morine which was followed by the construction of the Kosovar section of this highway.

Table 1. Active enterprises in Albania and Kosovo according to their legal form, 2011

No	Legal form	ALBANIA Total no.	KOSOVO Total no.
1	Physical person	85675	44036
2	Limited companies	18539	4372
3	Anonymous companies	791	165
4	Insurance companies	10	6
5	Savings – credit companies	116	-
6	Branches or represent. of foreign companies	332	298
7	Other companies	110	565
8	Other cooperatives	-	39
9	Agricultural cooperatives	-	23
10	Limited state companies	-	12
11	State enterprises	940	69
12	Social enterprise	-	172
13	Public administration	760	238
14	Limited partnership	-	9
15	General partnership	-	1471
16	Non – profit organizations	1745	1471
17	International organizations	31	

Source: INSTAT (2012) and ATK (Compliance Strategy 2012 – 2015)

From the other side, import has increased with a faster pace. Starting from 4 million EUR in 2002, it has reached 100 million EUR in 2010 and 2011.

The highest increase was registered after the construction of the highway Durres – Kukes – Morine, increasing from 40 million EUR to 61 million EUR. Beside import volume, import structure has also changed. However, statistics are not sufficiently detailed to differentiate between transit goods and goods originating in production from Albania and Kosovo.

According to Kosovo Customs, until June 2012, 56 different products were imported, totalling 70.700 kg. Meanwhile, in 2011, 62 products were imported from Albania totalling 467.600 kg. In general, according to Kosovo Customs, for the period 2005 – June 2012, Kosovo

has exported to Albania goods totalling 864.500 kg, whilst has imported 1.402.400 kg. It should be stated that Kosovo is not yet a big market for the Albanian economic, taking a small share in goods' exchange. Thus, in 2007, Kosovo had 4.8 per cent of total exports whilst in 2011 only 7.4 per cent. In terms of imports, Kosovo's share in imports is very small: in 2007 was 0.6 per cent whilst for 2011, 0.8 per cent. Albania has a volume of foreign trade of 4.6 billion EUR and Kosovo 2.5 billion EUR. A trade of 100 million EUR between the two countries constitutes only 1.4 per cent of the combined trade volume of both countries.

Business inter – penetration

If in Kosovo there are a limited number of Albanian enterprises, although declaring a zero capital, the penetration of businesses from Kosovo to Albania is frozen. The number of Kosovo businesses operating in Albania is small, totalling 386. Their structure is not appropriate because it is dominated by small businesses. According to data from Albanian authorities, 197 businesses are limited companies, 180 are physical persons and 9 are anonymous companies. Attempts have been made from Kosovo businesses to penetrate in Albania, especially in hotels and tourism, but these initiatives are small. The main obstacles to investing Kosovo capital to Albania are fiscal barriers between countries despite the political rhetoric of removing such barriers. Besides the difficulties posed by the business climate, there is a lack of attractive offers by both countries.

Constraints to economic integration between Albania and Kosovo

Both countries analysed have small basis of exports. Albania is specialized in the export of clothes, shoes and other raw materials, industries benefiting from the advantage of the cheap labour and proximity with the naval transport. Kosovo exports mainly products of the food industry and their export base is even smaller. The main sector of economic cooperation between the two countries is the sector of touristic services, which are not included in the statistics of the trade of goods. The most promised sector for increasing the trade volume between the two countries is electric energy, mainly because of the compliancy between the water sources of Albania and coal sources of Kosovo. In conclusion, the export of agricultural products is limited.

Although Albanian and Kosovo are rural countries, with an important role of agriculture in their economy and with potential for exportation, the agriculture sector is facing many difficulties, as lack of organisation of exporters, large collection, storage and processing facilities. Furthermore, there are administrative and legal issues with quality control.

In the fiscal context, differences between countries start from the difference in VAT rate (in Albania is 20% and in Kosovo 16%), the include the taxable basis and continue with the Profit Tax and Income Tax, with the flat rate applied in Albania until December 2012 and the semi – progressive rate applied in Kosovo.

The exchange of agricultural crops has experienced crises due to the application of reference prices in customs. It started with products like potatoes, grape and dairy products in 2010 and was intensified in summer of 2011. Kosovo authorities pretended that the Albanian Government was applying reference prices and that Kosovo was obliged to reciprocally apply such references for products exported from Albania. The Albanian government reacted by reducing 36 % the reference price for Kosovo potatoes (18 cent/kg), while Kosovo applied a reference price 60 % higher for Albanian potatoes (40 cent/kg). Kosovo applies a higher reference price also for Albanian tomatoes (37 versus 40 cent/kg). This battle – field of reference prices has influenced the strategic relationships of a common economic policy.

In the beginning of 2013, this battle was extended to milk and flour. Rather than a tariff barrier in this case was a high level of aflatoxin. A lack of aflatoxin certificate induced the Albanian authorities to block 135 tons of flour exported from Kosovo to Albania.

Such difficulties in economic integration between Kosovo and Albania have been in the agenda of talks between the two countries.

Conclusions

Albania and Kosovo are too small to reach the potential and necessary level of welfare of their citizens. To enable that, they need bigger markets as the size of the market is very important; it increases the efficiency of producing companies, reduction of prices and increase of competition with foreign markets. The economic integration between Albanian and Kosovo will increase the size to 6 million EUR.

Climatic conditions and high temperatures of Albania enables to our products to come in the market one or two months before those of Kosovo, Macedonia and Montenegro. Improvement of infrastructure will increase the surfaces planted. However, there is a need for changing the crop structure and to improve the marketing infrastructure of local products. Both governments have agreed to make a common zoning of crop species for Albania and Kosovo together as one region.

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Agri–Environment Policy Design for Environmentally–Sensitive Areas of Agricultural Importance

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Abstract

There are several areas of both environmental and agricultural importance in Albania where the balance of development and conservation is very difficult. No special consideration is given to these areas in policy or strategic documents, like agricultural development strategy. Therefore, common objectives of such strategies like reaching fertilizer target rates, increase of mechanization level have deteriorated the nature of these areas, also with consequences to tourism. We have analyzed the agricultural development of the last twenty years or lowlands around Skadar Lake and assessed the trend in the use of mechanization, fertilizer, pesticides as well as changes in the structure of crops and livestock. The analysis has enabled us to properly evaluate the environmental performance of agriculture in this particular region. Based on this analysis and best experience, especially from the Common Agricultural Policy of the European Union as series of actions are recommended for the agricultural and rural development policies, with particular focus on the application of agri-environment indicators and agricultural systems with fewer impacts on agri-environmental resources. Other recommendations are particularly focused on the re-designed of governmental support, especially subsidies, to agriculture to use it as an instrument for environmental objectives.

Keywords: Agri-environment indicators, agricultural policy, nature conservation

Introduction

In general, this Region is distinguished for its diverse and dynamic natural and human resources. It is a border Region and it extends itself along the shores of Shkodra/Skadar Lake with access to the sea and many water resources (Mima et al., 1984). Shkodra/Skadar Lake is the largest natural, shallow (mean depth 5m), freshwater lake of tectonic-karst origin in the Balkan region (Mijović et al. 2006). The lake can be considered at least in part the outcrop of a large transboundary karstic groundwater aquifer which connects Shkodra/Skadar Lake, through the Drin River Basin, to Lake Ohrid, and Lake Prespa, two other karstic "Balkan lakes" (WB, 2007). Most of the land in this Region is devoted to agricultural activities. Therefore, the following analysis will concentrate mostly on agriculture (including livestock), food processing industry and other industries as a source of pollution for the ecosystems trying to assess the current status and future trends and how the latest could affect these ecosystems.

Material and Methods

Although there have been a large number of projects on Shkodra/Skadar Lake's ecosystem, during our literature review we did not found any analyses of the impact of agriculture and related industries on the Lake. Phase 1 of the research was used to review all existing data, reports, studies on the Region under study. Moreover, the author has reviewed in detail the international experience in dealing with similar situations, with particular emphasis to EU member states. Phase 2 was designed as a data collection through an institutional survey and supplemented by in-depth face-to-face interviews with various stakeholders in the Region under study. Due to the multiplicity of questions of interest and the complexity of the topic, it was decided to carry out a survey for local government authorities like Regional Council and communes, regional directorates and agencies of Ministry of Environment and Ministry of Agriculture, and many other pertinent agencies. The survey ran from September to November. The goal of the survey was to gain a deeper insight into the crop structures and changes in the

last decade due to competitiveness, levels of intensification, use of good practices, etc. using three comparative periods: 1990, 1998 and 2011.

Results and Discussions
The main agronomical problems in this Region are related to land degradation due to uncontrolled deforestation, livestock grazing, and illegal construction and rapid urbanization.

Agricultural mechanization
Figure 1 shows the changes in the possession of various agricultural machineries between the two comparing periods. Machines for harvesting fruit trees, grapes, corn, pressed silage machinery, etc. are still deficient. Machines that perform many work processes with a shift such as planting and rolling, levelling and planting and machineries of different types that are universal, are missing. Plough of ears-returning, flat disks, equipment for making mole drains are generally of low quality.
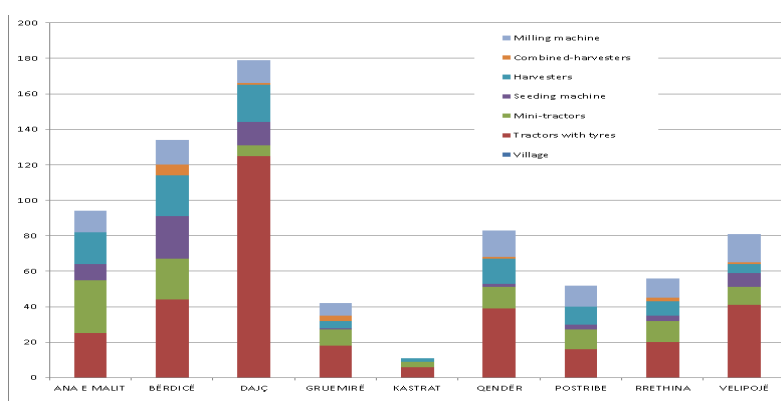
Figure 1. Developments in agricultural mechanization in the Region in the last 20 years.

Irrigation and Drainage
The Region under study is part of the western lowlands, the latest being the main area of the country in terms of irrigation and drainage infrastructure. Much of these investments were damaged during transition but anyway it has benefited from several irrigation and rehabili-tation projects mainly funded through World Bank (impleme-nted in stages from 1993 – 2009). At the current stage, the irrigation potential capability is 75% whilst the actual capability is 35%. Progress in terms of irrigation coverage is shown in Figure 2.
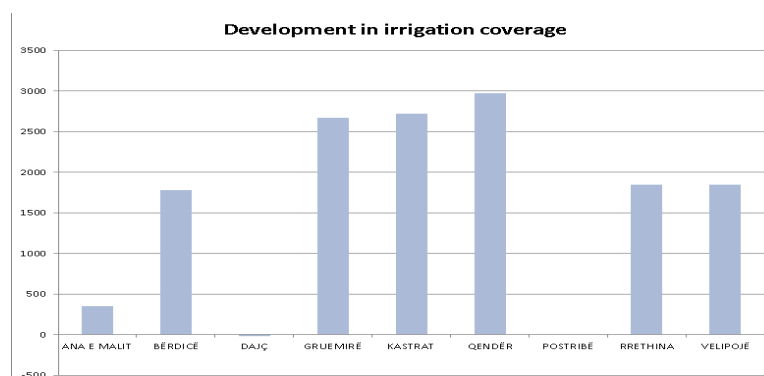
Figure 2. Developments in the use of irrigation (1990 – 2011).

Fertilizers and Pesticides
Survey data show that the rate of chemical fertilizers in the Region under study is 0.25 ton/ha totalling 5280 tons of chemical fertilizers. However, as the data shows, this average value hides a wide variation of fertilizer rates between different locations. The variations in rates can be

explained by the change of crop structure, abandonment of some arable surfaces, high prices relative to the profitability of crops in a specific location, improper appreciation of their importance for crop yield, etc. It should also be noted that a good part of the arable land is planted with alfalfa which requires fertilization only on the planting year.
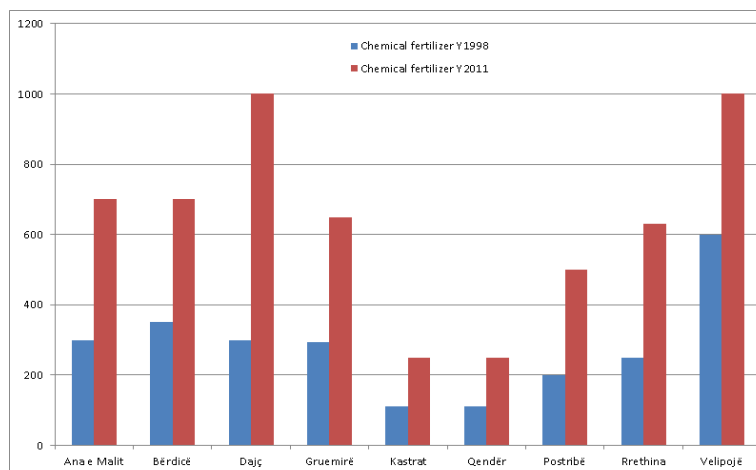
Figure 3. Developments in the use of chemical fertilizers in the Region (1990 – 2011).

Crops

Most of the field crops are dominated by cereals with maize and wheat occupying the vast majority of land under cereals, and forage crops, dominated largely by alfalfa. In the last decade, the surface at the Region has not changed. The changes in the structure of field crops is given in Figure 4. Maize cultivation finds suitable conditions in the coastal lowland, including the Region under study. Tobacco is a typical product of the area. Compared to the Central Western Plain, staple crops are substituted by more vegetables, grapes and temperate fruit trees in this Region. The coastal strip west of Shkodra has ideal conditions for vegetable production and there is a long tradition. Shkodra is an important production area for open field vegetables, especially for tomatoes, watermelons and melons and young onions. Although production of open field and green field vegetables (which accounts for 90% of total domestic vegetable output) has been reduced by 8.4% during the period 2009/2000, yields and production have increased by about 26% and 15% respectively mainly due to increased adoption of new production technologies (better use of inputs, water, seedlings).
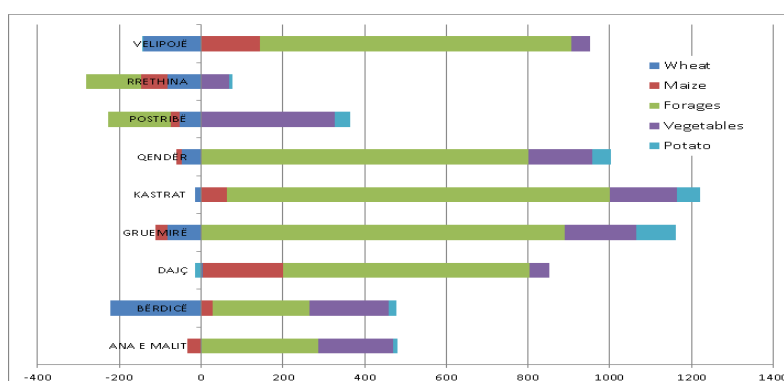
Figure 4. Developments in planting various arable crops in the Region (1990 – 2011).

The Region has a well-known tradition in cultivating fruit trees and grapevine. Proper pedo-climatic conditions have enabled the growth of a large number of fruit trees. After a large reduction in their number during 1990 – 1992, the last decade has witnessed a revitalization of this sector (see Annex 8). It is perceived by the farmers that under a small – scale production, fruit trees have a higher profitability compared to arable crops (Çakalli, et al. 2013).

The Region is well known for the trade of aromatic and medicinal plants. Sage, in particular, growing well in calcareous areas in the neighbouring mountains has been collected by many inhabitants of theses area, becoming an important source of income.

Livestock production

In the Region under study and broader at country level, it is mainly based on the household economy with 90 % of the farms developing their activities based solely on the family labour, a typical feature of Albanian farms. According to survey data, about 80 % of the farms breed farm animals but farms are mixed, i.e. they cultivate various crops too. The general trend is to raise cattle and small ruminants whilst the pigs and poultry number has decreased because these animals are more attractive for the livestock business rather than farm breeding.
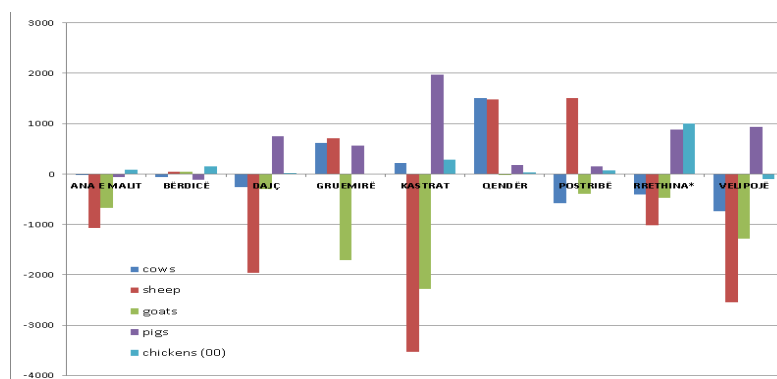
Figure 5. Change in the number of livestock.

Conclusions

The Region under study is an important agricultural area of Albania. Trends and projections show an increasing growth in farm production. Traditional methods (flooding) should be replaced by irrigation techniques like sprinkler or use of pressurized tubes, despite the investment and maintenance costs. Governmental subsidies should be in place in order to save on environmental costs.

To protect the biodiversity of the Shkodra Lake, subsidies or other incentives should be in place to substitute chemical fertilizers with biological fertilizer. N should be credited from all other sources such as manure and previous legume crops. Use of soil tests should be enforced by law in order that N rates are based on these tests and reasonable yield potential. Variable rates should be applied also depending on each zone and specific technology.

Although the area has been oriented toward the field vegetable production, intensification by installation of greenhouses will happen. This should not be stimulated because of the high levels of intensification in terms of the use of agricultural inputs. As for arable crops, the same goes for improvements in the technology. Arable crops need to be diversified to include deep rooted annual crops as well as consider legumes.

Government policies should be in place to change the livestock composition (numbers, proportion of different breeds and species in their total population) depending on the restrictions on access to feed/fodder resources and, quantitative and qualitative change in the types and availability of fodder. These policies should strongly strengthen the crop – livestock integrated mixed farming system, with a positive impact on the environment.

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Situation in Laboratories for Seed Quality Control in the Republic Of Croatia - Starting Point for Accreditation

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Abstract

Laboratories for seed quality control test the quality of domestically produced and imported seeds. There are 16 laboratories in Croatia registered in the Register of laboratories for seed quality control. Laboratories conduct the testing of seed quality parameters, such as: seed purity, determining the presence of other species and weeds, seed moisture, energy and germination, weight of 1000 seeds, health condition of seeds and seed rinsing test – determining the presence of Tilletia spp. spores.

Given that Croatia is a full member of the EU as off July 2013, the question arose about the need for accreditation of laboratories according to internationally recognized standards HRN EN ISO / IEC 17025 and about whether Croatian laboratories for seed quality control are ready for the introduction of quality systems and laboratory accreditation according to HRN EN ISO / IEC 17025 standard.

The goal of this research is to determine the current state of laboratories for seed quality control in the Republic of Croatia and possibilities of laboratory accreditation according to internationally recognized HRN EN ISO / IEC 17025 standard. A questionnaire for laboratory managers was conducted for that purpose. The questionnaire was composed of three parts. The first part contains general laboratory information, the second part is related to laboratory equipment and qualifications of employed staff while the third part presents the views of laboratory managers on the importance of accreditation according to the HRN EN ISO/IEC 17025 standard.

Keywords: Laboratories for seed quality control, accreditation, HRN EN ISO/IEC 17025

Introduction

Regulations on entry into the register of suppliers, laboratories and agricultural seed samplers (NN 29/08) prescribe the conditions required for entry into the Register of laboratories for quality control of agricultural propagating material. Regulations prescribe basic equipment and conditions to be met by the head of the laboratory and technicians in terms of education and work experience. Prior to entry into the register, the representatives of the Ministry of Agriculture, Fisheries and Rural Development and representatives of the Croatian Centre for Agriculture, Food and Rural Affairs (HCPHS) – Institute for Seed and Seedlings, check whether all conditions are met.

Methods for testing the quality of seeds are prescribed by the Regulations on the methods of sampling and testing of seed quality (NN 99/08) which are compliant with international testing methods prescribed by ISTA's International Rules for seed testing (International Seed Testing Association). Every laboratory issues a report on the quality of agricultural seed where they state the exact test methods. That way it is possible to repeat the test in any laboratory and in every country importing the seeds. This applies only to the test methods of germination and seed health, because only these quality parameters can have several prescribed methods for one plant species.

Equipment and methods of seed testing of a laboratory is controlled by HCPHS – Department of Seeds and Seedlings. Laboratory equipment and its condition as well as maintenance of documentation are controlled by representatives of the Institute for Seed and Seedlings (ZSR) once a year. ZSR is controlling the conducting of seed testing methods by inter-laboratory comparative tests – Ring tests. Three times a year, every laboratory receives seeds samples on which the analysis is carried out. ZSR is sending the Ring test results to every laboratory after the statistical processing.

ZSR is conducting workshops and trainings for education of laboratory staff. Employees propose topics for the workshops, which have theoretical and practical part. Training of new

analysts in laboratories is carried out by ZSR according to the Regulations on entry into the register of suppliers, laboratories and agricultural seed samplers (NN 29/08).

The quality management system includes organizational structure, processes and procedures, while technical requirements relate to staffing, accommodation of laboratories, environmental requirements and testing methods (Gradečki Poštenjak, Jakovljević i Ćelepirović, 2006).

Material and research methods

The study is based on data collected by questionnaires on a sample of 10 laboratories out of a total of 16 registered and active laboratories for quality control of agricultural propagating material entered into the Register of laboratories (research did not include ZSR's laboratory).

The aim of the research is to determine the level of laboratory equipment, qualified personnel, methods of keeping records, manner of storage of analysed seed samples, and to get information from staff and the head of the laboratory on the possibility of implementation and the importance of accreditation of a quality system in accordance with HRN EN ISO/IEC 17 025 norm.

The questionnaire consists of three parts and has 40 questions. The first part of the questionnaire contains general information about the lab, the second part refers to the equipment and keeping records, and the third part is related to employees' attitudes about the possibility and necessity of accreditation. One part of the questionnaire was analysed descriptively, and the other part by quantitative methods. The research results are used to draw conclusions which would relate to the entire Republic of Croatia by using inductive-deductive method (Žugaj, Dumičić, Dušak, 2006).

Results and Discussion

The survey involved 10 of the 15 laboratories, which amounts to 66,7% of laboratories. As the main reason for not participating in the survey of the rest 33,3 % of laboratories, the heads of laboratories state that they are not allowed to provide information about laboratories outside the companies within which the laboratories operate.

Laboratories for quality control of agricultural propagating material work on seed processing which is the most important link in the chain of seed production. Seed processing is mostly done in private companies so 90% of laboratories are in private ownership, and only 10% is state-owned. Most of the laboratories are entered into the register after the year 2000. Number of employees ranges from one to three. All heads of laboratories have a university degree. Professional qualifications of all employees are presented in figure 1.

STRUCTURE OF EMPLOYEES' QUALIFICATION IN %
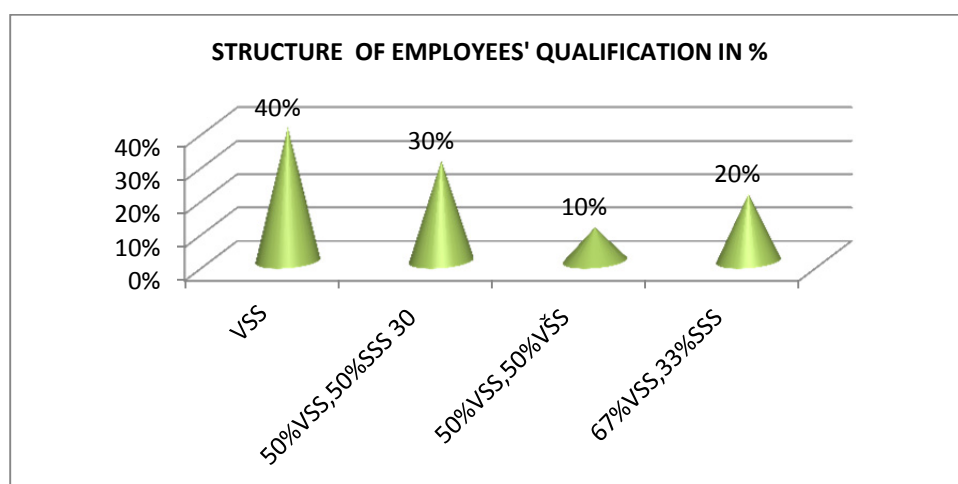
Figure 1. The structure of employees in the laboratories based on professional qualifications.
Source: Processed by authors

In all laboratories, at least one employee had training in seed health testing, and most often it is the head of a laboratory. All laboratories are equipped with the equipment prescribed by the Regulations on entry into the register of suppliers, laboratories and agricultural seed samplers

(NN 29/08). Equipment is generally older than 10 years and in most laboratories, measuring instruments are not regularly calibrated. Only three laboratories execute regular calibration of laboratory equipment.

Quality assurance of test results is an important element for building a trust in the laboratory. The seed is placed on a market based on a certificate issued upon test results and reports on the quality of the seed. The accuracy of the seed quality test results is of great importance, because errors in the test results which are visible in production can cause major economic damage. One way of ensuring the quality of test results is the implementation of HRN EN ISO/IEC 17 025 norm − General requirements for the competence of testing and calibration laboratories. The third part of the survey provides answers on the possibility of accreditation of laboratories for testing the quality of agricultural propagating material according to HRN EN ISO/IEC 17 025 norm. In Croatia, only two laboratories for testing the quality of agricultural propagating material have established a quality system according to HRN EN ISO/IEC 17 025 norm, while five laboratories have quality system established according to HRN EN ISO/IEC 9001 norm. Other laboratories did not implement any quality management system. According to the Regulations on methods of sampling and testing of seed quality (NN 99/08), laboratories are required to keep the basic documentation about the tested seeds. Due to the specific tasks in the laboratory, it would be advisable for the laboratory to keep technical documentation on the equipment, monitor the temperature in the chamber for germination, keep records on equipment maintenance, etc. Most of the surveyed laboratories, that is 70%, keep only basic documentation. Opinions of heads of laboratories on the need of documentation keeping are shown in table 1.

Table 1. Opinions of heads of laboratories on the need of documentation keeping

Statement	Do not agree at all	Partially agree	Do not know	Completely agree
Record-keeping is important for the quality work of laboratories	0	1	1	8
Laboratory is keeping too much documentation	4	4	1	1

Source: Processed by authors

Heads of laboratories are aware of the importance of establishing a documented management system, which is evident from the above results. Disagreement with the statement that the laboratory is keeping too much documentation means that most laboratory managers are ready to keep additional documentation required by the HRN EN ISO/IEC 17 025 norm. Lack of employees is stated to be the fundamental problem for the establishment of a documented management system.

After Croatian accession to the EU the competitiveness in domestic and international markets has increased, and implementation of quality system according to the requirements of the HRN EN ISO/IEC 17 025 norm in laboratories would increase their competitiveness and business image. Table 2 shows Opinions of heads of laboratories on the advantages of accreditation according to the requirements of HRN EN ISO/IEC 17 025 norm.

Table 2. Opinions of heads of laboratories on the advantages of accreditation according to the requirements of HRN EN ISO/IEC 17 025 norm

Statement	Do not agree at all	Partially agree	Do not know	Completely agree
Having HRN EN ISO/IEC 17 025 certificate helps laboratories to create competitive advantages in both domestic and global markets	3	3	1	3
The introduction of ISO certification has a positive impact on the performance of the laboratory	5	1	2	2
Employees respond positively to certification	5	4	1	0

Source: Processed by authors

From the research it is evident that the laboratory managers generally agree with the statement that the possession of a HRN EN ISO/IEC 17 025 certificate would help in creating competitive advantages in both domestic and global markets, but only 20% of respondents completely agree that it would help to acquire a positive image of the laboratory. It is worrisome that 50% of respondents declared that employees do not respond positively to the certification.

The implementation of a quality system according to HRN EN ISO/IEC 17 025 norm is not regulated by law, and the majority of laboratories does not plan to implement a quality management system.
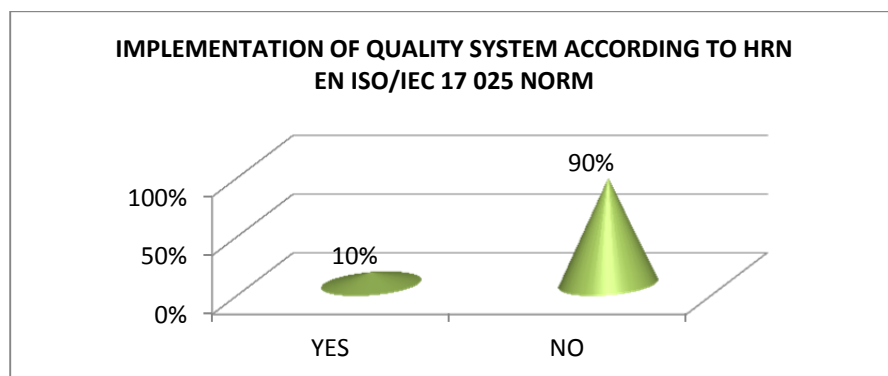
Figure 2. The implementation of quality system according to HRN EN ISO/IEC 17 025 norm.
Source: Processed by authors

Conclusion

Laboratories for testing the quality of agricultural propagating material are properly equipped and keep all documentation which is required by law. All heads of laboratories have a university degree, while other employees have either higher education or secondary school education. Employees regularly attend educational workshops and keep track of the changes in legislation.

Most laboratories are private, which results in too small a number of employees and conducting additional analysis and operations not related to testing the quality of agricultural propagating material. In some laboratories, laboratory manager is the only employee, hence performs the tasks of leaders, technicians and samplers. This results in a negative attitude towards accreditation, because accreditation would increase the number of tasks, while at the same time, the number of employees would remain the same. Implementation of quality system and accreditation of laboratories according to HRN EN ISO/IEC 17 025 norm clearly defines mandatory conditions concerning laboratory space, testing methods, education and number of employees, and keeping the necessary records. Accreditation requires months of work and considerable financial resources and business owners within which laboratories work are generally not ready for such investment, unless it is obligatory by law.

Heads of laboratories are aware of the positive aspects of accreditation, but they are also aware of the situation in which their laboratories are concerning the possibility of financial investment, which is the only reason for opposing to accreditation.

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Trends in Foreign Trade of Bosnia and Herzegovina in Live Animals, Meat and Meat Products

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Abstract

Given the importance of international trade for the whole economy of B&H, and the role and share of agricultural and food commodities in it, there is a need for permanent monitoring and analysis of the scope and volume of foreign trade in food sector, its characteristics and trends. In this paper, the analysis of trade in live animals, meat and meat products in the period 2006-2010 was carried out.

The collected secondary data were processed in accordance with the scientific methodology and has led to significant results. The total volume of foreign trade increased by 60.26 %, while imports increased by 46.43 % and export by 222.82 %. But continuous trade deficit was observed as well, resulting in its growth by 30.04%.

Price changes contributed to the reduction of the trade deficit only in trade of meat products. Trade of live animals recorded a growth of 106.72 %, mainly due to the growth in imports which led to a rise in trade deficit of 85.35%. Trade of fresh meat increased by 55.26 %. As imports had dominant influence on this growth, trade deficit grew by 24.69 %. Exchange of meat products increased by 26.70 %.Thanks to the increase of exports the trade deficit for this group of commodities recorded a decrease of 52.70 %.

Keywords: Foreign trade balance, live animals, meat and meat products

Introduction

Nowadays, it is almost impossible to imagine a country in trade isolation. The government is trying to import products which, in general, do not exist or are not present in sufficient quantities in the domestic market, at the best prices through foreign trade, and under the most favourable conditions to export local products to foreign markets (Andrijanic,2009)[1]. Considering that B&H is a member of Central European Free Trade Agreement (CEFTA), and considering its efforts to become a full member of the World Trade Organization (WTO), it has opened its borders goods, services and capital to CEFTA countries but to other countries as well. Having in mind the openness of the borders, Bosnia and Herzegovina must and improve its position in international trade on both domestic and foreign market. Having in mind that the meat sub-sector, according to Kulelija, B. (2012) and Kulelija, B. (2010), is one of the most important sub-sectors in the foreign trade of agro-food sector in Bosnia and Herzegovina, this paper analyzes the trends in foreign trade of Bosnia and Herzegovina in live animals, meat and meat products.

Material and Methods

Analysis of B&H foreign trade in live animals, meat and meat products was performed on the basis of secondary data obtained from Chamber of Foreign Trade of Bosnia and Herzegovina. The analysis encompassed the scope and value of imports, exports, total trade and trade balance in live animals, meat and meat products (Ognjenovic, 2009). So, parsing, comparing and calculating of the balance was carried out, and trends were conducted. The aforementioned analysis is related to the period 2006-2010.

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[1] Confirmed by Salvatore, D. (2009).

Results

Table 1. Foreign trade of BH in live animals, meat and meat products (2006-2010)   (in tones)

Commodity		Year					Index 2006=100
		2006	**2007**	**2008**	**2009**	**2010**	
Live animals[2]	Import	14062	21218	34021	29377	27574	196.09
	Export	74	139	411	304	1647	2233.58
	Trade	14136	21357	34431	29680	29221	206.72
	Balance	-13988	-21078	-33610	-29073	-25927	185.35
Meat	Import	24457	25456	31427	36595	34257	140.07
	Export	146	368	702	1768	3942	2705.71
	Trade	24603	25824	32129	38363	38199	155.26
	Balance	-24312	-25087	-30724	-34827	-30314	124.69
Meat products	Import	11844	10787	10066	10772	11844	100.62
	Export	4064	5328	7422	8719	4064	202.71
	Trade	15907	16115	17488	19492	15907	126.70
	Balance	-7780	-5459	-2645	-2053	-7780	47.30
Total	Import	50363	57461	75514	76744	73748	146.43
	Export	4283	5836	8535	10791	13826	322.82
	Trade	54646	63296	84049	87535	87575	160.26
	Balance	-46080	-51625	-66979	-65953	-59922	130.04

Source: Own calculations based on data from CFTBIH

Data presented in previous Table clearly shows increasing volume of foreign trade in meat sub-sector in all elements. It is also obvious that export' volume increased more than import, particularly in live animals and unprocessed meat. But, due to poor situation in previous periods, balance has been recording increasing negative value.

Table 2. The structure of foreign trade of BH in live animals, meat and meat products (2006-2010)[3]   (In %)

Commodity		Year					Index 2006=100
		2006	**2007**	**2008**	**2009**	**2010**	
Live aniamals	Share in sector' import	27.92	36.93	45.05	38.28	37.39	133.91
	Share in sector' export	1.72	2.39	4.81	2.81	11.91	691.89
Meat	Share in sector' import	48.56	44.30	41.62	47.68	46.45	95.65
	Share in sector' export	3.40	6.31	8.23	16.38	28.51	838.14
Meat products	Share in sector' import	23.52	18.77	13.33	14.04	16.16	68.72
	Share in sector' export	94.88	91.30	86.96	80.80	59.58	62.79

Source: Own calculations based on data from CFTBIH'

The structure of the volume of the meat sub-sector foreign trade shows expected permanent dominant share of unprocessed meat in import, increasing share of live animals and decreasing share of meat products. Changes in the structure of export had different trends, but meat products maintained dominant share in it over the whole period.

Data in following two tables present value of foreign trade in the meat sub-sector and its structure over the observed period.

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[2] Cattle, pigs, sheep, goats and poultry with categories were taken into account.
[3] Shares are related to the share of the total trade of the observed sector.

Table 3. The value of foreign trade of BH in live animals, meat and meat products (2006-2010)   (In 000 BAM)

Commodity		Year					Index 2006=100
		2006	2007	2008	2009	2010	
Live animals[4]	Import	40667	57169	107690	98287	91914	226.02
	Export	200	678	1960	1623	7044	3528.48
	Trade	40866	57847	109650	99910	98957	242.15
	Balance	-40467	-56491	-105730	-96664	-84870	209.73
Meat	Import	68658	69215	110001	121944	109477	159.45
	Export	1727	2787	4462	8633	13338	772.10
	Trade	70386	72002	114463	130576	122815	174.49
	Balance	-66931	-66428	-105539	-113311	-96139	143.64
Meat products	Import	65481	57636	62766	71070	74084	113.14
	Export	10061	17016	29514	38874	38822	385.86
	Trade	75542	74652	92280	109944	112906	149.46
	Balance	-55420	-40620	-33252	-32197	-35262	63.63
Total	Import	174806	184021	280457	291301	275474	157.59
	Export	11988	20481	35937	49130	59203	493.85
	Trade	186794	204501	316393	340431	334678	179.17
	Balance	-162817	-163540	-244520	-242172	-216271	132.83

Source: Own calculations based on data from CFTBIH

Table 4. The structure of foreign trade value of BH in live animals, meat and meat products (2006-2010)[5]   (In %)

Commodity		Year					Index 2006=100
		2006	2007	2008	2009	2010	
Live animals	Share in sector' import	23.26	31.07	38.40	33.74	33.37	143.42
	Share in sector' export	1.67	3.31	5.46	3.30	11.90	714.49
	Share in sector' balance	24.85	34.54	43.23	39.91	39.24	157.89
Meat	Share in sector' import	39.28	37.61	39.22	41.86	39.74	101.18
	Share in sector' export	14.41	13.61	12.42	17.57	22.53	156.34
	Share in sector' balance	41.10	40.61	43.16	46.78	44.45	108.13
Meat products	Share in sector' import	37.46	31.32	22.38	24.40	26.89	71.79
	Share in sector' export	83.92	83.08	82.13	79.12	65.57	78.13
	Share in sector' balance	34.03	24.83	13.59	13.29	16.30	47.90

Source: Own calculations based on data from CFTBIH

Data in both previous tables shows improvement of the meat sub-sector foreign trade, as increase of its value (79%) is mainly due to stronger increase of export (393.85%) than of import (57.59%). Different categories of commodities had different trends in foreign trade elements over the observed period. The most favourable changes took places in meat products. Processed meat commodities, therefore, cut the share in trade deficit by over 50%. General characteristic of the whole sub-sector foreign trade is instability and variation over the time. The worst situation is in live animals.

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[4] Cattle, pigs, sheep, goats and poultry with categories were taken into account.

Discussion and Conclusion

Findings obtained on the basis of data analysis about trends in foreign trade of Bosnia and Herzegovina in live animals, meat and meat products are:

In terms of volume, the highest share in import in the period 2006-2012 had fresh, cooled and frozen meat, and the highest share in exports had meat products. Trade in live animals recorded a growth of 106.72%, due to the growth of imports which led to a rise in trade deficit by 85.35%. Trade with meat increased by 55.26%. Imports had dominant influence on this growth, so trade deficit increased by 24.69%. Only the trade of meat products thanks to increase of exports recorded a decrease of trade deficit of 52.70%.

The total value of foreign trade of the sub-sector grew by 79.17%.over the 2006-2012. period. Although the value of exports increased by as much as 393.85%, and import by 57.59%, trade deficit increased by 32.83%. The highest share in import had meat, and meat products in exports. Although export grew it did not reduce trade deficit, and it further increased by 109.73%.

Price changes of meat products contributed to improvement of BH status in foreign trade. The trade of meat products increased by 49.46% and reduced the deficit by 36.37%.

Analysis of trends and characteristics of foreign trade in meat sub-sector led to general conclusion that, although certain improvements have been achieved, situation is still very unfavourable, and the sector is heavily burdened with lots of problems. The fact that changes of cattle fund of B&H did not increase with accordance of increase of live animals import indicates that animals are imported for slaughtering as primary animal production in the country does not meet demands of meat processors. In addition, domination of fresh meat in import proves high dependence of meat processing on imported raw material. While valuable commodities are imported, BH exports cheap products or semi-processed meat products. Instability in fodder yields and prices in certain years makes fattening unprofitable, so domestic raw material basis is not only insufficient, but unstable and unreliable too.

Having in mind importance of meat for human nutrition, importance of foreign trade for whole economy, abundance of available underused natural resources for animal agricultural production, as well as economic and social role of agriculture, future agricultural policy should offer set of measures that would treat agricultural production and processing as the whole, thus creating preconditions for improvement of competitiveness on both domestic and foreign market.

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Production of Cold-Pressed Oil from Pumpkin Seeds (Cucurbita Pepo)

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Abstract

Justification of manufacturing of cold-pressed oil from pumpkin seeds (Cucurbita Pepo) in the Una-Sana Canton is explained in this paper. Besides extremely high prices it has greater use from year to year, especially because of the fact that it has positive impact on human health. This paper presents the research results of the needs for this type of oil of the male population aged over 40 years, required area for planting, as well as opportunities of squeezing on already installed oil presses by municipalities of the Una-Sana Canton. The study included the effects of the introduction of this culture on employment of the population.

Keywords: Pumpkin, cold-pressed oil, pressed, health.

Introduction

The popularity of pumpkin seed grows from year to year, and its pharmacological and medical value was tested by multitude of scientists (Gossel-Williams et al. 2008; Get et al. 2008; Nkosi et al. 2006; Nkosi et al. 2005). The effect of pumpkin seed protein on the liver was researched, as well as on benign prostatic hyperplasia (enlargement) of the prostate (BHP), (Castillo et al. 2006; Gossel-Williams et al. 2006). BHP is a frequent benign tumor in men population that causes various urinary symptoms. Researches published in the New England Journal of Medicine, demonstrated that the risk of prostate is reduced by 35% in men population who regularly consume pumpkin oil in the amount of 5 ml per day. In some countries (Bulgaria, Romania, Turkey, Ukraine and Austria) there are no prostate diseases, and it is believed that the main reason for this is daily presence of pumpkin seeds in the diet. In addition to the preventive and therapeutic effects on the prostate, pumpkin oil has a number of other positive characteristics and effects: it reduces the level of cholesterol in the blood, acts as a prevention from atherosclerosis, has a positive effect on the immune system, eyesight, mood, facilitates learning and concentration, improves intestinal flora, has a good effect on the complexion (preventing the occurrence of eczema), and has especially good effects on fertility (Wanasundara & Shahidi, 2005).

In addition, experimental researches were done with pumpkin seeds, grown in on the area of Turkey, especially its effect on bacteria, viruses and fungi. The results showed good antibacterial effect against Klebsiella pneumonia, Pseudomonas saeruginosa, Enterococcus faecalis and Acinobacter baumannii, a potential antifungal effect on the mold Candida albicans and a modest effect against Parainfluenza Virus Type-3 by concentrations of 2% (Caille et al., 2006; Sener et al . 2007, Wang & Ng, 2003).

Edible oils are a rich source of fatty acids, and bioactive ingredients, but processing and refining of the product leads to losses in nutrient value of oil, and therefore people begin to raise awareness about healthy diets, and needs for food consummation with positive effects on health. For this reason, the demand for cold-pressed oils or pressed unrefined oil is growing. In order to cultivate specific characteristics of raw materials for squeezing, oil is produced by special technology in small capacities in mini-mills. After completing the process of pressing, the oil can be additionally improved through sedimentation or filtering, but usage of the refining process is not allowed. Thanks to this process and method of squeezing, as well as absence of refining, oil produced in this way is significantly different from others in appearance, color and flavor, and

also in the richness of omega-3 fatty acids, as well as favorable ratio of omega-3 and omega -6 fatty acids (Janick and Paris, 2006).

Until the beginning of World War I pumpkin (Cucurbita pepo) represented a very important raw material (Sanjuro et al. 2002). Its cultivation was not difficult, and was mostly grown as intercrop of maize, and unclean harvested fruits could be stored for the winter. If necessary, seeds are extracted, which were cold-pressed at this time with small pressings, called mills (Karlovic and Andric, 2006), while the fleshy part of the fruit was used in animal nutrition, and it represented a very important livestock meal in the winter period of quiescence. Today is pumpkin oil cultivated exclusively as an independent crop, even though on very small areas throughout the whole region. Due to the increasing demand of oil, the production process can be mechanized in today's time (machines for harvesting fruits, separation, washing and drying the seeds, which contributes to the fact that this culture began to cultivate larger areas again (Berenji, 2007).

Structure of Pumpkin seed

The seed is very rich in oil, protein, vegetable fibers, vitamins and mineral materials. According to literature data, the oil content in the pumpkin seed is around 40-50%, and crude protein content about 35-45% (Pereda and Balogh, 2005; Mansour et al. 1993a; Dimic et al. 2003, El-Adawy and Taha, 2001).

Out of mineral substances pumpkin seed is particularly rich in phosphorus, 1020-1090 mg/kg, potassium, 896-982 mg/kg, and magnesium, 483-510 mg/kg. Although present in small quantities significant are calcium, iron and copper (Pereda and Balogh, 2005, El-Adawy and Taha, 2001).

Besides stated, pumpkin seeds are a rich source of B group vitamins: 6.9 mg/kg-B1; 2.5 mg/kg- B2; 4.6 mg/kg- B6, as well as niacin 61.4 mg/kg (calculated on the dry matter), (Mansour et al. 1993b).

Work Method and Data Sources

To determine the production cost of oil from pumpkin seeds analytic-synthetic methods were used, and data sources are from domestic and foreign scientific and professional literature.

Research Results
The Health status of population in Federation of BiH

Based on the data of the Cancer Registry of Federation of BiH 5.143 people (2.672 men, and 2.471 women) with diagnosed invasive cancer (excluding skin cancer) were registered during 2011. The number of newly registered malignancies is regularly higher in men than in women population and is (52%: 48%). The average age of patients was 62 years (64 years for men and 60 years for women).

	2010	2011
lung, bronchi	27,9	26
prostate	11,5	12,8
rektum	6,2	7
urinary bladder	7,4	6,6
gizzard	6,1	6,4
colon	5,4	6
trachea	3,9	3,9
liver	3,3	3,4
pancreas		3,3
nervous system	3,2	3,3
kidney	3,8	
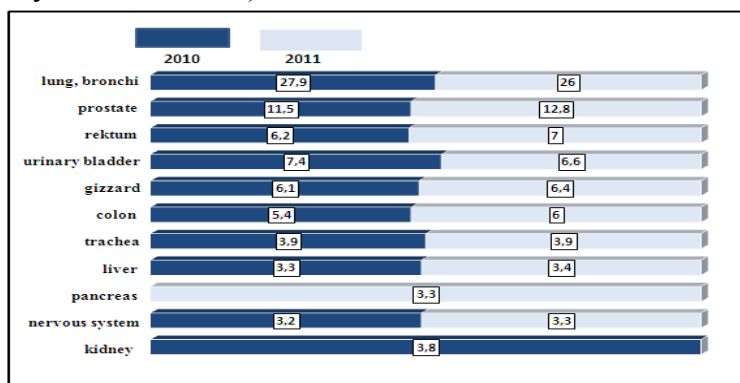
Graph 1 Leading cases of cancer in men population in the Federation of BiH, Comparison of 2011 and 2010, Source: Institute for Statistic of the Federation of BiH, 2012.

Ten most common cases of cancer in male population in Federation of BiH in 2011 constitute 78.6% of all registered cases of cancer in men population. According to the data of Institute for Statistics of FBiH, cancer of the respiratory system (trachea, bronchi, and lungs) makes 26%, **prostate cancer 12,8%**, and rectal cancer 7.0% of all newly diagnosed malignancies in male population (graph1).

Production cost and oil price

The surface of the Una-Sana Canton (USC) is 4.125.0 km^2, and the Canton is located in the northwestern part of BiH. By the surface it occupies 15.79% of the Federation of BiH. Total agricultural land has a surface of 196,308 ha, out of which plowed fields and gardens have a surface of 102,490 ha, grasslands 91,203, and orchards 1,615 ha. Significant areas, which are treated as uncultivated (32.2%), through an investment programme can be converted into arable land. Due to the favorable geographic position and moderate-continental climate suitable for growing oil pumpkin this area can provide an important contribution in the production of this crop. USC has population of 288,114, out of which about 40.1% of men aged between 35-64 years, and about 10.5. % of men aged over 65 years (ADP, 2004).

The average daily need of adults (male) is 5 ml of oil, and this quantity on an annual basis is approximately 1.82 liters. In the area of USC lives 60.298 men aged over 50 years, and the annual needs of pumpkin seed oil for the male population of USC is 109.742 liters of oil. To satisfy the need for the afore-mentioned quantity of oil, it is a required approximately 219.484 kg of pumpkin seeds. The average yield of pumpkin per ha is about 1500 kg (850-900 kg of dry seeds), and for the cultivation of the mentioned quantity of seed a surface of 243,8 ha is needed.

Based on data from the Institute for Statistics of the Federation of BiH from 2012, the number of unemployed people in USC was 43.271. Starting from the fact that a four-member family can successfully take care of plating, care measures and harvesting on an area of 2 ha, we come to the data that the pumpkin production on a surface of 243 ha could employ 122 households. The initial costs of cultivation of pumpkin seed on the surface of 1 ha are 1.700 KM (sowing material, muck, work of machines, protection, harvesting fruit, cleaning, drying and squeezing of seeds). With an area of 2 ha will be produced about 800 liters of oil as final product, with the price of 25.00 KM per 1 liter of oil, and with an initial investment of 3.400 KM (area of 2 ha) achieved earnings are 16.600 KM.

Analyzing data about uncultivated surfaces in USC, we conclude that the cultivation can be successfully utilized for farming of pumpkin, while through finalizing the production process until squeezing of oil the unemployment in USC, and beyond will be significantly reduced. Currently 4 presses for cold pressed oil are installed in municipalities of Cazin, Sanski Most, and Bosanski Petrovac, as well as Bihac (Faculty of Biotechnical sciences). The capacity of the presses ranges from 45 kg/h to 700 kg/h of seed, depending on the model. Presses with a capacity of 250 kg/h of seed are installed on the afore-mentioned locations, which means that in one working day of 8 hours one press can squeeze up to 1.000 liters of oil.

Conclusions

Based on conducted research and obtained results, following conclusions can be made:
- Nutritional and pharmacological value of pumpkin oil is mainly based on fitosterol, specific fatty acid structure, as well as vitamin E, and has a benevolent effect in cases of benign prostatic hyperplasia (BPH).
- USC has large areas of uncultivated land, which could be easily adapted for planting with certain investments, and converted into arable land.
- USC has a favorable climate for cultivation of this crop, and besides of the improvement of the general state of health, its introduction in daily diet, would significantly reduce unemployment.

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Economic and Legal Analysis of Financial Derivatives in Terms of Increasing Certainty in Agricultural Production in Serbia

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Abstract

The Republic of Serbia has surplus in agricultural production in relation to domestic needs. Opportunity to decrease market surplus in period after harvests, primarily of wheat and corn, lies in creating conditions to trade in financial derivatives on the stock market. The goal of the paper is to identify basic conditions for introduction of financial derivatives, primarily forwards and futures into the Serbian stock market. In order to create a developed and well-organized term market, commodity exchange should be normatively regulated and laws regarding financial market changed. Financial derivatives that entail unconditional contracts or firm offers, but also conditional or option contracts must be precisely regulated, as autonomous law in this field in Serbia is almost inexistent. This paper particularly analyses whether educating market participants (both larger agricultural producers and stock market participants) is necessary along with legal solutions. The authors find that stock markets also lack infrastructure that could support trade in financial derivatives. It is important to establish whether financial companies are interested in trade in financial derivatives. Experiences of countries with developed term trade indicate that it is a way to increase the planning possibilities and set standards that should characterise agricultural production in contemporary environment.

Keywords: Agriculture, financial derivatives, risk, Serbia, uncertainty

Introduction

Positive theories to explain financial risk management require a considerable number of assumptions concerning the objective of management (Benson and Oliver, 2004). The use of derivative instruments in corporate risk management has grown rapidly in recent years, caused partly by financial deregulation and partly by the success of the financial industry in designing a great variety of OTC and exchange-traded contracts (Fender, 2000).

In the analysis of financial derivatives from the aspect of increase of certainty in agricultural production in Serbia, the initial presumption is that the domestic stock market still does not have all prerequisites for the introduction of financial derivatives into its offer. Research done in Serbia so far is related to the possibility of application of financial derivatives pertaining to climate variables (Marković, 2013).

The starting point for analysis is the fact that agricultural producers in Serbia face similar dilemmas on a yearly basis: what to sow and whether it pays to sow at all? The prices of agricultural products in Serbia vary from those that can bring solid earnings to those that bring losses. Essentially, neither good nor bad harvest do not automatically mean high or low earnings, as even more important than yield is the possibility of marketing of agricultural products. State intervention is insufficient, thus purchase of market surpluses is symbolic. The state has obviously no agrarian policy that would prevent this kind of situations and probably also not enough resources in order to be a corrective at the unforeseeable market. A surplus in offer after harvest would be mitigated by the fact that a certain portion of agricultural products would be realized through financial derivatives in the form of term contracts tradable on the stock market. This primarily concerns those products dominant in the structure of sowed cultures or prominent in terms of yield, so the most important field crops can be considered (Marković and Jovanović, 2011; Marković, 2011).

From the aforementioned data it is clear that one must seek for comparative normative and economic institutes that allow for this problem to be solved. In comparative legal and economic systems, financial derivatives protect farmers from risk to a certain extent (hedging). Financial derivatives refer to futures contracts and option contracts. (Veselinović, 2011). The most important financial derivatives that could be used on Serbian market of agricultural products are forwards and futures and the goal of the paper is to establish what obstacles should be removed, how much time is needed and whether it is possible to gradually introduce certain forms of financial derivatives into some of the Serbian stock markets, primarily the Commodity exchange in Novi Sad.

Material and Method

Scientific papers on the topic of financial derivatives are very few in Serbia and there have been no comprehensive research studies with analyses of stock markets, investment companies and agricultural producers, as potential subjects in that field. Hence, this paper compares, by means of comparative law and comparative economy methods, the experiences of other countries and Serbian legislation and practice in this field. Starting from economic and legal institutes existing in other countries, conclusions have been reached about their establishment in Serbian legislative or absolute absence and their inexistence in practice. The paper includes the analysis of the most important financial derivatives that could be used in the field of agriculture – forward and futures. In addition to this, legal sources from this field are analysed in order to ascertain what needs to be done in the ensuing period in terms of creation of a legal framework for this type of work.

Discussion

Agricultural production is just one of the fields in which different financial derivatives are used (Figure 1). The paper analyses forward and futures contracts researching on whether there are enough regulatory frameworks in Serbian law for such financial derivatives.

Serbian law recognises "financial instruments", which include, among other things, the futures, swaps, interest forwards and other derived financial instruments related to goods, climate variables, transport expenditures, inflation rates, emission quotas or other official, economic and statistical data (Law on the Capital Market, 2011). In addition to the tendency of harmonisation and unification of rules on financial derivatives on national and international levels, the interest of states in these securities has been growing (Carić et al., 2011). Financial derivatives include futures contracts and option contracts.
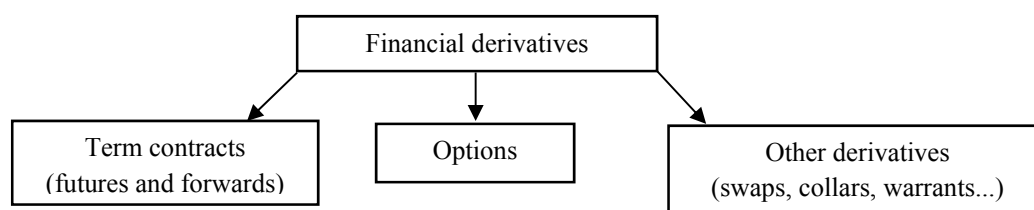
Figure 1. Types of financial derivatives.
Source: (Nevidal, 2002)

Forward contracts are term contracts by means of which two sides oblige to trade in certain property at a certain date in the future. Forward contracts in general, as well as in agriculture, are usually related to a specific type of goods, such as wheat or corn and are used in risk-protection, which, in analysed cases, refers to the change of price of agricultural products. Forward contracts on the most developed capital markets are the ones traded over the counter - OTC. Swaps are a special type of forwards and research has shown that application of this financial derivative has significant effects on mitigation of wheat production risk (Marković et al., 2012).

A future is a contract that stipulates the delivery of certain assets on an agreed date of delivery at an agreed price – the futures price. This is precisely the basic purpose of futures – enable the investors to control the risk of unfavourable price fluctuation of assets that they are going to

trade in in the future (Stanković, 2014). This is a term contract, as there is no trade at the moment of contract signing, but only agreement on future transaction, where the buyer obliges to purchase assets, while the seller obliges to deliver the assets. Based on this, the sellers gain guarantees that their goods (wheat, corn, soy, sunflower, etc.) will be bought at a fixed price, as stipulated by the signed futures contract. These commodity futures also require an "intermediary" that guarantees realisation of the term contract. In comparative practice, those are clearing houses that form stock markets in order to facilitate the trade and make it safer.

In Serbia there are no clearing houses within commodity exchanges, thus term contracts cannot be realised in the form of futures. One can ask whether non-typical, bilateral forward contracts that do not require clearing houses within stock markets could be realised in Serbia. There are certainly greater possibilities for that and, according to current Serbian regulations, there would be no obstacles. A bilateral forward could be considered an obliging preliminary contract, partially subject to the regulations of purchase contracts from the Contractual Obligations Act.

If term contracts are to be used on the Serbian market of agricultural products in the future, a distinction must be made between the forwards and the futures (Table 1). Futures are said to be standardised forward contracts, as they are virtually identical to the forwards, but with standardised terms. While with the forwards, the parties themselves agree on all terms, the futures have a standardised contract size, acceptable quality of goods, delivery dates, means of delivery, etc. which makes futures contracts "cleaned" from the flaws of the forward contracts. Owing to this, the parties only negotiate the futures price. Futures are more liquid and are not susceptible to the risk of unpaid obligations by the other party, the risk eliminated by the clearing house. (Hirsa and Nefci, 2014).

Table 1: Differences between futures and forward contracts

	Forward	**Futures**
Price determination	As agreed by the parties	Fully transparent and available to all
Nominal amount	As agreed by the parties	Standardised
Liquidity	Bilateral contracts hard to sell on	Outstanding
Margin payment	As agreed by the parties	Obligatory on all stock markets
Credit risk	Exists if there is no agreement on margin payment	Does not exist, as margin is obligatory

Source: (Nevidal, 2002)

In order to develop stock marketing of financial derivatives, it is important that the role of OTC market be assessed. In Serbia there is no adequate regulation of OTC markets, which are not typical stock markets and where forwards and bilateral contracts are traded. This modest legal regulation is not the main reason for the inexistence of financial derivatives in Serbia. The main reason does not lie in the fact that there are no institutions that would develop this field (primarily the specialised stock markets) nor are there a sufficient number of experts educated for this type of work.

Taking as an example a term contract related to the purchase of the 2017 wheat yield, whose term purchase is realised in 2014, one must have, apart from regulatory conditions, a stock market institution specialised in such trade, but also the stock market participants, both buyers and sellers of financial derivatives with certain goods as basis. In order for a financial derivative to be fully functional, merely having someone buy out the wheat on "term" basis does not suffice. There should also be a possibility for someone else to potentially buy out the term contract, taking on a certain risk; as such purchase is usually not at the nominal price of the first term purchase of goods. It is obvious that term arrangements can have a speculative character, thus state role is very important.

Based on research done in Croatia, researchers have tried to establish whether the OTC market participants could present a support for the development of the Serbian market of financial derivatives. The initial presumption was that there had already existed a satisfactory degree of staff education and technological equipment. Still, at the end of research it is written

that it is "evident that OTC derivative market in Croatia cannot be a sufficient developmental support in that it cannot have a sufficient leverage role to support (technologically and educationally) the development of their domestic derivative market (Šestanović, 2013)."

Considering the fact that the analysis of the situation in Croatia could largely be applied not only on Serbia, but also on a significant number of countries of South-eastern Europe, the paper uses the comparative method to conclude that the organizational capacities of financial derivative markets must be strengthened. This primarily refers to additional strengthening of internal organisational capacities of investment institutions (funds), but also to investments in IT, raising the educational levels in these areas, increase of level of knowledge and skills, further advancements in managing operational and market risks, as well as acquaintance with regulation and comparative practice.

Conclusion

Based on the regulation analysis and the state of stock markets in Serbia, it can be concluded that there are still no conditions for a significant trade in financial derivatives. In order to create the conditions for the use of financial derivatives, primarily forwards and futures, a range of activities must be undertaken. It is primarily important that the research survey covers the opinion of local stock markets and the attitudes of domestic investment associations on basic indicators related to financial derivatives. From the preliminary analysis it can be concluded that there should be a special approach to forward contracts, seeing as it is the type of contract that could be rather suitable for a more significant introduction to our capital market. However, it is only through the futures that the full effect of introduction of financial derivatives should be expected. The conclusion that can be drawn from the analysis is that it is necessary to additionally clarify the economic effects of introduction of financial derivatives into capital market in the field of agricultural products. In this respect, it is important that investors and sellers have a will to make such financial arrangements. The basic condition for that is forming of knowledge through education and creation of prerequisites through equipping of financial institutions and stock markets.

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The Socio-Economics Characteristics of Fish Consumers in Antalya

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Abstract

This study has been made to put forward socio-economic structures and fish consumption characteristics and habits of families living in the province of Antalya. The material of this study, which was performed during the years of work 2011-2012, consist of survey-derived data obtained from surveys conducted with a total of 208 families living in the 165 neighbourhood residents in Antalya who are determined by a proportional simple random sampling method. According to the survey results; monthly fish consumption of the families is around 4.8 kg in the period surveyed and that of a person is 1.4 kg. It has been identified that among the fish families consume in total, anchovies is in the lead, followed by, trout, sea bream culture, and the culture of sea bass, mackerel and red sea bream respectively. it was determined that fish consumption is directly proportional to family income status and level of education and that the most important factors affecting the consumption of fish are due to the fact that fish is a healthy and delicious food, high in nutritional value.

Keywords: Consumer, habits, fish consumption, Antalya

Introduction

With the rapid increase of the world population, nutritional needs of human beings are increasing. Therefore, people are working to benefit at the highest level from terrestrial sources on earth in order to answer to the nutritional needs. However, they are seeking alternative sources of nutrients to sustain human life because terrestrial resources are increasingly inadequate to provide the nutritional needs of the rapidly increasing population. In this case, the aquatic resources are the first alternative food sources that come to mind. Approximately 75% of our world is covered with water and aquatic resources have a significant potential to meet the world's increasing food demand. On the other hand, the high nutritional value of fishery products, their easy digestion and their possession of components necessary for a balanced diet makes them important in meeting a portion of people's needs for healthy food. Indeed, per capita fish consumption in the world is about 18.8 kg that in EU is 22.1 kg while per capita consumption of fishery products in Turkey varies between 6-8 kg (FAO, 2012). According to this situation, per capita consumption of fish of Turkey needs a 3 times increase compared to the world average and a 4 times increase compared to EU to reach the EU level. In Turkey, one of the most important factors affecting per capita fish consumption is the amount of annual anchovy fishing.

For the occasion, in this study, which reviewed the city centre of Antalya (ranking as 9th most populous city in Turkey and having an importance in terms of education, tourism, agriculture and fisheries), an examination of basic features of families' fish consumption and their choices, of factors having an effect on their decision related to consumption was tried.

Material and Methods

For the research, neighbourhoods where families residing in the city live and numbers of households living in those neighbourhoods have been identified based on records of province, municipality, district chief and Turkish Statistical Institute (TUIK) records. Later, number of exemplary households was determined using simple random sampling and surveys were conducted with family chiefs of households randomly selected in 2011-2012, between the months of September to April when there was no ban on hunting.

In Turkey, in nearly all of researches on consumers, simple random sampling method has been used based on the example ratio estimate (p). This method is also called as one-stage simple random sampling in many studies. The equation is used in this method;

$$n = \frac{Nz^2 pq}{Nd^2 + z^2 pq}$$

is in the form (Esin et al., 2001). In here; n shows: number of samples, z: standard normal value for selected confidence level (95% confidence level), p: The probability of occurrence of the event of interest (fish consumption probability of any one of the families chosen), q: The possibility of non occurrence of the event of interest (the possibility not to consume fish of any family selected) d: Margin of error equal to 5%.

This study involves families living in 165 neighbourhoods in Kepez, Konyaaltı and Muratpasa districts located at the city centre of Antalya. In order to distribute the sample volume consisting of 208 households to quarters, levels of development of the quarters formed by TUIK were taken as a base (a: most advanced, b: developed, c: intermediate level, d: underdeveloped, e: undeveloped). Quarters which have a quality to represent any one of the groups above were picked randomly. Thus, it was intended to represent the entire population. Data provided by questionnaires were analyzed using SPSS 17 software package.

Results and Discussion

Research was made with 208 families stratified by socio-economic factors, in and around Antalya and according to the survey average household size was found to be 3.4. Turkey average household size was found to be 3.7 (TUIK, 2013a).

In this study, men's rate in the surveyed families was determined to be 54.5%, while the women rate was determined to be 45.5%. In the research conducted, 82.6% of the heads of family have been identified as men while 17.4% as women. An analysis of the educational status of male heads of families showed that 3.5% of which were illiterate, 23.8% of primary school, 39.6% high school, and 33.1% of high school graduates. As for female heads of households, while 11.1% are illiterate, 36.1% were found to be high school and college graduates. The percentage of heads of family who graduated from college was found 33.3% and 37.1% in Isparta and Burdur respectively (Hatirli et al., 2004; Ozkan et al. 2006; Orhan and Yuksel, 2010).

Average monthly incomes of the families studied were found to be 1794.30 TL. The average share of food expenditure in the monthly expenditure was determined to be 27.1% while it was found 27.1% in a research in 2009 by Adıguzel et al. As of 2012, the share of food expenditure in Turkey's total spending is 19.6% (TUIK, 2013b). On the other hand according to the study, the share of food expenditure in total expenditure varies according to income group and the share of food expenditure in total expenditure of the lowest income group is 33.6%. This ratio is 31.2%, 29.6% and 21.5% respectively in low, medium and high income groups. As expected, the share of food expenditure in low-income groups is more than that which in higher income groups.

After having studied who gave the decision of purchasing fish in surveyed families, it was seen that both of the parents as decision making mechanism were in the first rank with a percentage of 49.5, followed by mother with 29.3% and fathers with 10.6% in the third rank. As for the execution of food purchase operation, it was found out that parents together were in the first rank with 51.4%, fathers in the second rank with 19.7%.

In the surveyed period (October-April), fish consumptions of families by income group were examined and was determined that the monthly fish consumption amount is 4.8 kg and fish consumption per person per month is 1.4 kg. In a previous study conducted in the same province, this figure was calculated to be 1.03 kg (Ozkan et al., 2006). Comparing the fish consumption per capita per month with results of the conducted research in the other provinces, Tokat (1.9 kg) (Erdal and Esengun, 2008), Trabzon and Giresun (2.4 kg) (Adiguzel et al., 2009; Aydin and Karadurmus, 2013) are higher, Tunceli (0.3 kg) (Yuksel et al., 2011), Isparta (1.03 kg) (Hatirli et al., 2004) are lower.

The amount of monthly fish consumption in the most low-income families is 2.3 kg. It is 4.3 kg in the low-income group, 5.9 kg in the middle income group and 8.5 kg in the high-income group. In this context, it can be said that in urban areas of Antalya, the higher the family income the more families consume fish. Similar results were found by Ozkan et al. (2006). Since the fact that fish consumption in Turkey is not homogenous was taken into account, it was concluded that the coastal location of Antalya and its ongoing development contributed to the amount of consumption.

In Antalya, a large portion of the fish consumed is sea fish. In fact, after having asked to examined families which fish they consume most, it was found out that 34.2% of the families consume anchovies most while 9.8% of them mostly consume trout, 8.8% sea bream culture, 7.1% perch culture, 6% mackerel, 5.2% of the Striped bream. Accordingly, anchovies are more preferred in our provinces located in coastal and near coastal areas because it is cheaper compared to other fish species and in the provinces not close to coastal areas mostly trout, of freshwater fish is preferred. According to a research done in Burdur, Tokat, Istanbul, Trabzon and Giresun, anchovy is ranked as the first in fish consumption while trout is ranked as the first in Elazığ (Orhan and Yuksel, 2010; Erdal and Esengun, 2008; Aydın and Karadurmuş, 2013, Sen et al., 2008).

In the families examined, % 25.7 of the amount of fish consumed consisted of fish produced by fish farming. While 32.3% of families who consume fish in the province of Antalya consumed them on weekends, 17.2% of them consumed fish on weekdays. The percentage of those who say it does not matter whether they consume fish during the week or weekend was 50.5%.

When the relation of monthly fish consumption rate level with education of the household was considered, the proportion of the families in the highest education group was 45.9%. While this rate is 36.6% in middle education group, it is 16.0% in the primary education group and 1.4% in the illiterate group. According to these results there is a direct positive relationship between level of education and fish consumption.

Opinions of families about fish consumption were also examined. Within those who attended the research and held positive opinions about fish consumption, 33.2% underlined that price compliance was important, 51.8% stressed that nutritional value was very important, 40.2% said that taste and flavour were very important and 56.4% underlined that fish was very important because of its quality of being a healthy food product. Accordingly, when families' reasons for consuming fish were ranked, healthiness of fish was in the first rank, its high nutritional value was in the second, taste and flavour in the third. Therefore, for those having a positive opinion on fish consumption, fish prices ranked as the fourth important reason.

Within those who attended the research and held negative opinions about fish consumption, 35.7% underlined that the adverse effect of expensiveness of fish on consumption was extremely important, 41.7% stressed that changes in taste and flavour was important, 31.3% said that the difficulty of cooking fish was very important, 32.1% underlined that the fact that it was not very much used in other meals was very important, 32.1% said that the absence of habit of eating fish was very important and 51% stressed that dirt-oil-smell formation in the kitchen was extremely important. Accordingly, when families' reasons for not consuming fish were ranked, dirt-oil-smell formation in the kitchen was in the first rank, the fact that fish was not favourable to their taste was in the second, the fact that it was not very much used in other meals in the third (while red and white meats are used in many kind of meals, fish meat is eaten alone) and the height of prices was in the fourth.

When the relationship between educational status of families who consume fish and the place they purchase fish was examined, it has been identified that families with low levels of education buy fish mostly from neighbourhood market places. Families with higher levels of education are more likely to buy fish from supermarkets.

The opinions of families surveyed about conditions which would increase their fish consumption in the future. According to their percentages, 38.5% of them said an increase in income, 24.5% said dietary habits, presentation as ready meal and diversification of processed products according to consumer tastes, 21.2% occurrence of health problems, 15.9% in case of an increase in the prices of other types of meat. Among surveyed families, 15.9% stated that fish consumption would decrease in the future, 38.5% of them told that it would increase and 45.7% of them said it would not change. This shows that in Antalya fish consumption will increase in the future but that this increase will be gradual.

When asked to research within the scope of family if conditions occur which will increase your consumption of fish in the future? 38.5% increase in income, 24.5% of dietary habits and presentations in ready meals and processed products according to consumer tastes diversify, 21.2% of the occurrence of health problems, 15.9% are in the case of the high prices of other meat would increase fish consumption stated. 15.9% the surveyed families stated fish consumption will decrease in the future, 38.5% would increase, and 45.7% will not change.

Conclusion

In the study, it was aimed to determine socio-economic factors affecting fish consumption habits and consumer preferences of families, living in urban areas of Antalya province, one of the important cities of Turkey in terms of education, tourism, agriculture and fisheries.

Demand for fish is rising owing to the growing population and the changing feeding habits among Turkish people. The research concluded that fish consumption is directly proportional to family income status and level of education and that the most important factors affecting the consumption of fish are due to the fact that fish is a healthy and delicious food, high in nutritional value. The factors that negatively affect fish consumption are respectively dirt and smell that occur during cooking, lack of taste, that a few different types of meal can be made and expensiveness. It has been identified that High-income and cultured families preferred markets and fisherman shops for buying fish while low-income families preferred local street markets.

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Strengthening of Local Identity Through Evaluation of Traditional Regional Products

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Abstract

Production in rural area should be cost-effective, ecologically eligible, socially fair and technologically up to date. Traditional products are part of general strategy of sustainable development considering their possibility to revitalize and develop rural area, strengthening entrepreneurship and entrepreneurs networking as well as creating advantageous environment via higher incomes and creating local, regional, national and international partnerships. Very important for preparing such products for market is identification of factors affecting consumers' attitudes and preferences. Researching and evaluating of ideas for traditional products is conducted via two groups of criteria concerning commercialization potential and usefulness for rural area. Commercialization potential is evaluated through following criteria: product's originality, quality, natural conditions for production, production experience and competence, experience and knowledge in production organization and sale as well as existing production. Criteria for rural area usefulness evaluated were: employment of rural farms, preserving environment, economic cost effectiveness, time needed for starting production and sales and creating image of production area. Increasing of production amount and services of traditional products is possible by means of entrepreneurship marketing and targeting market segments. Model of evaluation and encouraging of traditional production plus adjusting law regulations and standardization can help in further development of traditional products on agricultural households and increasing competitiveness of total Croatian agriculture.

Keywords: Traditional products, local identity, evaluation model

Introduction

Redefining the role of agriculture as the oldest economic activity, with the evaluation of rural resources, in contemporary conditions of management is an inevitable process that will enable its further development in relieving disrupted ecological capital. In fact, agriculture has always been multi-functional, since it tended to social welfare and cohesion, ecology, landscape and water management. However, modernization processes that influenced the modernization of agriculture were reflected in the destruction of the ecological sustainability of agriculture. Moreover, rural areas are changing from "productive" to the "consumer" areas (Potter and Tilzey, 2005), by reducing use of human capital and rural poverty. In addition, the modernization process of agriculture is faced with other limitations such as market restrictions for high direct payments that have affected EU countries to become net exporters of food, as well as unfair competition, and there are social limitations in which farmers become victims of isolation and a reduction of income with increasing financial risk.

The development and the entry of new, non-agricultural activities in rural areas are often not planned processes, but a consequence of the impossibility of existence of dealing with primary sector activities. Processes of deruralization, industrialization, urbanization are present at certain stages of development and were extremely selective and had negative impact on the development of Croatian villages. Agriculture and/or agriculture with some other additional activities, future perspective primarily sees in farms which are exclusively related to agricultural income. (Sudarić, 2009.).

Production of traditional products in Osijek-Baranya County is mainly concentrated on small farms. However, the amount of product they offer is small and generally of variable quality. Therefore, one of the priorities of the Osijek-Baranya County, where agriculture is the dominant, and often the only population activity is increasing commercialization of traditional products from farms. Traditional products to customers mainly come through direct marketing and sales as "no name" which is why manufacturers as a rule obtain less value than potentially possible.

Protection of traditional products gets more importance, which is looking to achieve greater economic, social and environmental effects. The essence of the activity consists in the fact that the products get greater potential for commercialization with simultaneous benefits for the rural area in which the production is performed.

Material and Methods

The survey was conducted in Osijek-Baranya County in spring 2012. The study was conducted on a sample of 500 randomly chosen respondents. The questionnaire was consisted of questions related to: quality rating of the most important East Croatia traditional products, supply satisfaction. Statistical analyses for this paper were generated using Enterprise Guide 5.1. of the SAS System for Windows (Copyright© 2012 by SAS Institute Inc., Cary, NC, USD, All Rights Reserved). Nominal scale data were analyzed by two sample chi-square test. Chi-square test was used to determine whether observed distribution of frequencies is different from expected frequencies or frequencies that would appear by chance. Lickert scale data were analyzed using one-way analysis of variance (ANOVA) as well as Tukey HSD and Mann-Withney test. The paper objective: to obtain information on the perception of the market value and importance of traditional products for rural development.

Results with Discussion

Production in rural areas should be profitable, environmentally responsible, social and technologically modern. Traditional products fit into the overall strategy of sustainable development, considering that they provide rehabilitation and development of rural areas, systematic entrepreneurship and entrepreneurial networking by creating a more favorable environment and increasing income and the creation of local, regional, national and international partnerships. The specifics of climate, cultural heritage and tradition unite of a traditional product allows them their uniqueness and diversity compared to other food products in the same category. Traditional agriculture is based on an authentic way of land, autochthonous plant varieties and breeds of farm animals, a lot more human labor, minimal use of chemicals, domestic seed and planting material, the use of traditional methods of processing and use of natural herbs and supplements in the process of processing primary agricultural products.

The Osijek-Baranya County, where the research was conducted, and the east part of Croatia generally is known as Croatian granary where agriculture and food processing industry take the most prominent position in economy. Eastern Croatia has many traditional food products, but the most important are traditional food products (TFP) made from smoked pig meat (kulen, smoked Slavonian ham, sausages, smoked baken, greaves, svargl), Slavonia brandy-rakija, cottage cheese and honey. Many households in this region produce these products by themselves. Cottage cheese and honey are exception. East Croatia is not famous within regional framework for milk and cattle-meat industry. In research participated the similar number of male (53,6%) and female respondents (46,4%) with prevailing number of respondents with high school diploma and lower (65,6) while participants with higher education (college 23,4 and university degree 10,6%) participated less. The average family size was 3,85 members. 65,4 % of respondent were from urban areas. The average family income was approximately 900 €.

Economies that have income from other sources do not show a willingness to engage in agriculture or investing in a business related to farming. The available resources of small rural holdings are modest in scope, inadequate in structure, and thus insufficiently attractive for investment. The study of key socio-economic indicators of rural economies in terms of improving possibilities of their economic performance towards the diversification of the rural economy pointed out that the rural farms low-evaluate the importance of the workforce as a resource and do not recognize the additional skills and abilities of its members.

According to the survey results we received the information about consumers' opinion regarding: TFP supply, quality of traditional East Croatia products, purchase frequency of selected TFP (demand) and consumers' willingness to pay higher price for TFP. When we calculated supply results, the highest rank we give to the products with insufficient supply (1=oversupply, 2=sufficient supply, 3=insufficient supply) because it means there is room for production increase for TFP producers. According to that, supply of rakija and sausages is too high, and that's the reason for the lowest ranks. Supply of these products is statistically significantly different from kulen, svargl and greaves, the products with the lowest supply and the highest marks for production increase (Figure 1).
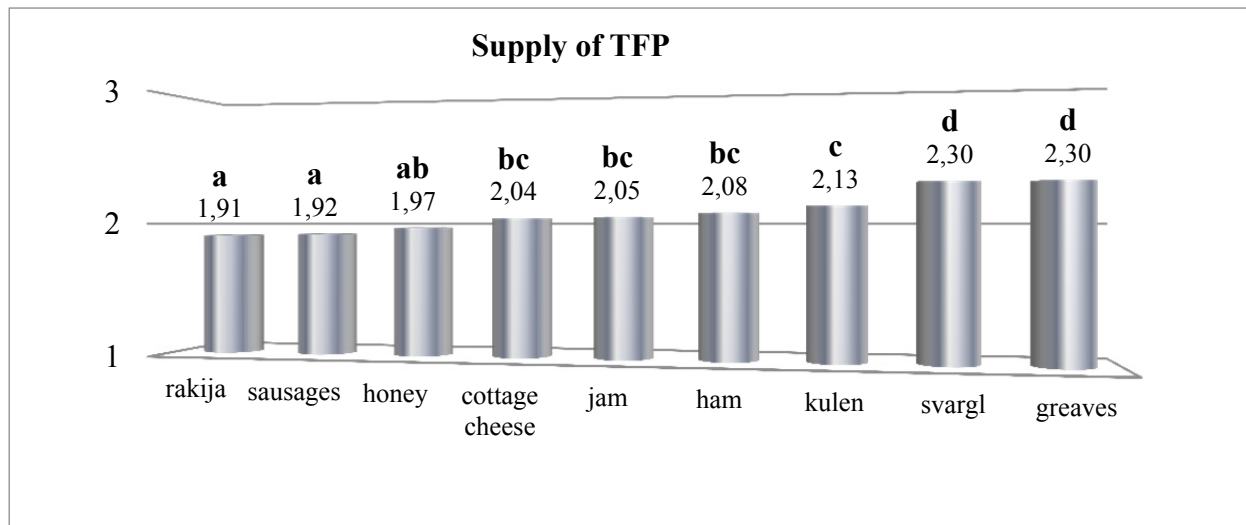
Figure 1. Supply of traditional food products (1=oversupply, 2=sufficient supply, 3=insufficient supply).

When asked about the quality, respondents rated kulen, ham, cottage cheese and sausages the best (the average marks were 4,58, 4,44, 4.29 and 4.27 respectively on 1-5 Likert scale), unlike the svargl and greaves, rated with the lowest marks (3,14 and 3,76). Differences between those products are statistically significant (Figure 2).
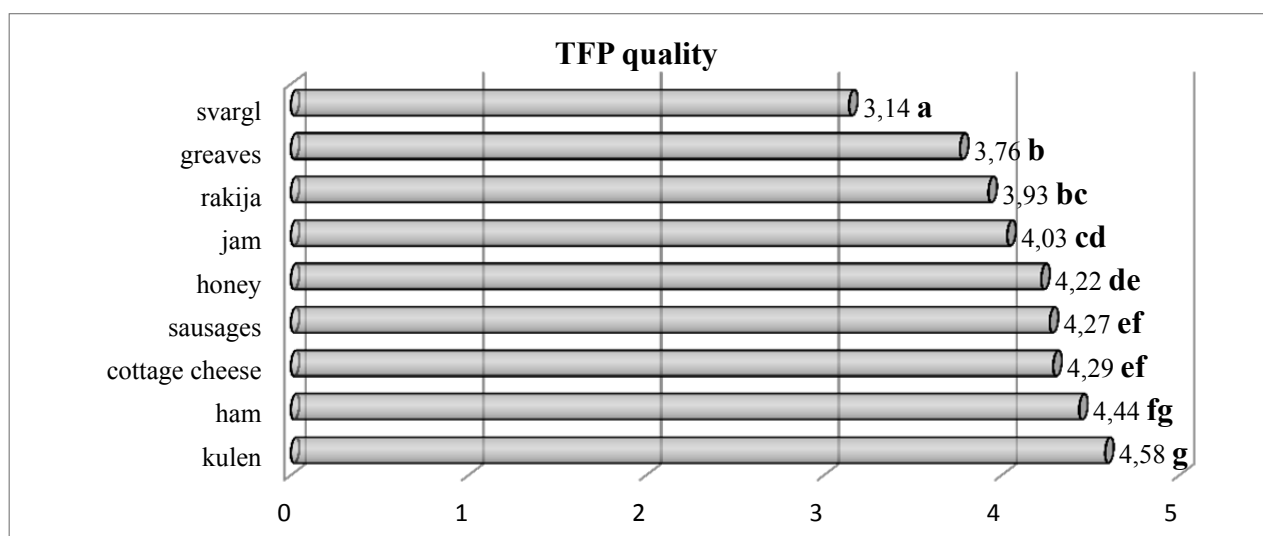
Figure 2. Quality of traditional food products according to consumers' opinion (Likert scale 1-5 (1=lowest rating, 5=highest rating).

The production structure on farms indicates that the most respondents are based on agricultural and livestock production (grade 3). Processing on the farm was rated as the most important productive activity of farms (grade 4), which is based on the processing and diversification of livestock and crop production. On the basis of the weighted average rating and their derived by summing the total sum of points of individual products are derived. Ranking of products according to the number of points and criteria for potential commercialization selected the five most important traditional products, which are then evaluated according to the criteria of usefulness for rural space.

Table 1 Dynamics and synergy of traditional products in the rural areas development

Traditional products	Characteristics and criteria	
	The benefit for the rural area	The potential for commercialization
Kulen and sausages	5,28	5,15
Rakija	4,74	4,96
Honey products	4,96	5,17
Cottage cheese	5,38	5,12
Homemade jam	5,24	4,38

Analysis of the results of the evaluated products showed that these five products have great originality in Osijek-Baranya County and have usefulness for rural space as well as great potential for commercialization. Kulen, sausages and honey products have the greatest potential for commercialization, while local cheese and homemade jam have the greatest utility for the rural area. Preservation and improvement of traditional production on the one hand, and lack of entrepreneurial and a management potential among the local population on the other hand, imposes the need for further investment on the empowerment of marketing in terms of the market brand products development, planning, promotion and supervision of traditional production, the organization's own sales network for products, product marketing, promotion and sales of tourist services.

Conclusion

The structure of rural areas and rural farming households makes one more or less significant part of which is tightly linked to other economic activities, social and natural environment. Until now, most attention was focused on agricultural issues, and not on the totality of rural areas, which need to be changed. Strategic framework of agricultural policy is a respond to the need of improving the situation in the sector, in order to properly deal with the challenges and difficulties. Through diversification of rural economic activities, farmers and other rural population in recent years are trying to secure additional sources of income. In order to improve the quantity of product and service offerings of traditional products it is necessary to adjust the entrepreneurial marketing target market segment. With the improvement of product quality and service of agricultural households it is necessary to build models to encourage traditional production, adapt legislation and introduce standardization which would contribute to the further development of traditional products in rural households and thus increase the overall competitiveness of Croatian agriculture.

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Performance of Beef Cattle Grown on an Artificial Pasture Over Two Consecutive Years under the Mediterranean Conditions

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Abstract

It was aimed to determine the performance of Holstein breed beef animals grown on an artificially established pastures over two consecutive years (2011 and 2012) under the Mediterranean climate conditions. For this purpose, 20 Holstein breed beef cattle with an average of 6 months old were assigned equally to two grazing paddocks established as a 3 ha-artificial pastures. Pasture 1 (P1) was composed of *Medicago sativa* L. (20%) + *Bromus inermis* L. (40%) + *Agropyron cristatum* L. (30%) + *Poterium sanguisorba* (10%); and Pasture 2 (P2) had mixtures of *Medicago sativa* L. (15%) + *Onobrychis sativa* Lam. (15%) + *Agropyron cristatum* L. (35%) + *Bromus inermis* L. (35%), respectively. The first year experiment lasted for 90 and the following year 70 days.

The results showed that there were no effects of the years and the pasture types on the performance of the animals. The total weight gains of the animals were 98 and 88.5 kg at the end of the first year grazing and the second year respectively. Daily liveweight gains (DLWG) of the animals were as follows: 1.089 v. 0.983 kg, respectively. Similarly, the total weight gains of the animals grazed on P1 and P2 were 95 and 91 kg respectively. DLWGs were 1.058 and 1.013 kg for P1 and P2 respectively. Consequently, both type of artificial pastures can be recommended for beef cattle production in the region.

Keywords: Holstein, artificial pasture, performance, beef production

Introduction

The most important problem of raising livestock is the shortage of feed stuff and in fact only one-third of needed forage can be supplied in Turkey. Supplementary feed is required to compensate feeding animals for pasture deficiencies. One solution for the lack of roughage is to establish artificial pastures. Artificial pasture establishment has increased in recent years in Turkey. The commonly used species in establishing artificial pasture in Turkey is crested wheatgrass, smooth bromegrass and alfalfa (Acar et al., 2011). Flora, stage of maturity, soil composition, climate, altitude and other managerial factors affect the physical and chemical properties of grassland (Church, 1991; Holmes, 1994; McDonald et al., 1995).

In general, all forages are highly succulent and palatable in early growth. The objectives of this study were to examine the pastures artificially established in the Mediterranean region in terms of stage of maturity, quality, yield and botanical composition.

Beef production constitutes an important sector of the agricultural industry of many countries. The type of beef industry which develops in any country depends largely on climatic conditions and land types (Allen and Kilkenny, 1984).

Beef production systems have changed substantially towards more planned beef production systems even in developing countries. The main reason for the change is that the older systems became too demanding in their requirements for land and labour to be economically viable. This has led to intensification, coupled with an increase in the scale of production, or alternatively, to the keeping of the original number of animals in a smaller area, which allows more land to be used for other farming enterprises (Field, 2006).

Therefore, the objective of this study was to determine the performance of Holstein breed beef animals grown on an artificially established pastures over two consecutive years under the Mediterranean climate conditions.

Materials and Methods

Experimental location

This study was carried out in Isparta Province (37°45′N, 30°33′E, elevation 1035 m) located in the Mediterranean region of Turkey on two consecutive years of 2011 and 2012. Total precipitation as a long-term average for both years was 450 mm. Average temperature was 12.1 ºC for both years.

Animals and pasture management

The experiment was set up at Suleyman Demirel University Research Farm and lasted for 90 and 70 days for the years 2011 and 2012 respectively and involved a total of 40 Holstein beef cattle with an average 6 months old and each year 20 Holstein beef animals were used in this experiment with an initial weight of 184 and 232 kg for the first and the second year experiments respectively.

Animals were initially weighed at the beginning of the experiments and were randomly divided according to their weights into two grazing groups. Each group was weighed and monitored on a fortnightly basis, using electronic weighing scale (True-Test2000 SmartUnit). The free access of the animals to water was available throughout the experimental period.

For the establishment of artificial grazing land, 3 ha pasture land was chosen adjacent to the university farm and cultivated in March 2010 with two different botanical compositions. Pasture 1 (P1) was composed of Medicago sativa L. (20%) + Bromus inermis L. (40%) + Agropyron cristatum L. (30%) + Poterium sanguisorba (10%); and Pasture 2 (P2) had mixtures of Medicago sativa L. (15%) + Onobrychis sativa Lam. (15%) + Agropyron cristatum L. (35%) + Bromus inermis L. (35%), respectively.

In order to monitor chemical composition changes in pastures, grass samples were collected by using 1m^2 quadrats fortnightly from May to August each year. The fresh biomass yield, dry matter (DM) yield, crude protein (CP), acid detergent fibre (ADF) and neutral detergent fibre (NDF) contents were determined as well.

Statistical analysis

General Linear Model (GLM) procedure was used for the statistical analysis of the data by using Minitab.16 statistical software programme and initial weight and age were taken as covariates to eliminate the weight and age differences at the start of the experiment.

$$Y_{ijk} = \mu + \alpha_i + \beta_j + \varepsilon_{ijk}$$

where *Yijk* is the *ijk* th observation of animal weight,

μ is the overall mean,

αi is the effect of treatments,

ßj is the effect of initial weight and,

εijk is the residual effect or random error associated with the individual animal

Results

The least-squares means and standard errors for liveweights for treatment groups are shown in Table 1.

Table 1. Overall performance comparisons of animals by years and pasture types*

Years	N	IW (kg)	s.e.	FW (kg)	s.e.	TWG (kg)	s.e.	DLWG (kg)	s.e.
2011	20	184	6.20	282	7. 40	98^a	2.43	1.089 ^{a}	0.027
2012	20	232	13.0	322	11.0	90^a	4.56	0.983 ^{a}	0.051
Pastures									
P1	20	206	10.8	301	10.1	95^a	4.08	1.059 ^{a}	0.045
P2	20	212	12.3	303	10.7	91^a	3.48	1.014 ^{a}	0.039

IW= Initial weight, FW= Final weight, TWG= Total weight gain, DLWG= Daily liveweight gain

* The means with the same superscripts presented in the table are not statistically significant (P >0.05).

As it is presented in Table 1, final weights of the animals in the years 2011 and 2012 were 282 and 322 kg; the average total weight gains 98 and 90 kg and finally daily liveweight gains of 1.089 and 0.983 kg respectively. Similarly, in respect to performance of animals in pasture types, the final weights were 103 and 303 kg for P1 and P2 respectively. The average total weight gains 95 and 91 kg and finally daily liveweight gains of 1.059 and 1.014 kg respectively.

There were no significant (P >0.05) differences between years and pasture types in FW, TWG and DLWG. However, the animals in 2011 and in P1 tended to perform better than the cattle in 2012 and in P2 in all parameters observed. There were also no statistical differences in chemical compositions of grasses in both pastures.

Discussion and Conclusion

In literature, there are no many published studies on performance of different breeds and comparison on different beef production systems in the Mediterranean conditions. However, Bozkurt (2007 and 2012) reported about the superior performance of Holstein cattle compared to other some local and European breed cattle and concluded that under the Mediterranean conditions Holstein cattle were better suited to the feedlot beef systems than other local and some European type cattle.

The results showed that there were no effects of the years and the pasture types on the performance of the animals. Keane et al. (1989) and Keane and More O'Ferrall (1992) reported some results on breed comparisons indicating that differences in factors such as production systems, slaughter weights and climate conditions are of great importance. Similarly, it was stated that breeds and crosses of beef cattle show distinctive differences in performance in different production systems (Bozkurt and Ap Dewi, 1996). Performance potential vary greatly between different breeds of cattle and different production systems. While there are certainly differences between performance of animals in growth rate, the liveweight gain which can be achieved from a given area of grass or quantity of feed is similar for most breeds of animals, provided that animal is fed and managed according to its own particular requirements in its own environment (Wilkinson, 1985).

The results of these comparisons, including those reported in literature are not necessarily applicable outside the countries where such experiments were carried out due to the differences in factors such as production systems, slaughter weights and climate, etc.

Consequently, since there were no differences in performance of animals and chemical composition of pastures between years, both type of artificial pastures can be recommended for farmers for beef cattle production in the Mediterranean conditions.

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Laying Hen Behaviour and Welfare in Housing Systems

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Abstract

Poultry behaviour is a reflex of their welfare status at a particular moment, and it is related to genetic, physiological and environmental factors. Considering layer behavioural needs in the design of housing facilities optimize their welfare. Laying hen housing systems must provide feed, water, light, air quality, space and sanitation that promote good health and welfare for the hens. There are a lot of different housing systems for layers. But most models are cages, enriched/furnished cages, outdoor housing systems use and more under development. All housing systems should provide for expression of important natural behaviours, protect the hens from disease, injury and predation, and promote food safety. But commercially housed hens in both cage and colony systems; cages can provide a highly controllable environment that protects hens from a range of health and injury problems; however, they afford limited space and behavioural enrichments and also frequently show behaviours that are not observed in wild or feral chickens. The enriched/furnished housing systems provide a wider range of behavioural opportunities, while conserving many of the advantages of a conventional cage. The outdoors systems provided hens are able to perform the broadest range of naturalistic behaviours, but they may also be exposed to climatic extremes, toxins and disease. The aim of this review is to discuss behaviour of laying hens that are reared in different housing systems. Laying hens have an innate behavioural rhythm for certain behaviours such as; feeding, drinking, foraging, scratching, nesting or perching. Therefore the opportunity to perform these behaviours at the right time may be an important for animal health. Feather pecking, cannibalism, dust bathing, locomotion activities, and aggressive behaviours are also the most frequently observed in layers and therefore, monitoring their incidence may contribute to measure poultry welfare.

Keywords: Egg layer, behaviour, housing systems, abnormal behaviour

Introduction

The ethology is an important science area for the understanding the animals and their behaviours. Birds especially poultry shows very complex behaviours and the producers might be familiar this behavioural norms of chicken to distinguishe normal and abnormal situation of their chickens. Most of researchers associate the general concept of stress to animal welfare. Maintaining birds in good health is essential for their welfare and important for production more (Beloretchkov, 2010). All animals under stress conditions show different behaviour than usual. Social stresses changes behaviours and especially number of hen affect from stress may influence production performance (Scanes *et al.,* 2004).

Laying hens have certain normal behaviours such as; feeding, drinking, sleeping, laying, foraging, scratching, nesting or perching. The abnormal behaviours such as; feather pecking, cannibalism, and aggressive behaviours are also the most frequently observed in layers. Therefore, monitoring incidence of abnormal behaviours may contribute to poultry welfare. The aim of this review is to discuss behaviour of laying hens that are reared in different housing systems.

Housing Systems and Behaviour – Welfare

Because of the importance attached to animal welfare in recent years various production systems for laying hens have been developed. A lot of different production systems are currently available for egg production, including conventional and enriched (furnished) cages, alternatives systems such as aviaries, percheries, deep litter, and free range (outdoor) systems. Welfare can be satisfactory in each of these systems, if they are well designed and managed. However production costs are lowest in cages and highest on free range (Elson, 2004). The purpose of all system is to ensure the welfare of chickens and their needs.

Feeding, drinking and sleeping are life sustained behaviours in poultry. The nest provides a place for the hen to lay its egg. If there is not any nest in housing system hens may show vacuum nest building and stereotyped pacing (Faure and Jones, 2004). The foraging is a behaviour that depends on opportunity therefore free ranged chickens may spend about half their time for foraging (Scanes et al. 2004). Chickens show resting and lying behaviour mostly at noon which the light intensity is very high. After that they show dust bathing behaviour (Fölsch ve Hoffman, 1995). Dust bathing is a comfort behaviour in which hens work dust or other loose material into the feathers, where it helps to remove oily secretions and control parasites (Faure and Jones, 2004). Preening - feather maintenance is a comfort behaviour in which hens fixes their feathers with their beak and claw also lubrications to feathers. Feathers have an important role for the body temperature regulation, protection from environmental and seasonal changes, safe flight and searching food in poultry. Mutual feather maintenance and mixing behaviour very common in cage mates, but this is different than feather pull or pecking behaviour (Scanes et al. 2004).

Abnormal behaviours can provide a way to identify welfare problems. When a number of strange hens are placed together in a pen, fights or threatening occurs to establish a dominance order or peck order and this might lead to cannibalism. Chickens confined to small cages in laying batteries will develop stereotyped head movements (Scanes et al. 2004). Mild fear creating unrest in animals but severe fear causes harmful effects on animals. If animals feel intense fear; escape, stay still or resist behaviours can occur. That causes huge economic losses in intensive production systems (Elrom, 2001). Tonic immobility is a best way to test the level of fear level of animals. If tonic immobility duration of hen is long this hens are taken into consideration as timid and cowardly (Jones 1986). Egg eating is a behavioural disorder that can be easily spread within the flock. Especially hens firstly eat her egg and the others. It mostly depends on lack of nutrient and grit, but high cracked egg rate is also effects the occurrence of this behaviour (Tauson, 2002).

If housing system provides adequate space to hen and access to diverse resources, they candisplay normal or natural behaviours which are origin of the ancestral behaviour patterns exhibited (Lay et al., 2011).

The conventional cage systems are traditionally used cage systems. This cage have an significant advantages to the producer in controlling behavior (Appleby, 1998).The plumage damage and reduction on thermoregulatory capacity generally observed depending on the number of hen in per cage unit (Hughes and Black 1976). The beak trimming is applied to the feather pecking and cannibalism is much less common (Craig and Muir 1996). And also number of broken and dirty egg is lower than other systems (Hidalgo *et al.*, 2008). Hens in a small cage will work to expand their cage size because they prefer more space to perform certain behaviour (Cooper and Albentosa 2003). In these systems hens could not show their natural behaviour they are exposed to intense fear and stress. This system has not provided natural facilities such as; roosting (perching), foraging, dust bathing, nesting, wing flapping, flying, escaping from aggressive chickens, hens spent most of their time on feeding, standing, sleeping and in comfort behaviours (Castellini et al. 2006). If hens are moved from conventional cages to a large space after several weeks rebound of wing flapping, tail wagging and stretching occurs (Nicol 1987). Johnson et al. (1998) reported that caged birds spent more time eating compared to aviary birds.

The enriched furnished cages are the systems that provide horizontal space for locomotion and comfort behaviours but limit the behaviours such as wing flapping, jumping, running and flying. These systems are formed by addition to conventional cages perch, nest, claw rasp, scratching area and nearly number of 40 to 80 can be reared in one cage unit (Appleby et al. 2002). In these systems hens are easily move and escape from dominant or aggressive individuals and also can do wing stretching. But there are many disadvantages of these systems, such as feather pecking, cannibalism, could not able to detect sick animal, increased number of cracked and dirty egg. And also some of hen might choose laying on open area other than the

nest, this might trigger cloacal cannibalism (Newberry 2004). Installation of perches in cages improves bone strength (Tactacan et al. 2009) but landing failures when jumping between perches in extensive systems may contribute to breaks (Gregory et al. 1990). High use of perches can also lead to keel bone deformities (Vits et al. 2005).

The outdoor housing systems are the systems currently becoming increasingly popular. This housing system has a potentially favourable effect on layer welfare. Because it ensure them to perform natural patterns of behaviour such as locomotory, body maintenance and exploratory behaviour and opportunity to high sized flock rearing (Mahboub et al. 2004; Leone and Estevez 2008). These systems contains closed house that contained perch, nest, feeder, drinker and open are that contain especially forage. These systems provide a comfortable environment for laying hens and they can enjoy comfort behaviours, head shaking, head scratching, ruffling, trail wagging, wing flapping, wing and leg stretching, ground scratching, dust bathing and also running, foraging, discovery, more freely than in cage systems (Tumova and Ebeid, 2003). But in these systems greatest probably that may occur is injurious pecking which can lead to body wounds, cannibalism and, sometimes severe mortality (Elson, 2004). Depend on flock size cannibalism might be spread quickly in flock by learning (Cloutier et al. 2002). The number of dirty egg and egg eating is higher than other systems depend on laying on open place instead of into the nest (Hidalgo *et al.*, 2008). The leg health of hens may reduce the food pad dermatitis and bumble food depends on wet litter (Vits et al., 2005). The plumage conditions of hens are better than the cage systems (Castellini et al. 2006).

Conclusion

In 1965 Brambell (1965) establishing a committee for the protection of animals has released a report containing regulations. In this report, animal production systems should allow at least five main freedoms such as rotate around themselves, grooming, stand up, lie down and stretch the arms and legs. The first legal regulation for farm animals was made for the first time for laying hens. In 1986, the minimum standards for the protection of laying hens in the European dimension that defines the regulations came into force (88/166/EEC). Today egg production is derived from caged hens. However, there is an increasing awareness in many countries ability to fully express the full range of their normal behaviour patterns. This has led to increasing public concern in some areas about the continued use of cages in their present form (Elson, 2004). Recently welfare movements and organisations have tried to force egg producers to abandon battery cage systems, placing humane attitude to animals and their wellbeing in the foreground (Lukanov and Alexieva, 2013). All housing systems offer some advantages and disadvantages but the disadvantages are not always minimized. However conventional cages are less likely than other systems to provide freedom of movement, freedom from fear, comfort and shelter, suitable flooring and freedom to display most normal patterns of behaviour (Tumova and Ebeid, 2003, Appleby et al. 2004). But unfortunately banning cages might not give an overall improvement in bird welfare.

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Egg Handling and Incubation Conditions Affect Hatching Success and Survival of Chicks in Ostrich (Struthio camelus domesticus)

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Abstract

In ostrich (Struthio camelus domesticus) industry, the high rate of embryonic mortality during artificial incubation and the low hatchability of ostrich eggs are recognized as major concerns worldwide. Some important factors that cause a reduction in the hatchability in ostrich are failures in egg collection, cleaning and storage conditions during pre-incubation period and insufficient incubation conditions, especially in the way of temperature and humidity. During incubation, insufficient egg weight loss results in high rate of embryonic mortality due to edema and malposition. As well as, these failures in egg handling and incubation conditions also result in poor quality of chick and early term chick mortalities due to edema, anasarca, unabsorbed yolk sac, unhealed navel, omphalitis, leg problems. In that respect, knowing the egg characteristics and physiological requirements of developing embryos is crucial for obtaining optimum hatchability and producing maximum number of healthy hatchling. It is essential for successful and profitable breeding. In this study, it is aimed to discuss the egg handling and incubation conditions and the possible effects of these practices on the hatching success and survival of chicks in ostrich.

Keywords: Ostrich, handling, incubation condition, hatchability, chick quality

Introduction

Ostriches (*Struthio camelus domesticus*) are an important commercial species for its leather, meat and feathers in the World, especially South Africa, Namibia, Zimbabwe and Israel with interest growing in farming the bird in the USA, Australia, Europe (Swart et al., 1987). In ostrich industry, there are some problems that affect negatively profitability of producers due to lower hatchability resulting from infertile eggs and embryonic mortality or post-hatch hatchling health such as navel problems, yolk sac infections and leg deformity (Hastings and Farrell, 1994).

The hatchability of fertile ostrich eggs is lower compared to the other avian species and it ranges from less than 30% to nearly 60% (Van Schalkwyk et al 1996). Low hatchability is a result of bad management practices (Cooper, 1999). Hatchability in Australia, South Africa and England is reported to be less than or about 50 % (Philbey et al., 1991). In this respect, there are some affecting factors for successful incubation results and maximum hatchling quality (İpek ve Şahan, 2004). These factors are grouped as breeders status such as breeders age, mating rate, breeders nutrition, egg quality (Badley, 1997); pre-incubation factors such as egg collection, fumigation, storage (Badley, 1997) and incubation variables such as incubator temperature and humidity settings (Foggin and Honywill, 1992). In the review, egg handling practices before incubation and incubation conditions that affect hatching success and survival of chicks in ostriches are explained.

Egg Handling

Egg handling practices include egg collection, cleaning, storage and sterilization of storage and incubator rooms. Firstly, eggs should be collected in 10-15 minutes after laying, thus the cuticle layer dry until collection time. It has an important role in preventing microbial contamination of eggs (Cooper, 2001). It is known that microbial contamination causes embryonic mortalities especially midterm embryonic mortalities. As well, Brand et al. (2007) concluded that contamination have an important role in embryonic mortalities, it was found that 130 eggs of 37 740 fertile eggs (approximately 3.45%) were classified as contaminated in their study. The bacterial contamination is commonly caused by *E. coli* (Dzoma and Dorrestein, 2001) and *Bacillus spp*.(Jahantigh, 2010).

After collection process, the eggs should be carefully cleaned by a clean and dry towel to remove its fecal matter or dirt. If the eggs are very dirty, it could be used commercial egg sanitizer or fumigants (disinfectant contains potassium peroxymonosulfate, sodium dodecylbenzenesulfonate and sulfamic acid; mixture of potassium permanganate and formalin etc.) could be used for cleaning of eggs (Huchzermeyer, 1996). If egg cleaning is performed poorly, incidence of bacterial contaminations especially caused by *E. coli, Aeromonas spp., Enterobacter spp., Penicillium spp., Fusarium spp.*, could increase and it causes of increasing of embryonic death and yolk sac infections (Foggin and Honywill, 1992).

Ostrich eggs are normally stored for up to seven days before being artificially incubated (Şahan et al., 2003). Egg storage conditions can influence hatchability so that storage conditions should be provided sufficiently to prevent embryonic development during this period and to avoid moisture loss. The optimum temperature is between 15 and 20 °C and relative humidity ise between 75 and 80% during storage (Anonymous, 2008). Şahan et al. (2003) studied out the effects of different storage temperatures as 16°C, 21°C and 25°C on the embryonic mortalities. They found that as the storage temperature increased, the rate of embryonic mortalitites (total of early, mid, late) increased (28.6% in 16°C; 32.0% in 21°C; 42.9% in 25°C). Besides storage conditions, storage time also affects the hatchability of ostrich eggs (Wilson et al. 1997). Deeming and Ar (1999) recommended that storage temperature should be lowered as storage time was extended for the best incubation results. Şahan et al. (2004) concluded that maximum hatchability was obtained when eggs were stored up to 7 day before incubation in their study. In their study, storage length also affected the hatchability of fertile eggs, early and late term embryonic mortalities, weight loss, incubation length and chick weight. It was observed a decline in hatchability, increase of embryonic mortalities, longer incubation period and decline in chick weight.

Incubation conditions

During artificial incubation of ostrich eggs, there are incubation variables that have to be provided to obtain optimum embryo development and therefore best hatchability and chick quality. Incubation conditions are incubation temperature, humidity, turning and ventilation (Cooper, 2001). Failures in incubation conditions results in high rate of embryonic mortalities originating from edema and malpositions or newly-hatched chick mortalities originating from unabsorbed yolk sac (Philbey et al., 1991).

Temperature is a very important factor that affects embryo development, incubation results (Deeming and Ferguson, 1991), and also post hatch performance (Wilson, 1991). The incubation temperature of ostrich eggs under natural conditions was determined as 36.0 °C (Swart et al., 1987). It was reported that embryo growth during incubation retards or the ratio of second quality chicks increased as the incubation temperature increased (Wilson, 1991). In a study, Ipek et al. (2003) investigated the effects of different incubation temperatures (36.0°C, 36.6°C, 37.2°C) on the incubation performance of ostrich eggs. They found the hatchability of fertile eggs and hatchability of total eggs and chick weight as the lowest value of 57.14%, 38.70% and 968.13 g, respectively in 37.2°C group. The total embryonic mortalities were also found the highest with a value of 42% in 37.2°C group. Besides these negative effects, it was also reported that an increase in eye abnormalities in chicks caused by high temperature application in the incubation of ostrich eggs (Stewart, 1996). The incubation period for ostriches changes between 40 and 44 days, but being 42 days under optimum conditions (Swart and Rahn, 1988). Ipek et al. (2003) found that the incubation length was 42.6 d in 36.0°C, 41.8 d in 36.6°C, 40.8 d in 37.2°C.

Second condition during incubation is relative humidity and it is important to ensure enough egg weight loss. Egg weight loss is needed for air space that is used by chick after internal pipping for lung respiration. To obtain good incubation results, from setting to external pipping stage, egg weight loss should be approximately 15% (Anonymous, 2008). Wilson et al. (1997)

concluded that egg weight loss on day 38 was approximately 13.2%, and the rate of chick weight at hatching to initial egg weight was 63.6%. Excessive water loss during incubation results in embryo dehydration (Meir et al.,1984) while insufficient water loss leads to oedema (Philbey et al.,1991). In this case, insufficient egg weight loss during incubation is a major cause of low hatchability (Gonzalez et al.,1999) and it affects chick hatching weight. Especially higher relative humidites (67-83%) leads to a decline in hatchability, occurring of anasarca in newly hatched chicks and increasing of early chick mortalities (Philbey et al., 1991).

The eggs should regularly be turned from setting to transfer stage so that the death originating from sticking of developing embryo to the eggshell could be inhibited and also ensuring a uniform temperature (Deeming,1991). The sticking of embryo to the shell causes dehydration and in death in the first days of incubation and it causes abnormal development, malpositions and chick mortality in the later stages (Deeming, 1989). It was reported that mortalities originating from malpositions is one of the predominant reasons in ostrich eggs. The malpositions usually results in pipped death (Philbey et al., 1991). The chicks that succeeded to hatch in this situation are weak, little, sticky-haired and generally classified as second quality. To minimize these problems, the eggs are turned to the right and to the left. The long axis of the eggs makes an angle of 45° with the vertical axis, then eggs become 45° inclined to the other side by turning 90° (Van Schalkwyk,1998). Also the turning frequency should be 24 times a day in automatically incubators (Wilson, 1991). Ipek et al. (2004) investigated the effects of frequency of turning (8 or 24 times daily) on incubation results and embryonic mortalities. They found that as the frequency of turning increased from 8 to 24, hatchability of fertile eggs and hatchability of total eggs showed an increase (65.7% and 44.2% in 8 times turning; 70.6% and 48.0% in 24 times turning groups, respectively). Late term mortalities were only found significantly higher in 8 times turning group (20.0%) than 24 times turning group (14.7%).

During incubation, developing embryos breathe, so they use oxygen in incubator, they give out carbon dioxide into incubator. Therefore, ventilation is necessary for supplying an adequate level of oxygen for embryos and exhausting carbon dioxide from incubator (Stewart, 1996). For successful results, oxygen concentrations are not allowed to fall below 20.5% and to not exceed of carbon dioxide level of 0.5%. The oxygen requirement of ostrich eggs is computed that oxygen consumption of 200 ostrich eggs at peak metabolism equates to 1000 chicken eggs (Stewart, 1996). To prevent cumulating of carbon dioxide and increasing of water vapor, an air flow with a value of 45L/h/egg is provided in incubator (Cooper, 2001).

To identify infertile or nonviable eggs, candling should be performed during incubation. After candling, these eggs are removed from incubator, therefore it prevents to increases of evaporative water vapor and contamination risk. The candling should be preferentially performed on day 14 and at transfer (Stewart, 1996).

The other critical points about incubation are hygiene of workings, cleaning and disinfection of incubators and rooms. During working times, workers have to be careful about their hand and disinfection to prevent contamination, so that they should use hand sanitizers and disinfectants (Cooper, 2000). Besides, incubators, trays, hatchers and hatching baskets have to be cleaned and disinfected between egg settings (Perelman and Kuttin, 1992). To ensure optimum incubation conditions, the maintenance of incubators has to be done routinely. Failure in hygiene and incubator conditions leads to microbial infections, so it affects negatively survival of the chicks.

Conclusion

Incubation is a wide process that includes pre-incubation factors and incubation conditions and affects hatchability success and post-hatch chick performance. Due to the hatchability of ostrich eggs is lower compared to the other avian species, incubation management has vital importance for efficiency and profitability of hatcheries and also producers.

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Analyses of the Milk Yield and Milk Composition of Different Genotypes Latvian Breed Goats

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Abstract

The most popular goat breed in Latvia country is Latvian breed goats (LVK). The purpose of the present research was to evaluate the effect of different LVK genotypes and also environmental factors on the goat milk yield, fat and protein contents. Milk productivity data from 959 first lactation LVK goats obtained in the period from Y2002 to Y2012 was used in this research. Using mathematical model for data analysis, it was determined that goat milk productivity was significantly influenced by LVK breed genotype, breed of bucks used in mating, herds in which goats were kept as well as interaction of named factors ($p < 0.05$; $p < 0.001$). Significantly highest milk yield was observed for goats whose genotype contains 50 – 75% of LVK breed blood and for goats originating from mating of local goats with German Noble (VBD) breed bucks ($p < 0.05$), while the highest fat and protein content was observed for mating with Thuringian (TIR) breed bucks. Average milk yield for LVK breed goats in first lactation was 495.9 kg with average fat content of 3.67% and protein content of 3.21%.

Keywords: Goats, milk yield, composition, breed

Introduction

The breeding of milk goats is one of livestock breeding branches in Latvia. As of January 1st 2014 there were 10647 goats in Latvia, of which sixty percent are Latvian goats (LVK), 15% Saanen goats (ZK), but rest 25% include Alpine (AK), German Noble (VBD) and Thuringian (TIR) goats. The milk recording was done for 1015 dairy goats in Latvia in 2013. The average milk yield in Latvia in Y2013 was 529 kg, the fat content 4.08%, the protein content 3.16%, but the average somatic cells count was 1140 thousand mL^{-1} (Goat milk recording, 2013).

LVK breed was developed at the end of 19th century by mating local goats with Russian and Megrel breed bucks. The most significant feature of LVK breed is its high reproduction capacity – fertility 300 – 350%, and kid rearing till the weaning age. Average live weight of an adult goat is 45 – 50 kg.

The selection of milk goats in Latvia was started at the beginning of 1990ties by mating LVK goats with ZK, AK, TOG, and VBD breed bucks. Therefore genotypes of LVK goats are diverse containing different amount of blood from named breeds.

The purpose of this research was to evaluate the effect of different genotypes and also environment on LVK breed goat milk yield, fat and protein content.

Material and Methods

The information from the Agricultural Data Centre was used in this research. It contained data on different genotype LVK breed goats, which were under monitoring and kidded in the period from Y2002 up to Y2012. The milk yield (kg), fat and protein content (%) in standard lactation (240 – 305 milking days) was analyzed.

The milk samples were analyzed in the accredited milk quality control laboratory according to the method of ISO 9622:1999 with device Milko-Skan 133 B. The milk yields in Latvia were recorded by the ICAR A4 method.

The milk yield was compared for goats in first lactation. In the analyzed period 959 goats have completed first lactation of which 42 were kept in small herds (SH) with 1 – 10 goats, 110 were kept in medium herds (MH) with 11 – 30 goats, while 807 were kept in large herds (LH) with more than 30 goats.

Depending on enhancing breed's blood content or LVK genotype 4 gradation classes were created: 1 – LVK blood up to 50% (n=369), 2 – LVK blood 50.0 up to 74. 99% (n=277), 3 – LVK blood 75.0 up to 93.74% (n=215), 4 – LVK blood more than 93.75% (purebred, n=98).

To determine the influence of mating breeds on LVK goats' milk yields, five gradation classes were created: ZK – Saanen breed bucks were used for mating (n=402), VBD – German Noble breed bucks (n=33), AK – Alpine breed bucks (n=85), TIR – Thuringian breed bucks (n=37), XX – buck crossbred from different breeds or unknown origin (n=304) and LVK – purebred.

The statistical data were processed using SPSS program package and Microsoft Excel for Windows. Data in tables and figures are presented as least square mean (LSM) $\pm$ standard error of means (SE). The following mathematical model was used:

$$y_{ijklm} = \mu + H_i + G_j + B_k + (H_i \times G_j) + (H_i \times B_k) + e_{ijk}$$

where

y_{ijk} – i-the trait of the animal milk productivity;
μ – the general mean;
H_i – the fixed factor herd (i= 1 – 3);
G_j – the fixed factor genotype (LVK blood)   (j=1– 4);
B_k – the fixed factor breed used for mating (k=1- 6);
e_{ijk} – random residual error.

Bonferroni test was used to determine the statistically significant differences. The differences were considered significant if $p < 0.05$.

Results and Discussion

For LVK breed goats in first lactation average milk yield was 472.9±5.15 kg, fat content 3.91±0.02%, protein content 3.25±0.01%, somatic cells count 770.7 ±24.21 thsd. mL⁻¹. In the period from Y2002 to Y2012 maximum milk yield in standard lactation was 1290 kg that was observed for LVK goat with 50% ZK breed blood. For LVK breed significant milk yield variability is observed, confirmed by variation coefficient value of 33.8%.

Goat milk yield productivity is affected by genetic as well as environmental factors, the influences of which have been studied by many authors' researches (Zoa-Mboe et al., 1997; Mioč, et al., 2008; Roger G. Pambu, et al., 2011; etc). The influence of analyzed factors on LVK breed goats' milk productivity variability is shown in the Table 1.

Table 1. The influence of factors on goat milk productivity traits

Factors	Milk yield, kg		Fat content, %		Protein content, %	
	sig	p-value	sig	p-value	sig	p-value
Herd	0.000	***	0.886	n.s.	0.791	n.s.
Genotype	0.043	*	0.577	n.s.	0.081	n.s.
Breed	0.000	***	0.087	n.s.	0.203	n.s.
Herd × Genotype	0.069	n.s.	0.483	n.s.	0.220	n.s.
Herd × Breed	0.012	*	0.018	*	0.000	***

*$p < 0.05$; *** $p < 0.001$; n. s. (non-significant) $p > 0.05$.

LVK goat milk yield were significantly affected by herd in which the goats were kept, as the feeding and keeping conditions varies between herds. In most small herds breeding is not done thoughtfully and purposefully – crossbred bucks are used instead of purebred bucks. Milk yield changes during research were also influenced by LVK genotype and the breed to which the mating buck belongs. Fat and protein content changes were significantly influenced by the effect of interaction between herd and mating buck breed.

Goat milk productivity depending from their genotype is shown in Table 2.

Between different LVK genotype goats the highest milk yield (553.8±19.84 kg) was observed for the ones with LVK breed blood content of 50 to 75%. Also for goats with LVK breed blood content of 75 to 93.74% average milk yield was just 1.0 kg less than Genotype 2 goats. Local origin LVK goats had lower average milk yield (495.9±40.44 kg) than the ones that were improved with Europe grown milk breed bucks. Significantly lower milk yield (465.4±21.04 kg) was recorded for Genotype 1 goats. Included in this category were the goats originating from crossbreeding of different breeds or unknown origin bucks.

Table 2. Effect of goat genotype on LVK breeds milk yield and composition

Genotype	LVK breed blood content	LSM ± SE		
		Milk yield, kg	Fat content, %	Protein content, %
1	LVK < 50%	465.4±21.04 [a]	4.01±0.08	3.31±0.05
2	LVK 50 – 74.99%	553.8±19.84 [b]	3.89±0.07	3.16±0.04
3	LVK 75 – 93.74%	552.8±32.69 [b]	3.75±0.12	3.20±0.07
4	LVK 93.75 – 100%	495.9±40.44[ab]	3.67±0.15	3.21±0.09

[a b] - milk yield with different letters differ significantly between goats genotype (p < 0.05).

Goat milk fat content was from 3.67% up to 4.01% while protein content was from 3.16% up to 3.31% and did not differ significantly between goats' genotypes.

The effect of mating bucks breed on LVK goats' milk productivity is shown in Table 3.

Table 3. LVK goat milk yield and composition depending of the mating buck breed

Breed	LSM ± SE		
	Milk yield, kg	Fat content, %	Protein content, %
ZK	505.1±12.68[ab]	3.95±0.05	3.25±0.03
VBD	581.5±34.18 [a]	3.85±0.12	3.18±0.08
AK	429.9±24.42 [c]	3.77±0.09	3.18±0.05
TIR	520.8±45.27[ab]	4.22±0.16	3.42±0.10
XX	526.7±25.73[ab]	3.74±0.09	3.14±0.06
LVK	495.9±40.44[bc]	3.67±0.15	3.21±0.09

[a b c] - milk yield with different letters differ significantly between buck breed (p < 0.05).

Significantly highest milk yield (581.5±34.18 kg) was obtained from mating LVK goats with VBD breed bucks, while lowest – with AK breed bucks (429.9±24.42). Highest fat (4.22±0.16%) and protein (4.22±0.16%) content were obtained LVK goats mating with TIR breed bucks.

Breed's influence on goat milk productivity is significant factor and it has also been studied in other authors' researches. Brito et al. (2011) studying Alpine and Saanen breed goats' different genotypes discovered that genetic group significantly affects milk yield as well as milk composition. In research carried out in South Africa it was discovered that highest daily milk yield under the same environmental conditions were obtained from Toggenburg and British Alpine breed goats (Roger G. Pambu, et al. 2011).

Also the research carried out in Latvia discovered that Saanen breed goats had the highest milk yield from all breeds kept in Latvia, while the Alpine breed had the highest fat and protein content (Piliena, Jonkus, 2012).

Analysis of factors shows that significant milk yield and composition variability was observed from interactions of herd and breed factors. (Figure 1 and 2)
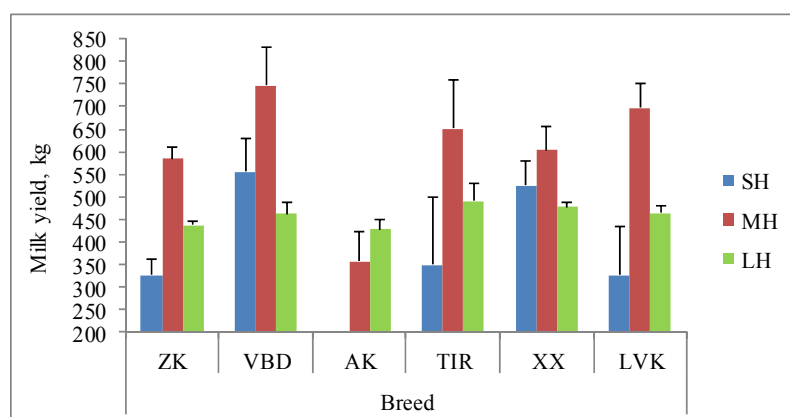
Figure1. Effect of other breeds on LVK goats' milk yield in different size herds.

Highest milk yield was observed in medium herds with less than 30 goats. In these herds highest milk yield was recorded for LVK goats originating from mating local goats with VBD and TIR breeds bucks (746.7 and 651.5 kg respectively).

In large herds (with 73.4 goats on average) highest milk yield was (491.3kg) obtained from LVK goats' mating with TIR breed bucks. In medium and large herds LVK local breed goats' milk yields were high (696.4 and 463.7kg respectively). In both medium and large herds significantly lower milk yields had goats originating from mating with AK breed bucks.
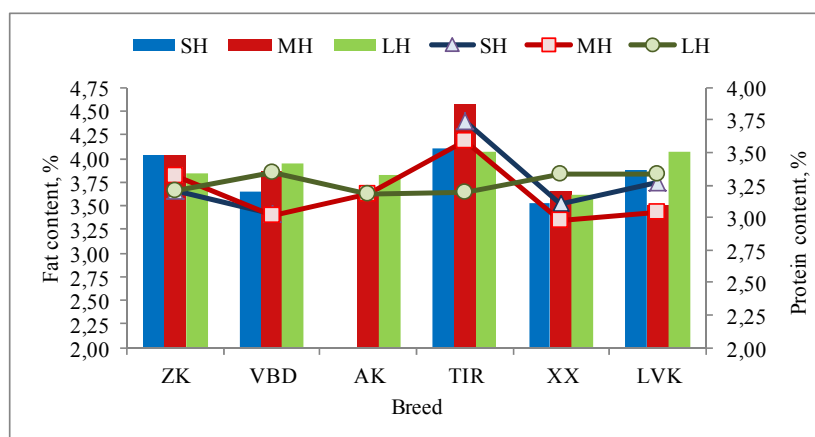
Figure 2. Effect of other breeds on LVK goats' milk composition in different size herds.

The milk with the highest fat content in small, medium and large herds was obtained from mating LVK goats with TIR breed bucks (4.11, 4.58 and 4.08% respectively). The same mating combination also resulted in highest protein content in small and medium herds (3.74 and 3.59%) while in large herds the highest protein content (3.34%) was obtained from LVK and VBD breeds goats' descendants.

Conclusions

Goat milk productivity was affected by LVK breed genotype, bucks' breed used for mating and herds in which the goats were kept as well as interaction of all these factors ($p<0.05$; $p<0.001$).

Highest milk yield (553.8 kg) observed for goats with genotype containing 50 to 75% LVK breed blood. Local origin LVK goats had average milk yield of 495.9 kg.

Notwithstanding the size of herd, the highest milk yield (581.5 kg) was obtained from LVK goats mated with VBD and TIR breed bucks ($p<0.05$), but the highest fat (4.22%) and protein (3.42%) content – with the TIR breed bucks.

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Analysis of the Piglets Loses in the First and Later Parities in Latvian Landrace

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Abstract

The aim of this study was to investigate number of piglets born alive (NBA), number of piglets weaned per litter (NW), number of stillborn – dead piglets (ND), number of piglets died during the suckling period (NDW) and determine factors affecting these traits on large data set in the 1st and later parity of Latvian Landrace sows. 14577 of the 1st parity and 27359 records of the later parities (2 – 10parity) were collected from 2000 till 2012 and were included in the analysis. For statistical analyses of the sows' reproduction traits a liner mixed model was performed. All analyses were carried out using R programm. The average of NBA in the first parity was 11.3 piglets with maximum 20 alive piglets per litter. In the later parities were 11.9 piglets with maximum 22 piglets per litter. Low mortality during the 24 h after birth at the first and later parities – 1.0 or 7.6% and 1.4 or 9.5% piglets also is good indicator for the nucleus heard. NBA piglets increase with parity ($p<0.05$), but ND piglets does not differ with parity. In analysis of NW and NDW piglets parities with cross-fostering was not include. The average NW piglets in the first parity were 9.7 piglets per litter; mortality of piglets during the suckling period was 1.5 piglets or 12.5%. 35.7 % of the sow's had no piglets loses and 24% loss 1 piglets per litter. For later parities the average NW piglets were 10.3 piglets per litter, the weaned piglets decrease with parity number ($p<0.05$) and in the 8th -10th parities the NW was less than 10 piglets (8.8 – 9.9 piglets). In the later parities mortality of piglets during the suckling period was 1.9 piglets or 13.9%.

Keywords: Pig, reproduction, mortality, litter size

Introduction

The number of born alive and weaned piglets as well the number of parities per year maximise profitability of the pigs breeding herds. The breeding goals in the swine selection program for the maternal breed in Latvia for the last ten years and in perspective till 2016 are to increase born alive till 11.5 piglets per litter and to increase the number of piglets weaned per sows per year till 25 piglets. Number weaned piglets not include in Latvian Landrace (LL) sows genetic evaluation, because cross fostering are using in the nucleus herds. Therefore, direct selection on number of born alive piglets improves the number of piglets weaned. Pig breeding programs in different country are focused on sows productivity – total number born or number born alive piglets and this has resulted in an increase in piglet's mortality and decrease piglets survival.

Serenius et al. (2004) conclude selection for high number of piglets weaned should be performed either by selecting simultaneously for high total number of born and low number of stillborn piglets and, piglets mortality or alternatively by selecting simultaneously for high number of piglets born alive and low piglets mortality between birth and weaning. According to Su et al. (2007) investigation changing the selection criteria from total number born to litter size at day five improves the litter size at weaning and piglets survival rate.

Pig nucleus herds need to improve piglet survival rates and continue to focus on sow's productivity. Only optimal production systems that balance selection, physiology and environment of the sow and her piglets will improve both – productivity and piglet survival.

The aim of this study was to investigate number of piglets born alive, number of piglets dead, number of piglets weaned per litter and number piglets died until weaning and determine factors affecting these traits on large data set in the 1st and later parity of Latvian Landrace sows population.

Material and Methods

The data of LL sows from the litter recording scheme collected by Pig Breeding Centre (CCC, Latvia) were used. 14577 of the 1st parity and 27359 records of the later parities (2 – 10parity) were collected from 2000 till 2012 and were included in the analysis. The traits studied were divided into two trait groups: litter size and piglet loses traits. The litter size traits were total number of piglets born (TB), number of piglets born alive (NBA), and number of piglets weaned (NW). Number of stillborn piglets – born dead (ND), number piglets died during suckling period (NDW), percent of stillborn piglets (ND%=ND/TB*100%), and percent of piglets lost during suckling period (NDW%=NW/NBA*100%) were the piglet loses (mortality) traits.

Litters with cross-fostering were not including in the analysis. A record was also excluded when mortality during the suckling period was 100% and the number of weaned piglets was zero.

For statistical analyses of determine factors affecting the sows' reproduction traits a liner model was performed and that included factors herd (i=1…7), year (2000-2012), parity (1-12) us fixed factor and litter size us covariate factor. Pairwise comparisons t test was performed to determine whether factor classes had affected litter size and piglet loses traits (Hothorn et. al., 2008). Differences were considered statistically significant when p<0.05. All analyses were carried out using R version 2.15.2 (R Development Core Team, 2012).

Results and Discussion

The average litter size at birth was 13.1 piglets with born alive 11.9 piglets (Table 1). Ten or more piglets were born alive in 88.2% of the litters. Average litter size at weaning was 10.2 piglets and ten or more piglets were weaned in 69.4 % of the litters. As a result, of the 3 (21.7%) piglets lost on average per litter, 1.8 (13.5%) during suckling period and 1.2 (8.2%) was born dead. In 35.7% of the litters no piglet loses.

Table1. Summary statistics for litter size and piglet losses traits

Traits/Factors	Abbreviation	Mean	SD	Min	Max
Total number of piglets born	TB	13.1	2.47	2	25
Number of piglets born alive	NBA	11.9	2.22	2	22
Number of piglets weaned	NW	10.2	1.75	0	17
Number of stillborn piglets – number dead	ND	1.2	1.42	0	14
Percent of stillborn piglets	ND%	8.2	9.71	0	82.4
Number of piglets lost during suckling period	NDW	1.8	1.86	0	15
Percent of piglets lost during suckling period	NDW%	13.5	13.04	0	84.6

In the study litter size and piglet losses traits were significantly influenced by herd, year, parity and litter size factors (p<0.05).

Litter size traits are related with parity (p<0.05). The highest NBA piglets are in second till five parity. The average NBA in the first parity was 11.3 and in the second - six parities over 12 piglets per litter (Fig.1). NBA is one of the traits which are included in LL Selection program and sows are selected for this trait in nucleus herds. Average NW is in range 9.7 – 10.5 piglets with maximum NW at third parity. Compared with sows of parity 2, 3 and 4, sows of parity 1, 7 and older tended to have smaller litter size at weaned (p<0.05).
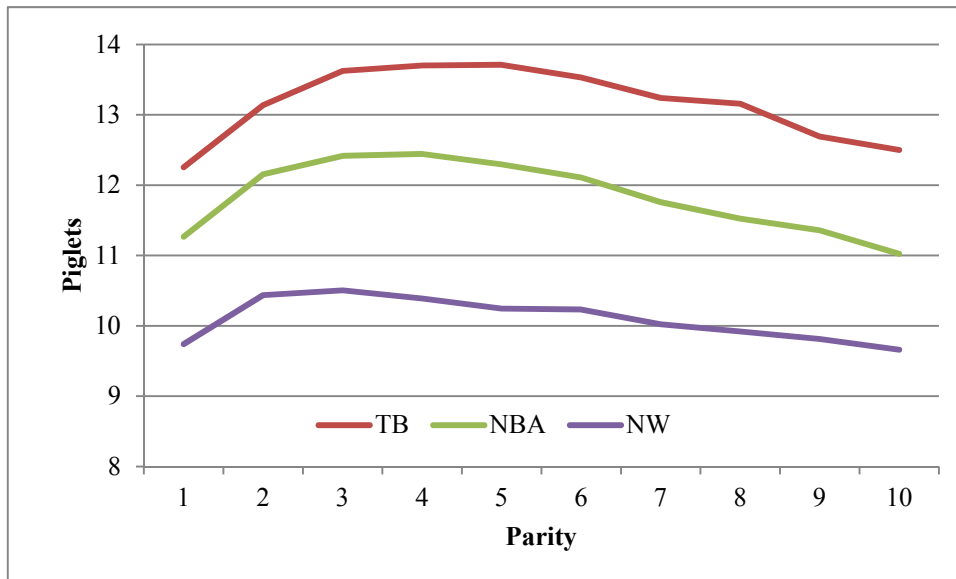
Figure 1. TB, NBA, and NW piglets in different parity.

ND does not differ with parity with lowest mortality at the first and second parity – 0.99 piglet or 7.56% and 1 piglet or 7% (Fig.2). During the suckling period mortality is higher with average NDW 1.5 – 2.1 piglets. The highest NDW and NDW% was in the 4th and 5th parity with average 2.1 dead piglets and mortality over 15%. In Li et al. study piglet mortality increased with parity and they conclude the youngest sows did not farrow the largest litters, but they saved the most piglets, which allowed them to wean the largest litters compared with the older sows (Li et al., 2012). Wolf et al. (2012) conclude for parities greater than 2, the number of stillborn piglets and piglets died until weaning increased with the parity and the highest losses occurred for parities greater than 9.
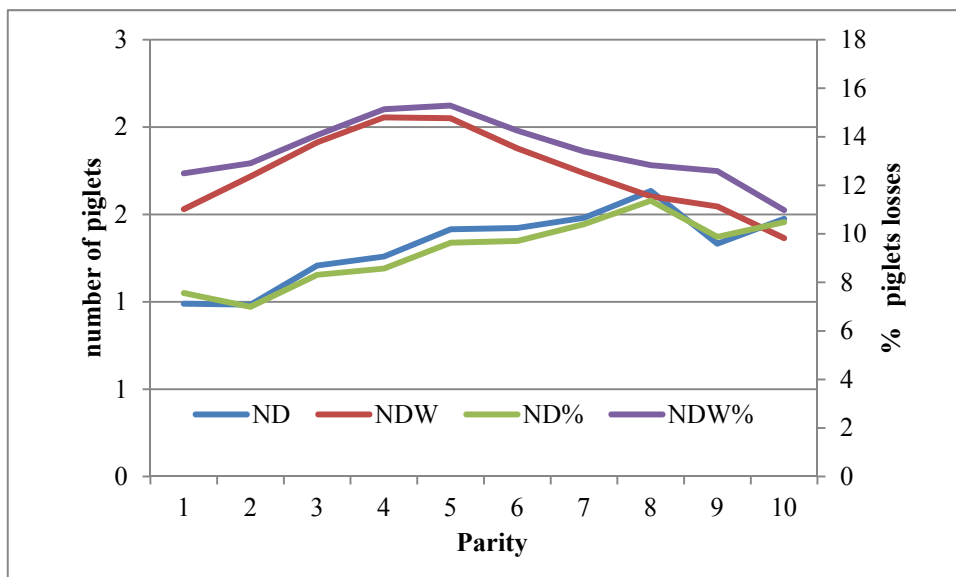
Figure 2. Piglet's losses in different parities.

Piglet's losses changed by litter size (p<0.05), the litter size had a large influence on the number of dead. Whereas for the litter size of ≤11 there were in average only 0.1 (2.9%) – 0.5 (4.9%) ND (ND%) piglets. Litters with 14 or more piglets had higher losses. Maximum loses 4.3 piglets or 20.2% was in large (≥16) litters.

Table 2. Piglet's losses by litter size. Effect of total born on the number dead and effect of number born alive on the number of piglets weaned until weaning.

Total born	ND	ND%	Born alive	NDW	NDW%
≤6	0.1	2.9	≤6	0.1	2.4
7	0.4	5.0	7	0.4	6.1
8	0.3	3.5	8	0.5	6.5
9	0.3	3.5	9	0.6	6.5
10	0.4	3.5	10	0.7	6.9
11	0.5	4.9	11	0.9	8.6
12	0.8	6.5	12	1.3	11.2
13	1.0	7.9	13	2.0	15.7
14	1.3	9.2	14	3.0	21.7
15	1.6	10.8	15	3.8	25.6
≥16	4.3	20.2	≥16	7.3	37.9

The number of piglets born alive had influence on the piglet's losses during lactation. Piglets loses was extremely high in litter size ≥16 and it is in average 7.3 piglets or 37.9%. Whereas for the litter size of ≤11 there were in average 0.1 (2.4%) – 0.9 (8.6%) NWD (NWD%) piglets. In Wolf et al. (2012) investigation the in litter size ≥20 the number of stillborn piglets and piglets dead until weaning was increased by 3 and 5.5 compared with litter size ≤8.

Conclusion

Analysis of this study showed that sows reproduction traits NBA and NW increase with parity number and decrease after the 6 parity. At the same time the highest mortality during lactation were in 4th and 5th parity, sows had the largest litters, but they saved the same number of piglets than the youngest sows. Relationship between litter size and mortality was conformed in LL population. The piglets losses increase with litter size. These results suggest in the pigs' nucleus herds paying attention for litter with more than 13 piglets to improve the piglet's survival rates.

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Metabolic Profile of Cow Race Bush during Cold and Warm Periods of the Year in the Sandzak Region in Serbia

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Abstract

Given the importance of conservation strategies of indigenous breeds of cattle genome Bush, the goal of our study was that in one village herd of Bush cows in critical period of the year for nutrition (winter - summer), exam MPT (Metabolic Profile Test) as a complement to control of cows diet. MPT testing was conducted on a total of 42 cows (21 in winter and 21 in summer), which are divided into three categories of seven cows: 1) cows in late pregnancy (n = 7 + 7); 2) cows in puerperium (n = 7 + 7); 3) cows in the second month of lactation (n = 7 + 7). For testing the TMP levels in blood serum there were determined concentrations of: glucose, total protein, urea, beta-carotene, vitamin A, calcium and inorganic phosphorus. The analysis of these parameters in the puerperal cows determined hypoglycemia and hypophosphatemia during the winter, and hypoglycemia during the summer feeding period. During the winter in all three categories of cows was established hipocarotenemia and lower levels of vitamin A than normal. Slightly higher level of urea was in high pregnant and puerperal cows in the summer, and there was hyperproteinemia in cows of all three categories in this period. Based on the results of the TMP can be concluded that the cows in the herd during the winter are not getting bulky food of good quality, and in the summer period there is a unbalanced ratio of the amount of energy and protein in cows diet.

Keywords: Cows, bush, blood, winter, summer

Introduction

Bush (Bos Brahyceros Adametz) is indigenous cattle of the Balkan Peninsula and in Serbia is traditionally grown in almost all regions. Intensification of livestock production has done that Bush today in Serbia, in terms of population size (500 - 1000 animals), according to the classification system defined in the document "The State of the World's Animal Genetic Resources for Food and Agriculture" (DAD-IS FAO, 2007) , belongs to the regional border races with vulnerable status. There is about 50 regions in Serbia known as places where Bush is still grown, with a small number of animals in the herd, and in the hilly - mountainous marginal areas of the country. Some of these sites are located in the Sandzak region in the southwest of the Republic of Serbia on Sjeničko-Pester plateau. It is the largest plateau in the Balkans, which is due to the harsh climate called "Serbian Siberia" and it is a unique geographic area where inhabitants are traditionally involved in livestock production, which is their main source of income (Lješević, 2004). Preservation of Bush, as well as other species of domestic animals in Sandzak region and their existence is conditioned by the quality and quantity of forage, which bears the stamp of the conditions prevailing in these areas, in fact, features of sub-mountainous climate (Sabic and Pavlovic, 2004).

Having in mind that the native genome of Bush is an important element of the agro - biodiversity and agro - ecosystems, and has great significance for the development of rural areas, as well as for the social and cultural heritage of the Sandzak region, the aim of our study was to, in the critical periods of the year for animals in the mountains (winter - summer), in a rural herd of Bush, estimate some parameters of MPT (Metabolic Profile Test), which were first introduced by Payne et al. in 1970, as a supplement to control of cows feeding in the most sensitive stages of reproduction.

Materials and Methods
Animals in experiment

The study was conducted on Sjenicko - Pester plateau Republic of Serbia, in the village herd of cows breed Bush. There were randomly selected 21 heifers during the winter period and 21 heifers in the summer, 42 in total, which are divided into three categories of seven cows. In first, there were cows in late pregnancy (n = 7 + 7) in other, cows in puerperium (n = 7 + 7) in the

third, the cows in the second month of lactation (n = 7 + 7). The average age of cows in the experiment was 6.78 years, weight of 276.42 kg and the average milk yield 1055 kg. All cows were cultured in the same conditions. In the cold period of the year (November - April), cows were housed in indoor stalls with drains (combined housing system), and during the warm period (May - October) cows were kept on pasture. Presence of nutrients in the diet depended on the season. During the winter diet was consisted of hay and a bit of concentrated feed, and during the summer of grazing on natural pastures.

Taking and analysing blood samples

Blood samples in all the cows were taken by puncture of the jugular vein in February and August. The concentration of glucose, total protein, urea, beta - carotene, vitamin A, calcium and inorganic phosphorus in the blood serum samples was determined by colorimetric method on the device Vet-screen (Biochemical Systems) using commercial test package Bioanalityca.

Statistical analysis

Interpretation of research results was performed in the statistical program Statistica (Statsoft. Inc., Ver. 6). The mean value, standard deviation and statistical significance of differences in mean values (Student's t-test) are presented in tables.

Results

The results of our study are presented in (Table 1, 2 and 3).

Table 1. Concentration of parameters in blood serum of cows in advanced pregnancy in the winter and summer period

Parameters	winter	summer	signifikance
Glucose (mmol/l)	2.47 ± 0.31	2.63 ± 0.29	ns
Total protein (g/l)	75.15 ±2.01	82.46 ±4.93	P < 0.05
Urea (mmol/l)	2.31 ± 0.69	5.98 ± 1.95	P < 0.01
Beta-carotin (mmol/l)	1.53 ± 0.68	2.47 ± 0.76	P < 0.01
Vitamin A (IU/l)	49.85 ± 13.84	75.05 ± 19.17	P < 0.01
Inorganic Phosphorus (mg/dL)	2.06 ± 0.29	2.13 ± 0.11	ns
Calcium (mmol/l)	2.37 ± 0.29	2.71 ± 0.17	P < 0.01

Table 2. Concentration of parameters in blood serum of cows in puerperium during winter and summer period

Parameters	winter	summer	significance
Glucose (mmol/l)	2.53 ± 0.33	2.35 ± 0.33	ns
Total protein (g/l)	75.51 ± 6.43	81.18 ± 8.50	ns
Urea (mmol/l)	2.97 ± 1.09	5.06 ± 0.62	P < 0.01
Beta-carotin (mmol/l)	1.31 ± 0.62	2.97 ± 0.87	P < 0.01
Vitamin A (IU/l)	40.99 ± 11.75	75.01 ± 21.18	P < 0.01
Inorganic Phosphorus (mg/dL)	1.59 ± 0.42	1.64 ± 0.28	ns
Calcium (mmol/l)	2.36 ± 0.23	2.45 ± 0.25	ns

Table 3. Concentration of parameters in blood serum of cows in the second month of lactation in the winter and summer period

Parameters	winter	summer	significance
Glucose (mmol/l)	2.53 ± 0.33	2.35 ± 0.33	ns
Total protein (g/l)	77.59 ± 7.86	82.92 ± 11.89	P < 0.05
Urea (mmol/l)	2.06 ± 0.57	5.17 ± 0.82	P < 0.01
Beta-carotin (mmol/l)	1.97 ± 0.64	3.07 ± 0.83	P < 0.05
Vitamin A (IU/l)	49.98 ± 19.02	82.12 ± 23.98	P < 0.01
Inorganic Phosphorus (mg/dL)	1.87 ± 0.40	1.88 ± 0.23	ns
Calcium (mmol/l)	2.28 ± 0.20	2.29 ± 0.26	ns

The obtained values of MPT parameters in our research, show that during the winter and summer there was determined hypoglycemia in cows in puerperium and hypophosphatemia during winter. In all three categories of cows during the winter feeding period was determined hipocarotenemia and hypovitaminosis A. Somewhat higher level of urea is determined during the summer, as well as hyperproteinemia in all three categories of cows.

Discussion and conclusion

Hypoglycemia in cows in puerperium indicates the state of NEB (Negative Energy Balance Sheet), where the input of energy of cows in early lactation is less than needed (Šamanc 2005; Djokovic et al., 2010). The level of glucose in the other categories of cows during winter and summer, is approaching the lower bound of the physiological minimum (Jovanovic, 1984; Stamatović and Jovanovic, 1990), and according to (Kaneko et al., 2008) is below minimum. Glucose is one of the blood parameters that determines the energy status of the cow and its level depends largely on the entries and quality of nutrients (Radovic et al., 2011). The concentration of total protein and urea are indicators of protein status of cows and hyperproteinemia which is found in all categories of cows during the summer, may occur as a result of dehydration of the organism (Kaneko et al., 2008), then in some inflammatory processes, as well as the surplus of protein in the diet, which is in our study indicated by the value of urea greater than 5 mmol/l (Lotthammer, 1991). Uremia is a sensitive indicator for assessing the supply of protein and its level increases in the blood at too high protein food offer, with insufficient supply of digestibile carbohydrates (Marenjak et al., 2004). In our holding conditions, as well as in this Bush herd, occurrence of hypovitaminosis A and hipocarotenemia are frequent, especially during the winter, and usually occur as a consequence of inadequate storage of hay, when the influence of adverse factors leads to oxidative inactivation of carotene. Then, during several months of storage, hay loses 40-80% of its original carotene content (Jovanovic, 1984), and by (Velickovic and Vukovic, 2005) up to 90%. The concentration of calcium and phosphorus in the blood, is an indicator of mineral metabolism. During parturition, and after a few hours of parturition occurs decrease in the physiological concentration of inorganic phosphorus to 1-1.6 mmol/l, as well as calcium to 1.7-2.1 mmol/l. Those concentrations are maintained for one to two days, and intensity of the drop of the these values increases with age of cows (Djokovic et al., 2014). Transitory deficiencies of calcium and phosphorus cows can temporary compensate by mobilization from their own reserves. Disturbances in the metabolism of these minerals may be due to their prolonged deficit in the diet, or their inadequate ratio and insufficient supply of vitamin D (Radovic et al., 2011).

Practical application of MPT, as a supplement to the diet control, or certain parameters of blood serum in our studies show that this rural herd of Bush does not get good quality forages during the winter and that there is unbalanced ratio of the amount of energy and protein in the summer period. For the sake of importance and preservation of this Bush herd, correction of nutrition during the winter and during the summer is required.

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Chick Weight, Length and Post-Hatch Performance in Male and Female Broilers From Different Breeder Ages

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Abstract

This study was carried out with the aim of determining the effects of broiler breeder age and hatchling sex on chick weight, length at hatch and post-hatch broiler performance. A total of one-day old 180 chicks (90 females/90 males) were randomly selected at hatch from each Ross 308 broiler breeder flocks at 36 and 52 weeks. All selected and weighed chicks were placed in pens. Daily mortality, weekly feed consumption and live weight at 21 and 42 d were recorded. The effects of broiler breeder age and sex on chick hatching weight and length were found (P<0.01). Heavier and longer chicks were obtained in 52 wk old age flock and also male chicks. At 1 d, the chicks from 52 wk old age were heavier than others from 36 wk old age (P<0.01), whereas female and male chicks were similar. At 42 d of age, heavier live weight was observed in males from 52 wk old with a value of 3320.0 g (P<0.01). At the end of the growing period, the cumulative feed consumption was found to be higher as 5368.8 g in males, whereas a higher feed conversion ratio was higher in females as 1.81 (P<0.01). A higher mortality with a value of 5.56% was observed in male broilers due to faster live weight gain compared to females (1.94%, P<0.05). Results indicate that broiler breeder age and chick sex affected chick weight and length that are indicators of one day old chick quality and broiler performance.

Keywords: Broiler, breeder age, chick weight, chick length, live weight

Introduction

Day old chick quality is an important criteria for profitability of broiler producers due to its effects on broiler performance (Molenaar et al., 2008). Some factors affect the chick quality, for example, broiler breeder age affects egg weight and in this way one day old chick weight, length (Hill, 2001; Tona et al., 2001; Boerjan, 2002; Tona et al., 2004). Chick hatching weight and length are indicative of development and a criterion of one-day-old chick quality (Deeming, 2000; Wolanski et al., 2003). Hatchling quality can be measured by different methods, including hatchling length and weight (Hill, 2001; Wolanski et al., 2006). An optimal development of the chick's body at hatch might affect also development of the digestive tract and therefore utilization of nutrients and feed conversion ratio (FCR).

Another important factor that affects the broiler performance is sex (Bilgili et al., 1992). The difference in chick's sex lets differences in physiological and nutrient requirements. For example, the FCR of female broilers is usually higher than males at the same age, especially after 30 days females tend to deposit proportionally more fat in their body (Leeson, 2000). Therefore, the objective of this research was to investigate the effects of broiler breeder age and sex on chick weight, length and post-hatch performance.

Material and Methods

A total of one-day old 180 chicks (90 females/90 males) were randomly selected at hatch from each Ross 308 broiler breeder flocks at 36 and 52 weeks. The average hatching weight was 40.9 g and 45.2 g in chicks from 36 and 52 wk of age breeders groups, respectively. A total of 25 chicks (male/female) from each breeder age group were measured for chick weight and chick length.

The chicks (n=360) were randomly allocated into treatment groups and then chicks were placed in 9 floor pens with a surface area of 2.0 x 2.0 m^2 to provide 3 replicate pens and 30 chicks per replicate. The chicks were weighed using a balance at ± 0.1 g precision at the beginning of trial. Wood shavings were used as litter material, which was laid at a thickness of 7-8 cm on the floors of the pens.

The chicks received a standard pelleted broiler starter, grower and finisher diets. Feed and water were offered ad libitum throughout the experiment. The live weight gain values were monitored by weekly pen basis weighing until the end of the 6th week; feed conversion ratios were calculated using the weekly live weight gains and feed consumption values. The mortality pen basis was recorded daily during the trial.

All data were subjected to analysis of variance (SAS Institute, 1989), utilizing ANOVA procedures for balanced data. Analyses for percentage data were conducted after a square root of arc sine transformation of the data. Significant differences among treatment means were determined by Duncan's multiple range test.

Results

The effects of breeder age and chick sex on chick weight and length are shown on Table 1. The effects of breeder age and sex affected significantly chick weight and length (P<0.01). The chick weight and length were higher in chicks from old flock as 47.8 g and 21.0 cm, and in male chicks as 46.5 g and 20.6 cm, respectively. No significant interactions between breeder age sex was found for these parameters.

Table 1. The effects of breeder age and chick sex on chick weight and length

Main effects		Chick weight (g)	Chick length (cm)
Breeder age	Young	40.4 ± 0.58 [b]	19.6 ± 0.16 [b]
	Old	47.8 ± 0.58 [a]	21.0 ± 0.16 [a]
	P Values	*0.00*	*0.00*
Chick sex	Female	41.7 ± 0.58 [b]	20.0 ± 0.16 [b]
	Male	46.5 ± 0.58 [a]	20.6 ± 0.16 [a]
	P Values	*0.00*	*0.007*

a,b Means within a column with different superscript letters differ (P<0.01,P<0.05)

The effects of breeder age and chick sex on live weight and live weight gain are given on Table 2. On day 1, the chick weight was found higher in chicks from old flock, whereas the chick weight was found similar for male and female chicks. During rearing period, the male chicks obtained from old flock was found highest on days 21 and 42. Likewise, live weight gain between days 21 and 42 was found significantly higher for male broilers obtained from young and old flocks than female broilers.

Table 2. The effects of breeder age and chick sex on live weight (g) and live weight gain (g) during rearing period

Main effects		Live weight (g)			Live weight gain (g)	
		Day 1	Day 21	Day 42	Days 1-21	Days 21-42
Breeder age	Young (Y)	39.2 ± 0.1 [b]	907.5 ± 8.6 [b]	2999.2 ± 33.4	868.3 ± 8.6 [b]	2072.8 ± 31.6
	Old (O)	44.1 ± 0.1 [a]	931.2 ± 8.6 [a]	2992.3 ± 33.4	887.0 ± 8.6 [a]	2068.0 ± 31.6
	P Values	*0.00**	*0.008**	*NS*	*0.033 **	*NS*
Chick sex	Female (F)	41.7 ± 0.1	881.5 ± 8.6 [b]	2726.5 ± 33.4 [b]	839.8 ± 8.6 [b]	1845.0 ± 31.6 [b]
	Male (M)	41.7 ± 0.1	957.2 ± 8.6 [a]	3253.0 ± 33.4 [a]	915.5 ± 8.6 [a]	2295.8 ± 31.6 [a]
	P Values	*NS*	*0.00**	*<0.01**	*0.000**	*0.00**
AgexSex	Y x F	39.2 ± 0.1	879.6 ± 12.2 [c]	2774.7 ± 47.3 [c]	840.4 ± 12.2 [c]	1895.0 ± 44.7 [b]
	Y x M	39.3 ± 0.1	935.3 ± 12.2 [b]	3185.9 ± 47.3 [b]	896.1 ± 12.2 [b]	2250.6 ± 44.7 [a]
	O x F	44.2 ± 0.1	883.3 ± 12.2 [c]	2678.3 ± 47.3 [c]	839.1 ± 12.2 [c]	1795.0 ± 44.7 [b]
	O x M	44.1 ± 0.1	979.0 ± 12.2 [a]	3320.0 ± 47.3 [a]	935.0 ± 12.2 [a]	2341.0 ± 44.7 [a]
	P Values	*NS*	*0.024**	*0.001**	*0.023 **	*0.004**

a,b Means within a column with different superscript letters differ (P<0.01,P<0.05)
NS= not significant at P>0.05

The effects of breeder age and chick sex on cumulative feed consumption and feed conversion rate during rearing period are shown on Table 3. The cumulative feed consumption was higher in male broilers than females during rearing period (P<0.01). No significant interaction was found

for cumulative feed consumption between broiler breeder age and broiler sex. A significant correlation for FCR was only observed at week 6. FCR was higher with a value of 1.83 in female broilers obtained from old flock (P<0.05). In the study, the mortality was only found significantly higher in male broilers (5.56%) than females (1.94%; P<0.05). No significant interaction for mortality was observed.

Table 3. The effects of breeder age and chick sex on cumulative feed consumption and feed conversion rate during rearing period

Main effects		Cumulative feed consumption			FCR		
		Week 1	Week 3	Week 6	Week 1	Week 3	Week 6
Breeder age	Young	165.5 ± 1.9 [b]	1232.9 ± 13.4	5169.9 ± 68.7	0.76 ± 0.0 [a]	1.35 ± 0.0	1.73 ± 0.0
	Old	172.5 ± 1.9 [a]	1235.0 ± 13.4	5136.8 ± 68.7	0.92 ± 0.0 [b]	1.32 ± 0.0	1.72 ± 0.0
	P Values	*0.005***	*NS*	*NS*	*0.000***	*NS*	*NS*
Chick sex	Female	164.3 ± 1.9 [b]	1181.7 ±13.4 [b]	4938.1 ± 68.7 [b]	0.84 ± 0.00	1.34 ± 0.0	1.81 ± 0.0 [a]
	Male	173.7 ± 1.9 [a]	1286.2 ± 13.4 [a]	5368.6 ± 68.7 [a]	0.84 ± 0.00	1.34 ± 0.0	1.65 ± 0.0 [b]
	P Values	*0.001***	*0.000***	*0.00***	*NS*	*NS*	*0.000***

a,b Means within a column with different superscript letters differ (P<0.01,P<0.05)
NS= not significant at P>0.05

Discussion and Conclusion

It is known that there is a critical relationship between the day old chick quality and post hatch broiler performance (Tona et al. 2003). As the broiler breeders become older, the egg weight increases and therefore chick hatching weight and also chick length (Wilson, 1991; Hill, 2001; Tona et al., 2004). Likewise, in our study the chick weight and length was found higher in chicks from the old flock. Similarly, Ulmer-Franco et al. (2010) and Willemsen et al. (2008) found higher chick weights in older flocks. Previous researches have demonstrated a strong relationship between breeder age and chick weight and also chick length (Suarez et al., 1997; Ulmer-Franco et al., 2010). On other hand, in our study sex affected the one day old chick weight and chick length. Male chicks were found to be higher and longer than females.

There have been many studies that stated there is a higher positive correlation between one day old chick quality and broiler performance (Decuypere et al., 2002; Meijerhof, 2006). In our study, the male broilers obtained from old flock were found higher than others, and the higher live weight gain was observed in males from young and also old flocks. It could be concluded that breeder age and also broiler sex have effects on live weight and live weight gain during rearing period. Similarly, Ulmer-Franco et al. (2010) stated that chicks from 59 wk broiler breeder flock found heavier and gained more weight than the chicks from 29 wk broiler breeder flock. In our study, the other broiler performance parameters were cumulative feed consumption, FCR and mortality during rearing period. As it is expected, breeder age did not affect the cumulative feed consumption and FCR at week 6. These results were also similar to findings of Ulmer-Franco et al. (2010). On the other hand, it was found that female broilers consumed more feed and a lower FCR than males. In another study, Veerapen (1999) also showed that male broilers required less feed to gain a unit of weight, and males had efficiently FCR than females.

In a study that carried out by Wolanski et al. (2003), it was found a positive relationship between hatching weight and body weight at 6 weeks of age without taking into account of broiler sex. But, it could be seen that in our study, broiler sex had importance in evaluating of broiler performance. Similarly, Molenaar et al. (2008) also found a difference in relationships between chick length and broiler performance for male and female broilers.

In conclusion, chick quality parameters have importance in estimation of broiler performance, especially for profitability of broiler producers. In evaluation of chick quality, chick sex should be considered due to its effects on broiler performance, slaughter yield and carcass quality, especially live weight gain and FCR. In addition, the sex has an importance in the respect of

welfare, especially leg and foot health in male broilers. So, in broiler management practices could be manipulated according to factors that affect performance.

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The Effect of Supplementary Feeding during Mating, End of Pregnancy and Milking stage on Fertility, Birth weight, and Blood parameters of Moghani Ewes

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Abstract

This study was conducted to investigate the effects of supplementary feeding on the fertility of Moghaniewes, birth weight, weight at weaning time, weight and some blood parameters of ewes, in three flocks. In every flock, half of the ewes were selected for control group and were fed according to usual diet without receiving supplemental food. The second half of the ewes of the three flocks received supplemental diet in three experimental stages consisting: 1) Mating season, 2) 1.5 months of the end of gestation, and 3) Milking stage. Body weight and body condition scores of all of the ewes were measured before of the flushing in mating season and at the end of it. The fertility in the control and supplemental feeding treatment ewes were 85.29% and 94.44% respectively ($P<0.01$). Supplemental feeding had a significant effect on the birth weight and the weaning weights of lambs. The means of birth weight of lambs were 3.38 kg for the control group and 4.09 kg for treatment. The means of the weight of lambs of one to three months in the control group were 9.16, 12.99 and 22.65 kg and in the supplemental feeding group were 11.23, 16.55 and 27.21 kg indicating a significant difference between them. The rates of blood urea nitrogen and blood sugar were 11.18 and 53.72 mg/dl in control group whereas in supplemental feeding treatment group were 16.09 and 65.54 mg/dl, respectively ($P<0.01$).

Keywords: Moghani ewea, supplemental nutrition, lamb weight, blood parameters

Introduction

For the purpose of competition in the world market an effort is made in modern ewe breeding industry to increase the number of lambs at each birth as well as the weight of each new-born lamb. On the other hand, in order to decrease breeding costs, ewe breeders have to keep the costs of feeding (as the most significant parameter in breeding) down. This results in the weakening of more productive ewes. Birth rate has a significant role in determining economic return of ewe breeding and return of birth as a significant step in the development of the production of ewes. Reproductive efficiency is generally low in non-centralized breeding systems due to limited feed and improving efficiency in such systems requires improvement of management system in order to secure food in the critical stages of production. These stages include the period before mating up to mating (in order to increase the rate of spawning) mating period and immediately after it (in order to minimize the rate of embryonic mortality), final period of pregnancy (to prevent subnormal birth weight) and early milking period (to improve growth speed). Since fertility and pregnancy rates in ewes is determined by physical and nutritional status of ewes before mating period, monitoring ewe nutrition during the first 2-3 weeks before mating until 2-3 weeks after it results in the least open days in the herd. This causes increased ovulation rate and in some cases multiple ovulation and lower mortality. On the other hand, since the development of the embryo is very high during late gestation, supplying sufficient nutrients in the course of pregnancy is important in order for the lamb to have suitable weight and for the ewe to be healthy after delivering the lamb. The birth of heavy lambs is better for the owner, since lambs with higher birth weight have a higher growth rate. On the other hand, the rate of economizing energy is higher in heavier new-born lambs because the ratio of body surface to volume is lower, as a result the rate of energy loss is also lower. It has also been identified that in lighter lambs due to the less growth of secondary follicles of skin, the growth of wool is slower. As a result the

thermal insulation is weaker. Bearing in mind the above descriptions, the advantages of huge lamb is known. However, it should be noted that any change in growth rate of the fetus (the lamb's birth weight) should be considered in relation to the management of the ewe's nutrition during the final two month of pregnancy. Inadequate nutrition during pregnancy in ewes can result in premature birth, increased mortality of lambs and decline in breastfeeding due to the insufficient development of milk glands. Diets low in protein, for example, feeding the animal with Low-quality forage or feeding with low quality straw for 8-10 weeks before giving birth to the lamb can result in a decrease in **saving** colostrum and producing milk, that in due course results in the decrease of the possibility of survival, resistance against desease and growth rate. Adequacy of dietary protein level can be measured by sampling blood of sheep and concentrations of urea nitrogen and serum or plasma. Low concentrations of blood urea nitrogen, usually indicate a lack of protein digestion in the rumen. Blood urea concentrations 6-4 hours after feeding is the highest and the lowest just before feeding time. The first changes of pregnancy in ewe includes the lowering of blood glucose, ketones in the blood, increased ketones and urea in the urine.

Materials and Methods

The research was carried out three flocks of sheep in the town of Shabestar. At the beginning, the ewes were weighed and numbered. Also, in order to assess the amount of body fat and muscle in ewes, a measure of body condition score were used. Then the flock of ewes were divided into two groups of witness and complementary feeding. The mean and standard deviation of live weight and body condition of the ewes before flushing the food in the control group was 35/1 ± 77/37 and 9/0 ± 17/2 and 83/0 ± 85 / 38 and 05/0 ± 21/2,in the nutritional treatment group. The first step in flushing nutritional supplement for food was during intercourse. This stage began 3 weeks before the intercourse and continued up to 2 weeks after it. The supplemental food in this phase consisted of 300 grams of concentrated animal feeding barley, wheat bran, cottonseed meal, corn, alfalfa, dried beet pulp and supplements per ewe per day. Based on the timing, 6 weeks before the estimated time of birth, the second phase began when ewes receiving food aid received 400 g of concentrate daily for 14-16 weeks of pregnancy, 430 g of concentrate to 18-16 weeks of pregnancy, and 450 g of concentrate for 18-20 weeks pregnancy. Then two weeks before lambing time, 10 heads of ewes in every flock (5 heads of the experimental and 5 heads of control group) were taken blood samples from the jugular vein. After separating the serum levels of urea nitrogen and serum glucose of ewes were determined in pathobiology laboratory. It should be noted that ewes were starved for 14-16 h before blood sampling,. The ewes in the treatment group received supplemental feeding (500 g concentrates per ewe) after calving and the stage of lactation. Monthly lamb birth weight and weight of both groups in each herd were recorded until weaning. Data analysis was performed by SAS.

Results and Discussion

As Table 1 shows supplemental feeding of ewes during critical phases of their life has significant effects on lambs' birth weight and also their weight from one to three months of age (since weaning).

Table 1. Supplemental feeding of ewes during critical phases of their life

Weight 3 month	Weight 2 month	Weight 1 month	Birth weight	trait
				effect
27.21a	16.55a	23.11a	4.09 a	nutrition
22.65b	12.99b	9.16b	3.38b	control

The average birth weight of lambs in the group receiving supplemental feeding was 4.09 kg. It was 3.38 kg in the control group which did not receive any supplemental feeding. In addition, the lambs' birth weight in the supplemental food receiving group from one to three months of age was 11.23, 16.55, and 27.21 respectively. It was 9.16, 12.99, and 22.65 respectively in the control group. The weight difference between the two groups was statistically significant.

The study by Rahmani et al. (2001) indicated a positive correlation between weight and age of ewes and the weight of their lambs. Esmaeilizade et al. (2002) concluded that ewes fed properly at their critical stages of reproduction were much more likely to have lambs with high weight at birth. In the last 6 weeks of gestation, sufficient nutrients must be provided in order to buttress embryo and primary nodes development. Supplying these nutrients during this period is very important especially for lambs' optimal weight and mother's health. Therefore, the growth of lambs and ewes' milking capacity are significantly affected by the feeding which takes place at the end of gestation. Table 2 shows the effects of supplementary nutrition in pregnant ewes on serum glucose and blood urea nitrogen in their last two weeks of pregnancy. It is observed that supplemental feeding to ewes in late pregnancy significantly increases the level of blood urea nitrogen and serum glucose, compared to the control group. In this experiment, serum urea nitrogen levels in pregnant ewes and the control group was 11.18 milligrams per deciliter of blood serum urea nitrogen feeding ewes receiving 9.16 mg dl. Blood glucose levels for both treatment and control groups, were 54/65 and 72/53 mg respectively. The above table also indicates that the levels of blood urea nitrogen and serum glucose in the pregnant ewes are greater at the end of pregnancy that resulted in higher birth weight. It can be seen that the maximum amount of blood urea nitrogen and serum glucose belonged to the ewes that have their birth weight between 1.4 and 4.5 kg. Increased urea concentration in pregnant ewes is due to the high protein metabolism during pregnancy. Bell (1995) concluded that the total amount of plasma protein in ewes with heavier fetuses were smaller and were significantly low in lighter fetal sheep. In contrast, plasma urea concentrations were higher in ewes with heavier fetuses and significantly lower in ewes with lighter fetuses. Ewes with heavier fetuses analyzed more protein and sent more amino acid into the pathways of gluconeogenesis to secure the needed glucose by the embryo and as a result of domination blood urea has gone up.

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Assessment of Manure in Livestock Managements in Turkey

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Abstract

Manure is composed from combination of waste materials as urine, feces of livestocks and some litter materials. Manure management includes the process of the removal of livestock manures from farm field and the appropriate storage of these manures for plant growing. Nutrients within the manure when is stored in an appropriate conditions, provide a possibility to producers for growing better of crops. On the other hand, the manure is arisen in livestock managements, if it is left uncontrolled in environment without processing in appropriate conditions. It becomes harmful even of it is useful for plant production. In this respect, the assessment and the removing of manure in livestock managements is an issue which should be seriously considered. In this paper, it is aimed to explain the amount of manure production and the assessment of current manure management systems and practices of livestock managements in Turkey.

Keywords: Livestock, shelter, manure, manure management

Introduction

Manure could be defined as waste material that obtained from farm animals and it is a combination of urine, fecal matter and litter materials. The manure is classified into three groups as solid (>20-25% solid content), semi-solid (10-20% solid content) and liquid (0-10%) manure (Atılgan et al., 2005). Unless manure is managed carefully, it causes some environmental problems such as surface and underground water pollution due to its nutrient (especially nitrogen and phosphorus (Olgun and Polat, 2005)) and microorganisms (Burtor and Turner, 2003). On the other hand, it also has some risks for human and animal health. So, both solid and liquid manure have to be saved in the manner that preventing from these damaging effects (Harris et al., 2001). Storage and maturation of manure for a certain period is made in manure pits depending on working conditions of farms. Manure storages have a great importance in controlling of malodor and pollution inside and outside of shelters and also in protection of underground and surface water sources. If gaining more income from manure obtained in the farms is desired, the storage of manure should be performed in conditions that could cause any health problems in animals or human. While planning of animal houses, direction of shelter, climatic conditions and the other factors are taken into consideration, the manure pits for storage are unfortunately neglected and therefore manure is accepted as component for environmental pollutant (Karaman, 2005).

Table 1. The total numbers of cattle, sheep, layer and broiler, annual manure amount per animal and total manure amount in Turkey

Animal	Amount (tonne/year/animal)	Animal amount (number)	Total manure amount (tonne/year)
Cattle	32	14 415 257	461 288 224
Sheep	10	29 284 247	292 842 470
Layer	13	88 720 709	1 153 369 217
Broiler	11	177 432 745	1 951 760 195

Reference: Bayındır et al., 2004; Demirkıran 2004; Anonymous, 2013

As seen on Table 1, the animal capacity is 177 million broilers, 88 million layers, 14 million cattles, 29 million sheep in Turkey. With an easy calculation, it could be estimated that approximately 3 billion tones chicken manure, 460 million tones cattle and 300 million tones sheep manure are obtained annually. Similarly, as a result of another studies, it was found that a

cattle with a weight of 454 kg produce approximately 36.4 kg manure daily (Harner et al., 1997). Besides, cattles produce approximately 32 tones manure in a year and when these manure is supplemented to area with a size of a decare provides to plants nutrients as 28 kg nitrogen, 11.2 kg phosphorus pentoxide and potassium oxide (Demirkıran, 2004).

The quantity of beneficial nutrients in the manure changes by ration content, amount of litter and water, manure collection and storage procedures, usage of manure methods for plant production, soil and plant characteristics and climate conditions. The fecal matter contains macro and micro nutrients for plants. Actually the manure is an organic material that contains nutrients for plants and when manure is mixed into soil, it regulates the soil pH with its carbondioxide and organic acids. Furthermore, manure improves the cation alteration capacity of soil so that micro nutrients turn into utilizable forms for plants and it affects positively the soil efficiency (Taban et al., 2014). Stabile nitrogen in the fecal matter often decomposes slowly. Approximately 40-50% of these nitrogen continues to decompose in first year, 12-15% in second year, 5-6% in third year and then it continues decompose by gradually (Herbert, 1998; Demirkıran, 2004).

Manure Assessment Methods In Farm Plants

The manure assessment methods show differences among the countries according to their economic conditions and requirements. The manure is evaluated in biogas production, composting, drying and using in plant production or dung cake production (Anonymous, 2011a). Especially biogas production has a importance for plant production as productive material and for inhibiting environmental pollution (Boyacı et al., 2011). These assessment methods are selected by farmers taking account of animal species, manure characteristics and farms' strategies and development level. The farms have to take consciously essential precautions for manure storage, processing and assessment. However, in Turkey, it was concluded that farms in Van (Bakır, 2002), Bursa (Yaslıoğlu and Arıcı, 2005) and Aydın (Bardakçıoğlu et al., 2004) constructed their manure pits paying no attention to technical information and legal procedures.

Manure Magement in Turkey

In Turkey, liquid manure is usually let to flux in water source, there is any practice about using liquid manure in plant production. In some cases, solid fecal matters are used as manure, however the fecal matters are laid on empty fields or used for heating in small villages. Now, there is any legal regulation for fecal matter management, assessing methods of fecal matters and liquid manure storage, utilizing or processing. However using of liquid manure causes some important environmental problems due to lacking of management standards. So having a sustainable manure management system is important in the way of preventing nitrate cycle (Anonymous, 2011b).

Manure management and usage of manure are performed unconsciously in Turkey (Boyacı et al., 2011). However, inadequacy in consumption and imbalance in usage or manure are the other problems in management. Whereas the usage of manure is done under average in many cultivation areas in extensive agriculture, excessive manure usage has caused serious environmental pollution problems in some areas (Ergin and Eyicil, 2000). In this respect, storage of manure that produced in farm plants in suitable conditions, processing and conscious usage of manure has importance in efficient usage, increasing of profitability of producers and preventing acceptance of manure as an environmental pollutant.

A study was carried out to exhibit the structure of manure pits and manure management systems in cattle farms that are registered to cooperative in Tire area of İzmir. The choice of barn place and manure storage in these plants is unsuitable with technical standards and legal procedures. In these farms, mechanization (74%) are generally used for manure collection process. The manure is stored as bulk inside or outside of farm in 78%, in paddocks 16% and in a manure pit 6% of all farms. Nearly in all of farms (99%) manure is used in agriculture lands without taking required precautions for maturation of manure, in the other 1% of farms manure is used as a firing material (Öztürk and Ünal 2011).

In another study that was performed in Tokat, it was found that there is any manure pits 35% of farms, and in 98% of these farms the manure is stored outside in empty fields as bulk. In farms that have manure pits, a building is designed manure storage as closed of three side near the barn for collection of urine and feaces together. The average storage time of animal fecal matter is determined as 5 months. These solid matters are evaluated in agriculture fields in 87% of farms, given to another farms in 5% of farms and sold in 7% of farms. But, the precautions for maturation of manure for becoming beneficial for plants during storage are neglected. These negligence causes degrading of manure quality and some environmental problems such as odor and sight pollution (Karaman 2005).

In many of cattle farms (95%) around of Burdur Lake, they have any manure storage compartment and the manure is stored outside of barns without any precautions. Although there are manure storage compartment in a few of farms, the manure pits are used for other purposes and mechanization is not used for storage process. On the other hand, in some of farms, the manure is stored in barns, so it inhibits movements of animals and affects negatively animal heatlh. The regulation declared that manure bulk must be away at least 30 m from water source is carried out only 7% of the farms. Thus, animals are kept in unhealthy conditions and also the rational working of the plants could not be achieved in these farms (Çayır et al., 2012).

Polat and Olgun (2009) who studied out in cattle farms in counties of Ankara found that the manure and the other waste are stored in outdoor with inappropriate conditions in all surveyed farms. It is identified that 24.1% of farms have any manure pits and in farms that have manure pits, available manure storage buildings show an inadequacy for storage process due to paying no attention manure amount and planning of manure pits randomly. The level of manure accumulation due to the inadequacy of these buildings shows an increase, as a result of these increases the manure overflows outside of manure pits and causes environmental pollutions. Besides, because of any precaution is taken for removing of manure to prevent detriments effects of manure on the environment, seeping water from fecal matter mixes in surface water sources. As a result, the seeping causes ponding in agriculture fields and also increasing of malodor and flies around these fields. The water sources in the investigated region do not assure the quality standards for drinking water, so it causes some health risks for human and animals.

In another study, it was investigated 24 farms in Balıkesir and it was found that 21 farms of these have manure pits and the remained 3 farms of 24 have any manure pits. The farms have any manure pits let to leaving of manure in uncontrolled way to the agriculture fields. These uncontrolled treatment causes accumulation of urine and fecal matter in agriculture fields and some environmental pollution risks by malodor, insect and microorganism (Aydın and Derinöz 2013).

In region of Kahramanmaraş, there is any manure pits in all farms that have 1-5 cattles, in 78% of farms that have 6-10 cattles, in 60% of farms that have 11 or above cattles. The manure is removed by a trolley from barns and left outside randomly in front or behind of barn without taking any precautions. In the study, it was investigated a total of 80 farms and only a farm that have 11 or above cattles has a liquid manure storage. It was found that whereas the manure produced in farms that have 1-5 cattles is usually appraised in agriculture fields for plant production (45%), the manure produced in farms that have 6-10 cattles and 11 or above cattles is appraised by selling (45% and 60%, respectively). The average storage time of manure was varied between 2 months and a year in all farms (Boyacı et al., 2011).

The manure that produced in cattle farms in Kars is mainly stored by collection in outside near the barns (81.07%). It is appraised by using in production of dung cake or in plant production as natural fertilizer (Tilki et al., 2013).

Conclusion

The appraising of manure that produced in farms is an essential process in Turkey agriculture activities. It could be easily understood that manure assessment methods has been performed unconsciously and randomly. The required consideration has to be given to manure management so that the manure could gain value as a natural source especially for plant production. In many

of agricultural fields for plant production, the soil shows an inadequacy in the way of organic matter. On the other hand, in Turkey biogas production is still insufficient for benefitting effectively from manure. So, farmers are supported for biogas production to minimize the problems originating from manure and maximize the utilizing of fecal matter as a fertilizer in plant production.

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Nutritional Adjustments to Minimize the Effects of Heat Stress in Dairy Cows

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Abstract

Heat stress is often defined as incorporating two or more of the primary components of environment, eg. temperature, humidity, radiation and wind. The most common stress indicator is temperature humidity index (THI). A THI level exceeding 68 is considered stressful and requires management of intervention. Metabolic heat associated with high productivity can also contribute to heat stress, which means high yielding dairy cows are likely more prone to thermal stress in summer months and need extra attention. The result of heat stress is that as feed intakes decrease, the risk of rumen acidosis increases, as cows selectively reduce forage intake, milk and component yields drop sharply.

This paper describes environmental and nutritional modifications that help re-establish homeostasis and prevent nutrient deficiencies that decrease animal productivity. There are a number of options to ameliorate the adverse effects of heat stress on dairy cows (adjustment of rations, environmental modifications and selection of heat tolerant breeds). One of the most effective options to minimize the negative impacts of heat stress is through ration manipulation. The first step is to recognize the heat increment of feeds and then formulate rations for reduced nutrient intake. Accordingly, a common strategy is to increase the energy and nutrient density (reduced fiber, increased concentrates and supplemental fat) of the diet without compromising rumen health. Furthermore, protein supply must also be adjusted to decrease excess rumen degradable protein (RDP). Hence, the disposal of protein increases energy requirements and produces more heat. The ration will also need to supply extra minerals and certain feed additives may also be considered (rumen modifiers, direct fed microbials, probiotics, antioixdants and drugs).

Keywords: Heat stress, nutritional adjustments, nutraceuticals, pharmaceutical, dairy cows

Introduction

Dairy production is negatively affected by heat stress. Decreased feed intake and milk production are the most noticeable responses to heat stress. Heat stress occurs when the balance in thermal regulation is disrupted (Bligh and Johnson, 1973). In other words, animals increasingly lose the ability to dissipate heat as ambient temperatures become higher than the upper critical temperature (UCT) of the thermal neutral zone (TNZ) (Bligh and Johnson, 1973). For dairy cattle, the TNZ ranges from 5-20°C (NRC, 2001). But external temperature is not the only parameter: relative humidity is also contributed on the occurrence of heat stress. For this reason, the temperature–humidity index, or THI has become a common indicator to assess the risk of heat stress. The principle of THI is that as the relative humidity at any temperature increases, it becomes progressively more difficult for the animal to cool itself. Armstrong and Wiersma developed a THI chart for producers to stratify environmental conditions (see review by Armstrong, 1994). This chart developed orders of stressful significance with non-stressful conditions occurring under a THI of 72, mild stress between 72-78, moderate stress between 78-89 and death occurs when THI reached >96. However, recent data indicates that todays high producing dairy cows start to experience with heat stress at a THI of approximately 68 (Zimbelman et al., 2009). This shows that increased milk production results in more metabolic heat production from elevated nutrient intake (needed to support extra milk synthesis) leading to a larger heat increment of feeding and both put the modern dairy cow at a higher risk for heat stress (Purwanto et al., 1990).

Heat abatement strategies are often employed as a means to mitigate the negative effects of heat stress on production during the warm summer months (Smith et al., 2006). Cooling cows with shade and evaporative cooling with soakers and fans is a relatively cheap strategy to help minimize economic losses during an increased heat load (Collier et al., 2006). However, despite new barn construction and heat abatement systems, milk yield and other production parameters continue to decline by heat stress (Burgos et al., 2007). Therefore, this paper hopes to review the nutritional adjustments to ameliorate the adverse effects of heat stress on dairy cows.

Nutritional Aspects of Managing Heat Stressed Dairy Cows

Nutritional alterations in the diet can help to reduce the thermal load of cows enduring heat stress. Ration reformulation to account for decreased dry matter intake (DMI) and for basal heat production, the need to increase nutrient density, changing nutrient requirements, avoiding nutrient excesses and maintenance of normal rumen function is necessary.

Energy and fiber nutrition

Most limiting factor for dairy cows during summer is usually energy intake. In hot weather if milk yield is to be maintained at a level comparable to that at thermoneutral conditions, nutrient density should be increased proportionally to the expected reduction in feed intake. A common procedure to accomplish this is to reduce forage in the ration and increase concentrates which contributes to lower dietary heat increment (West, 1999; Baumgard and Rhoads, 2007). Forages produce a high amount of heat of fermentation; have a higher net energy value at high temperature. This is due partly to the greater ruminal heat of fermentation partly to the high heat increment of acetate, the VFA in greatest production with high forage diets (West, 1999). However, low fiber and high grain diets must be balanced with caution since fiber is very important to maintain feed intake, milk fat, proper ruminal function and health. Thus, rations should contain a minimum 19% ADF and 27 to 33% NDF, and 75% of NDF should come from high quality forages.

Another common practice to combat heat stress is fat inclusion. When compared to starch and fiber, fat has much lower heat increment and can provide more energy without negative thermal side effect. The addition of 3% to 5% fat to the rations can work successfully without compromising rumen microorganisms. For more supplementation rumen protected fat is needed. Montgomery et al., (2008) stated that diets with more than 8% total fats suppress ruminal starch digestion. Studies where fats have been fed to heat-stressed cows have shown inconsistent responses (Nayeri et al., 2011). Several experiments have demonstrated a reduction in heat load (Beede and Collier, 1986; Huber et al., 1994), the others have shown little benefit (Knapp and Grummer, 1991; White et al., 1992).

Protein nutrition

During hot weather, due to the reduction in nutrient intake and high lactation demand requires increased dietary protein density (West, 1999). However, feeding too much crude protein has an energetic cost and can increase body heat production. Inclusion of extra protein above requirements reduced ME by 7.2 kcal/g of N (Tyrrell et al., 1970). Studies have shown that the energetic cost associated with processing and excreting urea can compromise milk production when feeding excess protein (West, 2003). Formulations with either inadequate or excess CP can reduce performance by lactating cows during summer. Thus, bypass and degradable protein are both should be well balanced. Daenfaer et al. (1980) demonstrated that dairy cows fed with diets containing 19 and 23 % CP had lower milk yield by over 1.4 kg per day. Huber et al. (1994) summarized protein research by concluding that, when cows are subject to hot environmental conditions, ruminally degradable protein should not exceed 61% of dietary CP.

Mineral and vitamin nutrition/ cation-anion difference (DCAD)

Unlike humans, bovines utilize potassium (K^+) as their primary osmotic regulatory of water secretion from their sweat glands. During hot weather there is a sharp increase in the secretion of K^+ through sweat glands. In addition, dietary levels of sodium (Na^+) and magnesium (Mg^+) should be increased as they compete with K^+ for intestinal absorption (West, 2002; Staples, 2007). Therefore, the levels of K^+, Na^+ and Mg^+ for dairy cows during the summer should be 1.5-1.6, 0.45-0.60 and 0.35-0.40 % of DM respectively (Staples, 2007).

The dietary cation-anion difference (DCAD) contributes to maintain the acid-base status of cows in hot weather. Since production and heat stress are both acidogenic, elevated DCAD improves blood buffering capacity to cope with H+ as a consequence DMI and production can be

enhanced. For heat stressed cows alkaline diets are preferable and for healthy lactation ~+20 to +30 meq/100 g DM level DCAD is recommended (Wildman et al., 2007).

Water

Water is arguably the most important nutrient for the dairy cow. Water intake is closely related to DMI and milk yield. Water consumption increases during heat stress. Water and macro-mineral needs, influenced heavily by demands to maintain homeostasis and homeothermy, are altered for lactating dairy cows during heat stress. Milk is about 87% water, and contains large concentrations of the electrolytes Na, K, and CI. Therefore, lactating dairy cows have large turnover of water and these electrolytes (Shalit et al., 1991). Clean fresh water should be freely available at all times; and especially after milking.

Nutraceuticals/pharmaceutical

Supplementing nutraceuticals or pharmaceutical that manipulate rumen environment and maximize production of glucose precursors in rumen or enhance insulin sensitivity could be possible tactics to diminish the effects of heat stress.

Rumen modifiers which improve and protect the rumen environment, such as ruminant specific direct-fed microbials or probiotics are highly recommended. Some of these products help maintain rumen pH and stimulate feed intake and both would benefit the heat-stressed cow. Lehloenya et al. (2008) demonstrated that *Propionibacterium* tended to decrease molar proportion of rumen acetate, increased molar proportion of rumen propionate (by 9.7%) which is the predominate gluconeogenic precursor in ruminants, may reduce symptoms of heat stress. Aspergillus oryzae (AO) inclusion reduced body temperature (Gomez-Alarcon et al., 1991). Monensin assists to stabilize rumen pH and improves the glucose status of heat-stressed cows (Baumgard et al., 2011). Some herbal preparations have also been shown to relieve the heat stress in dairy cows and ultimately improve their productivity (Zhang et al., 2007). Another important aspect is to increase the digestibility of forages for a stable rumen, especially for high producing dairy cows receiving high starch diets. Fibrolytic enzymes (cellulases and hemicellulases) hold promising results for efficient digestion and stabilizing rumen pH as well as providing additional energy, all of which should benefit the heat-induced hyperthermic cow (Erasmus et al., 1992; Beauchemin et al., 2003). Since the increased respiration rate induces a higher production of reactive oxygen substances (Bernabucci et al., 2002), it is recommended to use antioxidants. Therefore, vitamin E and beta-carotene may help to limit the impact of heat stress on cows due to their ability to scavenge damaging free radicals at the cellular level (William et al., 2007). In addition recently, organic selenium from selenium yeast is seen crucial during heat stress periods, when the oxidative balance is challenged (Smith et al., 1997). Moreover, heat stress also affects cow's immune system. Supplemental organic Chromium (Cr) also improves milk yield or immune response of stressed dairy cows (AL-Saiady et al., 2004). However, evidence for the benefits of supplemental Cr with heat-stress is very limited. Finally, lipoic, dihydrolipoic acid and thiazolidinediones may have a positive effect on animal performance during heat stress by enhancing insulin action (Rhoads et al., 2013).

Conclusions

Environmental and dietary modifications are easily adjustable strategies to minimize the negative effects of heat stress and should be implemented before the effects of heat stress are noticed. However, environmental and dietary modifications are serving a supportive role. Genetic selection for thermal tolerance could be one potential to mitigate the effects of stress but it takes too long and may adversely affect the production traits. More indebt researches are still needed to understand full mechanisms of heat stress and to improve other beneficial modifications, which can be translated to productivity.

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Microflora Contributed to Ripening of Cheeses Produced in Aegean Region

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Abstract

Many of food products are still produced according to age-old practices and traditional methods in Turkey. Cheese is one of the most important traditional foods in Turkish cuisine. Many kind of cheese which produced only in restricted geographical areas are consumed locally in large quantities in our country. Aegean Region, which is on the west coast of Turkey, has distinctive food products; and also it is rather rich in terms of traditional cheese varieties. It is estimated that approximately 20 cheese varieties are known as local in Aegean Region. The most traditional cheeses are usually produced under poor hygienic conditions with different manufacturing technologies that are dependent on the geographical location. Numerous cheese types with different taste, shape, texture and color are produced in this region. The main flavor forming pathways in cheese includes proteolysis, lipolysis or glycolysis and the enzymes which catalyse them originate from; milk, coagulant, starter lactic acid bacteria, non-starter lactic acid bacteria, adjunct secondary cultures and exogenous enzymes. In this region, 7 varieties of these local cheeses were identified microbiologically which contain Koponesti Cheese, İzmir Teneke Tulum Cheese, Armola Cheese, Posa Cheese, Sepet Cheese, Sepet Loru Cheese, Afyon Tulum Cheese. In addition, there are a few more traditional cheese types in Aegean Region, too. The aim of this study is giving information about microflora contributed to ripening of some local cheese those belonging to Aegean Region.

Keywords: Traditional cheese, Aegean Region, non-starter bacteria.

Introduction

Aegean Region is one of the 7 census-defined regions of Turkey and it is in Eurasia. It is located in the west part of Turkey; bounded by the Aegean Sea (Ege Denizi) to the west, Marmara Region to the north, Mediterranean Region to the south-southeast and the Central Anatolia Region on the east. Aegean Region has distinctive food products and also it is rather rich in terms of traditional cheese varieties. Not only Aegean Region, but also whole Turkey has specific food products. It is estimated that approximately 20 cheese varieties are known as local in Aegean Region. The most traditional cheeses are produced with different manufacturing technologies that are dependent on the geographical location. There are numerous cheese types with different taste, shape, texture and color in our region. Sheep and goat milk is commonly used for cheese production in rural areas of Aegean Region. In Aegean Region, we have lots of traditional cheese like Koponesti Cheese, Tire Camur Cheese, İzmir Teneke Tulum Cheese, Kırktokmak Cheese, Armola Cheese, Kirlihanim Cheese, Kuru Cokelek Cheese, Posa Cheese, Sepet Cheese, Sepet Loru Cheese, Afyon Tulum Cheese, Karaburun Lor Goat's Cheese, Kuru Ezme Cheese, Bergama Tulumu Cheese, Kazıklı Cheese, Cayır Cheese etc. In this review, 7 most known varieties of these local cheeses (Koponesti Cheese, İzmir Teneke Tulum Cheese, Armola Cheese, Posa Cheese, Sepet Cheese, Sepet Loru Cheese, Afyon Tulum Cheese) will be examined microbiologically. The aim of this study is giving information about microflora contributed to ripening of these cheese varieties belonging to Aegean Region.

Cheeses of Aegean Region
Kopanesti cheese

Kopanesti is manufactured in around İzmir from the whey obtained from goat's milk cheese production (Hayaloğlu et al., 2011). Furthermore according to Karali et al. (2012) kopanesti is a traditional soft Greek cheese manufactured exclusively in the Cycladic island complex. It is made from raw bovine, ovine or caprine milk or a mixture of them without lactic acid cultures. It has a spreadable texture, an intense salty and peppery taste and a strong flavour (Karali et al., 2012).

It is a lor cheese of Greek origin. The cheese, produced in the Greek islands of the Aegean, is most often consumed as an appetizer. It has the consistency of yoghurt and it is dark yellow-light brown. It is salty, with an acid-flavour and a pungent aroma (Kamber, 2008). Kaminarides et al. (1989) stated that the total streptococci, lactobacilli, yeast and molds counts as well as coliforms were found in microflora of kopanisti cheese in their study. They showed that 86 strains of yeast from the cheese samples had been also isolated and identified out of which the following species: *Trichosporon cutaneum (T. beigelil), Kluyveromyces lactis (KI. marxianus* var. *lactis), Saccharomyce*s *exiguus, Saccharomyces cerevisiae, Rhodotorula rubra, (Rh. mudlaginosa), Trichosporon penicilatum (Geotrichum penicillatum), Candida lusitaniae (Clavispora lusitaniae)* and *Debaryomyces hansenii.* Ergüllü et al. (1998) showed that the number of aerobic microorganisms, lipolytic bacteria proteolytic bacteria, yeast and mould, coliform bacteria was $3.2x10^5$ cfu/g, $2.5x10^4$ cfu/g, $2.7x10^4$cfu/g, $4.6x10^3$ cfu/g, and 0 cfu/g, respectively. The following species of yeast: *Pischia membrane fasciens, Trichon cutaneum, Kluyveromyces lactis, Kluyveromyces marxianus spp. lactis, Saccaromyces cerevisiae, Rhodotorula ruba, Rhodotorula mucilaginosa, Candida lusitanrae and Debaryomyces hanseii* together with various species of penicillin mould, most significantly *Penicilium commune,* play a role in the ripening of Koponesti Cheese. *Pischia membrane* and *Penicilium commune* are the main microorganisms (Kamber, 2008).

İzmir tulum cheese

İzmir Tulum is one of the most known cheeses and it is produced by pressing to goat leather bag and by putting into sack, metal boxes or barrels. Production method of tulum is different from others (Durlu-Özkaya et al., 2014). İzmir Tulum Cheese is called "Teneke Tulum" or "Salamura Tulum Cheese" according to the packaging material. Kılıç ve Gönç (1992) found that mostly *Lactobacillus, Enterococcus* and *Lactococcus i*n their study about isolation from İzmir Tulum cheese (Büyükyörük et al., 2010). Bostan et al. (1992) indicated that *Streptococcus lactis* and *Streptococcus faecalis* played first role in ripening, and then *Streptococcus faecium, Streptococcus lactis, Lactobacillus casei* and *Lactobacillus plantarum* were observed in ripening of tulum cheeses made from raw cow's milk. According to Patır et al. (2001) while *Streptococcus cremoris, Streptococcus lactis, Lactobacillus casei* and their subspecies are more effective; *Streptococcus plantarum, Lactobacillus curvatus, Leuconostoc cremoris, Streptococcus faecium, Streptococcus faecalis* and their subspecies are effective in ripening of tulum cheeses too (Patır et al., 2003). Also, Patır et al. (2003) indicated that *Streptococcus lactis, Streptococcus cremoris, Lactobacillus casei* and their subspecies, *Lactobacillus plantarum, Leuconostoc cremoris, Leuconostoc dextranicum* and *Pediococcus* group were more effective in ripening of tulum cheeses. Öner et al. (2004) stated that *Lactobacillus* were the dominant flora in their research about tulum cheese. They found that *Lactococcus* were ratio of 15.8 % (Büyükyörük et al., 2010). Öksüztepe at al. (2005) reported that *Enterococcus* species which belongs *Streptococcaceae* family, *Lc. lactis* subsp. *cremoris, Lc. lactis* subsp. *lactis* and *Leuconostoc mesenteroides* subsp. *cremoris* were responsible for ripening in tulum cheeses (Büyükyörük et al., 2010).

As for the lactic bacteria, which plays a significant role in maturity, it is reported to be $9.15x10^5$ cfu/g in traditional methods, while it is $8.49x10^5$ cfu/g in cheese samples produced with starter culture. Streptococcal bacteria exist in the natural flora of raw milk. So that, it can be encountered in every phase of maturity of cheeses. The mean of Streptococcal bacteria is $4.23x10^6$ cfu/g in cheese samples that are produced without starter culture, while it is $6.17x10^6$ cfu/g when culture is used (Kamber, 2008). Büyükyörük et al. (2010) studied with 90 tradition İzmir tulum cheese samples were collected from Aydın province. They stated that identified isolates by using PCR were consist of lactis and cremoris primers. Because of production of Tulum cheese by traditional methods in small-scale establishments, starter cultures are generally not used and fermentation depends on indigenous bacterial flora (Güven et al., 1995; Öner et al., 2004; Öksüztepe et al., 2005, Karaca et al., 2007).
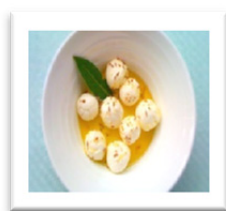
Armola

İzmir Tulum

Kopanisti

Armola cheese

Armola is a local cheese produced in Seferihisar, İzmir with the consistency of yoghurt. In the production, separately kneaded lor, white cheese and yoghurt are mixed together, placed into a bag and hung to strain. Oregano and olive oil are added after 3-4 days. The acidity is increased by itself and the milk coagulates. In animal skin, a large amount of whey leaks out. However if it is cauldron, after the whey removes out, the cheese is put into the animal skin (Kamber, 2008). Orşahin et al. (2011) found that *Lactococcus* as between 6.55-8.08 cfu/g, *Enterococcus* as between 5.35-7.29 cfu/g in Armola cheeses produced in Seferihisar in their study. There are no enough research about Armola cheeses.

Posa cheese

Posa Cheese is produced in İstanköy (Bodrum) in the west of the region and is only known here. According to local people, Atatürk, founder of The Republic of Turkey, liked very much posa cheese during a tour and request some was sent to him every year. Red and white wine dregs were used in production of Posa Cheese. Therefore it is called "Cheese with red wine dreg" and "Cheese with white wine dreg" according to wine dregs used. In crude cheese, at the beginning the number of total aerobic microorganisms is 4.0×10^{7} cfu/g, after ripening 7.2×10^{6} cfu/g in cheese of normal brine, in cheese with red wine dregs 4.5×10^{6} cfu/g, in cheese with white wine dregs 9.0×10^{6} cfu/g. So that the number of yeast and mould is higher in cheeses with wine dregs than in cheeses of brine, because the dregs contain residual yeast from wine-making (İnal, 1998; Kamber, 2008).

Sepet and sepet loru cheese

Sepet and Sepet Loru Cheese is named Sepet (basket) cheese because the appearance of the surface of Sepet cheese has a basket-weave impression. Baskets, made from stalks collected near rivers and moist areas, are used in the production of this cheese. It is produced in towns, near sea, Ayvalık and also Dikili, Burhaniye, Foça, Çeşme, Urla, Karaburun, Ödemiş and Söke (Karakaş vd., 2006; Kamber, 2008). Ercan (2009) indicated that according to phenotypic identification isolates were closely related to *Lactococcus lactis* subsp. *lactis*, *Lactobacillus casei* spp. *rhamnosus*, *L. plantarum*, heterofermentative *Lactobacillus* spp., *Streptococcus thermophilus*, *Leuconostoc* spp., *Enterococcus durans* and *E. faceium* in her study. Furthermore Ercan et al. (2014) stated that phenotypic and genotypic identifications, isolates were closely related to *Lactobacillus plantarum, Weisella confusa, Weisella paramesenteroides, Pediococcus pentasaceous, Enterococcus casseliflavus, Enterococcus durans* and *Enterococcus faceium* in traditional Sepet cheeses.

Posa Cheese

Sepet Cheese

Afyon Tulum Cheese

Afyon tulum cheese

Afyon Tulum Cheese is made from fresh, or dries salted, whole or medium-fat, or unsalted White Cheeses. However, cheeses produced on mountain pastures and those stored in animal skins tend to be preferred. Although there is "tulum" word in its name, in recent years plastic has also been used as packaging material (Kamber, 2008). Technologically, the most different characteristics are using salamura and dry salt together in production and relatively high ripening temperature (18-20 ^{o}C). Kara (2012) reported that in the beginning, the total numbers of total aerobic mesophilic bacteria, *Enterobacteriaceae*, coliform, *Micrococcus/Staphylococcus*, psicrophilic bacteria, proteolytic bacteria, lipolytic bacteria, yeast/mould, *Lactobacillus* spp./*Leucocnostoc* spp./*Pediococcus* spp., *Lactococcus* spp. and *Enterococcus* spp. were found at high levels in the fresh Afyon Tulum cheese samples (p<0,01). An increase was observed (p<0,01) in the numbers of total aerobic mesophilic bacteria, *Micrococcus/Staphylococcus*, psicrophilic bacteria, proteolytic bacteria, lipolytic bacteria, yeast/mould, *Lactobacillus* spp./*Leucocnostoc* spp./*Pediococcus* spp., *Lactococcus* spp. and *Enterococcus* spp. in the Afyon Tulum Cheese samples in first 7 days of ripening. A decrease was observed (p<0,01) in the numbers of total aerobic mesophilic bacteria, *Enterobacteriaceae*, coliform, *Micrococcus/Staphylococcus*, proteolytic bacteria, lipolytic bacteria, yeast/mould, *Lactobacillus* spp./*Leucocnostoc* spp./*Pediococcus* spp., and *Lactococcus* spp. in the Afyon Tulum Cheese samples during the ripening periyod of between 7th and 90th days.

Conclusions

Various chemical, biochemical and microbiological reactions are available during manufacture processes of fermented dairy products. It is important to bring under control the whole reactions during fermentation and ripening. As mentioned above, raw milk could be used in production of our traditional cheeses. However ripening time is very significant for cheeses produced from raw milk. During ripening, microflora of cheeses obtaine typical aroma and flavour. Therefore these dairy products are being distinctive. Furthermore it could be said that hygienic conditions during manufacture and ripening are needed to obtain a reliable product. For cheese production, pasteurization should be included in the manufacturing protocol and the cheese quality may be improved by using starter cultures based on microorganisms isolated from traditionally produced cheeses.

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Determination of Total Phenols and Antioxidative Activity in Teas of Wild Thyme and Mint Depending on Duration of the Extraction

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Abstract

The aim was to determine the content of total phenols (TP) and antioxidant activity of wild thyme (*Thymus serpyllum*), and mint (*Mentha piperita*), in different tea packages (teabags and bulk package) by extraction (15, 30, 45 and 60 minutes). The content of TP was determined spectrophotometrically using Folin-Ciocalteu, and the antioxidant activity by pFRAP method.

The content of TP in the tea of wild thyme (n=10) was in the range 134.83 - 808.28 while the mint (n=10) was 227.35 - 866.41 mg GAE/100 g. Wild thyme in teabags with the extraction of 45 minutes had significantly the highest TP content, and in a bulk the extraction of 15 minutes had significantly lowest. In the mint in a bulk extraction of 30 minutes had significantly highest TP content, and 15 minutes, was significantly lowest.

The antioxidant activity in the teas of wild thyme was in the range (61.37 - 334.45), while the mint was 106.54-308.24 mgGAE/100g.

The highest antioxidant activity for the both of teas (bulk) was 30 minutes and extraction of 60 minutes had significantly lowest.

Results showed the significant differences in the content of TP and antioxidant activity was dependent of the extraction.

Keywords: Teas, wild thyme, mint, total phenols, antioxidant activity

Introduction

Phenolics belong to the very important group of plant antioxidants. Phenolics compounds are almost always substituted with one to three hydroxyl groups on the aromatic rings in different positions. A carboxylic acid group may also be present as the main substituent or another ring may be linked to the aromatic ring. The antioxidant effect depends mainly on the number and position of hydroxyl groups and the identity of the main substituent's, but also on many other factors (Chrpova, et al. 2010).

Damage of lipids, proteins, enzymes, nucleic acids and ultimately cells and tissues is caused by overproduction of reactive species leading to aging and wide range of degenerative diseases including inflammation, cancer, atherosclerosis, diabetes, liver injury, Alzheimer, Parkinson and coronary pathologies among others (Duan et al. 2006).

Medicinal plants can be a rich source of antioxidants, especially compounds, such as flavonoids, tannins and phenolic acids and antioxidative vitamins, including ascorbic acids, tocopherol, β-caroten and anthocyanins (Salah et al. 1995).Wild thyme and mint are plants that most often used in Bosnian household as teas.

The aim of this research was to determine and compare the total phenols (TP) content and antioxidant activity of teas wild thyme and mint depending on duration of extraction.

Material and methods
Material

To carry out the experimental part of the work (20 samples), of which 10 samples of teas of wild thyme (*Thymus sepyllum*) and 10 samples of teas from mint (*Mentha piperita*) in filter bags (5 samples) and bulk packaging (5 samples), were collected. Samples were obtained in Bosnia and Herzegovina, at various outlets, which are properly guarded by performing analysis in a sealed container in a dry place at room temperature and protected from light.

Determination of total phenols content

The total phenols content was measured using the Folin Ciocalteu reagens (FC), by a method based on colored reaction of phenols with FC (Ough and Amerine, 1998), with slight modification.

Sample preparation

Teas samples about 1-2 g of dry sample is weighed with accuracy of ± 0.1 g homogenized with 40 ml of warm distilled water (approx. 50 ° C). The homogeneous mixture was extracted 15, 30, 45 and 60 minutes at a temperature of about 90-95 ° C with reflux. The resulting extract was filtered in a volumetric flask and added distilled water up 50 ml.

The tube is pipetted per 1 ml of the extract, add 2.5 ml of Folin-Cioalteau reagent (diluted 1:10). After 5 minutes 1 ml of saturated sodium carbonate and 5.5 ml of distilled water were added. In the same way the blank was prepared, and distilled water was used instead of the extract. The sample is thermostated in a water bath for 20 minutes at 50 ° C. The absorbance of resulting blue color was measured at 600 nm (Shimadzu 2200 UV-VIS spectrophotometer). Quantification was done with respect to the standard curve of gallic acid (300 mg/L). The results were expressed as gallic acid equivalents (GAE) miligram per 100g of dry weight (DW).

Determination of antioxidant activity (pFRAP method)

Determination of antioxidant activity in tea of wild hyme and mint was performed by spectrophotometry using pFRAP (potassium ferric antioxidant power) method according Meng et al. (2011) and Jayaprakasha et al. (2003), with slight modigications.

Components with antioxidant activity react with $K_3[Fe(CN)_6]$ and translate it into a form of $K_4[Fe(CN)_6]$. Reaction with $FeCl_3$, is resulted by production of blue colored complex with maximum absorbance at 700 nm. The antioxidant activity is expressed as mgGAE/100g.

All measurements were performed in triplicate.

All data were evaluated statistically in Excel by two –way analysis of variance (ANOVA).

Results

In the present study the results of total phenols content in studied teas of wild thyme and mint are presented by tables (Table1 and 2), and antioxidant activity are presented in (Tables 4 and 5).

Table1.Total phenols content (TP) in tea of wild thyme in dependents of extraction

Extraction (minutes)	Filter bags				Bulk package			
	TP(mgGAE/100g) of dry weight	Min	Max	Stdev.	TP(mgGAE/100g) of dry weight	Min	Max	Stdev.
15	411.35	342.82	528.45	72.32	238.75	134.83	335.30	77.52
30	443.08	387.81	559.18	69.70	417.55	259.41	700.55	181.62
45	651.49	528.04	808.28	131.94	442.17	253.63	624.14	147.65
60	632.93	500.52	798.48	150	496.25	275.58	759.99	176.30

Table 2.Total phenols content (TP) in tea of mint in dependents of extraction

Extraction (minutes)	Filter bags				Bulk package			
	TP(mgGAE/100g) of dry weight	Min	Max	Stdev.	TP(mgGAE/100g) of dry weight	Min	Max	Stdev.
15	427.78	328.76	601.48	106.57	341.69	227.35	381.28	81.74
30	652.55	443.05	737.25	124.36	722.10	549.35	866.41	158.04
45	613.16	436.98	770.41	105.54	657.61	553.07	745.39	88.50
60	639.17	436.89	774.47	145.53	632.14	455.09	737.59	113.99

Table 3. The antioxidant activity in tea of wild thyme in dependents of extraction

Extraction (minutes)	Filter bags				Bulk package			
	Antioxidant activity mgGAE/100g)	Min	Max	Stdev.	Antioxidant activity (mgGAE/100g)	Min	Max	Stdev.
15	186.62	106.76	279.96	70.12	152.68	93.99	197.74	42.33
30	268.01	189.71	334.45	51.93	210.21	152.49	241.06	37.66
45	195.10	147.67	260.22	52.77	150.51	95.87	192.37	35.09
60	111.56	85.45	151.10	29.60	88.17	61.37	117.46	20.40

Table 4. The antioxidant activity in tea of mint in dependents of extraction

Extraction (minutes)	Filter bags				Bulk package			
	Antioxidant activity (mgGAE/100g)	Min	Max	Stdev.	Antioxidant activity (mgGAE/100g)	Min	Max	Stdev.
15	205.71	174.33	218.13	18.17	186.20	135.63	218.84	34.44
30	283.42	232.56	308.24	36.65	192.82	154.53	214.04	29.97
45	198.42	115.91	271.34	58.04	152.47	132.92	160.74	11.34
60	143.20	106.54	208.09	40.92	127.42	109.62	141.38	11.74

Statistical analysis showed that there was no statistically significant effect of packing on the TP content in the tea of wild thyme ($F=3.26 <F_{crit} = 3.92$). There was statistically significant difference for duration of the extraction ($F = 34.34 > F_{crit} = 2, 68$) and their interactions ($F= 4.46 > F_{crit} = 2.68$).

On the contents of TP in mint teas there was no statistically significant impact of packing ($F = 0.07 <F_{crit} = 3.92$), while statistically significant difference of the duration of extraction ($F = 46.55 > F_{crit} = 2.68$) and their interactions ($F= 2.96 > F_{crit} = 2.68$) was determined.

Discussion and Conclusion

The total phenol content in samples of teas from wild thyme ranged from 134.83 to 808.28 mg GAE/100 g, while the tea of mint from 227.35 to 866.41 mg g GAE/100. Based on the obtained results it can be seen that the samples of mint teas have higher total phenol content compared to wild thyme.

By increasing the duration of the extraction, in the many cases the total phenol content increases in the teas, except for the extraction of 60 minutes, where the total phenol content decreases. Samples of tea wild thyme (filter bags) with the duration of the extraction of the 45 minutes had significantly highest average content of total phenols (651.49 mg GAE/100 g), while the extraction of 15 minutes were statistically lowest content of TP (411.35 mg GAE/100 g).

It can be seen that the samples wild thyme in bulk with the duration of the extraction of the 60 minutes had significantly highest average content of total phenols (496.25 mg GAE/100 g), while the samples with the extraction of 15 minutes were statistically lowest average total phenol content (238.75 mg GAE/100 g). Kulišić et al. (2006) founded the average content of total phenols in tea of thyme is 4000 mg /L. In their study, determination of the total phenol was carried out using HPLC. Gallic acid was used as standard. Samples were obtained in Dalmatia, Croatia, and sample extracts were prepared with hot distilled water with 30 minutes of extraction.

Samples of tea of mint (filter bags) with the duration of the extraction of the 30 minutes had significantly highest average content of total phenols (652.55 mg GAE/100 g), while the samples with the duration of the extraction of 15 minutes had statistically lowest average content (427.78 mg GAE/100 g). Atanassova et al. (2011) found that the average content of TP in mint was 45.25

mg GAE/100g. Samples were obtained from different areas in Bulgaria, and extracts prepared in methanol: water (80:20), at 20 minutes. The total phenolic content reported by Vabkova and Neugebauerova (2010) was 530 mgGAE/100g FW in thyme.

Our results showed that samples wild thyme (filter bags) with extraction of 30 minutes was significantly highest average antioxidant activity (268.01), while the extraction of 60 minutes was statistically lowest antioxidant activity (111.56 mg GAE/100 g).

It can be seen that the bulk samples of wild thyme with the extraction of the 30 minutes had significantly highest average content of antioxidant activity (210.21 mg GAE/100 g), while the extraction of 60 minutes were statistically lowest average antioxidant activity (88.07 mg GAE/100 g).

Katalinic et al. (2006) reported that the antioxidants activity in tea of thyme was 9069 mmol /L. The antioxidant activity was determined using the FRAP (ferric reducing antioxidant power) method and extracts of sample was prepared with hot distilled water (98 °C) at 30 minutes.

In our study samples of the mint (filter bags) with a 30 minutes of extraction had significantly highest average antioxidant activity (283.42 mg GAE/100 g), while samples with extraction of 60 minutes had statistically lowest average antioxidant activity (143.20 mg GAE/100 g).

The samples (bulk packaging) with the extraction of the 30 minutes had significantly highest average content of antioxidant activity (192.82 mg GAE/100 g), while the samples with the duration of the extraction of the 60 minutes had statistically lowest average antioxidant activity (127, 42 mg GAE/100 g).

According to Chrpová et al. (2010) total phenols content in *Mentha piperita L* (63mgGAE/g) and the antioxidant activity of mint is 147,5 mg AAE/g, DW, determined spectrophotometricaly by DPPH (2,2-diphenyl-1-picryl hydrazyl) method with standrd Ascorbic acid.

It can be concluded that samples of mint teas have higher total phenol content in relation to wild thyme. Increasing the duration of extraction, in many cases the total phenol content and antioxidant activity of teas increases, except for the extraction of 60 minutes, where the total phenol content decreases, as well as the antioxidant activity. Both of teas showed high antioxidant activity, although mint tea has higher compared to the wild thyme.

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Threshold of Sensory Perception of Sulphur Dioxide in Herzegovinian White Wines

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Abstract

Sulphur dioxide is almost inevitable tool in the modern wine production. In addition to certain negative impacts on consumers' health, sulphur dioxide used in large doses may compromise the smell and taste of wine. The aim of the study was to determine the threshold of sensory perception of sulphur dioxide odour in six white Herzegovinian wines and model wines obtained by them through adding increasing amounts of potassium metabisulphite the concentration of 400 mg/L. The results showed that in different wines smell of sulphur dioxide was sensory registered at different concentrations (in the range of about 73 to about 163 mg/L) and that concentrations of total sulphur dioxide a bit above 100 mg/L affect observed wines with recognizable, sharp, and unpleasant odour. It was interesting that wines with higher sensory scores for overall and odour quality had lower thresholds of sensory detection of sulphur dioxide.

Keywords: Herzegovinian white wine, sulphur dioxide, sensory threshold

Introduction

Considering that sulphur dioxide (SO_2) is still almost inevitable external substance used in wine production there is surprisingly low number of published researches about influences of SO_2 on odours of wines. Some general averments about influences of overdosed SO_2 on wine odour (pungent, unpleasant smell) could be found in classical oenological literature (Ribéreau-Gayon et al., 2006; Jackson, 2008; Butzke, 2010, etc). However, it is difficult to find detailed researches of relations of SO_2 concentrations in wines and possible endangering of wine odour by these concentrations. Some articles state that common concentrations of SO_2 in wines do not affect their sensory properties (Bakker et al., 1998; Henick-Kling et al., 1998, Lopes et al, 2009), that moderate concentrations of SO_2 improve odour of wine (Ough, Crowell, 1987) or that lower concentration of SO_2 is desirable for high quality odour of wine (Garde-Cerdán et al., 2008). Among rare concrete results is that of Amerine and Roessler (1983 – cited in: Jackson, 2008) who reported that around 100 mg/L of total SO_2 could bring burnt match odour to wines. The same authors reported that sensory thresholds for SO_2 in wines are between 15 and 40 mg/L (cited in: Boulton et al., 1996).

The aim of this study with a limited range was to find concentrations of total SO_2 in some Herzegovinian dry white table wines which could be olfactory detected (and thus jeopardize the odour of wine) and possible relations between sensory estimated overall and odour quality of wines with thresholds of sensory detection of SO_2 in wines.

Material and Methods

The research was done on six bottled Herzegovinian dry white table wines (Table 1). Wines for with pH around 3.3 were taken for analyses.

All wines were analyzed on total and free SO_2 contents. The total and free SO_2 were determined by the Ripper method (OIV-MA-AS323-04B: R2009) in two replications for each of the wines. No one of the wines contained total and free SO_2 above limits set for dry white table wines by the wine regulation in Bosnia and Herzegovina (40 mg/L of free and 200 mg/L of total SO_2).

Sensory evaluation of overall wine quality was performed by system of positive pointing up to 100 which includes evaluation of odour of wine evaluation by pointing up to 30. The average scores for overall quality of wines 1 and 6 (86.8) were significantly higher than those allotted to

wines 2 (70.8) and 5 (73.4). Besides, statistically significant was difference between scores for wines 2 (70.8) and 4 (86.4). All wines were allotted with relatively high scores for their odours. Only the score for wine 2 (21.2) was significantly lower compared to those for wines 4 (26.8) and 6 (26.6 points).

Table 1. Herzegovinian wines used for research with theirs alcohol and SO_2 contents and sensory evaluation scores for overall quality and quality of odour

Wine	Producer	Declared wine quality and GI	Alcohol (% vol.)	Total SO_2 (mg/L)	Free SO_2 (mg/L)	Sensory evaluation score (<100; $\overline{X} \pm S_{\overline{x}}$)*	Evaluation score of wine odour (<30; $\overline{X} \pm S_{\overline{x}}$)*
1	Citluk Winery	Table wine, w/o GI	11.0	37	55	86.8 ± 1.96^a	26.2 ± 1.11^{ab}
2	Hercegovinavino	Table wine, w/o GI	11.0	19	100	70.8 ± 1.77^c	21.2 ± 0.37^b
3	Hercegovina produkt	Table wine, w/o GI	12.0	12	65	81.6 ± 3.16^{abc}	24.0 ± 1.26^{ab}
4	Citluk Winery	Quality wine, GI	12.2	31	85	86.2 ± 4.49^{ab}	26.8 ± 1.50^a
5	HEPOK Mostar	Table wine, w/o GI	11.0	16	90	73.4 ± 1.86^{bc}	23.2 ± 0.97^{ab}
6	Zadro Winery	Table wine, w/o GI	12.5	22	95	86.8 ± 4.03^a	26.6 ± 1.54^a

*Tukey test (p≤ 0.05); the same letters in the same column indicate no statistically significant differences.

Added sulphuring (modelling wines) was done by adding of 0,4% solution of potassium metabisulphite ($K_2S_2O_5$; approximately 0,2% solution of SO_2) in a way that modelled wines contained around 100, 200, 300, and 400 mg/L of total SO_2). Solution of $K_2S_2O_5$ was added to wines 15 minutes before their presenting to panellists. On sensory detection of smell of SO_2 for each wine each panellist had seven glasses with following contents: modelled wines with added SO_2 (4 glasses), pure wine (no added SO_2, 2 glasses) and wine diluted with water 1:3 (1 glass). Each glass contained 10 mL of wine or diluted wine whose temperature on serving was around 15°C. Each panellist was expected to smell content of each of its glasses and note presence or absence of smell of SO_2. Modelled concentration of SO_2 and orders of glasses for each wine offered to panellists are presented in the Table 2.

Calculation of the average threshold of smell of SO_2 for certain wine was done in the following way. The lowest concentration of total SO_2 recognized by all panellists was multiplied by 5 (number of panellists). Concentrations lower than that recognized by at least some panellists were multiplied by number of those panellists and added to aforementioned multiplication. Finally, the sum of the multiplications was divided by the total number of panellists who registered smell of SO_2 on all those levels.

Basic statistic analyses (descriptive statistics, ANOVA, correlation coefficients) were carried out with Microsoft Excel 2007® software and significance of differences between means (Tukey test) with XLSTAT® (Addinsoft, New York).

Results

The design of the experiment with concentrations of SO_2 in non-modelled and modelled wines and numbers of panellists who detected or not detected odour of SO_2 in the contents of certain glasses are presented in the Table 2.

At least some panellists recognized smell of SO_2 in all tasted even non-modelled wines. It is particularly interesting that in two probes smell of SO_2 in wine 1 (which contained only 55 mg/L of total SO_2) was recognized in sex out of ten trials. This could be explained by extremely high concentration of free SO_2 in this wine (37 mg/L, Table 1). Excluding wines 5 and 6, all panellists

easily recognized smell of SO_2 in modelled wines which contained around 200, 300 and 400 mg/L of total SO_2. With wine 5 all panellists recognized smell of SO_2 only with its concentrations of around 300 and 400 mg/L. In two probes of non-modelled wine 5 panellists recognized smell of SO_2 in seven out of ten trials. Even four panellists registered smell of SO_2 with its concentration of 110 mg/L, but only two with its concentration of 210 mg/L in wine 5. With wine 6 all panellists recognized smell of SO_2 with its concentrations of 105 and 395 mg/L. However, both with concentrations of 195 and 295 mg/L of total SO_2 one panellist with each wine did not registered smell of SO_2. Those two panellists were excluded from calculation of average threshold concentrations. As with wine 4, one panellist recognized smell of SO_2 in diluted wine 6. In both cases (i.e. wines 4 and 6) those panellists were excluded from calculation of average threshold concentrations of SO_2 for these wines.

Table 2. Concentrations of total SO_2 in modelled and non-modelled wines, contents of glasses offered to panellists, number of panellists who detected (+) or not detected (-) smell of SO_2 in certain glasses, and average thresholds of sensory detection of SO_2 in the wines

Wine	Glass content – Total SO_2 (mg/L)							Average threshold (total SO_2 mg/L)
	Number of panellists who detected smell of SO_2 (+ detected; - not detected)							
	1	2	3	4	5	6	7	
1	55 mg/l (Wine)	95 mg/l	215 mg/l	Diluted wine	295 mg/l	55 mg/l (Wine)	395 mg/l	73,2
	2+, 3-	5+	5+	5-	5+	4+, 1-	5+	
2	100 mg/l (Wine)	Diluted wine	100 mg/l (Wine)	200 mg/l	100 mg/l (Wine)	300 mg/l	400 mg/l	138,5
	2+, 3-	5-	3+, 2-	5+	3+, 2-	5+	5+	
3	65 mg/l (Wine)	65 mg/l (Wine)	105 mg/l	205 mg/l	305 mg/l	405 mg/l	Diluted wine	81,7
	4+, 1-	3+, 2-	5+	5+	5+	5+	5-	
4	85 mg/l (Wine)	105 mg/l	85 mg/l (Wine)	Diluted wine	205 mg/l	305 mg/l	405 mg/l	95,0
	2+, 3-	5+	2+, 3-	1+, 4-	5+	5+	5+	
5	90 mg/l (Wine)	110 mg/l	210 mg/l	Diluted wine	90 mg/l (Wine)	290 mg/l	390 mg/l	163,3
	4+, 1-	4+, 1-	2+, 3-	5-	3+, 2-	5+	5+	
6	95 mg/l (Wine)	105 mg/l	Diluted wine	195 mg/L	295 mg/l	95 mg/l (Wine)	395 mg/l	101,7
	1+, 4-	5+	1+, 4-	4+, 1-	4+, 1-	2+, 3-	5+	
Average threshold (total SO_2 mg/L) for all wines								108,9

Relations among sensory scores for overall wine quality, quality of wine odour, and threshold concentrations of total SO_2 in analyzed wines are presented on Figure 1.
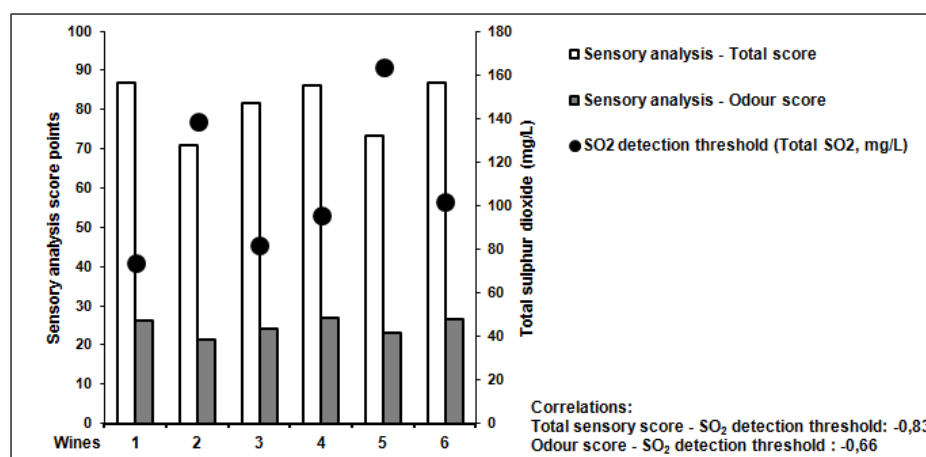
Figure 1. Overall quality and wine odour sensory scores with the average sensory thresholds of total SO_2.

Sensory scores for overall wine quality and quality of their odours were in inverse relation with the average sensory thresholds of total SO_2. This is evidenced through very high (-0.83; total sensory score – SO_2 threshold) and high (-0.66; sensory score for wine odour – SO_2 threshold) negative correlation coefficients.

Discussion and Conclusion

The average thresholds for sensory recognized smell of SO_2 notably varied from wine to wine (from 73.2 mg/L with wine 1 to 163.3 mg/L of total SO_2 with wine 5), with the average threshold of 108.9 mg/L of total SO_2 for all wines. Regardless the fact that in one non-modelled wine all panellists recognized smell of SO_2, thresholds bellow 100 mg/L of total SO_2 in three out of six analyzed Herzegovinian white wines (wines 1, 3, and 4) warn on risks for wine odour. The average thresholds in these wines were lower than that (100 mg/L of total SO_2) referred by Amerine and Roessler (1983 – cited in: Jackson, 2008).

To some extent it was surprise that lower thresholds of SO_2 were registered in wines which had higher sensory scores for overall quality and quality of wine odour (relatively high negative correlation coefficients).

Some shortcomings of this research should be noted here. The wines were not chemically analyzed in detail, while their composition (e.g. acetaldehyde concentration) for a sure affects binding of SO_2 in wine. Smell of SO_2 in modelled wines was sensory detected just after adding of $K_2S_2O_5$ solution when, supposedly, a high portion of added SO_2 was in its free form. In reality, sulphuring of wines usually comes long time before their consumption.

Results of this limited study with no doubts ask further more extensive research and detailed analyses of relations between sensory experienced wine quality (especially quality of wine odour) and concentrations of SO_2 in wines. Those researches should find possible models for such sulphuring which will protect wine without endangering its odour.

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The Fatty Acid and Antioxidant Stability of Cold Pressed Oil Obtained by Different Olive Varieties

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Abstract

Location of olive cultivation and variety are one of the factors that affects on the content of fatty acid and antioxidation stability of oil. Olives are grown in southern Herzegovina. The aim of this study was to determine whether there are differences in the quality of oils. Indicators on the basis of which will determine the presence of content fatty acid, phenols, chlorophyll and carotenoids, from the oil obtained by different olive varieties Drobnica,Lastovka, Krvavica and Oblica. Processing oil is made on the principle of cold pressing.The t-test showed that the values for fatty acid content in all oil samples significantly differ. The t-test showed that the oil Drobnica and Lastovka contains a great amount of total phenols (306.55 and 323.72 mg/kg) in comparison with oil Krvavica and Oblica (137.67 and 262.41 mg/kg). Also, the t-test showed that the oil and the variety Drobnica and Krvavica contain significantly greater amount of chlorophyll (19.09 and 18.85 mg/kg) and carotenoids in relation to oil Lastovka and Oblica (7.98 and 8.09 mg/kg). The content of chlorophyll and carotenoids are not significantly different between the oil Oblica and Lastovka. Towards for on the content of fatty acids, oil Lastovka has the highest content of oleic fatty acid (63.6 %) and lowest oil Oblica (58.6 %).

Keywords: Olive oil, fatty acid, phenols, chlorophyll, carotenoid

Introduction

Virgin olive oil is considered as a "functional" food because of its nutritional properties and health benefits. Oleic fatty acid is considered as beneficial for human health. Although, the amount of oleic acid changed little over the maturity period, linoleic acid was found to increase while palmitic acid decreased. Higher amounts of polyunsaturated fatty acids are nutritionally beneficial but reduce oil stability (Abdalla et al., 2008).Fatty acid composition may differ from sample to sample, depending on the growing area, latitude, climate, variety, and olive fruit ripness (Viola and Viola, 2009; Boskou, 2006). Phenolic compounds are present in very small amount, but they are very important as they increase oxidative stability of olive oil. The olive oil colour is related to the chlorophyll and carotenoid content. Significant impact on the pigment content decrese in olive oil has the daily light (Žanetić & Gugić, 2006; Boskou, 2006; Šindrak et al.,2007). The growning area and processing methods significantly affect the phenolic, chlorophyll and carotenoid content.

The aim of this studie was to analyse the fatty acid, total phenolic, chlorophyll and carotenoid content in olive oils obtained by cold pressing from different olive varieties, grown in southern Herzegovina.

Material and methods

Material

Four samples of monovarietal virgin olive oils (Drobnica, Krvavica, Lastovka and Oblica) were analysed. Samples were collected from southern Herzegovina. Olives were harvested by hand and also mechanically. Harvests were carried out from the end of October until the beginning of November 2013, when the oil content in olives was 16-20%. After washing and leaf-removal, fresh olives were stored at 10 °C in the dark for 24h. Olive oils were obtained by cold pressing using a hydraulic press. Before pressing, olives were de-stoned and milled, then the

olive paste was kneaded. The oil phases were collected and left to decant. All oil samples were filtered and stored in dark glass bottles at 5 ° C until being analysed.

Methods

The fatty acids composition in the analysed samples of olive oils was determined by standard method. Analysis was carried out on gas chromatogram GC/MS-6890 II, by using a Hewlett-Packard instrument with selective mass detector (MSD) 689 II: FKKT-UL. Capillary column: SP 2560, 100 m x 0,25 mmlD, 0,20 μm; Detector: flame ionization FID, 260 ^{0}C, separation 100.1; Gas carrier: helium, 20 cm ^{3} /sec. Temperature of the Owen was 140 ^{0}C / minute, cooling (DGF, C-VI 10a, 1985).

Total phenolic content were measured using spectrophotometer by method that is based on color reaction of phenols with Folin-Ciocalteau reagent. 1 ml of sample was mixed with 15 ml distilled water, 5 ml F.C reagent and with 15 ml 20 % Na_2CO_3 solution. After 2 hours of incubation, absorbance of all samples was measured at 765 nm, using Shimadzu UV visible spectrophotometer UVmini-1240. Total phenol content was quantified by gallic acid calibration curve (Ough and Amerine, 1998).

Chlorophyll content was determined, in undiluted sample of oil, by measuring absorbance at 670, 630 and 710 nm, using spectrophotometer. Results are expressed as the content of pheophytin a (Pokorny et.al., 1995).

Carotenoid content was determined, in 10 % diluted sample of oil, by measuring absorbance at 445 nm, using spectrophotometer. Results are expressed as the content of β-carotene (BSM, 1977). Statistical analysis and comparison of results were done by t-test ($p<0,05$, significance level), using Excel 2007.

Results

The results of fatty acid composition olive oil are represented as mean values (Tab.1.).

Fatty acid (%)	Sample			
	Drobnica	**Krvavica**	**Lastovka**	**Oblica**
Palmitoleic (C16:1)	1.60± 0.10[c]	2.00 ± 0.10[b]	2,96 ± 0,15[a]	1,25 ±0,05[c]
Oleic (C18:1 n9)	60.10±0.10[b]	60.10±0.10[b]	63.60±0.07[a]	58.60±0.30[c]
Linoleic (C18:2 n6)	7.10 ±0.10[c]	9.10±0.20[a]	8.30±0.05[b]	5.20±0.05[d]
Linolenic (C18:3 n3)	0.75±0.05[a]	0.50±0.02[b]	0.80±0.05[a]	0.51±0.02[b]
Eicosenoic (C20:1)	0.35±0.05[a]	0.10±0.02[b]	0.40±0.05[a]	0.11±0.01[b]
Myristic (C14:0)	0.03±0.005[b]	0.01±0.005[c]	0.05±0.002[a]	0.01±0.002[c]
Palmitic (C16:0)	10.10±0.10[b]	10.30±0.03[b]	12.70±0.05[a]	9.40±0.10[c]
Heptadecanoic (C17:0)	0.25±0.05[a]	0.05±0.007[b]	0.20±0.05[a]	0.11±0.02[b]
Stearic (C18:0)	2.50±0.07[a]	2.50±0.15[a]	2.80±0.10[a]	1.50±0.05[b]
Arachidic (C20:0)	0.40±0.1[b]	0.30±0.02[b]	0.60±0.05[a]	0.20±0.10[a]
Behenic (C22:0)	0.25±0.05[a]	0.10±0.02[b]	0.20±0.05[b]	0.11±0.01[b]
Lignoceric (C24:0)	0.15±0.05[a]	0.14±0.01[a]	0.10±0.01[a]	0.10±0.02[a]

*Values within the same row labelled by different letters are statistically different ($p<0.05$)

Total phenolic, chlorophyll and carotenoid contents of different olive oil samples, are shown in Figure 1.
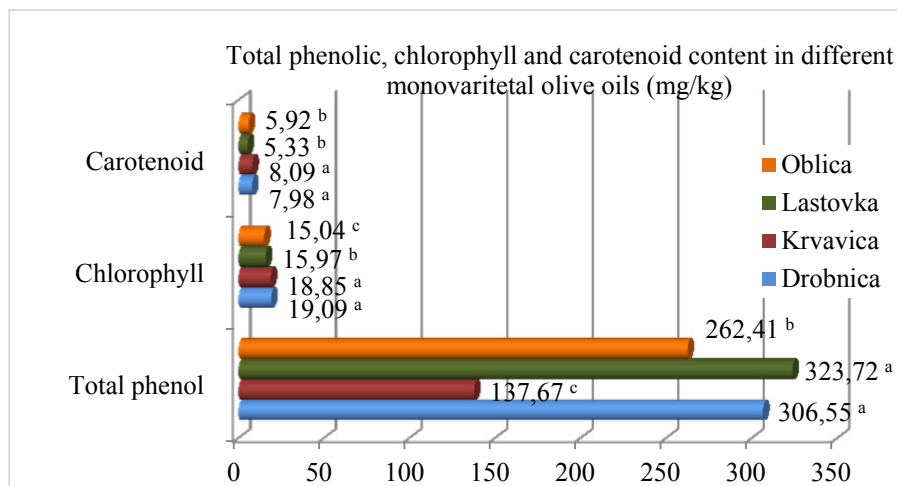
Figure 1. Total phenolic, chlorophyll and carotenoid contents (mg/kg) in different samples of olive oil.
*Values labelled by different letters are statistically different (p<0.05)

Discussion and Conclusion

The highest amount of oleic fatty acid was in Lastovka oil (63.60 %), and the lowest was in Oblica oil (58.60 %). The statistical analysis of the data showed that Lastovka oil contains significantl higher amount of oleic fatty acid in comparison to Drobnica, Krvavica and Oblica oil. With regard to linolenic fatty acid, in Lastovka (0.80 %) and Drobnica oil (0.75 %) no significant differences were observed. Those values are significantly different as compared to Krvavica (0.50%) and Oblica oil (0.51%). The statistical analysis of the data showed that those values are significantly different. Žanetić et al., (2012) for Oblica oil reported 75.91% oleic fatty acid, 75.14% in Drobnica oil and 71.81% in Lastovka oil. Čorbo et al., (2011) found also higher amount of oleic fatty acid in Oblica oil, between 73.30 % and 78.53%, showing differences between growing ares. Lower amount of oleic acid in Drobnica (60.10%) and Lastovka oil (63.60%) as compared to results reported by Žanetić et al., (2012) which ranged between 75.14% in Drobnica oil and 71.81% in Lastovka oil. Acording our results, Linoleic acid were lower in Drobnica (7.10%) and Lastovka oil (8.30%). Compared to the results presented by Žanetić et al., (2012), linoleic acid in Drobnica is 7.93% and 11.63% in Lastovka oil. Oblica oil showed the lowest amount of palmitic fatty acid (9.40 %), whereas the highest was in Lastovka oil (12.70 %). These results are lower than those reported by Škevin et al., (2011), who noted 11.3% of palmitic fatty acid in Oblica oil.

The highest total phenolic showed Lastovka oil (323.72 mg/kg), whereas Krvavica oil the lowest (137.67 mg/kg). The statistical analysis showed that Drobnica and Lastovka oil had significantly higher total phenolic content as compared to Krvavica and Oblica oil. As already reported in some previous studies (Šindrak et al., 2007; Hashempour et al., 2010) the olive variety showed significant impact on total phenolic content. Žanetić et al., (2012) noted that virgin oil made of Drobnica variety varied between 249.46 and 355.58 mg/kg, in oil made of Lastovka between 250.26 and 363.78 mg/kg, and oil of Oblica between 263.75 and 289.83 mg/kg. The total phenolic in oil Drobnica was 306.55 mg/kg, Lastovka oil 323.72 mg/kg and Oblica oil 262.41 mg/kg.

The highest chlorophyll was determined in Drobnica oil (19.09 mg/kg), whereas the lowest and Oblica oil (15.04 mg/kg). The statistical analysis showed that chlorophyll content in Drobnica and Krvavica was significantly higher as compared to Lastovka and Oblica oil. Among Lastovka and Oblica oil no significant differences were observed. Our results are consistent with data presented by other authors (Hashempour et al., 2010), wich ranged between 5.69 and 9.51 mg/kg. The content high of chlorophyll and carotenoid was related to the early olives harvest (in October). Thus, the olive pigment did not degradeted.

The highest content of carotenoid was in Krvavica oil (8.09 mg/kg), whereas the lowest in Oblica oil (5.92 mg/kg). The statistical analysis showed that the carotenoid content in Drobnica (7.98 mg/kg) and Krvavica oil were significantly higher as compared to Lastovka (5.33 mg/kg) and Oblica oil (5.92 mg/kg). No significant differences were found between Lastovka and Oblica oil. The carotenoid content in analysed olive oil samples were within the ranges presented by Giuffrida et al., (2011), between 4.19 and 16.12 mg/kg.

Lastovka oil contained the highest amount of oleic acid, and also a higher amount of linolenic acid as compared to other oils. The oleic content in Lastovka oil was significantly higher as compared to Drobnica, Krvavica and Oblica oil. Among Drobnica and Krvavica oil no significant difference in the oleic fatty acid content was found. The linolenic fatty acid content in Drobnica and Lastovka oil were higher as compared to Krvavica and Oblica oil. The linoleic fatty acid content was significantly higher in Krvavica oil compared to other analysed oils. The palmitic fatty acid in Lastovka oil was significantly higher as compared to Drobnica, Krvavica and Oblica oil.

Highest total phenolic contentin Lastovka oil, but lower chlorophyll and carotenoid content sa compared to Drobnica and Krvavica oil. The statistical analysis showed that the total phenolic content in Drobnica and Lastovka oil were significantly higher as compared to Krvavica and Oblica oil. The total phenolic content in Krvavica oil was significantly lower as compared to Oblica oil. The t-test showed that the chlorophyll and carotenoid content in Drobnica and Krvavica oil were significantly higher as compared to Lastovka and Oblica oil. Among Lastovka and Oblica oil no significant difference was found.The results showed that the analysed oil were extra quality. All samples contained adequate fatty acid, total phenolic, chlorophyll and carotenoid content.

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Importance of Probiotics in Functional Dairy Products

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Abstract

The interactions of the gastrointestinal microflora with human health have been the subject of considerable debate in recent years. Disruption of the ecologic equilibrium of the normal intestinal flora may result in gastrointestinal diseases. Functional foods, which are used in prevention and treatment of some intestinal diseases, are defined as "foods that may provide health benefits beyond basic nutrition". Probiotics are constituted an important part of functional foods. They are live microbial food supplements that affect the host beneficially by improving its intestinal microbial balance. It is widely accepted that sufficient level of probiotic bacteria should be in a product throughout its shelf life, to achieve the claimed health benefits. Probiotics must also be alive during transit through the acidic conditions of the stomach, and resist degradation by hydrolytic enzymes and bile salts in the small intestine. The growth and survival of probiotics during gastric transit is affected by the physico-chemical properties of food carriers. Gastric acid, juices and bile tolerance, adherence to gastrointestinal epithelium and the acid production of probiotics are also affected by the food ingredients used in probiotic delivery. The functional properties of probiotic strains can improve by the presence of different food ingradients such as prebiotics that encourage the growth of probiotic bacteria. The appropriate combination of prebiotics and probiotics manifest higher potential for a synergistic effect in functional food technology. In dairy industry, probiotics have a promising field for the extension of dairy products like yoghurt, cheeses, beverages, ice creams, and other desserts commercially.

Keywords: Probiotics, prebiotics, functional dairy products

Introduction

A probiotic is a live microorganism that exhibits beneficial effects on the host's health beyond inherent basic nutrition. (Sultan, et al, 2006). The whole concept of probiotics is not new, and in fact they have been consumed by human beings in the form of fermented foods, for thousands of years. It is accepted that daily intake of these probiotics contributes to improving and maintaining well balanced intestinal flora, and prevents gastrointestinal disorders (Ranadheera, et al, 2010). At present, probiotics and their effects on human health have been demonstrated both within different food matrices and as single or mixed microbial culture preparations (Coman, et al, 2012). Advantages of probiotics for health can only be realized if proper probiotic strain or product selection, and dose guidelines of commercial production are applied in human food or dietary supplement (Douglas and Sanders, 2008; Kalliomaki et al., 2010). Also ingredients in certain food products may naturally contain prebiotics which help to improve the functional efficacy of probiotics. Many other foods such as dairy and meat products, cereals, beverages and infant formulates can be fortified with prebiotics during manufacturing process to increase probiotic efficacy (Gibson, et al, 2004).

Physico-chemical properties of food carriers used for probiotic delivery, such as buffering capacity and pH, are significant factors that influence survival of the probiotic and hence potential probiotic effects during gastric transit. Food formulations with appropriate pH ranges and high buffering capacity would increase the pH of the gastric tract and thereby enhance the stability of probiotics (Kailasapathy & Chin, 2000). Since combinations of probiotics with synergistically acting components and properties such as pH from the food seems to be one of the best ways of improving probiotic efficacy Therefore careful selection of the food matrix is an important factor that should be considered in developing probiotic products. Probiotic viability in the foodmatrix depends on factors, such as pH, storage temperature, oxygen levels, and presence of competing microorganisms and inhibitors. It is important that the formulation maintains the activity and viability of the probiotic for extended periods of time (Shah, 2007).

Probiotic Dairy Products as Functional Food

Foods which promote health beyond providing basic nutrition are termed "functional foods". This term cover a broad range of products: typical examples are probiotic yogurt, cholesterol-lowering spreads, and oligosaccharide-added foods (Williamson, 2009). Food helps to buffer the bacteria through the stomach and may contain other functional ingredients that could interact with probiotics to alter their functionality. Colonic foods, which encourage the growth of favourable bacteria, are referred to as prebiotics. Oligosaccharides such as lactulose, galactooligosaccharides, inulin, fructooligosaccharides, and other food carbohydrates are some of the well known examples of prebiotics. There is an obvious potential for a synergetic effect when combining probiotics and prebiotics appropriately, because prebiotics promote the growth and activities of probiotics Nevertheless, populations of $10^6 - 10^7$ CFU/g in the final product are established as efficient quantities of probiotic cultures in processed foods (Talwalkar et al., 2004), equivalent to $10^8 - 10^9$ CFU, provided by a daily consumption of 100 g or 100 ml of food, hence benefiting human health (Jayamanne and Adams, 2006).

Food applications for probiotics are found mostly in dairy products, such as yogurts, kefir, and cultured drinks. Emerging food applications include probiotic ice creams and probiotic cheese, nutrition bars, breakfast cereal, infant formula, and many others. Usually yogurt is prepared by allowing milk to ferment by specific pure cultures of lactic acid bacteria (*S. salivarus subsp. thermophilus* and *L. delbrueckii subsp. bulgaricus* cultures) (Cruz et al., 2009)

Yoghurt and fermented milks are considered as the main vehicle for probiotic delivery. Increasingly yoghurts have been prepared with probiotic microorganisms with varying viability over a range of shelf lives. Different yogurts have demonstrated different viability levels of probiotics over shelf lives. Higher milk fat content further demonstrated inhibitory effects for probiotic cultures, particularly *B. bifidum* BBI in yogurts. Plain-yogurts demonstrated significant ability in retaining a higher level of *L. acidophilus* over the shelf life compared to yogurts containing mixed berry or passion fruits. Different nutrient compositions such as vitamin levels of fruit juice may also have an influence on viability. Fortification with ascorbic acid was reported to improve viability of L. acidophilus in yogurts although this was not to have any effect on bifidobacteria (Ranadheera, et al, 2010).

Ice cream and frozen dairy deserts demonstrated great potential for use as vehicles for probiotic cultures. Ice cream is considered favourably as a probiotic carriers due to the lower storage temperature and less risk of temperature abuse during frozen storage which leads to higher viability of probiotics at the time of consumption (Cruz, et al, 2009). Lactic streptococci/lactic starter cultures also demonstrated different percentage of viability, acid development and proteinase activity under different frozen storage temperatures in skim milk medium. Therefore, when a probiotic strain is used to produce frozen food product their efficacy in the small intestine may vary from non frozen food product fortified with the same strain. Probiotics incorporated into frozen food products have further demonstrated better viability during shelf life. Better survivability of probiotics in frozen products could be due to the lower temperature that they are held at and subjected to less temperature abuse. The addition of probiotic cultures to ice-creams, in addition to adding value to the product, provides it with the advantage of being functional. As a general rule, the addition of probiotics strains into a food matrix implies the need to assure the viability of the probiotic culture at high levels during the storage period, without altering its sensory characteristics. This category includes several related products, such as plain ice-cream, reduced fat, low fat, nonfat, fruit, and nut ice-creams, puddings, variegated, mousse, sherbet, frozen yoghurt, besides other frozen products (Ranadheera, et al, 2010).

Cheese is a versatile food product, appealing to many palates and is suitable for all age groups and provides a valuable alternative to yogurt and fermented milk as a vehicle in probiotic delivery. Its versatility offers opportunities for many marketing strategies, as a probiotic food

carrier. In fact, cheese provides a valuable alternative to fermented milks and yogurts as a food vehicle for probiotic delivery, due to certain potential advantages. It creates a buffer against the high acidic environment in the gastrointestinal tract, and thus creates a more favourable environment for probiotic survival throughout the gastric transit, due to higher pH. Moreover, the dense matrix and relatively high fat content of cheese may offer additional protection to probiotic bacteria in the stomach. Interestingly cheese produced with oligofructose and inulin demonstrated better consumer acceptability indicating advantages of selected prebiotics not only in probiotic growth viability and stability, but also in improving sensory qualities. The presence of the prebiotics inulin and oligofructose was described to promote increased growth rates of bifidobacteria and lactobacilli, besides increased lactate and short chain fatty acids production in petit-suisse cheese supplemented with these microorganisms and submitted to batch culture fermentation with human faecal slurry (Cruz, et al, 2009).

Foods used for dissemination of probiotics are usually fermented foods even if probiotics also could be present in infant formula, fruit drinks, whey drinks and sweet milk. Fermented milk and cheese are the most common foods with probiotics (Svensson, 1999).

Conclusions

To succeed in promoting the consumption of functional probiotic products the food industry has to satisfy the demands of the consumer. All probiotic foods should be safe and have good sensory properties. The probiotic foods should also include specific probiotic strains at a suitable level during the storage time. By examining existing products it has been suggested that this is not always the case (Hamilton-Miller et al, 1999).

When considered together the above mentioned evidences reinforce the fact that food can influence growth, viability and survival and different functionality of probiotics that determine their efficacy in gastrointestinal tract. Probiotics have been widely used in therapeutic applications including prevention of urogenital diseases (candidal vaginitis), alleviation of constipation, protection against traveller's diarrhoea, prevention of infantile diarrhoea, reduction of antibody-induced diarrhoea, control of inflammatory bowel diseases and irritable bowel syndrome, reduction of hypercholesterolemia, protection against colon and bladder cancer, prevention of osteoporosis and prevention of food allergy and atopic diseases (Ranadheera, et al, 2010).

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Some Phenolic Compounds and Antioxidant Activity of Apple Peel and Dried Apple Pomace

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Abstract

The antioxidant activity and phytochemical properties were determined in apples peel, flesh, raw juice and pomace of two different apple cultivars (red cultivar 'Starkrimson Delicious' (SD) and yellow cultivar 'Stark Spur Golden Delicious' (SSGD) and commercial apple pomace (CAP) also apple pomaces dried with two different methods. Antioxidant activity (AA) was investigated with the Ferric reducing antioxidant power (FRAP) method, total phenolics with using Folin–Ciocalteu method and flavonoid content was determined by a colorimetric method. Chlorogenic acid, epicatechin, quercetin glycosides, procyanidin and phloridzin were quantified using an HPLC-UV method. AA values of the samples ranged from 0.29 to 29.34 g trolox equivalents (TE)/100 kg dry weight dry weight (DW). The total phenolic and flavonoid content ranged from 12.33 to 570.92 mg of gallic acid equivalents (GAE)/100 g DW and 6.70 to 368.87 mg of catechin equivalents (CE)/100 g DW respectively. Chlorogenic acid was determined highest level in the flesh of SSGD, epicatechin in commercial pomace, phloridzin in commercial pomace and in SSGD of pomace, quercetin glyocosides in commercial pomace, procyanidin in SD of peel.

Keywords: Phenolic compounds, antioxidant activity, dried apple pomace, apple peel, HPLC

Indroduction

Apple pomace is the processing waste generated after apple juice manufacturing and represents up to 30% of the original fruit. Large amounts of apple pomace are produced worldwide, and being highly biodegradable, its disposal represents a serious environmental problem (Vendruscolo 2008). Apple pomace is a valuable source of polyphenols relevant for their antioxidant activity, as flavanols and flavonols (Garcia et al. 2009). Lu and Foo (1997), Schieber and et al. (2001) observed the presence of some phenolic constituents, as procyanidins and quercetin glycosides, which have been shown to exert strong antioxidant activity in vitro.

The objective of the present study was to investigate the nutritional quality of apple peel, flesh, apple cultivars pomace, commercial apple pomace and two different methods of dried apple pomaces.

Materials and Methods

Two apple cultivars SD and SSGD which grown in Atatürk Central Horticultural Research Institute were used. Peel and flesh samples were seperated carefully with a knife. To obtain the experimental pomaces, apples were shredded (Lan Elec, model FC 19, England) and quickly pressed by means of a small hydraulic press (Hafico). The obtained pomaces were immediately packed in plastic bags and frozen at -20 ºC. The samples were dried with infrared (IR) and freeze-dried (lyophilization) (Hetosicc CD 4, Denmark). Commercial pomace is constituted by multCPle cultivars. Aroma juice, Bursa, Turkey. These pomaces were immediately packed in plastic bags and frozen at -20ºC.

Fruit extracts for total phenolics, flavonoid and antioxidant activity in methanol extract analysis were prepared (Thapoing et al. 2006). Phenolic composition measured in methanol extract analysis was prepared using the method of with some modifications (Yılmaz and Toledo 2004). Antioxidant activity was measured using FRAP assay (Thapoing et al. 2006). Total phenolics content was determined by the Folin–Ciocalteu method (Thapoing et al. 2006). Determination of flavonoids of The method of Zhishen and et al. (1999) and Dewanto and et al. (2002) were used to determine flavonoid contents of samples. Quantification of phenolic compounds were quantified according to the procedure described (Ou et al. 2002).

Analyses were performed at least in three replicates. Statistical analysis of the data was performed using one-way ANOVA and mean values were compared applying the least significant difference using Jump 5.0.1.2 statistical program.

Results

AA of the various samples were determined with FRAP, TP and phenolics analysis and summarized in Table 1. AA of samples ranged between 0.29 and 29.34 g TE/kg DW. Peel extracts showed markedly high antioxidant activity. The group "total quercetin glycosides and epicatechin" were the most important contributor to the measured antioxidant activity.

The highest total polyphenols were determined in the peel of SD cultivar. Total polyphenols of commercial apple pomace dried with lyophilization were higher than the apple pomace dried with IR ($p<0.05$)

The flavonoids of the apple components were measured. The content of flavonoid was the highest in apple peel of SSGD and commercial pomace ($p<0.05$). The flavonoid contents in pomaces dried with IR were lower than the pomaces dried with lyophilization ($p<0.05$). The correlation analysis showed a medium relationshCP between total phenol antioxidant activity ($r=0.73$) and flavonoid and antioxidant activity ($r = 0.69$).

Altough the chlorogenic acid, phloridzin, epicatechin and quercetin glycosides were detected in pomaces, none of them was detected in raw apple juice. Phenolic contents of the commercial pomace, SD and SSGD pomaces were found different. Epicatechin and quercetin glycosides content were significantly higher in commercial pomace than SSGD and SD pomaces whereas and the highest chlorogenic acid was determined in the flesh of SSGD. Epicatecin and quercetin glycosides were not detected in the SSGD flesh. Detected polyphenols were higher in pomace dried with lyophilization than infrared. Chlorogenic and epicatechin were not detected in both of pomace dried with infrared.

Discussion and Conclusion

In peel, quercetin glycosides, procyanidins, and flavanols, due to their high radical scavenging activities and high concentrations, proved to be the major contributors to the calculated antioxidant activity (Chinnici et al. 2004). High antioxidant levels have multCPle benefits to the human health and the peel may be the richest source for antioxidant (Wang and Lin 2000). In our study, antioxidant activity was different for red (SD) and yellow cultivar (SSGD). Comparing with previous studies, the apple pomace, exhibited similar antioxidant activity or extracts of peels and pulps (4.1 and 14.5 g ascorbic acid/kg DW for pomace, 1.25 g AA / kg FW for pulps, 3.3 g AA / kg FW for peels, as reported by Chinnici and et al. (2004), which confirms the suitability of apple pomace as a valuable material. All pomace samples showed high AA degradation ratio during IR drying because of long drying time. Freeze drying didn't caused degradation of the AA of the samples.

The peel of apple was expressed a significantly higher concentration of phenolics compared to the flesh (McGhie et al. 2005; Veberic et al. 2005; Petkovsek et al. 2007; Drogoudi et al. 2008). The average content of total polyphenols in the apples cultivar evaluated by the FC assay was of peel, flesh and raw apple juice fruit with significant differences depending on the apple variety (Van der Sluis et al. 2001). Comparing with previous results on single-cultivar apple pomaces (C´etkovic et al. 2008; Garcia et al. 2009), the samples reported here exhibited higher levels of polyphenols. Phenolic profiles are closely related to cultivar (Mangas et al. 1999; Alonso-Salces 2004; Marks et al. 2007). Regression analysis, carried out by grouping each identified compound into their respective phenolic class, confirmed the correlation between the AA and the phenolic content of apples extracts. This relationshCP has been reported previously (Van der Sluis et al. 2002; Sun et al. 2002) but another study found only a weak correlation between phenolic antioxidant capacity (Imeh and Khokhar 2002).

Table 1. Antioxidant activity, total phenol, flavonoid and phenolic compoudns of peel, flesh, pomaces and dried pomaces

	Samples	Peel	Flesh	Raw Juice	Pomace	PD-IR*****	PDL******
Antioxidant activity (g trolox equivalent / kg DW)	SD*	29.34[a,****]	5.18[ef]	0.29[j]	6.94[cd]	1.06[hij]	7.27[c]
	SSGD**	19.57[b]	2.85[g]	0.31[ij]	6.20[de]	1.35[hi]	5.13[f]
	CP***	-	-	-	7.80[c]	1.68[h]	7.30[c]
Total phenol mg gallic acid equivalent / 100g DW)	SD	570.92[a]	460.04[c]	12.33[k]	421.59[de]	106.28[j]	214.84[h]
	SSGD	527.20[b]	381.76[f]	14.09[k]	451.28[cd]	108.86[j]	209.70[h]
	CP	-	-	-	408.25[ef]	161.26[i]	288.05[g]
Flavonoid content (mg catechin equivalent / 100g DW)	SD	304.16[b]	170.12[d]	6.70[h]	266.95[c]	97.06[g]	149.29[de]
	SSGD	368.87[a]	150.10[de]	8.89[h]	309.07[b]	109.47[fg]	135.35[ef]
	CP	-	-	-	372.04[a]	135.32[ef]	139.02[def]
Chlorogenic acid (mg/100 g DW)	SD	27.64[e]	38.06[d]	-	38.00[d]	-	8.17[h]
	SSGD	38.33[d]	56.73[a]	-	49.50[b]	-	22.61[f]
	CP	-	-	-	45.65[c]	-	12.52[g]
Epicatechin (mg/100 g DW)	SD	39.02[b]	-	-	16.88[d]	-	3.64[f]
	SSGD	22.50[c]	-	-	18.50[d]	-	9.59[e]
	CP	-	-	-	64.76[a]	-	18.71[d]
Phloridzin (mg/100 g DW)	SD	13.77[e]	5.09[g]	-	21.25[c]	3.32[g]	11.10[ef]
	SSGD	18.21[d]	3.03[g]	-	37.46[a]	11.35[ef]	33.15[b]
	CP	-	-	-	36.13[a]	4.21[g]	30.62[b]
Quercetin Glycosides (mg/100 g DW)	SD	140.80[c]	-	-	105.92[e]	27.61[h]	32.82[h]
	SSGD	216.29[b]	-	-	122.88[d]	43.84[g]	57.82[f]
	CP	-	-	-	243.58[a]	49.00[fg]	99.97[e]

(-) Not detected
SD* Starkrimson Delicious
SSGD** Stark Spur Golden Delicious
CP*** Commercial pomace
****Means (from three replications)with the same letter are not significantly different (p<0.05)
*****PD-IR: pomace dried with infrared
******PDL: pomace dried with lyophilisation

Phenolic compound contents were significantly different between lyophilization and infrared dried pomaces due to the effect of heat and long drying time. Procyanidin B2 was determined only in the peel of SD as 46.49 mg/100g. Quercetin glycosides were high both in the peel of SSGD and SD and commercial pomace. The peels in both yellow and red cultivar have quercetin glycosides and procyanidin B2 which are strong antioxidants (Van der Sluis et al. 2000). Apple peels contains quercetin glycosides but does not in flesh (Burda et al. 1990; Golding et al. 2001; Van der Sluis. 2001; Guyot et al. 2002). Quercetin conjugates are found exclusively in the peel of the apples. Chlorogenic acid tends to be higher in the flesh than in the peel (Escarpa and Gonzales 1998). The total polyphenols in the pomace was about 7.24 g/ kg-DW, of which more than half consisted of quercetin glycosides (4.46 g/ kg DW) (Lu and Foo 1997). Lee and et al. (2003) reported that quercetin is an important phenol with antioxidative properties, however it is much more easily taken up in the human body in the form of glycosides, which are afterwards transformed into quercetin. Therefore the amount of quercetin glycosides could be important for nutritional value of apples. Phloridzin concentration did not show difference between SSGD and commercial pomace. Phloridzin was present in both flesh and peel in SSGD and SD, although its concentration was higher in the peel. Only chlorogenic acid and phloridzin were detected in the flesh of SSGD and SD. Chlorogenic acid was highest in the flesh of SSGD.

Apple pomace was known as an inedible waste product of juice manufacture. AA, quercetin glycosides and epicatechin were found 7.80 g TE/kg DW, 243.58 mg/100g DW and 64.76mg/100g DW, in commercial pomace respectively so that it might be potent source of antioxidants. Apple pomace should be regarded as a valuable product and has potential as a value-added ingredient for functional foods.

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Analysis of Essential Oils in Mastic Gum (Pistachia Lentiscus V. Chia) Using Head Space GC-MS

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Abstract

The essential oil and gum of Pistachia lentiscus var. Chia, commonly known as the mastic gum tree, are natural antioxidant, antimicrobial agent that have found extensive uses in food, beverages and medicine in recent years. In this work, the chemical composition of the hydro - distilled essential oil of mastic gum was evaluated by gas chromatography – mass spectrometry (GC-MS) technique and the majority of their components were identified. Twenty -nine compounds were identified and quantified, repre. The gum oil contained monoterpene hudrocarbons, sesquitepenes, and also oxygen-containing monoterpenes. The main constituents of the gum oil are a-pinene follows b-pinene and β-myrcene. Essential oil of Mastic gum is valuable product in food industries and in folklore medicine due to its antimicrobial and antimutagenic activity. The aim of this study was to evaluate the principal congeners of these valuable natural resin tears of the tree which used to flavoring liquors, food, pharmaceutical and cosmetic industries.

Keywords: Pistachia, essential, oil, mastic, gum.

Introduction

Pisrachia lentiscus var.Chia is a member of Anacardiaceae family. Mastic is a yellow-white natural resin and is obtained as droplets from the mastic tree.In Greece it is known as the tears of Chios. Originally liquid, it is sun-dried into drops of hard brittle translucent resin. When chewed, the resin softens and becomes a bright white and opaque gum, (Barra et al. 2007). The flavor is bitter at first, but after chewing releases a refreshing, slightly piney or cedar flavor. The word mastic derives from the Greek verb μαστιχειν "to gnash the teeth", which is the source of the English word masticate. The word mastic is a synonym for gum in many languages. The aromatic, ivory coloured resin, also known as mastic, is harvested as a spice from the cultivated mastic trees grown in the south of the Greek island of Chios in the Aegean Sea. Originally liquid, it is sun dried into drops of hard, brittle, translucent resin. When chewed, the resin softens and becomes a bright white and opaque gum.

Mastic has been used as a medicine since antiquity and is still used in traditional folk medicine of the Middle East. In Ancient Greece, it was given as a remedy for snakebite and in India and Persia was used to fill dental cavities. The first century Greek physician Pedanius Dioscorides mentions the healing properties of mastic in his book "De Materia Medica". Hippocrates wrote that the mastic is good for prevention of digestive problems and colds and Galenus suggested mastic was useful for bronchitis and improving the condition of the blood. For more everyday applications, mastic was highly valued in medieval times by sultans' harems, as a breath freshener and tooth whitener.

Mastic contains antioxidants, and also has antibacterial and antifungal properties A Nottingham University study published in the New England Journal of Medicine claims that mastic can cure peptic ulcers by killing *Helicobacter pylori* bacteria. Other studies have indicated mastic has only a modest ability to eliminate *H. pylori*, but also suggested that refining mastic by removing the polymer poly-β-myrcene may make the active components, in particular isomasticadienolic acid more available and effective, (Barra et al.,2007). Mastic may also have some value in preventing tooth decays chewing mastic reduces oral bacteria levels.

Regular consumption of mastic has been proven to absorb cholesterol, thus easing high blood pressure and reduce the risk of heart attacks. Mastic oil is widely used in the preparation of ointments for skin disorders. It is also used in the manufacture of adhesive bandages.

Mastic gum has been used in clinical trials on patients with peptic ulcers,(Daferera et al.2002). The administration of mastic (1g daily) relieved the pain and healed the stomach and

duodenal ulceration of the majority of the patients within 2 weeks. The same group of researchers confirmed that mastic gum kills *Helicobacter pylori* at concentration as low as 0.06mg/mL.

Mastic resin is a relatively expensive kind of spice that has been used principally as a chewing gum for at least 2,400 years. The flavour can be described as a strong, slightly smoky, resiny aroma and can be an acquired taste.

The word mastic derives from the Greek verb μαστιχειν "to gnash the teeth", which is the source of the English word masticate. The word mastic is a synonym for gum in many languages.

In Greece, mastic is used to prepare mastic liqueurs, a spoon sweet known as "vaníllia", beverages, chewing gum, cakes, pastries, sweets, desserts, breads, and in cheese production. It is also a binding material or material preparation stabilizer for oriental sweets like Turkish delight or mastic gum ice cream, and is suitable for preparing a pudding. In desserts, as an ingredient of jam or cakes, mastic is used to replace cornstarch and gelatin. It can also be used to stabilize ice creams.

Materials and Methods

Distillation of Pistachia lentiscus gum

Mastic gum kindly provided by Chios Gum Mastic Growers Association (Chios Greece).A small experimental distillation apparatus was used to separate the fractions of different volatilities, (Koutsoudaki et al.2005). The mastic gum was ground and dissolved in ethanolic solution (30%mg/mL) and the undissolved part of the gum was removed by filtration and discarded. The three different fractions during distillation of the mastic gum collected in vials and analyzed by GC-MS, (Daferera et al.2002). The distillation apparatus when removed from the heat had become very viscus and the color had changed from very pale yellow to very intense yellow.

Chemical analysis of volatile compounds by head space CG/MS

The volatile components present in headspace fraction of distillates were isolated and identified by using a balance pressure headspace system Perkin-Elmer HS40 (Perkin-Elmer Analytical Instruments, Uberlingen, Germany) coupled to a GC/MS-Q 5050 system (Shimadzu Co, Kyoto, Japan). A 2ml sample from each samples was taken and introduced into a 22 mL round-bottomed vial with 1 mL aliquot of standard solution {2mg pentanol − 3 in ethanol-water solution(50+50 v/v)}; then, the vials were sealed with aluminium-rubber septa. The vials with samples were held at 50°C for 25 min, purged and pressurised with helium at a flow rate of 40 mL/min. The volatile compounds were driven through the transfer line which was held at 80° C to the injector of the Gas Chromatograph. The volatile compounds were separated on an HP Innowax capillary column (60 m length×0.25 mm internal diameter, 0.25 μm film thickness) at the following conditions: injector temperature 200 °C; carrier gas helium 0.6 ml/min; temperature program: 45–100 °C at a rate of 4 °C min^{-1}, held for 5 min and go to 200 °C at a rate of 8 °C min^{-1} and held for 12min. The GC column was directly connected without splitting to the ion source of QP 5050 quadrupole mass spectrometric detector which was operating in the scan mode within a mass range of *m/z* 30–350 at 2 scans/s. The interface line to MS was set at 250 °C. The MS was operating in an electron impact mode at electron energy of 70 eV and was calibrated by autotuning.

Identification of the compounds was carried out by computer-matching of their mass spectral data with those of known compounds in the Shimadzu NIST62 Mass spectral Database and by comparing their retention times and mass spectra to 3-pentanol as internal standards solution.

Quantification was performed by integrating the peak areas of total ion chromatograms (TIC) by the Shimadzu Class 500 software.

Oven temperature programme, 50–260 °C at a rate of 4 °C/min; transfer line temperature, 270 °C; carrier gas, helium at a linear velocity of 31.5 cm/s; inlet split ratio, 1:60; MS source ionization energy, 70 eV; scan time, was 1 s, covering a mass range of 40–300 amu.

The constituents were identified by comparison of their mass spectra with those in a computer library (LIBR-TR and Wiley 5 Library) or with authentic compounds. The identifications were confirmed by comparison of their retention indices of volatiles either with those of authentic compounds or with data in the literature.

Quantitative results were obtained by calculating the average value of three samples.

Results and Discussion

The distillation fractions were analyzed by GC-MS using the method described above.

Table 1 contains the identified the hydro-ethanol soluble components of mastic gum led to the identification of the majority of the components which listed in the Table 1.

The major constituents of the essential oil of P. lentiscus var. Chia were given in **Table 1** and **Table 2**. Major components are α-pinene(72.67-67.12%), β-pinene (3.9-2.9%),β-myrcene(6.8-5.9%), limonene(1.2-0.89%).Other constituents therefore are in smaller concentration of the major constituents. The distillation process separated the many volatile components and fraction1 and fraction 2 gives higher concentration of a-pinene and β-pinene and smaller concentration of β-myrcene and β-caryophyllene.

Conclusion

In conclusion comparison the hydro-distillation fractions of Pistachia lentiscus gum, the concentration of major components in essential oils fractions, are in 1st and 2nd fraction than the concentration of 3rd fraction.

Table 1. Chemical percentage composition(%) of essential oil from gum of Pistachia lentiscus v. chia

No	Component	RT	Oil 1	Oil 2	Oil 3
1	Tricyclene	924	0.68	0.61	0.31
2	α-thujene	927	0.79	0.67	0.11
3	α-pinene	935	72.67	69.61	67.12
4	cyclofenchene	946	0.61	0.52	0.4
5	camphene	957	0.98	0.87	0.23
6	thuja-2,4(10)-diene	959	0.34	0.28	0.21
7	sabinene	977	0.87	0.75	0.54
8	β-pinene	981	3.9	3.4	2.9
9	β-myrcene	995	6.8	6.5	5.9
10	α-phellandrene	1003	0.49	0.33	0.29
11	α-terpineol	1013	0.23	0.19	0.12
12	p-cynene	1021	0.14	0.12	0.11
14	limonene	1029	1.2	0.92	0.89
15	1,8-cineole	1033	0.26	0.21	0.11

RI: Retention Index

Table 2. Chemical percentage composition(%) of essential oil from gum of Pistachia lentiscus v. chia

No	Component	RT	Oil 1	Oil 2	Oil 3
16	cis-β-ocimene	1041	0.22	0.17	0.11
17	trans-β-ocimene	1049	0.67	0.49	0.12
18	γ-terpinene	1057	0.47	0.31	0.29
19	3-pinene-2-ol	1077	0.45	0.39	0.27
20	fenchol	1107	0.34	0.23	0.12
21	2-pinen-7-one	1119	0.45	0.39	0.11
22	α-campholenal	1124	0.56	0.45	0.33
23	trans-verbenol	1141	0.28	0.23	0.19
24	α-terpineol	1189	0.19	0.17	0.13
25	p-cymen-8-ol	1191	0.28	0.21	0.12
26	myrthenal	1196	0.23	0.21	0.19
27	verbenone	1201	0.56	0.47	0.39
28	trans-carveol	1213	0.46	0.34	0.29
29	carvone	1238	0.27	0.21	0.15
30	carvacrol	1299	0.81	0.77	0.57

RI: Retention Index

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Composition of Trans - Anethol and Other Aromatic Volatiles in Anisated Alcoholic Beverage by Head-Space GC-MS Chromatography

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Abstract:
Aniseed distillates, like, ouzo in Greece, Raki in Turkey, pastis in France, arak in Syria, are very popular in Mediterranean countries. This flavoured alcoholic beverage are produced by extraction and distillation of fermented grape pomaces with herbal seeds from aromatic plants like Pimpinella anisum L. , Foeniculum vulgare, Illicium verum and other plants and also are characterized by the presence of congeners which arise during fermentation process. Trans –anethol and its isomer cis-anethol are the main volatiles and are responsible for aroma properties of these traditional aniseed distillates. The aim of this research work, was to find the concentration of special aromatic agent, trans -anethol and cis- anethol and also the major aromatic substances which are responsible for the aromatic quality. The majority of their identified components isolated by extraction and distillation from different commercial brands and homemade samples. Totally 24 constituents were identified by GC-MS in this traditional spirit. The major constituents in distilled ouzo extract was also trans – anethol .

Keywords: Trans-anethol, anis, distillates, ouzo.

Introduction

Anisated fermented distillates are alcoholic beverage, served as aperitif as a short or long drink or used in mixed drinks and cocktails. All over the Mediterranean area beverages of same family are drunk under the name 'Ouzo' in Greece, 'Raki' in Turkey, 'Pastis' in France, or 'Sambuca' in Italy etc.

Aniseed spirits produced by the distillation of pressed fermented grapes during vinification and flavoured with *Illicium verum Hooker fil., Pimpinella anisum L.,Foeniculum vulgare var. vulgare,* aromatic agents which is used in the production of anisated distillates, commercially, (Nurhayat et al 2006). However, there are some differences between the production process of these spirits and their traditional use in Mediteranean culinary culture.

Raki and Ouzo appear to be more similar than others.

Chemical studies have demonstrated that the extract from *Pimpinella Anisum,Illicium nerum and Foeniculum vulgare* contain large amount of anethol(Figure 1).
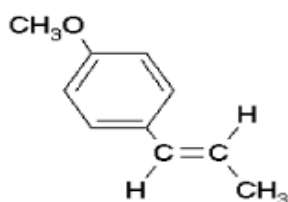
Figure 1: The structural form of anethol molecule

In Greece, local farmers developed small distilleries with topical character in order to produce anisated fermented grape pomace distillates, (Geahchan et al.1991). Up to 1989, the year that the European legislation 110/2008, about distilled beverages was issued, there were no legal restrictions concerning fruit distilled beverages in Greece. The National Law 971/1917 concerned only the production of industrial alcohol and distilled products of viticulture origin and among them alcoholic beverages from grape pomaces.

However, there is few available information or data on anisated fermented grape pomace distillates, (Cu et al.1990).

Furthermore, it is very important to provide knowledge about the volatile composition, especially, the concentration of the main aromatic compound of *Pimpinella anisum,* Foeniculum vulgare and Illiciun verum seeds which used as an aromatic agent on the distillation procedures from the artisanal and commercial distilleries, (Miraldi,1999).

This research is the third part of our researcher in anisated spirits

This knowledge should lead to a better quality and aromatic profile of this anisated spirit.

Material and Methods

Samples

Samples of grape pomace aromatised with the seeds of Pimpinella.anisum(glykaniso), Foeniculum vulgare(marathon) and dry seeds of star anise(Illicium verum), used after distillation in a small traditional distillation apparatus. The distillate was placed in vials and then stored at 4° C until used.

Reagents

The chemicals used in this work were analytical grade, commercially available reagents (from Merck). Trans and cis-anethol was obtained from Fluka Chemical Corp. They were supplied as pure grade chemicals with a purity > 98% GC. Water was distilled and deionised. The solution was stored in refrigerator (4^0C) in the dark.

Chemical analysis of volatile compounds by head space CG/MS

The volatile components present in headspace fraction of anisated distillates were isolated and identified by using a balance pressure headspace system Perkin-Elmer HS40 (Perkin-Elmer Analytical Instruments, Uberlingen, Germany) coupled to a GC/MS-Q 5050 system (Shimadzu Co, Kyoto, Japan). A 2ml sample from each   samples was taken and introduced into a 22 mL round-bottomed vial with 1 mL aliquot of standard solution {2mg pentanol – 3 in ethanol-water solution(50+50 v/v)}; then, the vials were sealed with aluminium-rubber septa. The vials with samples were held at 50°C for 25 min, purged and pressurised with helium at a flow rate of 40 mL/min. The volatile compounds were driven through the transfer line which was held at 80° C to the injector of the Gas Chromatograph. The volatile compounds were separated on an HP Innowax capillary column (60 m length×0.25 mm internal diameter, 0.25 μm film thickness) at the following conditions: injector temperature 200 °C; carrier gas helium 0.6 ml/min; temperature program: 45–100 °C at a rate of 4 °C min^{-1}, held for 5 min and go to 200 °C at a rate of 8 °C min^{-1} and held for 12min. The GC column was directly connected without splitting to the ion source of QP 5050 quadrupole mass spectrometric detector which was operating in the scan mode within a mass range of *m/z* 30–350 at 2 scans/s. The interface line to MS was set at 250 °C. The MS was operating in an electron impact mode at electron energy of 70 eV and was calibrated by autotuning.

Identification of the compounds was carried out by computer-matching of their mass spectral data with those of known compounds in the Shimadzu NIST62 Mass spectral Database and by comparing their retention times and mass spectra to 3-pentanol as internal standards solution.

Quantification was performed by integrating the peak areas of total ion chromatograms (TIC) by the Shimadzu Class 500 software.

Oven temperature programme, 50–260 °C at a rate of 4 °C/min; transfer line temperature, 270 °C; carrier gas, helium at a linear velocity of 31.5 cm/s; inlet split ratio, 1:60; MS source ionization energy, 70 eV; scan time, was 1 s, covering a mass range of 40–300 amu.

The constituents were identified by comparison of their mass spectra with those in a computer library (LIBR-TR and Wiley 5 Library) or with authentic compounds. The identifications were confirmed by comparison of their retention indices of volatiles either with those of authentic compounds or with data in the literature.

Quantitative results were obtained by calculating the average value of three samples.

Results and Discussion

The results of the quantitative determination of trans-anethol, cis-anethol and major volatiles in *Pimpinella anisum* (glycaniso),Foeniculum vulgare(marathon) and Illicium verum(star anise) samples are presented in Table 1.

In total, 10 major aromatic constituents were identified.

The chemical composition of volatiles in Pimpinella anisum(glykaniso) samples shows that the major volatile in seeds extract is *trans* –anethol(92,4%). *Cis* - anethol levels is 0,5%. Foeniculum vulgare trans -anethol concentration is 89,1 and cis- anethol 0,7%. Iliiciun verum(star anise) trans -anethol concentration is 95,3 and cis- anethol 1,1%

From our point of view, we hope that the results on the chemical composition of those seeds which are used in artinasal and commercial distilleries, will bring useful information associated with trans and cis-anethol concentration and the other aromatic agents .

Conclusion

In *Pimpinella anisum*(glykaniso),Foeniculum vulgare(marathon) and Illicium verum(star anise) seeds, which are used as an aromatic agent in anisated distillate, were identified trans and cis anethol and ten different aromatic compounds. The compound which gives the anisated taste in anisated alcoholic beverages, trans –anethol exist in all samples in satisfactory levels. Trans -anethol this aromatic agent, exist in higher levels in illicium verum(star anise)but with not important differentiation from the other aromatic seeds. We can say that limonene, mercene, was in satisfactory levels also to all samples.

Also, it is important to continue this research in to have better knowledge for the chemical variability of those seeds, which used from the ancient years as an aromatic and medicinal herb in food and beverages.

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Table 1. Chemical percentage composition(%) of major aromatic volatiles from Pimpinella anisum(glykaniso), Foeniculum vulgare(marathon), Illicium verum(star anise) in anisated alcoholic beverages..

Compounds	RT	Pimpinella anisum(glykaniso)	Foeniculum vulgare(marathon)	Illicium verum(star anise)
Sabinene	955	0.7	ND	0.3
Myrcene	979	0.9	1.4	0.5
p-cymene	1006	0.4	1.4	0.2
d-Limonene	1010	0.9	0.5	2.4
n-Nonanal	1075	0.2	0.3	0.5
Anisaldehyde	1203	0.1	2	ND
Carvacrol	1286	0.1	1.1	ND
a-Bergamotene	1436	0.3	1.2	2.1
Phellandrene	1511	0.2	0.4	1.4
Caryophellene	1568	0.2	0.2	0.3

Table 2. Chemical percentage composition(%) of trans and cis anethol from Pimpinella anisum(glykaniso). Foeniculum vulgare(marathon). Illicium verum(star anise) in anisated alcoholic beverages..
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Compounds	RI	Pimpinella anisun(glykaniso)	Foeniculum vulgare(marathon)	Illiciun verum (star anise)
Trans-anethol	1234	92.4	89.1	95.3
Cis-anethol	1221	0.5	0.7	1.1

Retention time

Investigation of Methods Using in Deacidification of Edible Oils

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Abstract

Major parts of Food, are water, carbohydrates, proteins, and fat. Fat is regarded as an important component of the diet, because it is an important source of energy, as well as of essential fatty acids, and of fat soluble vitamins such as vitamins A, D, E and K.

Today, In the oils industries, deacidification of oils and fats is important not only for consumer acceptance, but also because it has the highest economic impact on production. There are some methods for deacidification of oils and fats. Chemical, physical, and miscella deacidification methods have been used in the oil industries. There are several difficulties associated with these conventional deacidification processes. Some of these new approaches that may be tried out as alternatives to current industrial practices are biological deacidification, reesterification, solvent extraction, supercritical fluid extraction and membrane technology. These new methods, independently, or in combination with current technology may be useful to overcome major difficulties. Besides being eco-friendly, they could also lead to savings in energy and reduction in oil losses. Some of these methods could very well replace the existing technology in the years coming.

Keywords: Chemical and physical deacidification, membrane technology, supercritical fluid extraction

Introduction

Crude oils typically are degummed, refined, bleached, and deodorized to remove undesirable compounds, including free fatty acids (FFAs), phosphatides, particulates, coloring materials such as chlorophylls and xanthophylls, and miscellaneous unsaponifiable matter. In processing crude vegetable oils, considerable amounts of energy in the form of steam or electricity are required and each step of the edible oil process only removes one or two undesirable components. If crude oil is not properly processed, treatments during the following steps will be more difficult, and time and labor will be consuming.

Deacidification

Crude fats and oils consist of some quantity of FFA, along with triglycerides. FFA are virtually absent in fats/oils of living tissue. They can be formed, however, by enzyme (lipase) action, after the oilseed has been harvested, or the animal has been slaughtered. Hydrolysis of ester bonds in lipids (lipolysis) resulting in the liberation of FFA, may be caused by enzyme action or by heat and moisture (Nawar, 1996). The release of short-chain fatty acids by hydrolysis is responsible for the development of an undesirable rancid flavor (hydrolytic rancidity). Furthermore, FFA are more susceptible to oxidation than the glycerol esters of these fatty acids; and this lipid oxidation, leads to oxidative rancidity in edible oils and fatcontaining foods. Therefore, any increase in the acidity of the oil must be absolutely avoided.

The deacidification process has the maximum economic impact on oil production. Any inefficiency in this process has a great bearing on the subsequent process operations. The removal of FFA from crude oil represents the most delicate and difficult stage in the refining cycle, since it determines the quality of the final product. Chemical, physical, and miscella deacidification methods have been used industrially for deacidification.

Methods and materials
Physical deacidification

Physical deacidification has aroused renewed interest since the early 1970s when the process was reintroduced on a large scale to refine palm oil in Malaysia (Tandy &McPherson, 1984). Physical deacidification uses steam stripping under vacuum, a procedure that removes FFA,

unsaponifiable substances, and pungent compounds, thus circumventing chemical neutralization with its environmentally objectionable soapstocks. As a consequence, oil losses are reduced, the quality of FFA is improved, and the operation is simplified. It consumes less steam, water and power, and, hence, requires less capital investment. Deodorization and thermal bleaching of carotenoids are also accomplished accomplished by steam stripping. Molecular distillation, if adopted instead of the conventional distillation method, would help to preserve valuable natural substances, mainly the tocopherols and phytosterols .

Due to the improvements in vacuum systems, as well as the competitive price of incondensable gases, nitrogen has been proposed as an alternative to live steam. The use of nitrogen instead of steam provides a higher FFA vapourization efficiency, a lower loss of the unsaponifiable fraction, a minimal entrainment of triglycerides, and a lower total amount of deodorizer distillates.

Cmolik et al. (2000) compared the quality of oils produced by physical and alkali refining of crude rapeseed oil on a pilot-scale. No substantial differences in sensory acceptability and oxidative stability were observed between the refined oils, after storage over a period of 12months at 15_C; so they concluded that physical as well as alkali refining of crude rapeseed oil would yield oils of equivalent quality. Physical deacidification of crude vegetable oils has several advantages over traditional alkali deacidification–viz., simplicity, energy conservation, and reduced generation of environmental pollutants.

Chemical deacidification
Industrially the most commonly used method for deacidification is chemical deacidification. The purpose of deacidification in the conventional chemical process is to remove nontriglyceride impurities, consisting principally of FFA, along with substantial quantities of mucilaginous substances, phospholipids and colour pigments. Deacidification is accomplished by the addition of an alkali to degummed oil, thereby precipitating the FFA as soap stock; the latter is then removed by mechanical separation from the neutral oil. Since the alkali most often used for neutralization is caustic soda (sodium hydroxide), the process is widely known as caustic deacidification.

In chemical deacidification, there is considerable oil loss due to the hydrolysis of neutral oil by caustic. Besides, loss of oil also occurs in the form of occlusion in soapstock. The soapstock can hold as much as 50% of its weight of neutral oil, thereby reducing the overall yield of refined product. FFA content in the crude oil has a direct bearing on the neutral oil loss and therefore the yield in the case of a high-FFA crude oil such as rice bran oil (RBO) is relatively low (Gingras, 2000).

The FFA in their native state find many uses and therefore the soapstock is usually split with concentrated sulfuric acid, which result in heavily polluting streams. The disposal of this waste stream has become very expensive since the waste stream is to be treated to meet the statutory requirements. Another major disadvantage in the case of deacidification of RBO is the loss of valuable oryzanol (1–3%) which gets easily saponified, and is removed along with soapstock. Alkali refining results, typically, in a decrease in total oryzanol content from 16000 to 2000mg/kg.

In spite of having several disadvantages, chemical deacidification is still commercially followed in   many industries because of successful reduction of FFA up to the desired level irrespective of FFA content in raw/crude oil. Chemical neutralization reduces the FFA to an acceptable level down to 0.03% depending on the characteristics of the vegetable oil. Soaps formed during deacidification have the combined effects of purifying, degumming and partially decolouring the oils.

Membrane Technology

The expression ''membrane separation'' covers a wide range of product separation techniques. They involve the separation of components mostly in fluid or even, sometimes, in gaseous state, through the application of the physical properties of ionic charges, diffusivity, and difference in molecular size of the compounds to be separated. It uses a wide range of inorganic and polymeric membranes, the selection of which depends on the material to be processed.

Membrane technology is a mature industry and has been successfully applied in various food industries for separation of undesirable fractions from the valuable components of the feed streams. The industrial membranes are classified into various categories. They include particle filtration, microfiltration, ultrafiltration, nanofiltration, reverse osmosis, and pervaporation. Particle filtration is concerned with separation of particles that are greater than 2.0 micrometers (2 _ 104 angstrom units); microfiltration with macromolecules from 200,000 to 1 million molecular weight (MW) (500–2 million angstrom units); ultrafiltration with molecules 10,000–300,000 MW (40–2,000 angstrom units); nanofiltration with molecules 15,000–150 MW (8–80 angstrom units); and reverse osmosis (also called ''hyperfiltration'') with ions and molecules up to 600 MW (20 angstrom units).

Reverse osmosis retains all components except water, whereas ultrafiltration is primarily a size-exclusion-based pressure-driven membrane separation process. The UF membranes can retain macromolecules such as polysaccharides, proteins, biomolecules, polymers, and colloidal particles. Generally, ultrafiltration membranes are classified by the type of material and their nominal molecular weight cut off (MWCO), which is usually defined as the smallest molecular weight species for which the membrane has more than 90% rejection.

Advantages of membrane separation technology in food processing include gentle treatment, quality improvement, low energy consumption, simultaneous fractionation and concentration, demineralization, increased yield, and simple plant layout. The limiting factors of the technology include concentration, polarization, fouling, osmotic pressure, and viscosity. The critical parameters for a successful application in oils and fats industries may require special attention to feed characteristics, aging, pretreatment, process conditions, process mode, hygienic design, membrane cleaning, and disinfection.

The low energy requirement of membrane-based separation processes makes them an attractive affirmative to thermal technologies. The processing is carried out at low temperatures near ambient by avoiding thermal degradation of valuable components of the final products, which is of great interest to the processors aiming for the premium market, which will pay higher prices for the processed products. Membrane technology compared with conventional processors is a simple enclosed unit operation that can be clearly controlled and monitored to reduce costs. Each membrane technique and its economic impact to overall processing costs must be evaluated individually.

Supercritical fluid extraction

Extraction with a solvent at temperatures and pressures above its critical point is known as supercritical fluid extraction (SCFE). SCFE, with carbon dioxide as the extraction solvent, has been tested as an alternative deacidification process for high FFA containing oils. Several researchers have demonstrated the suitability of supercritical carbon dioxide (SC-CO2) as a solvent for the extraction of seed oils. Unlike the hexane extracted oils, these oils do not contain phospholipids and other complex substances; therefore, they do not require a degumming step. Deacidification and deodorization of edible oils are two potential applications for extraction with SC-CO2. The SCFE process has a number of advantages over conventional extraction—namely, low temperature and pollution free operation, inert solvent, selective separation and fractionation of tailor-made end-product, as well as extraction of a high-value product, or of a new product,

with improved functional or nutritional characteristics . Some of the solvents used in SCFE are carbon dioxide, ethylene, propane, nitrogen, nitrous oxide and monochlorofluoromethane.

The most common solvent is carbon dioxide because it possesses a number of desirable properties and attractive features over the presently used organic solvents, such as nontoxicity, safety, ease of separation, low cost, and ready availability, which makes it ideal for food processing processing .Another advantage of SCFE, as opposed to hexane extraction, is that SCFE could be made highly selective by controlling temperature and pressure. Solubility data of fatty acids and triglycerides in SC-CO2 showed that FFA are more soluble in CO2 than the corresponding triglycerides at certain temperatures and pressures.

SCFE is a costlier process. So extraction with supercritical fluid may be particularly useful for deacidifying expensive specialty oils and fats with high initial acidity, or where the quality and purity of the extracted components are of great importance.

Conclusion

The chemical, physical and miscella deacidification methods used in the industry have several drawbacks. The new approaches namely, biological deacidification, reesterification, solvent extraction, supercritical fluid extraction (SCFE) and membrane technology, either independently, or in combination with current technology, may help to overcome the major drawbacks. However, further studies on these new approaches are necessary, including an assessment of the economic viability, to successfully replace the existing technology.

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Production of Koruk Juice Concentrate and Determination of the Effects of the Process on Quality and Antioxidan Activity

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Abstract

Grape (*Vitis vinifera spp.*) is one of the most widely grown fruit in the world. Annual production of grapes in the worldwide is approximately 67.7 million tons while this figure is 4.2 million tons in Turkey (FAO, 2011; TÜİK, 2012). Koruk is the immature form of the grape fruit. It has high acidity, sour taste, low pH, low sugar and high phenolic contend. (Winkler, 1965). In this study, the production of koruk concentrate and the effects of the process on the quality and antioxidant activity were investigated.

In this respect, unripen Sultani Çekirdeksiz grape that obtained from Manisa Viticulture Research Station was used. Post-harvest, koruks crushed and pedicels detached. Crushed berries were pressed and koruk juice was obtained by the elimination of pomace. Then koruk juice was subjected to pre-precipitation, depectinization, gelatin and bentonit application, detartarization, clarification and filtration respectively. Obtained clear koruk juice concentrated to 45 °brix by vacuum evaporator at 50 °C. In concentrate, pH 2.48, °brix 44.63 and acid% 23.90 (tartaric acid) were determined. AE and 1/EC50 values were recorded between 0.145 – 1.19 mMol TE/L and 3.28-22.37 respectively.

Keywords: Grape, koruk, concentrated juice, quality, antioxidant activity

Introduction

Unripe grapes are called as "koruk" in Turkey. Turkey has the most suitable climate conditions for vine growing in the world and is also one of the origins of grape genetic resources. The archaeological findings in Anatolia proved that this culture of vine growing dates back to 3500 BC. Grape figures found in different locations of Anatolia points out to the fact that growing grapes has been the part of the culture for centuries (Karabat, 2009). Grape and grape derived products have been produced since ancient times. Koruk juice is also one of the grape products.

Koruk juice is made from unripe green grapes and called different names according to countries and regions. Koruk juice has been used as a food ingredient and as a medicine since ancient Greeks. In medieval and early modern times koruk juice has been used as an acidifying agent in cooking, as medicine and as digestive agent. It is still widely used in the oriental cuisine, e.g. in Persian and Turkish, regionally known as "Abe ghureh" (Persian: "unripe grape juice") and "Koruk suyu" (Turkish: "unripe grape juice"), (Nikfardjam, 2008). Koruk juice has a tart taste and a strong acidity. It is commonly used with salad and vegetables as an acidifying and flavoring agent in Turkey and neighboring countries. It is also consumed as a drink after being sweetened (Karapınar and Sengun, 2007).

Almost all furit juices are concentrated for preservation and alternative using in food industry. In this study; concentration of koruk juice and effects of process on quality parameters were investigated.

Material and Methods
Production of koruk juice concentrate

Aa a material unripe Sultani Çekirdeksiz grape that obtained from Manisa Viticulture Research Station was used. After harvest, koruks crushed and pedicels detached in machine. Crushed koruk berries were pressed in a mechanical press. Koruk juice was obtained by the elimination of marc. then, stored at +4 °C for sedimentation. Depectinization was carried out two hours at 50 °C (Shazym Claro Pectolytic Enzyme, 10.500 PGNU/g Polygalakturonase, 0,15

g/L). Gelatin and bentonite clarification, detartarization, and filtration were applied respectively. Obtained clear koruk juice concentrated to 45 ºbrix by vacuum evaporator at 50 ºC.

Measurements and analysis
General chemical properties
The general biochemical properties of the samples such as total soluble solids (TSS), pH value, acidity were analyzed according to "Methods for Analysis of Must and Wines" (Ough ve Amerine, 1988). pH values were directly measured with pH meter (Hanna pH meter 211). Acidity was determined by diluting of samples with deionized water and titrating to pH 8.2 with 0.1 N NaOH. Titratable acidity was expressed as percent tartaric acid.

Antioxidant activity
Free radical scavenging activity of the koruk juices was determined by using 2,2-Diphenyl-1-picrylhydrazyl (DPPH•) method (Brand-Williams et al. 1995). Results are expressed as ml sample/mg DPPH• and mMol Trolox/L. AE values were calculated and showed as 1/EC50.

Results and Discussion
pH, titratable acidity and soluble solid matter (SS) of harvested koruk and clarified koruk juice samples are shown Table 1.

Table1. pH, titratable acidity and soluble solid matter of samples

Sample	pH	SS (ºBrix)	% Acid[*]
Harvested Koruk Sample	2.17	9.5	3.55
Clarified Koruk Juice	2.59	9.3	3.03

*Tartaric Acid Equivalent

pH values of koruk and koruk juice samples were determined to very low. pH of the samples effected positively by the process steps. It was observed that of pH values increased while SS and acidity were decreased during process stages. Changes of SS values were relatively low. In concentrate, pH 2.48, ◦brix 44.63 and acid% 23.90 were determined.

Nikfardjam (2008) investigated the chemical properties of unripe grape juices which were produced at different countries. He reported that the acidities of the samples were changed between 19.6 and 39.6 g/l (as tartaric acid). Karapinar and Sengun (2007) studied the antimicrobial effects of koruk juices and they implied that pH values of the samples were 2.44-2.78 while the acidities were 27.5 -28.0 g/l (as tartaric acid). Hayoglu et. al (2009) investigated the chemical and sensory properties of verjuice samples which are traditional Turkish non-fermented beverage from Kabarcik and Yediveren grapes. They reported that fresh Kabarcık and Yediveren verjuice samples were shown 2.98 pH, 24.8 g/l acidity, 7.47 ºbrix SS and 2.91 pH, 30.0 g/l acidity, 4.50 ºbrix SS respectively. The our results were similar to other studies.
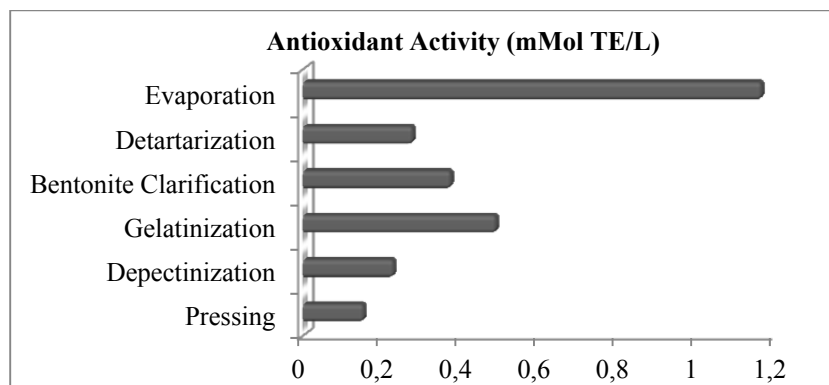
Figure 1.Antioxidant activity changes in the processing stages (mMol Trolox Equivalent/L).

Antioxidant activity (AA) and DPPPH• inhibition were presented Figure 1 and 2. The highest value of AA was determined after evaporation. The highest value of AA was determined after evaporation while the lowest value was observed after pressing. AA values were increased to gelatinization stage. Then the values were decreased in bentonite clarification and detartarization stages.
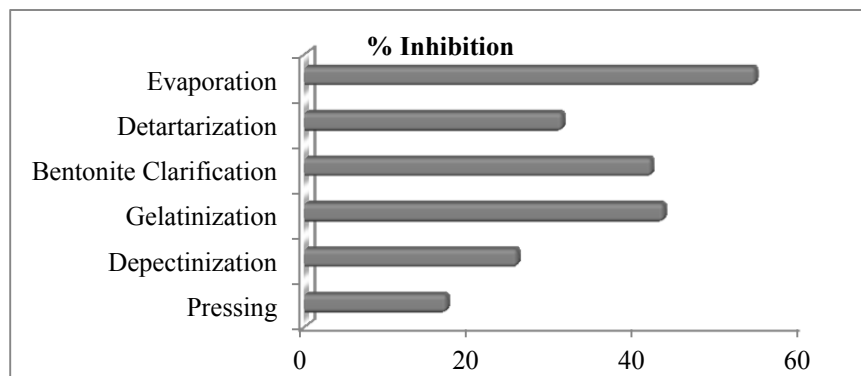
Figure 2.% inhibitions in the processing stages.

Sample inhibition values were shown similarity with AA values as symmetric. Inhibitions were observed between 17.1-54.2 % in the 15th minute.

Another antioxidant index EC_{50} was also investigated at all process stages. EC_{50} values were determined between 47.4-305μl. In this study, it was determined that koruk juice has high antioxidant properties. The highest AA, inhibition and EC_{50} values were observed at the end of evaporation. A detailed assessment could not be made because of limited research about this study.

Conclusion

As a result, it was determined that koruk juice has high acidity, low pH and SS and high antioxidant activity. These properties were affected during process stages. SS, acidity and antioxidant properties of koruk juice were increased by evaporation more than the other stages.

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Denitrification Dairy Wastewater with Microbial Cultures of Nitrificants and Denitrificants

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Abstract

The paper provides a research on dairy wastewater used in the process of denitrification conducted by means of microbial cultures of nitrificants and denitrificants. The microbial culture of nitrificants and denitrificants was previously adapted to the dairy wastewater, and was used for reduction of nitrate NO_3^-, using organic compounds of wastewater as an electron donors. Initially denitrification microbial culture utilizes readily biodegradable COD and achieves better denitrification. Further degradation rate of denitrification decreases. The concentration of organic compounds, expressed as COD value was 750 mg/L in the initial phase, while in the final stage was 35 mg/L.

Keywords: Denitrificantion, dairy wastewater, microbial culture of nitrificants and denitrificants

Introduction

Wastewater is a major environmental probem in production and processing of milk (Škrinjar 1985). High levels of COD and high concentrations of suspended matter can also be a problem in the wastewater from these industries, as well as the presence of other pollutants such as phosphorus, nitrogen and chlorides (Landeka et al., 2010). Waste in wastewater include emulsified fat, protein, lactose, lactic acid, vitamins, enzymes, trace of various elements and different amounts of cleaning agents, including phosphates and various other surfactants. Contamination of wastewater dairy industry can vary from very aggressive to the water with a mild acidity or alkalinity (Špiric 1977).

The organic load of dairy industry wastewater makes them a suitable substrate for the denitrification process of wastewaters rich in nitrate and of low COD/N ratio (Danalewich et al., 1998; Zayed and Winter, 1998; Bickers et al., 2003; Britz et al., 2006). The denitrification potential of milk processing industry wastewater was investigated using activated sludge (Cappai et al., 2004; De L ucas et al., 2005; Sage et al., 2006; Onnis-Hayden and Gu, 2008; Fernández-Nava et al., 2010) and mixed and pure microbial cultures isolated from activated sludge as suspended and immobilized biomass (Zayed and Winter, 1998). The optimal conditions for the growth of most denitrificants are the anoxic environment, the concentration of dissolved oxygen from 0.5 to 0.8 mg O_2/L, pH 7-8, and favourable temperature (Knowles, 1982; Tchobanoglous et al., 2003).

The aim of this study was to remove nitrates application of organic matter from the wastewater as an electron donor. The study used a microbial culture rich with nitrificants and denitrificants, which was previously adapted to the wastewater dairy industry.

Material and Methods

In this work, for investigation of denitrification potential of dairy industry wastewater a microbial culture of nitrificants and denitrificants was used. The nitrification process was carried out under aerobic and denitrification under anaerobic conditions.

For investigation of denitrification potential dairy wastewater with COD of 3100 mg/L and pH of 9,47 was used. In the wastewater are present easily biodegradable components such as lactose and lactate and slowly biodegradable components such as fats and proteins. All experiments were conducted in triplicate and the results are presented as mean with standard deviation. All experiments were performed in a laboratory reactor volume of 2 liters. Aerobic conditions are achieved airing reactor and supplying air with the help of an aquarium pump.

Denitrification is carried out in conditions without aeration, but with stirring the reactor contents. All analytical data were determined by the methods prescribed by APHA (APHA, 1998). Values were determined: the concentration of organic substances, expressed as COD,

NH_4-N, NO_3-N, NO_2-N, pH, temperature, dissolved oxygen, dry matter, annealed rest, suspended solids and biomass concentration.

To determine the concentration of ammonia, nitrite, nitrate, total nitrogen and COD were used Spectrophotometer PhotoLab®6600 UV-VIS, manufactured by WTW (Merck Spectroquant 1.14776 for nitrites, 1.14773 for nitrates and 1.14537 and 1.14763 for total nitrogen) and heater Thermoreaktor CR 2200, manufactured by WTW. The pH and temperature were determined with pH and temperature electrode by SensoDirect 150, Lovibon. To determine the concentration of dissolved oxygen is used oxygen electrode by SensoDirect 150, Lovibon.

Results

Table 1 shows the physico-chemical parameters of quality dairy industry wastewater before and after biological treatment. All experiments were conducted in triplicate and the results are presented as mean with standard deviation.

Table 1. Chemical and physical quality indicators of the quality of the dairy industry wastewater before and after biological treatment

Parameter	Concentration (before biological treatment)	Concentration (after biological treatment)
Color	White	Light yellow
Smell	Strong odor	Lower intensity
Temperature (°C)	23.9	23
pH	9.47	8.3
Conductivity (μS)	1683	474
Turbidity (NTU)	876	274
Oxygen saturation (%)	2.5	1.3
Dissolved oxygen (mg/L)	1.9	0.7
Evaporated residue (mg/L)	2266	1934
Suspended solids (mg/L)	384	275
Total hardness (°nj)	14.8	17.8
p- alkalinity (mg/L)	44	7
m – alkalinity (mg/L)	179	66
Consumption of $KMnO_4$ (mg/L)	75.24	11.34
Nitrites (mg/L)	39.4	0
Nitrates (mg/L)	452.2	0
Ammonia (mg/L)	37.55	0
Total nitrogen (mg/L)	66	3
COD (mgO_2/L)	3100	35
BOD5 (mgO_2/L)	1560	22
COD/BOD5	1,98	1.5

Experiments were carried out so as to 1L suspension with sludge added 1L wastewater dairy industry. It is noted that in the experiments leads to the complete oxidation of ammonia to nitrites and nitrates, and nitrate to nitrogen gas. Through experiments was monitored the biodegradation of wastewater. Parameters were measured every hour for 4 hours, and at 24, 26,28 and 48 hour.

All nitrification processes were carried out under aerobic conditions. After nitrite nitrogen completely oxidized, or transferred to nitrate nitrogen, an experiment was set out to investigate the ability of microbial cultures for the implementation of denitrification. Denitrification is carried out under anoxic conditions, only stirring. As carbon source in the denitrification assay was used dairy industry effluent. Parameters were monitored every 3 hours, and after 24 hours.

After the process of denitrification, there was a significant change in the color of wastewater, which can be seen in Figure 5.
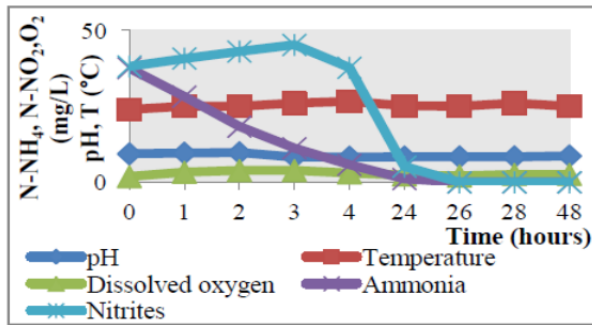
Figure 1. NH4-N, NO2-N and dissolved oxygen concentration, pH and temperature determined during the process of nitrification
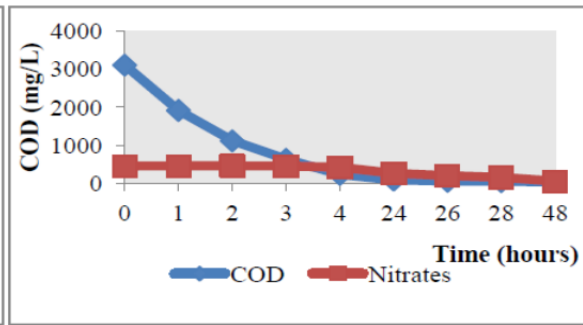
Figure 2. The concentration of organic substances, expressed as COD and concentration of NO3-N
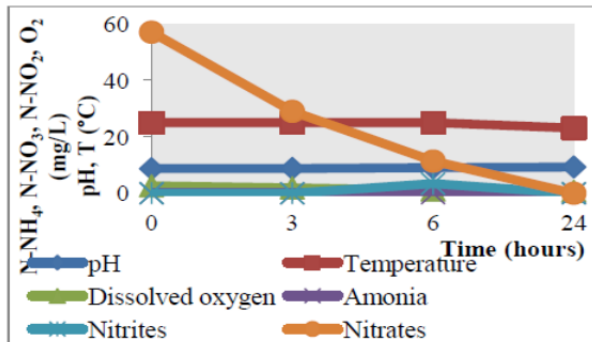
Figure 3. NH4-N, NO3-N, NO2-N and dissolved oxygen concentration, pH and temperature determined during the process of denitrification
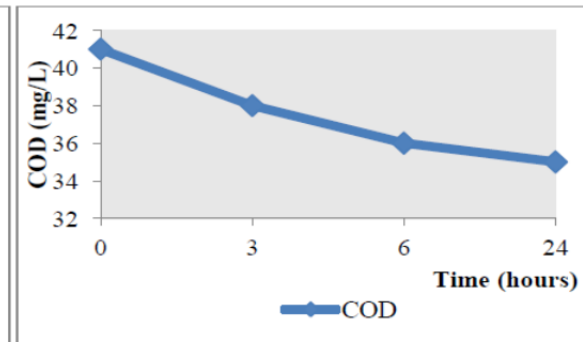
Figure 4. The concentration of organic substances, expressed as COD

Figure 5. Wastewater dairy industry before and after the biodegradation process

Discussion

In the activated sludge with a technique accumulation of nitrificants and denitrificants was prepared mixed microbial cultures which showed the ability of nitrification and denitrification. The potential of carbon source for denitrification depends on its biodegradability or for a complex substrate on the content of easily biodegradable fraction of COD. Oxidation of ammonia (ammonia converted into NO_3-N and NO_2-N) is followed by decomposition of organic matter (COD) in the beginning of the process, as well as the accumulation of nitrite and nitrate (see Figures 1 and 2). Extended aeration after 24 hours, all the NO_2-N is converted to NO_3-N. In the experiment, nitrification rate of oxidation of ammonia was 7.94 mg NH_4-N removed/L,h. The highest concentration of nitrite of 45.2 mg/L was determined after three hours of nitrification, when the pH of the lowest point is reached, known as "ammonium valley" (8.3). This "valley ammonia" pH profile can be used as an indicator of the end of accumulation of nitrite. For a further 26 hours of aeration nitrite is oxidized to nitrate, and the pH is slowly started to rise (8.4 and 8.7, (Figure 1). The concentration of organic compounds, expressed as COD value was 750 mg/L in the initial phase, while in the final stage was 35 mg/L. After nitrite nitrogen completely

oxidized, or transferred to nitrate nitrogen, an experiment was set out to investigate the ability of microbial cultures for the implementation of denitrification.

Denitrification is carried out under anoxic conditions, only stirring. Parameters were monitored every three hours, and after 24 hours. The concentration of NH_4-N during denitrification process has not changed, and amounted to 0 mg/L. The concentration of nitrate is reduced during the process of denitrification. Nitrates are from the initial 57.7 mg/L after 24 hours completely oxidized to nitrogen gas. Dissolved oxygen is consumed in the process of denitrification, and after 24 hours the dissolved oxygen concentration was 0.7 mg/L. The process of denitrification follow the increase in pH. The pH of the initial value of 8.7 after 24 hours the process was 9.3. The rate degradation of organic substances, expressed as COD value was 0.25 mg/L,h (see Figures 3 and 4). After the process of denitrification, there was also a significant change in the color of wastewater (Figure 5).

Conclusion

Daily control and analysis of wastewater dairy industry are examined: the total amount, composition, pH, temperature, amount of suspended solids, the amount of oxidizing substances, toxicity, BOD5, COD, turbidity, proteins, fats and dairy sugar..

Research has shown that the wastewater of this dairy industry can use as a source of carbon in the denitrification process. Denitrification process preceding the nitrification. After 48 hours of nitrification, there was complete oxidation of ammonia to nitrite and then nitrite to nitrate. Denitirification was performed for 24 hours, whereby nitrates are completely oxidized to nitrogen gas, without the accumulation of nitrite, and thus the nitrogen compounds were completely removed from wastewater. Rate of oxidation of ammonia in the initial phase of the experiment was 7.94 mg/L, with the use of easily biodegradable organic substances. In the final phase of the experiment the oxidation of ammonia was 0.19 mg/L. Oxidation rate of nitrate in the denitrification process amounted to 7.6 mg /L.

The rate degradation of organic substances, expressed as COD value, was 750 mg/L,h in the initial phase of the experiment, while in the final stage was 35 mg/L.

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Modelling of Microwave Drying of Sugar Beet

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Abstract

Drying behaviour of sugar beet was investigated in a microwave dryer. Microwave drying of sugar beet was explored and the effects of processing conditions such as microwave power, slice thickness on sugar beet slice characteristics were studied. The effects of microwave drying (180, 360, 540, 720 and 900W) on drying time of sugar beet slices have been investigated. Microwave drying was done in two different sugar beet thickness (3mm and 5 mm). The drying data were applied to nine different mathematical models, namely, Newton, Page, Henderson and Pabis, Logarithmic, Wang and Singh, Verma, Two Term, Two Term Exponential, Midilli-Kucuk Equation Models. The performances of these models were compared according to the coefficient of determination (R^2), standard error of estimate (SEE) and residual sum of squares (RSS), between the observed and predicted moisture ratios. It was found that the Midilli-Kucuk model described the drying curve satisfactorily in all drying methods.

Keywords: Sugar beet, microwave, modelling

Introduction

Sugar production from sugar beet has great economic value because of the large usage of sugar in food industries. The nutritional importance of sugar beet as supplier of minerals, dietary fiber and energy has been well recognized. However, this beet usually grows only during warm seasons and cannot be cultivated in all months of the year. Because of this, sugar beet should be stored for several months before processing (Sablani Shyam, 2006).

Sugar beet is characterized by its sugar and initial moisture content at harvest. The decompose of sugar beets during storage and the decrease of its sugar level is one of the most important prevention for sugar factories and they cannot operate constantly during the year An efficient way to stop this decompose is reduction of water content by a drying process.

The main aim of this study is to investigate the drying behaviour of a sugar beet sample in a microwave dryer with microwave output powers and to compare the developed mathematical models for drying of sugar beet samples.

Material and Methods

Sugar beets were used in this study. The whole samples were stored at 4±0.5 ºC before experiments in order to slow down the respiration, physiological and chemical changes (Maskan, 2001). Prior to drying, sugar beet samples were taken out of storage and were hand peeled and sliced 3 and 5 mm thickness with a knife. 100 g sugar beet samples were dried in an oven and the initial moisture content of the samples was determined as 70,26% (w.b.) using a standard methods by the drying oven at 105º C for 24 h (Soysal, 2004; Karaaslan & Tunçer, 2008). This drying procedure was replicated three times.

A programmable domestic microwave oven (Arçelik MD-824, Turkey) with maximum output of 900 W at 2450 MHz. was used in the experiments.. For the mass determination, a digital balance of 0.01 g accuracy (Sartorius GP3202, Germany) was used. Depending upon the drying conditions, moisture loss was recorded at 1 min gap during drying at the end of power-on time by removing the turntable from the microwave, and placing this on the digital balance periodically (Soysal *et al*, 2006).

Different sample thicknesses were determined as 3 and 5 mm in drying experiments at constant sample loading density of 100 g and microwave powers of 180, 360, 540, 720 and 900 W. A Teflon dish, containing the sample, was placed at the centre of the oven turn-table in the microwave cavity. In all the drying experiments, 100 g of sugar beet slices were used. The

samples were uniformly spread on the turn-table inside the microwave cavity during treatment for an even absorption of microwave energy afterwards the drying experiment started. Moisture loss was recorded with 1 min intervals during drying for determination of drying curves by an electronic balance (Maskan, 2001). Sugar beet slices were dried until equilibrium moisture content (no weight change) was reached.

Drying curves were fitted with ten thin layer drying models, namely, Newton, Page, Henderson and Pabis, Logarithmic, Wang and Singh, Diffusion Approach, Verma, Two Term Exponential, Simplified Fick's Diffusion, Midilli-Kucuk Equation Models (Table 1). The moisture ratio and drying rate of sugar beet slices were calculated using the following equations:

$$(MR) = \frac{M - M_e}{M_0 - M_e} \tag{1}$$

where, *MR, M, M₀, Mₑ,* are the moisture ratio, moisture content at any time, initial moisture content, equilibrium moisture content, respectively.

Midilli-Kucuk Model has been used to describe the thin layer drying characteristics of eggplant (Ertekin & Yaldız, 2004) and used to describe the thin layer drying of some vegetables and fruits (Akpınar, 2006).

The model is given as:

$$MR = a \cdot \exp(-k(t^n)) + bt \tag{2}$$

Statistical analysis was conducted using the sigma plot (scientific graph system, version 9.00, jardel). Non-linear regression analysis was performed using Sigma-Plot (SPSS Inc., version 9.00) to estimate the parameters of equations.

Results

Fig. 1 and Fig.2 suggest the variations of experimental and predicted moisture ratios by the Midilli-Kucuk drying model with drying time at the drying microwave powers of 180, 360, 540, 720 and 900W for slices thickness of 3 and 5 mm, respectively. The time required to reduce the moisture ratio to any given level was dependent on the drying condition, being highest at 180 W and lowest at 900 W. With drying, the time taken to reduce the moisture content of sugar beet slices from the initial 70,26 %(w.b) to a final 12 %(w.b) was 55, 42, 23, 12 and 7 min at 180, 360, 540 720 and 900W for slices thickness of 3 mm, respectively. The drying periods of sugar beet samples were 105, 40, 24, 23 and 13 min. in microwave powers of 180, 360, 540, 720, 900W for slices thickness of 5 mm, respectively. The effect of drying microwave power was most impressive with moisture ratio decreasing rapidly with increased microwave power. The decrease in drying time with increase in drying microwave power has been observed by Soysal (2004) for parsley, Wang and Xi (2005) for carrot slices.
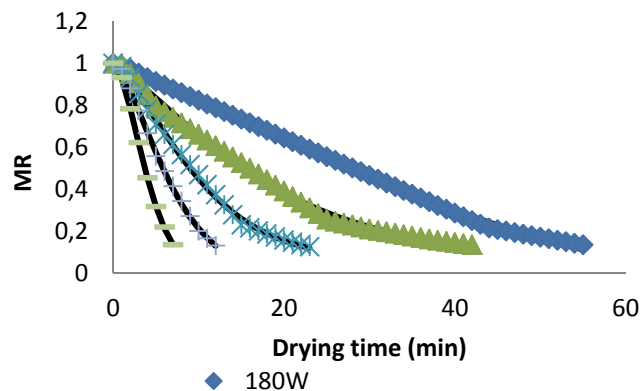
Figure 1. Variation of experimental and predicted moisture ratio by Midilli-Kucuk model with drying time at different microwave output powers (Sample thickness 3 mm)
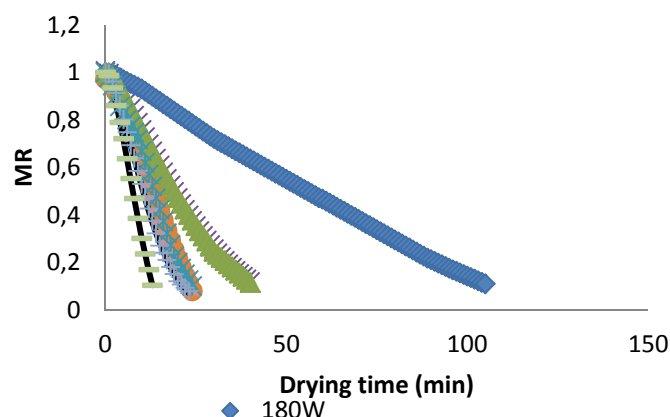
Figure 2. Variation of experimental and predicted moisture ratio by Midilli-Kucuk model with drying time at different microwave output powers (Sample thickness 5 mm)

The moisture content data at the different drying conditions were improved to the more useful moisture ratio expression and then curve fitting computations with the drying time were carried on the 9 drying models estimated by the previous researchers (Table 1).

Coefficient of determination (R^2) was one of the important factors for selecting the best model to define the drying curves of sugar beet slices. However, various statistical parameters such as Standard error of estimate SEE and residual sum of square RSS were also used to evaluate the goodness of fit of the models. The quality of fit was determined by the lower the SEE and RSS values and the higher the R^2 values (Karaaslan, 2008).

The results of statistical analyses undertaken on these models for 3 and 5 mm thickness of slices are given in Table 2 and 3.

Table 1. Mathematical models used to predict the moisture ratio values of the sugar beet

	Model name	Model equation	References
1	$MR=\exp(-kt)$	**Newton**	Ayensu(1997)
2	$MR=\exp(-kt^n)$	**Page**	Agrawal and Singh (1977)
3	$MR=a\,\exp(-kt)$	**Henderson and Pabis**	Akpinar *et al.*(2006)
4	$MR=a\,\exp(-kt)+c$	**Logarithmic**	Yaldiz *et al.*(2001)
5	$MR=1+at+bt^2$	**Wang and Singh**	Wang and Singh (1978)
6	$MR=a\,\exp(-kt)+(1-a)\exp(-gt)$	**Verma**	Verma *et al.*(1985)
7	$MR=a\,\exp(-kt)+b\exp(-k_1t)$	**Two Term**	Soysal *et al.*(2006)
8	$MR=a\,\exp(-kt)+(1-a)\exp(-kat)$	**Two Term Exponential**	Sharaf-Elden *et al.*(1980)
9	$MR=a\,\exp(-k(t^m))+bt$	**Midilli and Kucuk.**	Sacilik and Eliçin (2006)

Table 2. Non-linear regression analysis results for microwave drying of sugar beet under various microwave output power; SEE Standard error of estimate; R^2, coefficient of determination; RSS, residual sum of square (3 mm)

No	180W			360W			540W			720W			900W		
	R^2	SEE($\pm$)	RSS	R^2	SEE($\pm$)	RSS	R^2	SEE($\pm$)	RSS	R^2	SEE($\pm$)	RSS	R^2	SEE($\pm$)	RSS
1	0.9527	0.0597	0.1959	0.9890	0.0285	0.0341	0.9754	0.0462	0.0490	0.9508	0.0682	0.0558	0.9305	0.0864	0.0522
2	0.9962	0.0171	0.0159	0.9957	0.0180	0.0133	0.9970	0.0166	0.0060	0.9987	0.0116	0.0015	0.9999	0.0041	0.0001
3	0.9702	0.0478	0.1236	0.9935	0.0222	0.0202	0.9880	0.0329	0.0239	0.9712	0.0545	0.0327	0.9499	0.0792	0.0376
4	0.9971	0.0151	0.0121	0.9945	0.0207	0.0171	0.9933	0.0251	0.0133	0.9937	0.0267	0.0071	0.9907	0.0373	0.0070
5	0.9965	0.0164	0.0146	0.9967	0.0158	0.0103	0.9925	0.0260	0.0149	0.9900	0.0321	0.0114	0.9877	0.0392	0.0092
6	0.9527	0.0608	0.1959	0.9890	0.0292	0.0341	0.9733	0.0503	0.0531	0.9508	0.0747	0.0558	0.9305	0.1022	0.0522
7	0.9702	0.0488	0.1236	0.9935	0.0227	0.0202	0.9880	0.0345	0.0239	0.9712	0.0602	0.0327	0.9499	0.0970	0.0376
8	0.9527	0.0608	0.1959	0.9890	0.0292	0.0341	0.9754	0.0483	0.0490	0.9508	0.0747	0.0558	0.9305	0.1022	0.0522
9	**0.9984**	**0.0112**	**0.0065**	**0.9983**	**0.0166**	**0.0108**	**0.9979**	**0.0143**	**0.0041**	**0.9989**	**0.0120**	**0.0013**	**0.9999**	**0.0040**	**0.0001**

Table 3. Non-linear regression analysis results for microwave drying of sugar beet under various microwave output power; SEE Standard error of estimate; R^2, coefficient of determination; RSS, residual sum of square (5 mm)

No	180W			360W			540W			720W			900W		
	R^2	SEE(±)	RSS	R^2	SEE(±)	RSS	R^2	SEE(±)	RSS	R^2	SEE(±)	RSS	R^2	SEE(±)	RSS
1	0.9488	0.0607	0.3873	0.9537	0.0618	0.1526	0.9051	0.0917	0.2019	0.9305	0.0841	0.1628	0.8944	0.1009	0.1323
2	0.9946	0.0199	0.0412	0.9998	0.0041	0.0007	0.9915	0.0280	0.0180	0.9996	0.0065	0.0009	0.9977	0.0155	0.0029
3	0.9695	0.0471	0.2310	0.9777	0.0434	0.0735	0.9324	0.0791	0.1440	0.9607	0.0647	0.0921	0.9300	0.0855	0.0877
4	0.9997	0.0048	0.0024	0.9969	0.0163	0.0102	0.9933	0.0254	0.0142	0.9926	0.0287	0.0174	0.9959	0.0216	0.0051
5	0.9991	0.0082	0.0071	0.9931	0.0241	0.0227	0.9927	0.0260	0.0156	0.9868	0.0375	0.0310	0.9934	0.0263	0.0083
6	0.9409	0.0659	0.4472	0.9478	0.0673	0.1722	0.9050	0.0959	0.2021	0.9305	0.0881	0.1628	0.9521	0.0765	0.0702
7	0.9695	0.0476	0.2310	0.9777	0.0446	0.0735	0.9324	0.0828	0.1440	0.9607	0.0679	0.0921	0.9300	0.0937	0.0877
8	0.9488	0.0613	0.3873	0.9537	0.0634	0.1526	0.9051	0.0958	0.2019	0.9305	0.0881	0.1628	0.8944	0.1097	0.1323
9	**0.9997**	**0.0045**	**0.0021**	**0.9999**	**0.0032**	**0.0004**	**0.9966**	**0.0186**	**0.0073**	**0.9996**	**0.0063**	**0.0009**	**0.9998**	**0.0056**	**0.0003**

Discussion and Conclusion

The effects of five different drying methods on the drying of sugar beet slices were evaluated based on the drying parameters such as the moisture ratio and drying time. The increase in microwave power significantly reduced the drying time of sugar beet slices. As the thickness of the sugar beet slices increased, the time required to achieve a certain moisture content increased and water loss slowly.

In the present research experimental data for sugar beet slices are used in order to evaluate several thin-layer drying models available in the literature. Among these models, in each of five applications, the Midilli–Kucuk model gave the best results.

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Microwave Drying of Leek Slices and the Determination of the Some Quality Parameters

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Abstract

Drying characteristics of leek slices was experimentally studied in microwave dryer. Leek slices weighing 100 g (±0,03) were dried using five different microwave power levels: 180W, 360W, 540W, 720W and 900W. The effects of microwave drying on drying time, drying rate of leek slices have been investigated. The drying data were applied to nine different mathematical models, namely, Newton, Page, Henderson and Pabis, Logarithmic, Wang and Singh, Verma, Two Term, Two Term Exponential, Midilli-Kucuk Equation Models. The performances of these models were compared according to the coefficient of determination (R^2), standard error of estimate (SEE) and residual sum of squares (RSS), between the observed and predicted moisture ratios. It was found that the Midilli-Kucuk model described the drying curve satisfactorily in all drying methods.

Keywords: Leek, microwave, modelling

Introduction

Leeks are the most commercially produced vegetable in the entire world. Leeks, among onions and garlic, are owned by Alliaceae family, and the health gains from the their consumptions are well recognized (Doymaz, 2008). Leek production in Turkey was 229,579 metric tons in 2012 (Anonymous. 2012).

Drying of vegetables and fruits is the one of the most popular procedures used to develop food stability, since it reduces the water activity of the material, decreases microbiological activity and minimizes physical and chemical changes during its storage (Koç et al., 2008). Microwave drying of foods has become common because microwave drying prevents a falling in the quality of the product and provides the rapid and effective distribution of heat within the material (Alibaş, 2012).

The objective of this work was to study the effect of microwave output powers on the drying characteristics, drying time and drying ratio for the leek drying process. In addition to this, development of a mathematical model for thin layer drying of leek, choosing a suitable model also investigation of the effects microwave powers on the model coefficients which can portray the drying characteristics of leek samples were investigated.

Materials and Methods

Fresh leek slices were used in this work and was bought from a local market. The whole samples were stored at 4±0.5 ºC before experiments in order to slow down the respiration, physiological and chemical changes (Maskan, 2001). Prior to drying, leek samples were taken out of storage and leek slices were hand peeled and sliced 3 mm thickness with a knife. 100 (±0,03) g leek samples were dried in an oven and water content of the leek samples before drying was determined as % 86±0.5 (w.b.) using a standard methods by the drying oven at 105º C for 24 h (Soysal, 2004; Karaaslan and Tunçer, 2008). This drying procedure was carried out in triplicate.

A laboratory scale microwave dryer (Arçelik MD-824 ,Turkey) with maximum output of 900 W at 2450 MHz. was used in the experiments. The inner dimensions of the microwave chamber were 210 mm by 340 mm by 340 mm. The microwave dryer was equipped with a glass turntable (325 mm diameter) and was operated by a control terminal, which was able to control both microwave power level and emission time. For the mass determination, a digital balance of 0.01 g accuracy (Sartorius GP3202, Germany) was used. Depending on the drying conditions, moisture loss was recorded with 1 min interval during drying at the end of power-on time by

removing the turntable from the microwave, and placing this, along with the leaf sample on the digital balance periodically. Weighing time was not added to the drying time (Soysal *et al*, 2006).

To investigate the effect of microwave output power on moisture content, drying rate and drying time, five microwave output powers, 180, 360, 540, 720 and 900 W, were used for drying 100 (±0,03) g leek samples. A Teflon dish, containing the sample, was placed at the centre of the dryer turn-table in the microwave chamber. Samples were uniformly spread into a thin layer for an even absorption of microwave energy after the drying experiment started. Moisture loss was recorded at 1-min intervals during drying for determination of drying curves by an electronic balance (Maskan, 2001). Leek samples were dried until equilibrium moisture content (no weight change) was reached.

Moisture ratio and drying rate are defined as equation:

$$(MR) = \frac{M - M_e}{M_0 - M_e} \tag{1}$$

$$\text{Drying rate} = \frac{M_{t+dt} - M_t}{dt} \tag{2}$$

where, *MR is* moisture ratio; M, M_0, M_e, M_t and M_{t+dt} are the moisture content at any time, initial moisture content, equilibrium moisture content, moisture content at t and moisture content at $t+dt$ in kg [H_2O] kg $^{-1}$ dry matter, respectively and t is drying time in min. The equilibrium moisture content was assumed to be zero for microwave drying (Maskan, 2000; Doymaz, 2005). The values of M_e are relatively small compared with M or M_0 for long drying time. Thus, MR=$(M-M_e)/(M-M_e)$ can be simplified as MR=M/M_0 (Akgun and Doymaz, 2005).

Table 1.Mathematical models tested for the moisture ratio values of the leek samples

	Model name	Model equation	References
1	Newton	MR=exp(-kt)	Ayensu (1997)
2	Page	MR=exp(-kt^n)	Agrawal and Singh (1977)
3	Henderson and pabis	MR=a exp(-kt)	Akpınar *et al.* (2006)
4	Logarithmic	MR=a exp(-kt)+c	Yaldız *et al.* (2001)
5	Wang and Singh	MR=1+at+bt^2	Wang and Singh, (1978)
6	Verma	MR=a exp(-kt)+(1-a)exp(-gt)	Verma *et al.*(1985)
7	Two Term	MR=a exp(-kt)+bexp(-k$_1$t)	Soysal *et al.*(2006)
8	Two term exponential	MR=a exp(-kt)+(1-a)exp(-kat)	Sharaf-Elden *et al.* (1980)
9	Midilli-Kucuk	MR=a exp(-k(t^n)+bt	Sacilik and Elicin (2006)

Drying curves were fitted with ten thin layer drying models, namely, Newton, Page, Henderson and Pabis, Logarithmic, Wang and Singh, Verma, Two Term, Two Term Exponential, Midilli-Kucuk Equation Models (Table 1).

Values of moisture ratio measured during the experiments were fitted to the given models using the sigma plot (scientific graph system, version 12.00, jardel). Coefficient of determination (R^2), standard error of estimate (SEE), and residual sum of square (RSS were calculated as the criteria to select the best model:

Results

The initial moisture content of leek slices was about 86±0.5 % (w.b). Figure 1 show moisture ratio versus time of drying of leek at 180, 360, 540, 720 and 900 W. respectively. As the microwave output power was increased, the drying time of leek samples was significantly decreased. The microwave drying experiment which decreased the moisture content of leek samples from the initial 86±0.5% (wet basis) to a final 11±0.3% (wet basis) took 56-12 min. depending on microwave output power applied. The drying periods of leek samples were 56, 25, 17, 14 and 12 min. in microwave powers of 180, 360, 540, 720, 900W, respectively. This result is similar to the result of drying mint leaves (Özbek and Dadalı. 2007), chard leaves (Alibaş,

2006), parsley leaves (Soysal, 2004) and apple slices (Wang *et al.*. 2007). Experimental and predicted moisture ratio values with drying time by the Midilli-Kucuk model are shown in Fig. 1.

The drying rate (kg $[H_2O]kg^{-1}$[dry matter].min^{-1}) defined as the quantity of water removed with time is shown in Fig. 2 for leek samples during microwave drying at 180, 360, 540, 720 and 900 W. The total drying rates to reach the final moisture content for the leek samples were 3.38, 5.58, 8.79, 11.31 and 13.98 (kg $[H_2O]kg^{-1}$[dry matter].min^{-1}) at 180, 360, 540, 720 and 900 W, respectively (Fig. 2). The drying rate decreased continuously with the moisture content or drying time. In this curve, there was no constant–rate drying period and all the microwave drying experiments were seen to occur in the falling rate period.
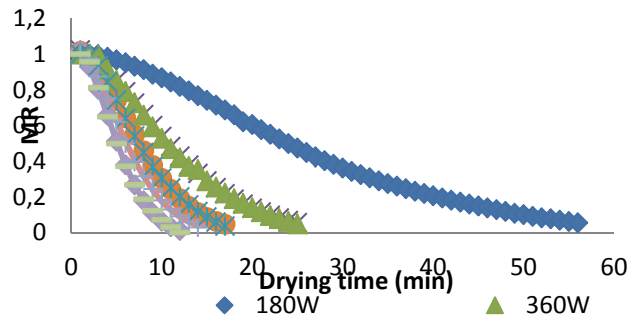
Figure 1. Variation of experimental and predicted moisture ratio by Midilli-Kucuk model with drying time at selected microwave output powers.
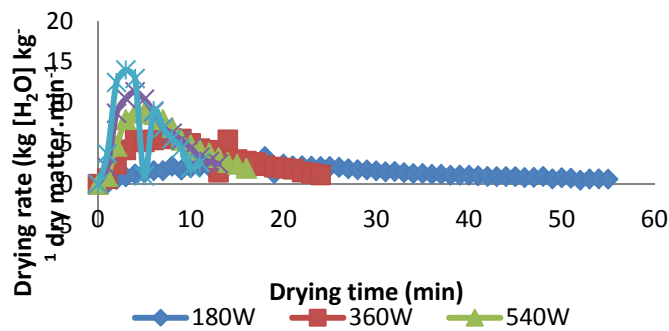
Figure 2. Variation of drying rate as a function of drying time for different microwave output powers.

The results of the statistical analyses applied to these models at drying process at 180, 360, 540, 720 and 900 W microwave output powers are given in Tables 2. The models were evaluated based on R^2, SEE and RSS. For all the drying conditions, the Midilli-Küçük Model was the best descriptive model as shown in Table 2 and Table 3. The Midilli-Küçük model gives the highest values of R^2 and the lowest values of SEE and RSS.

Based on the multiple regression analysis, the accepted model is as follows:

$$MR(a,k,m,b) = \frac{M - M_e}{M_0 - M_e} = a.\exp(-kt^m) + bt \qquad (3)$$

Table 2. Non-linear regression analysis results for microwave drying of leek samples

No	180W			360W			540W			720W			900W		
	R^2	SEE(±)	RSS	R^2	SEE(±)	RSS	R^2	SEE(±)	RSS	R^2	SEE(±)	RSS	R^2	SEE(±)	RSS
1	0.9183	0.0904	0.4491	0.9017	0.1031	0.2552	0.8733	0.1224	0.2396	0.9368	0.0875	0.0996	0.9358	0.0920	0.0931
2	0.9993	0.0083	0.0037	0.9967	0.0192	0.0084	0.9970	0.0194	0.0056	0.9992	0.0104	0.0013	0.9990	0.0122	0.0015
3	0.9676	0.0575	0.1783	0.9687	0.0595	0.0813	0.9580	0.0728	0.0795	0.9606	0.0720	0.0622	0.9560	0.0799	0.0638
4	0.9922	0.0285	0.0429	0.9912	0.0321	0.0227	0.9881	0.0402	0.0226	0.9889	0.0398	0.0174	0.9885	0.0431	0.0167
5	0.9790	0.0462	0.1153	0.9693	0.0588	0.0796	0.9602	0.0709	0.0753	0.9841	0.0458	0.0251	0.9853	0.0461	0.0213
6	0.9334	0.0831	0.3659	0.8977	0.1099	0.2655	0.9284	0.0983	0.1354	0.9368	0.0952	0.0996	0.9236	0.1110	0.1108
7	0.9676	0.0586	0.1783	0.9687	0.0622	0.0813	0.9580	0.0782	0.0795	0.9606	0.0789	0.0622	0.9560	0.0893	0.0638
8	0.9183	0.0920	0.4491	0.9017	0.1077	0.2552	0.9284	0.0983	0.1354	0.9368	0.0952	0.0996	0.9358	0.1017	0.0931
9	**0.9998**	**0.0049**	**0.0012**	**0.9989**	**0.0115**	**0.0028**	**0.9993**	**0.0099**	**0.0013**	**0.9994**	**0.0098**	**0.0010**	**0.9994**	**0.0105**	**0.0009**

Table 3. Non-linear regression analysis results of semi-empirical Midilli-Kucuk's equation [Eq. (3)] for microwave drying of leek samples under various microwave output power; SEE Standard error of estimate; R^2. coefficient of determination; RSS. residual sum of square

Controlled variable parameters	Constants	R^2	SEE (±)	RSS
180W	a= 0.0045 k= 1.0082 m= 1.6078 b= 0.0001	0.9998	0.0049	0.0012
360W	a= 0.0221 k= 1.0239 m= 1.5314 b=-0.0003	0.9989	0.0115	0.0028
540W	a= 0.0321 k= 1.0163 m= 1.6518 b= 0.0002	0.9993	0.0099	0.0013
720W	a= 0.0523 k= 1.0147 m= 1.5950 b= -0.0004	0.9994	0.0098	0.0010
900W	a= 0.0743 k= 1.0135 m= 1.5896 b= -0.0023	0.9994	0.0105	0.0009

Discussion and Conclusion

In this present study experimental data for leek samples are used in order to evaluate several thin layer drying models available in the literature. Among these models, in each of three applications, the Midilli-Kucuk model gave the best results. Relations between the model parameters and the drying conditions for the computation of the moisture ratio in relation to drying time were determined and reported.

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Carotene Content in Rainbow Trout Filet from Neretva River Fish Farms

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Abstract

Consumers have preferences for red-colored products of salmon fish species because of positive effects of astaxanthin on growth and disease resistance may be related to carotenoid antioxidant activity. The carotene could change this fact as carotenes not only help fish meat looks fresher and esthetically appealing, but they also have a positive effect on human health. For determination of the concentration of carotenoids and chemical composition it has been used two groups (54 samples in total) of rainbow trout body weight up to 800 grams from local fish farms at the Neretva River. Study was conducted where one fish group fed by diet with added astaxanthin in their feeding while the other one group fed with ordinary diet. The spectrophotometric analysis of red and white fish fillets showed there was a statistical significance in the amount of carotene ($p > 0,05$) between these two groups. Content of carotenes were 0,383 to 2,366 μg/g in white group, while in red group were from 2,027 to 4,671 μg/g. There were no statistical significance in the amount of moisture content, fat, protein and ash ($p > 0,05$), moisture content white group 74,08%, red group 74,17%, fat white group 6,01% red group 5,23%, protein white group 17,13% red group 18,51%, and ash white group 1,98% red group 1,77%.

Keywords: Carotene, astaxanthin, canthaxanthin, chemical analysis, spectrophotometry

Introduction

The color of salmonid fish is one of the most important quality parameters for customers (*Sigurgisladottir et al. 1997*). Consumers associate increased level of red in salmonids fishes with superior quality, and color is the first quality parameter inspected by the customer. Therefore, it is of outermost importance for the industry to understand the effect of breed conditions and processing on the color development in salmonids fish fillets.

Carotenoids are divided into two distinct groups: first group are called "Carotenes." This is probably the more widely known group because of its most famous member, beta carotene. Some of the other well-known carotenes are lycopene and alpha carotene. The second group is called Astaxanthin "Xanthophylls". Some other notable xanthophylls are lutein and zeaxanthin. The difference between these two groups is that Xanthophylls have hydroxyl groups at the end of the molecules. Astaxanthin has more hydroxyl groups than the other Xanthophylls, which allows it to do more in the human body than its closely-related lutein and zeaxanthin *(Capelli and Cysewski, 2007)*.

The sources of carotenoids may be artificial or synthetic and natural. In the group of synthetic carotenoid astaxanthin is the main pigment that is used worldwide in aquaculture *(Higuera-Ciapara et al., 2006)*, and canthaxanthin is the main source in salmonids. In the body of salmonids astaxanthin is present as a natural carotenoid, however, preferred to use synthetic astaxanthin because it gives a stronger color, while canthaxanthin in a yellow-orange coloration *(Johnson, 1992)*.

Studies have shown that the concentration of carotenoids in traditionally farmed salmon was higher than the concentration in natural and ecologically farmed salmonids *(Tolasa et al., 2005)*. In salmonids fish's fillet color is held to be an important quality parameter *(Sigurgisladottir et al. 1997)*, and pigment feeding is regarded as the most important management practice for marketing of farmed salmon *(Moe, 1990)*.

Material and Methods

Sampling

Fifty four samples of *rainbow trout* in total were selected at random from a population from cages*,* ranging of average weight up to 800 g. Fish samples were divided into two groups by feeding regime. First group fed up with fish feed with addition of astaxanthin and cantaxantin in the diet, in same time second group had been fed with commercial trout diet. They were anaesthetized by solution of *p-aminobenzo etil ester, 50 mg⁻¹* before their complete bleeding out. Measuring of body weight was carried out by *"Electronic Scale "BIRE K3052-P High Precision,* then were separated for further analyses. First group has been divided into two group, first group (15 samples) for spectrophotometric analyses and second one (12 samples) for chemical analyses, same vas with another group. Before laboratory testing that carried out, the fish was suspended usual feeding procedure for 72 hours for the authenticity of laboratory analyses.

Analyses

Chemical analyses of taken fish samples has been done in laboratories of Agricultural and Food Sciences Faculty of Sarajevo, it was intended to determine the moisture, protein, fat and ash. Chemical analyses of samples were carried out by methods commonly used for individual samples, crude protein content was calculated by converting the nitrogen content, determined by Kjeldahl's method (*AOAC 1995*), fat content by Soxhlet method, the moisture content of drying method at 105°C to the constant weight, and content of total ash method of burning in furnace at 550°C.

Quantitative anlyses of carotenoides of rainbow trout samples has been done by spectrophotometer *UVmini – 1240*. Content of carotenoids were meassured on absorbance 450 nm in 10 % diluted sample during three days continously for each group. Results are expressed as the content of carotene. Preparation and extraction of carotene from the samples was done according to the reference method described *Bjerkeng* (2000). Extraction was done in dark room and samples were homogenized with ice cooling.

Results and Discussion

Color differences noticed visually have been confirmed by instrumental color measurements (Rosche Score Color Card – Salmo Fan). Founded coloration was between 14-16 for white and 22-26 for red group as it according with finding *Karahmet, 2011.*

The spectrophotometric analysis showed there was a statistical significance in the amount of carotene (p>0, 05) between these two groups. Content of carotenes were 0,383 to 2,366 µg/g in white group, while in red group were from 2,027 to 4,671 µg/g.

Gathered data during three days measuring of absorbance and content of carotene showed there was difference during each next day. Absorbance goes down slightly in white group from 0,031% measured first day to 0,014% measured last day. In the red group was opposite situation from 0,019% measured first day to 0,029% measured last day.

Previous studies of astaxanthin *(Ljundquist et all 2012; Capelli and Cysewski, 2007)* found distinguished absorbance peaks of astaxanthin around 450-505 nm as it showed our experimental work on two groups of fish taken from the Neretva river fish farms.
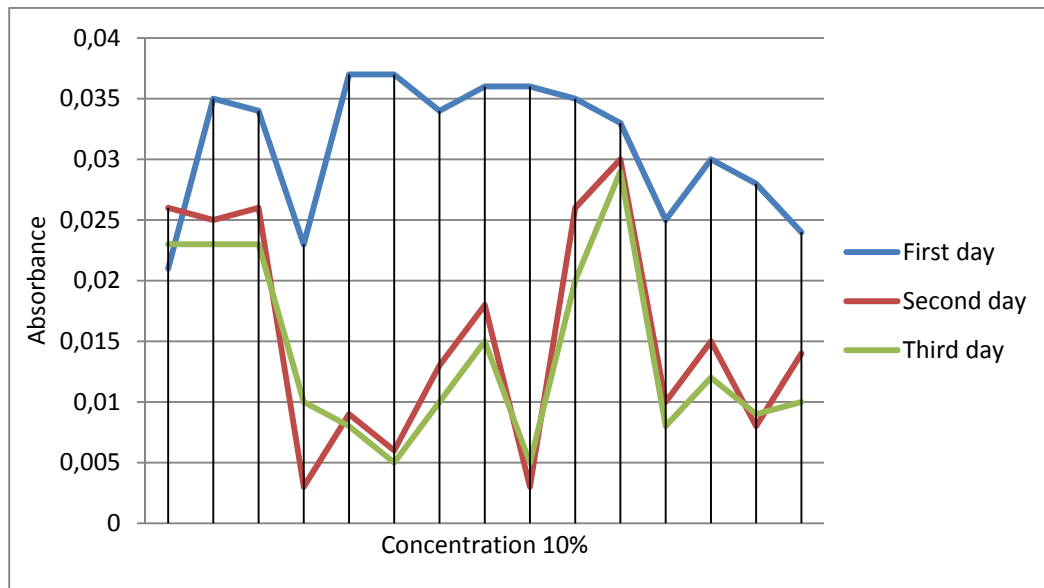
Graph 1. Measured absorbance first, second and third day in white fish filet.

As it shown in the graph 1 is it easy to see that absorbance was the highest first day (0,032), in same time second (0,015) and third day (0,014) were lower as it in accordance with *Ljundquist et all* 2012.

Measured data for red fish filet s were almost same for second (0,0293) and third day (0,0289) when for fisrt day was the lowest absorbance (0,0196). Gathered data did not showed significant differences between meassured absorbances during three days for red fish fillets.
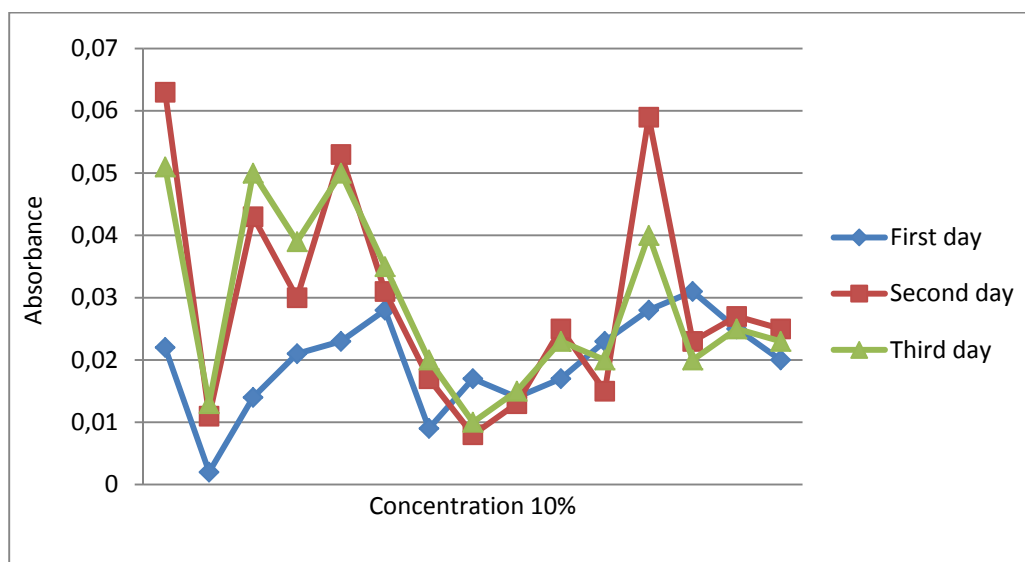
Graph 2. Meassured absorbance first, second and third day in red fish filet

Chemical analyses showed there were no statistical significance in the amount of moisture content, fat, protein and ash (p>0,05), moisture content white group 74,08%, red group 74,17%, fat white group 6,01% red group 5,23%, protein white group 17,13% red group 18,51%, and ash white group 1,98% red group 1,77%. There were no impact of fish feed on chemical composition as it shown on the table below. This is in accordance with chemical analysis *Omanović et all 2013*.

Table 1. Proximate chemical composition samples of fish between groups

GROUP	Moisture (%)	Fat (%)	Protein (%)	Ash (%)
A/ RED	74,17%	5,23%	18,51%	1,87%
B/WHITE	74,08%	6,01%	17,13%	1,98%

Conclusions

- The results show that it is easy to separate natural and carotenoids added in fish feed between investigated groups using spectroscopy analysis and Salmo Fan analysis.
- Gathered data didn't shows significant differences between meassured absorbances during three days for red fish fillets, for white fish fillets showed singnificance differencies between first and the second and third day.
- From comparative study of moisture content, protein, fat and ash, it can be concluded that the values ranged approximately within the same limits for both observed group.
- This investigation provides practical and useful information on the content carotenoids in the filet of rainbow trout which is widely consumed in Bosnia and Herzegovina.

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Comparison of Qualities Properties of Fresh, Frozen and Solar Dried Chokeberry Fruits

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Abstract

It was examined the chemical content in fresh, frozen and dried chokeberry fruits. Chokeberry, *Aronia melanocarpa*, is grown in mountainous Maleshevia in the Republic of Macedonia. Harvesting is carried out in September, under full technological maturity of the fruits. Drying of chokeberry fruits is made in solar drier. Following parameters were determined: total solids, total acids, vitamin C, sugars, content of anthocyanins, color density and polymeric color. The content of total solids is the highest in the dry fruits (52.29 %) and lowest in fresh fruits (26.33 %). The content of total acids was higher in fresh and frozen chokeberry fruits (1.00%) compared to dried chokeberry fruits (0.90 %). The content of vitamin C amounts to 17.52 mg/g in fresh chokeberry fruits and 15.64 mg/g in the dried fruits. In the fresh chokeberry fruit was determined 6.35 % sugars, and their concentration in frozen fruits is lowest and equals 4.35 %. The content of anthocyanins accounted for 106.38 % in the fresh chokeberry fruits, and 30.05 % in the dried fruit. The highest density of color (1.22) was determined in fresh fruits and the highest content of polymeric dyes (0.58) was determined in frozen chokeberries fruits.

Keywords: Chokeberry, solar dryer, chemical content.

Introduction

The chokeberry fruit is multi stem tree deciduous shrub that belongs to the family *Rosaceae*. It is originating from north-eastern and central United States and adjacent parts of Canada. Generally two types of chokeberry are known: *Aronia arbutifolia* (red chokeberry) and *Aronia melanocarpa* (black chokeberry).

The black chokeberry has exceptional, shiny, dark green leaves in summer that turns a satisfactory mix of yellow, orange and red in autumn. The flowers are white, appearing in May and with similar effectiveness in terms of landscape spatial and red chokeberry (Bulatović, 1989; Hassan, 1995).

Black fruit, because of its *Aronia melanocarpa* gets its common name, are glossy and larger (0.80 to 1.30 cm) in diameter than those of *Aronia arbutifolia* (Annon, 1974). The fruits can ripen early around mid-July, but they generally mature in August. The berries of black chokeberry withers soon after maturing, and falling or keep for a while as raisins of the plant. Some populations of *Aronia melanocarpa* fruit are more durable than others depending on geographical location (Velićković, 2002).

In the Republic of Macedonia, chokeberry, as a culture, begins to spread in recent years. The first plantings were already raised in areas with higher altitude, which is one of the conditions for their successful cultivation.

The growing interest for chokeberry is due to the unique properties of the fruit, with excellent characteristics as a raw material for processing and is classified as a curative plant with excellent chemical composition. The chemical composition of *Aronia melanocarpa* or black chokeberry may vary depending on the region and weather conditions during the vegetation period (Itoo, 1971). Fresh ripe berries of *Aronia melanocarpa* contain 74 to 83 % water and 17 to 26 % of dry matter. The chokeberry contains 18 % soluble matters, such as sugars, acids, tannins, pectin, pigments and mineral salts. The chokeberry also contains large amounts of vitamins, such as: C, P, B_2, B_9, E and carotene (pro-vitamin A). Among these, the vitamin P is incomparably high in comparison with other varieties of fruits and ranges between 1200 and 3977 mg in fresh fruit. In

the chokeberry vitamin P occurs in bioflavonoids groups: colorless catechins (600 to 1500 mg), red anthocyanins (600 to 1300 mg) and a negligible amount of yellow flavonoids.

Chokeberry can be used in fresh and dry condition. Fresh chokeberry can be used in food processing, especially as a source of vitamins and minerals, and colorants. The chokeberries are used as dried, and with their mashing, the pigments are extracted and receive ruby-red color that is now quiet popular in the food industry, while the usage of synthetic colors is becoming less common.

The aim of our research was to make comparative studies of quality properties of chokeberry fruits in fresh, frozen and dried condition.

Material and Methods

For tests making, used are fresh, frozen and dried chokeberry fruits, *Aronia melanocarpa*. Examinated chokeberry is grown in mountainous Maleshevia. The fruits ware harvested at physiological maturity during the month of September. After fruit harvesting was made preparation for its drying. Drying was done in Armenian solar dryer.

In the laboratory conditions, was made analysis on the chemical composition of fresh, frozen, and solar dried fruits.

Following examinations were made:

- Content of total dry matter determined by drying the material in dryer at a temperature of 105°C;
- Moisture content obtained by calculation that 100 % will be deducted % of total dry matter;
- The total acid content determined by the method of neutralization with 0.1 M NaOH solution in the presence of the indicator 1 % solution of phenol ftalein;
- Content of vitamin C determined by the Tillmans method based on the redox reaction between L-ascorbic acid and organic color 2.6 dichlorophenolindophenol;
- Content of sugars after inversion determined by gravimetric method with a solution of Felihg 1 and Feling 2;
- The antocyanins were previously extracted from the fruits with 50% ethanol. Their concentrations were determined with measuring of absorbance by spectrophotometer;
- The density of color in the sample, treated with water;
- The polymer color of the sample treated with bisulphate;

Results

Table 1. Chemical content of fresh, frozen and dry chokeberry fruits

Chokeberry fruit	Content of dry matters (%)	Content of moisture (%)	Total acids (%)	Content of vitamin C (mg/100g)	Content of sugars (%)
Fresh	26.33	73.67	1.00	17.52	6.35
Frozen	26.71	73.29	1.00	17.15	4.35
Dry	52.41	47.60	0.90	15.11	5.48

Table 2. Absorbance measuring in the chokeberry fruits

Chokeberry fruits	$A_{\lambda VIS-max}pH1.0$	$A_{700pH1.0}$	$A_{\lambda VIS-max}pH4,5$	$A_{700pH4.5}$
Fresh	0.125	0.0036	0.02345	0.00428
Frozen	0.26	0.01025	0.04821	0.01082
Dry	0.340425	0.00539	0.0244335	0.006975

Table 3. Content of antocyans in chokeberry fruits colors

Antocyanins	(mg/L)
Fresh chokeberry fruits	106.38
Frozen chokeberry fruits	51.21
Dry chokeberry fruits	25.41

Table 4. Color density in chokeberry fruits and polymeric

Chokeberry fruits	Color density	Polymer colors
Fresh	1.22	0.32
Frozen	0.45	0.58
Dry	0.48	0.28

Discussion

Dry chokeberry fruits were characterized by the highest content of dry matter (52.41 %), while fresh and frozen fruits were characterized by low content of dry matter (26 %). The reference data content of total dry matter in fresh chokeberry fruits ranged from 17 to 26%, depending on climatic factors. In dried chokeberry fruits dry matter ranging from 50 to 60 %, depending on the method and conditions of drying (Hardin, 1973; Niketić-Aleksić, 1994).

The moisture content was the lowest in the dry chokeberry fruits (47.60 %) and was higher in fresh (73.67 %) and in frozen chokeberry fruits (73.29 %).

In the fresh and frozen chokeberry fruits, content of total acids was 1%, while in the dry chokeberry fruits was lower, 0.90 %. Obtained data from the content of total acids in the examined chokeberry fruits were in accordance with literature data, where the values of total acid content ranging from 0.70 to 1.30 % (Jeppsson and Johansson, 2000).

The highest content of vitamin C (17.52 mg/100g) was obtained in fresh chokeberry fruits, and the lowest content (15.11 mg/100g) was obtained in dry chokeberry fruits. The content of vitamin C was lower in frozen chokeberry fruits (17.15 mg/100g). The reduction in the content of vitamin C in frozen and dried chokeberry fruits due to the high instability of vitamin C, on the influence of high temperature and oxygen. The process of chokeberry drying was a reason for losing the vitamin C, too. According to the literature data, the values for the vitamin C content are ranging from 14 to 28 mg/100g (Jeppsson, 1999).

The highest content of total inverted sugar (6.35 %) was obtained in fresh chokeberry fruits. In the frozen chokeberry fruits the content of total inverted sugars was reducing and its value is 4.35 %. During the process of drying the content of sugars was reducing, too, and its value was 5.48 %. The obtained results are in accordance with literature data, which are in range from 6.20 to 10.80 %, depending on climatic condition (Konic-Ristic et al., 2013).

In the Table 3 are shown the values for the content of anthocyanins in the chokeberry fruits expressed in terms of cyaniding-3-glucoside, with a molar mass of 449.20 M.

From the obtained results can be concluded that the content of anthocyanins was the highest in the fresh chokeberry fruits, 106.38 mg/L, and the lowest in dry chokeberry fruits, 25.41mg/L. Freezing and drying of chokeberry fruits, had a negative effect on the content of anthocyanins, which came to their destruction. It happens because they are not stable to light, oxygen, temperature change, change of pH and other components such as enzymes. According to the literature, the content of anthocyanins in chokeberry fruits is in range from 85.30 to 120 mg/L (Oszmianski and Sapis, 1988).

The highest color density, 1.22 was obtained in the fresh chokeberry fruits, and the lowest, 0.45 in the frozen chokeberry fruits. Polymeric colors were the highest in the frozen chokeberry fruits (0.58) and the lowest (0.28) in dried chokeberry fruits.

Conclusion

Based on the comparative examinations for determination of chokeberry fruits quality properties in fresh, frozen and dried condition the following conclusions can be made:

- The content of dry matter in fresh and frozen chokeberry fruits were around 26 %, and in the dry chokeberry fruits was 52.41%;

- The highest moisture content was obtained in the fresh chokeberry fruits (73.67 %) and the lowest (47.60 %) in the dry chokeberry fruits;

- In the fresh and frozen chokeberry fruits the content of total acids was 1.00 %, while in the dry chokeberry fruits was lower, at 0.90 %;

- The highest content of vitamin C (17.52 mg/100g) was obtained in the fresh chokeberry fruits, and the lowest content (15.11 mg/100g) was obtained in the dry chokeberry fruits;

- The highest content of total inverted sugars (6.35 %) was obtained in the fresh chokeberry fruits and the lowest (4.35 %) in the frozen chokeberry fruits;

- The content of anthocyanins was the highest in the fresh chokeberry fruits (106.38 mg/L), and the lowest in the dry chokeberry fruits (25.41 mg/L);

- The highest color density (1.22) was obtained in the fresh chokeberry fruits and the lowest (0.45) in the frozen chokeberry fruits;

- Polymeric colors were the highest in the frozen chokeberry fruits (0.58) and the lowest (0.28) in the dry chokeberry fruits.

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Effect of Sodium Chloride Addition During Distillation on Azeoptropic Ethanol – Water Change

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Abstract

Primary task of researchers and producers of strong alcoholic beverages is to achieve better and balancing evaporation of components during distillation in shortest possible time and with less cost. One way to achieve this is by adding salt during distillation. Salt (NaCl) as a surface inactive component distorts azeotrope that changes the dynamics of the evaporation of volatile components.Therefore, the aim of research is twofold: first, to determine the effect of salt addition during distillation on distillation time and second, to determine the effect of salt addition during distillation on dynamics of evaporation of certain components. For this purpose William brandy was produced. Three distillations of fermented mash were performed: one in a conventional manner, the second with the addition of 2% salt and the third one with the addition of 5% salt into the raw distillate. Fractionation of distillate was performed and fifth fractions were separated during distillations time. The content of alcohol, methanol, ethyl acetate, acetaldehyde and acetic acid were determinate in fractions.The results indicate that the addition of salt during distillation has an impact on the balance of other volatile compounds during the distillation and distillation time was shorter with the addition of salt.

Keywords: Williams pear, distillation, salt, volatile.

Introduction

Besides the fact that Bosnia and Herzegovina is a country with favorable climatic and soil conditions fruit production is devastating due to a lack of entrepreneurial spirit as well as the traditional approach to the cultivation. (Jašić et al., 2012). Technical and technological "lag", but also a lack of qualified working staff and resources are strong brakes for significant and noteworthy fruit production, especially the production of strong alcoholic drinks. Their sensory characteristics, but also the economic importance drawn special attention of researchers and manufacturers. The greatest efforts have been made to achieve a better and more uniform evaporation of components during distillation (Rath, 2009) and to achieve this in less time and with lower costs (Ohe, 2005). Separating the azeotropic composition which have low relative volatility by conventional methods such as fractional distillation is difficult or uneconomical. To overcome this problem a third component that will change the properties of the mixture is required. One way to achieve this goal is by adding salt during distillation. Common salt (NaCl) increases the surface tension of the mixture and belongs to the surface inactive components. In the mixture where dominant components are ethanol and water salt addition will ruin their azeotropic. That will change dynamics of evaporation, not only these components but also other volatile compounds (Cook and Furter 1968, Rath 2009).

Most studies (Furter, 1992, Gil et al., 2008; Jiquan and Die, 2012) about salt addition during distillation is done on extractive distillation therefore the aim of this study was to examine dynamics of evaporation of volatile compounds under the influence of salt addition during fractional distillation on simple pot.

Materials and Methods

In this study 50 kg of Williams pear was used for the production of the pear brandy. Initial concentration of the extract expressed in °Brix was 12.0 and pH value was 4.24. Pears were repening six days at room temperature The fruits were selected, pedicles was removed, and then squashed with hands and placed in the vessel for fermentation (60 kg). Sulphuric acid was added at 50mL/100 kg of mash for the regulation of pH and commercial dry yeast *Saccharomyces cerevisiae* was added in amount of 20 g/100 kg. Monitoring of fermentation was performed every second day and fermentation lasted until the concentration of sugar decreased to 5 °Brix.

Immediately upon completion of fermentation, distillation was carried out. The double distillation was performed in a traditional copper alembic pot. The first distillation was

performed on the pot with a volume of 8 L, wherein whole mash was done in order to obtain raw distillate. Five distillation was performed and obtained 18 L of 12% v/v raw distillate. Re-distillation of raw distillate was performed on the pot with a volume of 2 L. The distillation is performed in three variants. The first distillation is a conventional, second with 2% salt addition and the third with 5% salt addition to raw distillate. All variants were performed in three replications. Fractionating of distillate was performed during the distillation. Each distillation had five fractions per 100 mL. Total of 45 samples were taken (9 distillation x 5 fraction). During distillation following parameters was monitored: time, temperature and concentration of alcohol in the pot.

After distillation chemical and physical analysis of the samples was done. Determination of concentration of ethanol, total acid, acetaldehyde, esters, methanol and higher alcohols according to the Regulation about methods sampling and performing chemical and physical analysis of alcoholic beverages No. 70/1987.

Obtained results were statistically analyzed using the statistical program PAST (Hammer et al., 2001). Besides descriptive statistics, factorial (type of distillation), two factorial analysis of variance (fractionation and type of distillation) and LSD test was done.

Results and Discussion

Duration of distillation was monitored from the moment of placing raw distillate into a pot until the moment of taking the last fifth fractions.
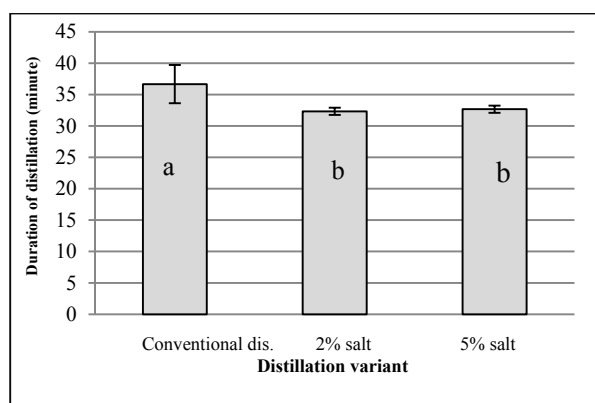
Figure 1. The average (n=3) duration of distillation in minutes and results of LSD test (LSD=3,65).

Average duration of distillation has statistically significant difference. Conventional distillation lasted significantly longer than the distillation with the salt addition (Fig 1.).

Dynamics of ethanol separation during distillation

The highest concentrations of ethanol were recorded in the first fractions. Thus, most concentration of alcohol was recorded in the first and second distillation fraction with the 5% salt addition to the raw distillate. On the other hand conventional distillation had the highest concentration of ethanol in the third, fourth and fifth fractions. The concentration of ethanol steadily declined during distillation in all three variants, which showed that the fractionation had statistically significant effect on the concentration of ethanol.

Table 1. Average concentration of ethanol and results of LSD test

Distillation variant	Fraction					LSD
	1	2	3	4	5	
Conventional	56,40	42,16	21,63	6,33	1,86	**25,68**
2% salt	58,33	43,00	19,56	4,63	1,06	**25,32**
5% salt	58,43	46,06	20,36	4,83	1,83	**26,30**
LSD (0,850007)	**57,72** [a]	**43,74** [b]	**20,52** [c]	**5,26** [d]	**1,58** [e]	

Dynamics of acid separation during distillation

Lower salt concentrations can intensify evaporation of acetic acid while higher salt concentration does not lead to evaporation of harder fumes volatiles like acetic acid.

Table 2. Average concentration of acid and results of LSD tests

Distillation variant	Fraction					LSD (0,03)
	1	**2**	**3**	**4**	**5**	
Conventional	0,05	0,08	0,19	0,23	0,2	0,15 [a]
2% salt	0,096	0,124	0,256	0,276	0,328	0,21 [b]
5% salt	0,07	0,10	0,17	0,29	0,06	0,13 [c]
LSD (0,04)	0,07 [a]	0,10 [a]	0,20 [b]	0,26 [c]	0,19 [b]	

Dynamics of acetaldehyde separation during distillation

The highest concentration of acetaldehyde was recorded in the distillation with the 5% salt addition which is significantly higher compared to conventional distillation with 2% salt addition. Thus it can be said that salt addition can force the evaporation of acetaldehyde in the first fraction, whose removal can purified fraction "heart" from this undesirable compound.

Table 3. Average concentration of acetaldehyde and results of LSD test

Distillation variant	Fraction					LSD (0,91)
	1	**2**	**3**	**4**	**5**	
Conventional	1,63	1,58	0,82	0,17	0,05	0,85 [a]
2% salt	1,87	1,44	0,27	0,04	0,01	0,72 [a]
5% salt	2,94	3,34	2,10	0,47	0,20	1,81 [b]
LSD (1,17)	2,15 [a]	2,12 [a]	1,07 [ab]	0,23 [b]	0,08 [b]	

Dynamics of ester separation during distillation

The concentration of ester per liter evenly decreases during three distillation. First fraction has a significantly higher content of ester compared to other four. Differences in the concentration of the ester compared to type of distillation are not statistically significant.

Table 4. Average concentration of ester and results of LSD test

Distillation variant	Fraction					LSD
	1	**2**	**3**	**4**	**5**	
Conventional	1513,60	692,26	469,33	457,60	176,46	701,65
2% salt	1149,86	551,46	387,20	363,73	305,06	551,46
5% salt	1232,0	680,53	363,73	281,60	305,06	572,58
LSD (253,01)	1298,48 [a]	1298,48 [bc]	1298,48 [c]	1298,48 [d]	1298,48 [d]	

Dynamics of methanol separation during distillation

Concentration of methanol grew during distillation which indicates that fractionation has a statistically significant effect on the concentration of methanol. In the distillation of raw distillate with 2% and 5% salt addition methanol has a higher value compared to conventional distillation. Exception is the second faction but this difference was not statistically significant.

Table 5. Average concentration of methanol and results of LDS test

Distillation variant	Fraction					LSD
	1	**2**	**3**	**4**	**5**	
Conventional	1,23	1,71	2,02	2,42	2,58	1,99
2% salt	1,27	1,56	2,16	2,57	2,64	2,04
5% salt	1,01	1,48	2,15	2,53	2,59	1,95
LSD (0,13)	1,17 [a]	1,58 [b]	2,11 [c]	2,51 [d]	2,60 [d]	

Dynamics of higher alcohols separation during distillation

The higher alcohol concentration in all fractions was significantly higher during conventional distillation compared to the other two types of distillation. In distillation of raw distillate with 2% and 5% salt addition concentration of higher alcohols has significantly less value. This indicates that the added salt has influence on azeotropic ethanol - water the change which it has moved to ethanol side.

Table 6. Average concentration of higher alchols and results of LSD test

Distillation variant	Fraction					LSD (196,79)
	1	2	3	4	5	
Conventional	3951,66	2951,66	2018,33	1760,00	1551,66	2446,66 [a]
2% salt	2443,33	1043,33	435,00	360,00	210,00	898,33 [b]
5% salt	1126,66	943,33	710,00	485,00	360,00	725,00 [b]
LSD (254,05)	2507,22 [a]	1646,11 [b]	1054,44 [c]	868,33 [d]	707,22 [d]	

Conclusion

On the basis of this empirical research it can be concluded that salt addition during distillation has an impact on azeotropic ethanol - water change and therefore on balance of other volatile compounds during distillation. Properly conducted and monitored technological process with the salt addition can be used in obtaining adequate quality brandy. Also this reduce time and cost of distillation. Appropriate quality with lower cost would motivate producers of strong alcoholic beverages to produce more significant and diverse offer of these beverages.

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The Volatile Aroma Compounds of Fresh Lovran's Marrone Cultivar

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Abstract

Chestnut has been cultivated in the Bosnia territory since the Roman Empire. Latterly sweet chestnuts (Castanea sativa Mill.) is regaining interest among consumers due to its nutritional qualities and potential health benefits, on account of a high amount of carbohydrates and the presence of essential fatty acids, minerals, vitamins and also fibre. The volatile aroma compounds of Lovran's marrone cultivar collected in the area of the Una-Sana canton (Bosnia and Herzegovina), which have not been studied prior to this report, were determined by headspace solid-phase micro-extraction (HS-SPME) by the application of a specific fiber (DVB/CAR/PDMS fiber) with a mass selective detector. Freshly harvested chestnuts were manually peeled and after that milled in a laboratory blender. The sample contained 48.1% dry matter, 0.55% crude proteins, 1.6% crude fibre, 6.1% fats and 4.1% ashes. Volatile fraction was composed of 34 main compounds. Esters (66.90% of the total peak area), alcohols (17.6%) and ketones (5.3%) appear to be the most important contributors impacting essence aroma of fresh chestnut. The main constituents was ethyl acetate (49.4%) with pineapple, ethereal aroma, followed by 3-methylbutyl acetate (6.8%) with fruity, pear, banana-like odour. The second most abundant compounds were alcohols, with the leading components ethanol (5.7%) with alcoholic odour and 1-octanol (5.2%) with fruity-flowery, sweet soap, orange, waxy, sweet note.

Keywords: Chestnut aroma, chestnut volatile, solid phase micro-extraction.

Introduction

Chestnut cultivation became common in many European countries during late Roman times and the Middle Ages. They are a major food crop in regions where they are grown. The nuts are normally not eaten raw but used baked, boiled, roasted or in confectionary. Consumers prefer boiled or roasted chestnuts, the shell is then peeled and the kernel is eaten (Koca et al. 2014). Chestnuts have also been used to make flour and for animal feed (Kiple and Ornelas 2012).

There are many different types of the chestnut, varying in shape and color of fruit. One of them is "Lovran's marun" which is appreciated for high quality of its fruit. The word "marron" usually signifies big, improved sort of domestic chestnut by inoculation, while in Italy the word "marron" signifies a special sort of chestnut with high quality fruits. (http://www.hotelvillaastra.com/).

Chestnut is easily digestible and healthy which is known for long time in the native medicine and recently in the pharmacology. Compared to other nuts chestnuts are low in protein and especially low in fat. Carbohydrate content is relatively high at 32 percent. Water comprises 40 percent (Kiple and Ornelas 2012). Because of its fats low level it is recommended in weight-loss diets, and because of its edibility and energy value it is recommended in diet-therapies for certain diseases. It is an excellent source of energy and helps in strengthening of immune system. Of the tree nuts, chestnuts, walnuts and pecans have the highest content of antioxidants (Blomhoff et al., 2006).

Flavour is an important organoleptic property of foods and cooking usually leads to positive changes in flavour; this is the case for chestnut fruits. However, the type of cooking determines whether potentially toxic compounds are formed (De Vasconcelos et al., 2010).

Unexpected, the volatile compounds occurring in chestnut fruit and flour have not yet been extensively described, although their peculiar aroma is one of the most typical organoleptic characteristic of chestnut-based products (Cirlini et al., 2012).

In this paper we present results of the study of the volatile fraction of fresh Lovran's marrone cultivar (Castanea sativa, Mill.).

Material and Methods

Chestnuts (Lovran's marrone cultivar) were harvested from area of the Una-Sana canton (Bosnia and Herzegovina) in October 2011. Analysis of fresh sample include classical chemical analysis and determination of volatile compounds

The dry matter contents of the samples were determined by drying them overnight in the hot-air oven at 105 $^{\circ}$C. Ash analysis was carried out by burning the sample in muffle furnace at 525 $^{\circ}$C for 8 h. Crude protein quantity was calculated by multiplying the nitrogen content using Kjeldahl method by the coefficient 5.30 (AOAC, 1990). Crude fibre quantity was determined according to the method reported in AOAC (1990). Total fat quantity was determined after extraction with ether for 6 h in Soxhlet extraction devices (AOAC, 1990).

Freshly harvested chestnuts were manually peeled and after that milled in a laboratory blender. The amount of 4 g milled fresh chestnut was put in 20 mL vial. All experiments were performed at least in triplicate. The samples were analysed using solid phase micro-extraction (SPME) kit. On the solid phase SPME device (Supelco, Bellefonte, PA, USA), the 20 mm 50/30 μm divinylbenzene / carboxen / polydimethylsiloxane fiber was mounted. Samples were conditioned for 45 min at 37 ± 1°C and then exposed another 45 min to the SPME fiber under the same conditions Afterwards the device was introduced in a gas chromatograph with mass selective detector (GC-MS - Agilent 6890 Series GC System with Agilent 5973 Mass Selective Detector). The total volatile production was estimated by the sum of all peak areas in the chromatogram. Relative volatile abundances were obtained by dividing each individual peak with the total volatile produced. All experiments were performed at least in triplicate. The results are presented as mean values ± SD.

Results

The sample contained 48.1% dry matter, 0.55% crude proteins, 1.6% crude fibre, 6.1% fats and 4.1% ashes.

A chemical analysis was performed in order to establish which specific compounds or group of compounds could be responsible for specific flavor of row chestnut.

In Table 1 volatile aroma compounds of fresh Lovran's marrone cultivar were shown.

Table 1. SPME headspace volatiles of fresh Lovran's marrone cultivar (Castanea sativa, Mill.)

No	Retention time (min)		Flavor description (Arctander,1969; Furia and Bellanca, 1975; Bauer et al., 2001; Sigma-Aldrich 2001)	Mean ± SD % (of total area)
		Alcohols		**17.58**
1	5.25	Ethanol	Alcoholic	5.68 ± 0.29
2	5.70	2-Propanol	Butter	0.45 ± 0.05
3	10.2	3-Methyl-1-butanol	Oily, whiskey	2.31 ± 0.09
4	10.32	2-methyl-1-butanol		0.60 ± 0.02
5	10.934	1-Pentanol	Sweet, vanilla	0.48 ± 0.01
6	11.925	2,3-Butanediol		1.76 ± 0.05
7	12.29	2-Methyl-3-pentanol		0.24 ± 0.02
8	13.09	1-Hexanol	Alcoholic, medicinal	0.49 ± 0.08
9	18.04	1-Octanol	Fruity-flowery, sweet soap, orange, waxy	5.19 ± 0.07
10	20.69	Phenylethyl alcohol	Honey, rose	0.38 ± 0.04
		Aldehydes		**1.30**
11	13.57	Furfural	Sweet, woody, almond, fragrant, baked bread	0.24 ± 0.07
12	16.76	Octanal	Fatty, lemon, honey	1.06 ± 0.57
		Ketones		**5.27**
13	5.91	Aceton	Apple, ethereal	0.39 ± 0.05
14	11.66	2-Hexanone		1.50 ± 0.01
15	12.57	2,3-Heptanedione	Apple, berry, butter, cheese, oily, fruity, pineapple	0.21 ± 0.05
16	13.86	3-Hepten-2-one	Powerful green-grassy, pungent odor	1.90 ± 0.19
17	15.38	(E)-3-Hepten-2-one		0.47 ± 0.08
18	16.54	6-Methyl-5-hepten-2-one	Oily, herbaceous, green	0.80 ± 0.02
		Esters		**66.88**
19	6.35	Methyl acetate	Ethereal, sweet	5.79 ± 0.29
20	7.87	Ethyl Acetate	Pineapple, ethereal	49.40 ± 0,67
21	11.150	Ethyl 2-methylbutyrate	Apple, green, plum	1.60 ± 0.07
22	13.21	1-Butanol, 3-methyl-, acetate	Fruity, pear, banana-like odour	6.79 ± 0.86
23	13.27	1-Butanol, 2-methyl-, acetate		3.30 ± 0.18
		Other		**7.90**
24	8.69	Heptan		0.33 ± 0.17
25	9.14	2-Chloro-2-methylpropane		0.58 ± 0.11
26	11.09+ 11.18	Butanoic acid		0.22 ± 0.15
27	12.09	Isovaleric acid	Cheese, animal	0.61± 0.03
28	12.18	4-Methyloctane		0.26 ± 001
29	12.99	Oxime-. methoxy-phenyl-		0.69 ± 0.06
30	14.29	Carane, (1S,3S,6R)-(-)-		0.44 ± 0.05
31	14.42	Styrene	Sweet-grassy, balsamic, almost floral odor	2.47 ± 0.08
32	15.17	2,2,4,6,6-Pentamethylheptane		0.80 ± 0.01
33	16.16	2-Pentilfuran		1.50 ± 0.34
		Terpenic compound		**0.67**
34	17.25	Limonene		0.67 ± 0.07

The gas phase was composed of 34 main compounds belonging to different classes, mainly esters (66.88% of total areas), alcohols (17.58%), ketones (5.27%), aldehydes (1.30%), acids

(0.83%), and terpene - limonene (0.67%). The most abundant compound of the volatile fraction of fresh chestnut was ethyl acetate (39.3%) with the characteristic pineapple, ethereal aroma. The other two esters were present in medium percentages: 1-butanol, 3-methyl-, acetate (6.79%) with fruity, pear, banana-like odour, and methyl acetate (5.79%) with ethereal, sweet aroma. Further, the most common alcohols were ethanol (5.68%) with an alcoholic note, as well as 1-octanol (5.19%) with fruity-flowery, sweet soap, orange, waxy aroma.

Discussion

Chemical composition of chestnut depends of many factors, such as cultivar, growing conditions, and other. Some important domestic chestnut cultivars contained (g/100g dry matter basis) total protein 4.88 - 10.87, crude cellulose 3.58 - 5.96, total fat 0.49 - 2.01 and ash 1.02 - 3.22 (Ertürk et al., 2006).

Cirlini et al. (2012) were detected compounds which mainly contribute to the volatile profile of chestnut as terpenes (49.2% of total areas), followed by saturated and unsaturated alcohols (24.3%), aldehydes (18.3%) and ketones (6.7%). In our research, the main components were esters, while concentration of terpenic compound (limonene) was only 0.67% of total areas. Amount of alcohols and ketons in our study of fresh Lovran's marrone cultivar were similar to Cirlini et al. (2012), but concentration of aldehydes in our research was much lower (1.30%).

Conclusion

This study represents effort aimed at the characterization of volatile compounds of fresh Lovran's marrone cultivar. The compounds that contribute to the volatile profile of chestnut fruit were mainly esters (66.88% of total areas), alcohols (17.58%), ketones (5.27%), aldehydes (1.30%), acids (0.83%), and terpene - limonene (0.67%). The study contribute to better understanding of volatiles may have originated by metabolism of the plant. Their occurrence in chestnut fruit is thus influenced by both genetic and environmental factors.

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The Traditional Turkish Beverage: Koumiss

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Abstract

Koumiss (spelled also koumys and kumyss) is artificial milk prepared by simultaneous lactic acid and alcoholic fermentation. It was originally produced by the natives in the steppes of eastern countries as a refreshing and slightly intoxicating beverage. It has some beneficial or curative influence in chronic diseases, such as phthisis, chronic bronchitis, chronic gastrointestinal and catarrh. As a result, the manufacture of koumiss has been increased especially United States and other country. Many pharmacies can be obtained daily, prepared freshly in pint or quart bottles. This review aims to contribute to understand production, chemical composition and health effects of koumiss.

Keywords: Chemical composition, health, koumiss.

Introduction

Koumiss which is a traditional drink originating in the Central Asian is a very popular fermented dairy product for the people of Mongolia, Kazakhstan, Kirgizstan, the province of Xinjiang in China and some regions of Russia (Kerr and McHale, 2001; Kücükcetin et al., 2003; Danova et al., 2005).

It is usually produced from mares' or camels' milk by spontaneous fermentation of lactose to lactic acid and alcohol (Kosikowski and Mistry, 1997; Ozer, 2000; Kücükcetin et al., 2003). The fermentation, has a symbiotic nature, depends on the action of two distinct types of microorganisms. Lactobacilli and yeasts (*Kluyveromyces*, *Saccharomyces*, *Candida*) are the major partners in the product (Montanari et al. 1996; Danova et al., 2005). Lactobacilli play a major role affecting the preservative qualities such as aroma, texture and acidity of the product during the acidification and enzymatic fermentation as well as being of some benefit to human health (Montanari et al. 1996; Danova et al., 2005; Ahmad et al., 2007; Wu et al., 2009).

Conventionally, these cultures were obtained it by inoculating fresh milk with a small volume of already fermented milk. Three types of koumiss exist as 'strong', 'moderate' and 'light' koumiss according to the lactic acid content. 'Strong' koumiss is produced by lactic acid bacteria (*Lactobacillus bulgaricus*, *Lactobacillus rhamnosus*) which acidify the milk to pH 3.6–3.3 and whose conversion ratio of lactose into lactic acid is about 80–90%. 'Moderate' koumiss includes *Lactobacillus* bacteria (*L. acidophilus*, *L. plantarum*, *L. casei*, *L. fermentum*) and acidification properties of product is lower the pH to 4.5–3.9 at the end of the process, and the conversion ratio averages 50%. 'Light' koumiss is a slightly acidified product (pH 4.5–5.0) and is generated by *Streptococcus thermophilus* and *Str. Cremoris*. The best fragrance and taste belong to 'Moderate' koumiss (Shigaeva and Ospakova, 1983; Baldorj, 2000; Danova et al. 2005).

The Composition and Production of Koumiss

The composition of mares' milk is markedly different from that of bovine milk. It is similar to human milk due to its low nitrogen content, its low casein to whey protein ratio (1:1), and its high content of lactose (Yaygin, 1992; Bonomi et al., 1994; Kücükcetin et al., 2003). Lactose whose concentration is 6.7% is a major component in mare milk. At the end of the fermentation, it is decomposed into lactic acid, alcohol and other small molecules substances by microorganism and the concentration of lactose increases range of 1.4-4.4% (Lv and Wang, 2009). Additionally, several properties of mares' milk, such as a high level of polyunsaturated fatty acids and low cholesterol content, increase the interest to use mares' milk for human consumption (Iametti et al., 2001; Kücükcetin et al., 2003). Mares' milk includes calcium,

phosphorus, magnesium, zinc, iron, copper, manganese. Moreover vitamin A, C, E, B_1, B_2, B_{12}, pantothenic acid and bacteriosin occur in it (Lv and Wang, 2009). Nutritional value of koumiss is given at Table 1.

Table 1. Nutritional labels belonging to koumiss (Lv and Wang, 2009).

Ingredient	Fat (%)	Lactose (%)	Protein (%)	Alcohol (20°C, %, v:v)	Amino acid (%)	Fatty acid (%)	Acidity (°T)	Vitamin C (mg/kg)
Amount	1.75	2.80	2.00	2.20	1.77	1.65	110.00	78.40

Home-made koumiss can be prepared as follows: Two teaspoonfuls of wheat-flour dough, two tablespoonfuls of millet flour, one tablespoonful of honey and one tablespoonful of beer yeast are taken. They are mixed into a thin paste with milk. The milk is place in a warm place to ferment. During the fermentation, it is waited in a covered jar, linen bag. It is standed for twenty-four hours, or until the milk becomes acid, at a temperature of 30° or up. It is skimmed, decanted and agitated for an hour. Then it is bottled and corked tightly. The koumiss is kept in a refrigerator. Absolute cleanliness must be provided; otherwise different forms of fermentation will occur (Thompson, 1905). In industry, the first step of koumiss production is heating mare's milk at 90°C during 2 minutes. Then it is cooled at 25°C and starter culture (200 g L^{-1}) is added in it. At the end of the fermentation at 25°C, it is agitated at 600 rpm for 15 minutes. It is holding without agitated during 2 hours and second agitation at 600 rpm for 15 minutes is applied. Finally, it is agitated at 50 rpm until 4.6 pH and then the production is packaging (Lv and Wang, 2009).

Many reasons such as a high cost of mares' milk and falling short of the traditional koumiss' production are caused the use of bovine milk for koumiss production has been of great interest for researchers (Kücükcetin and Yaygın, 1999; Kücükcetin et al., 2003). Due to the difference in composition between mares' milk and bovine milk, it needs to modify bovine milk to make it suitable for the production of koumiss. Some researchers study on various methods to modify bovine milk such as a decrease in fat content, addition of water and lactose, ultrafiltration (UF) retentate of bovine milk (Kücükcetin et al., 2003). So, the capacity of koumiss' production can be increased and the cost of it can be decreased.

The Health Benefits of Koumiss

The koumiss has been known as a wholesome beverage for centuries (Danova et al., 2005). The operation of a range of body organs and processes, including the alimentary canal, metabolism, the circulatory and nervous systems, blood-forming organs, the kidneys, endocrine glands and the immune system is improved with consumption of koumiss improves (Montanari et al., 1996; Pan et al., 2011). As known, the major components of koumiss are probiotics such as lactobacilli and various yeasts (Pan et al., 2011). Addition to being easily digestible, fermented milk is an origin of functional compounds that have beneficial effects on health (Philanto et al., 2010; Chaves-López et al., 2012). Therefore, koumiss has been thought not only as a kind of food, but also as complete nutriment and medicinal remedies for centuries (Ishii and Konagaya, 2002; Wu et al., 2009). It is known that Mongolian people had created the "koumiss therapy" which combined traditional medicine with koumiss to assist treatment of hepatitis, chronic ulcer, tuberculosis and so on in Inner Mongolia (Cagno et al., 2004; Wu et al., 2009). In Turkish society, it was used extensively in the treatment of diseases like typhoid, paratyphoid, dysentery, tuberculosis. Koumiss can be also used for fatigue, depression, constipation. It is observed that koumiss regulates intestinal flora by preventing colonization of pathogen microorganism in colon due to its antimicrobial properties and lowering pH of the colon (Ozden, 2008).

Conclusion

Nowadays, koumiss is a beverage that belongs to the family of functional foods and provides health benefits beyond or in addition to basic nutrition. So, there is increasing interest in the manufacture of koumiss at an industrial level. In order to increasing the consumption of koumiss, promotion and advertising should be considered important much more.

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Comparative Analysis of Quality of Juice; Brand "Sole Mio"

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Abstract

Juices are one of the most important final products of the food industry in the market and they have important place in everyday diet of both adults and children. Although, the task of each manufacturer is to carry out the analysis of quality of final product, the market control by independent analysis is significant, because obtained results confirm both quality and storage conditions of these products in retail.

The goal of this survey is to create an image on microbiological and chemical quality of three juice sample available on the market of the City of Mostar, brand Sole Mio, from manufacturer "Hepok d.d." Mostar. Sampling was carried out at random on "Multivitamin", "Nectar blueberry" and "Nectar apple".

These juices have an important place when it comes to consuming these kinds of product and obtained results are of great importance in terms of health and hygienic as well as chemical product quality. Microbiological results have proven that three analysed samples meet the standards set in Official Gazette of Republic of Bosnia and Herzegovina 2/92 and that in terms of their quality they deserve their place on the market.

In terms of chemical analysis, we have included the content of dry mater, total sugar and acidity, pH value and presence of artificial colours. Pursuant to the Rulebook (Official Gazette of Bosnia and Herzegovina 83/08) and literature statements, obtained results indicate that all three analysed samples meet the quality of final food product and that as such can be found in sales on free market.

Keywords: Juice, microbiologic analysis, chemical analysis, market, quality

Introduction

Significant increase in production of juices in chemical industry results in everyday market placement and distribution of new final products i.e. juices. Analyses of this research should give an answer to the quality of juices produced at "Hepok d.d. Mostar" placed on the market of Mostar region. Research will cover three sample of juices produced from different sorts of fruit from Sole Mio programme and they are as follows, "Multivitamin", "Nectar blueberry" and "Nectar apple". These juices were chosen for analyses because they are the juices, which are placed and consumed in the largest quantities on the market.

We will carry out chemical and microbiological analyses on the studies juices samples, on which basis we can determine, with certainty, quality and safety of the products for the market without being health hazard for the final consumer. Chemical analysis will include an analysis of dry matter, total sugars, total acidity, pH value, and the presence of artificial colours.

Microbiological analyses will provide information on whether the samples of juice have bacteria that could damage hygienic and health safety of final products.

Materials and Work Methods

Analysed juices chosen at random were bought in supermarkets in retail. The objective was to choose three different products by the same manufacturer with increase in consumption. We have chosen following three samples: As Sample 1 Sole Mio "Multivitamin"; as Sample 2 Sole Mio "Nectar blueberry" and as Sample 3 Sole Mio "Nectar Apple."

Chemical and microbiological analyses of foodstuff samples for analyses of health safety were carried out by using methods in accordance with the Regulations. The analyses were carried out at the Department of Public Health in Mostar and the Federal Department of Agriculture in Sarajevo.

Chemical analysis included determination of following parameters: dry matter (% gravimetric technique), pH values (% electrochemical determination technique), total acidity (% titrimetric

techniques), total sugar (% titrimetric determination technique) and the presence of artificial colours (volumetric). Microbiological analysis included the determination of: Salmonella species, coagulate-positive staphylococci, Sulphur reduced clostridia, Proteus species, Escherichia coli, yeasts, molds.

Results and Discussion

The research was carried out on the juices manufactured in the juices plant "HEPOK" dd Mostar from the "Sole Mio" programme, made of different sorts of fruit: multivitamin, nectar blueberry and nectar apple, The results of chemical analyzes on defined parameters are shown in Table 1.

Table 1: Result of chemical analysis of juices

Parameter	Sample			Referent/average values
	1.	**2.**	**3.**	
% dry matter	10,38	11,12	11,49	<12% (Niketić-Aleksić,1989)
% total sugar	9,65	9,60	10,00	7-12% (Sen and associates., 2006)
% total acidity	0,30	0,32	0,45	0,4 do 0,5% (Niketić-Aleksić,1989)
pH value	3,87	4,07	4,18	2,72 – 4,49 (Josipović, 2006) 2,75-2,82 (Bošnir and associates., 2007) 2,80-5,20 (Cavalcanti and associates., 2008)
Presence of artificial colours	Not present	Not present	Not present	Allowed usage of colours from the List of approved foodstuff additives and according to the Rulebook[*]

The amount of dry matter in percentage is slightly lower than the referent (average) values given by author Niketić-Aleksic. There is a difference among juices; therefore, the lowest value of the dry matter is determined in sample No. 1, multivitamin (10.38%), while the highest value is determined in Nectar apple juice (11.49%).

Results in percentages of the total sugar content are different depending on the sample, but they are all within the limited values, i.e. within the optimal range of 7 to 12% by referent values given by Sen and colleagues in 2006. The lowest values in percentages of total sugar were found in sample multivitamin (9.65%), and highest in the sample apple Nectar (10.00%).

Total acidity in sample number 1 and sample number 2, multivitamin (0.30%) and Blueberry Nectar (0.32%) was lower than the values given by the author Niketić-Aleksić where referent value of total acidity in percentage was from 0.4 to 0.5% , where sample number 3 apple Nectar (0.45%) was in line with the referent values.

pH Reference values by different authors vary in different limits, but what they all have in common is that all juices should have an acidic pH values. All analysed juices have an acid pH value ranging from 3.87 in multivitamin juice to 4.18, in Nectar apple.

We did not find traces of artificial colours in all analysed juices, what can be an indicator that they are natural juices what would definitely put them in a category of high-quality juices.

We are dealing with foodstuff, which is very much present in the daily diet of adults as well as Particularly important part of this research was to determine the microbiological analysis, because children. We have analysed the bacteria that can be commonly found in food: Salmonella, Staphylococcus, Proteus species, Escherichia coli, yeasts and molds. Results of microbiological analysis are presented in Table 2.

Table 2. Results of microbiological Analysis

Parameter	Sample			According to the Rulebook[*]
	1	2	3	
Salmonella types (in 25 g/mL of sample)	Neg.	Neg.	Neg.	Neg.
Coagula for positive staphylococci (in 1g/mL of sample)	Neg.	Neg.	Neg.	Neg.
Sulphur reduced clostridia (in 1g/mL of sample)	Neg.	Neg.	Neg.	Neg.
Proteus types (in 1g/mL o)f sample	Neg.	Neg.	Neg.	Neg.
Escherichia coli (in 1g/mL of sample)	Neg.	Neg.	Neg.	Neg.
Yeasts and molds (in 1g/mL sample)	Neg.	Neg.	Neg.	Neg.
Total number of bacteria of contaminant (in 1 g)	0	0	0	Up to 100
Isolated types of bacteria	0	0	0	

* Rulebook on conditions in terms of microbiological safety required for foodstuff on market (Official Gazette of Bosnia and Herzegovina, number 2/92, 13 and 14 /94)

Results of microbiological analyses have shown that there is no trace of a single microorganism studied, what definitely puts analysed juices into the foodstuffs that present no health hazard to consumers.

Conclusion

Based on the results of chemical and microbiological analyses of studied juices, we have concluded several following important facts:

According to the percentage of dry matter and percentage of total sugar all analysed juices meet referent values which are below the limited value of 12%.

According to the percentage of the total acidity, apple juice Nectar has a value of 0.45 and it is within the referent range from 0.4 to 0.5. Percentage of total acidity in juices multivitamin (0.30) and Blueberry Nectar (0.32) is lower than the referent values.

PH-value indicator in all the analysed juices are within the referent range, that is, they are within the acidic values. Multivitamin juice has the lowest pH value of only 3.87, and apple juice Nectar has the biggest with 4.18.

It is particularly significant that none of the analysed juice had traces of artificial colours.

Microbiological analyses on the presence of common microorganisms in foodstuff show that not a single juice sample contains any trace of bacteria, what is encouraging given that it is easily perishable food product and high level of their consumption in daily diet of adults and especially children.

For the purpose of our analysis, we used three samples of different sorts of juices by the same manufacturer. All samples analysed were bought in the City of Mostar. The analysis of the products gave clearer picture regarding their quality, safety, and the importance of certain ingredients found. Results were given in tables and the analyses showed that samples meet standards set in Rulebook on fruit juices, fruit nectars and similar products ("Official Gazette of Bosnia and Herzegovina", No. 87/08). and as such can be consumed by consumer in City of Mostar.

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Traditional Production and Processing of Milk in Sjenica-Pester Area

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Abstract

Sjenica - Pester plateau has excellent conditions for livestock production with dominant large and healthy pastures and meadows of high-quality. The main branch of agriculture is livestock breeding and within it dominates the production and processing of milk into cheese. Worldwide known Sjenica cheese, which belongs to a group of white cheese in brine, is dominant by quantity and quality of production. It is producted by indigenous technology on individual farms, from fresh whole sheep and cow milk, and the process of making cheese starts immediately after milking. Bearing in mind the potential and importance which this cheese has for this area, it is necessary to meet and investigate all the specifics of indigenous technology, working on its preservation and development and to determine chemical composition and quality of mature white cheese. Indigenous technology for making white cheese is quite simple. The very process of making milk into cheese lasts up to 1.5 hours, and the clot is not cut, but the whey is separated by dripping that lasts several hours. Chemical composition of white cheese is characterized by a high content of water as a result of making time and clot processing way. An average of it is 52.07 % for sheep cheese and 56.99 % for cow cheese. The fat content in dry matter in cheese was too high and had average values 56.46% for sheep cheese and 53.14 % for cow cheese, which means that these kinds of cheese belong to the group of fatty cheese. Titratable acidity average stood 220 ^{0}T for sheep cheese, and 208 ^{0}T for cow cheese.

Keywords: Sjenica cheese, indigenous technologies, chemical composition

Introduction

Highland area was and still is the traditional center of indigenous production and processing of milk. Milk production in these areas is related to the production of indigenous milk products. Hilly area is characterized by developed animal production, which takes place on individual farms.

Sjenica-Pester plateau has very favorable conditions for the development of livestock, due to the abundance of healthy vast pastures of high quality. Thanks to the natural conditions, the main branch of agriculture is farming within it dominates the production and processing of milk. People mainly bred cattle and sheep, and they less bread goats so as a raw material occurs sheep, cow and goat milk. Therefore, milk traditionally has always been dominantly processed in the very famous Sjenica cheese. Sjenica cheese is produced by the indigenous technology in Sjenica-Pester area, from fresh whole sheep and cow milk, and the production takes place at individual farms.

Sjenica cheese belongs to the type of white cheese in brine. According to (Codex / Standard, A-6), cheese dough is white or light yellow color, compact or with a little dimples. Cheese does not have a crust, and it is formed in the shape of slices. The main feature of this group is cheese ripening and storage in salt brine that provides aerobic conditions of ripening, and which gives specific properties (taste, smell) and is used as a preservative.

Taking into account the natural resources of Sjenica-Pester plateau, the goal was to get familiar with traditional production and processing of milk, to improve work process, unify technology and gain Sjenica cheese of standard quality which is a requirement for the protection of name and geographical origin of it.

Materials and Methods

Researches of indigenous technology and production methods were carried out by the survey. The survey was conducted in 20 households, which were selected randomly over a wide area of Sjenica-Pester plateau. The survey included 32 questions, which combined the basic elements and advanced indigenous technologies. From 20 surveyed households, the samples of ripe cheese were taken in 10 households (five samples of cow cheese and five samples of sheep cheese), in

which the analysis determined the average of chemical composition. The following analysis was performed:

The percentage of solids by drying method at 102 0C; The percentage of milk fat by Acid-Butirometric method; Percentage of total nitrogen by Kjeldahl method; The percentage of soluble nitrogen compounds; The percentage of NaCl by Morr; Titratable acidity. Analyses of cheese were performed by standard methods (Caric et al., 2000).

Results and Discussion

The survey showed that in Sjenica-Pester area milk is predominantly processed into the famous Sjenica cheese. Basic characteristics of indigenous technology are following - the raw material for the production of cheese is fresh whole cow and sheep milk, where the process of milk curdling starts immediately after milking. Curdling of milk-coagulation takes a long period of time from 40 min, an hour, even an hour and half. After curdling, the curd is treated. The curd processing is fairly simple. The curd is not cut in order to save as much water as possible in it. Extraction is done by squeezing the whey in cheese making rags and it takes few hours. The squeezing is carried out on the table, and there are a number of ways. One way is self-pressing where the cheese making rag is loaded with wooden circle and it lasts from 4 to 6 hours. Another way of squeezing is with the pressure which is usually performed by using a stone of varying weight as a load, and it lasts from 2 to 4 hours. The third way is squeezing s in two phases. In the first phase, which lasts for half an hour to an hour, curd is "hanged", and occasionally rotated, and when the greater part of the whey is separated, the process of squeezing resumes on the desk, with or without the load. Time filtering is shorter and it lasts from an hour and a half to 3 hours. At the same time the separation of whey performs cheese shape.

After formation of cheese lump, the next step is cutting of it. The lump is usually cut once lengthwise and crosswise and then slice has the form of triangle. Another method of cutting is many times cut lengthwise and crosswise to provide the slices with dimensions of 10x10 cm or 15x15 cm. Cut slices are stacked in containers, usually wooden tubs. It's original packaging, which is the best for high-quality storage and ripening.

Along with the stacking salting is done successively in the order of arrange. For the salting is used sea salt. Dry salting is the way which is applied. When the tub is full, a wooden circle is placed on the cheese, and on it load, usually stone. The entire weight of the cheese must be below the level of the brine. The cheese release brine because at the time of arranging there is enough whey in it, and if there is not enough it can be poured more if needed.

Storing and ripening is done usually in terms of production and during the ripening it is required regular care of cheese. The cheese achieves commercial maturity in 20 to 30 days when it is put on the market.

Jovanovic et al., (2004), describe the basic principles of indigenous technology of Sjenica cheese that are consistent with our results. Indigenous technology of Sjenica cheese and characteristics of the chemical composition are described by (Maćej et al., 2006).

Dozet et al., (1996) reported that the variable technology and uneven quality of the cheese is also characterized by other similar kinds of cheese from this group, such as Travnicki cheese in Bosnia and Herzegovina, Pljevaljski cheese in Montenegro, Zlatarski and Homoljski in Serbia.

Savic et al., (2000), have proposed measures for the improvement and development of technologies based on indigenous production in order to obtain products of standard quality.

Figure 1.Traditional packaging of Sjenica cheese.

As a result of this technology development, we have proper chemical composition of cheese whose results are given in Table 1

Table1. The average chemical composition of Sjenica cheese indigenous production

Cheese	N=10	Indicators %								
		Humidity	D.M.	M.F.	F in D.M.	Total Proteins	Dilution N	Coef.of Maturity.	NaCl	pH
Cow cheese	Min	55.53	42.20	22.09	51.49	13.93	0.414	18.78	3.21	4.00
	Max	57.80	43.47	23.87	54.91	15.29	0.465	21.04	3.72	4.56
	$\overline{X}(n=5)$	56.99	42.76	22.73	53.14	14.43	0.441	19.58	3.46	4.22
Sheep cheese	Min	51.09	46.28	25.49	54.45	16.43	0.473	18.15	1.51	4.28
	Max	53.72	48.91	29.05	59.39	17.91	0.546	19.93	2.92	4.62
	$\overline{X}(n=5)$	52.07	47.92	27.11	56.42	17.34	0.510	18.80	2.18	4.34

Key: DM-dry matter; FM-fat milk; F.in DM-fat in dry matter

Indigenous Sjenica cheese is characterized by high water content, which was 56.99% for cow cheese and 52.07% for sheep cheese, which is a consequence of the way of making cheese such as: length of coagulation, curd processing method, the method of drying and salting. According to the water content, the cheese belongs to the group of soft cheese. The cheese of with higher water content have faster degradation proteins (Lawrence et al., 1984).

The water content in indigenous Sjenica cheese is similar with literature data: in the Travnicki 49.20% (Dozet et al., 1987); in Zlatarski 47 - 48% (Pudja et al., 1994).

Milk fat content in dry matter was high and in average it was 53.14% in cow cheese and 56.42% in sheep cheese. Based on the fat content in the dry matter , the cheese belong to a group of full-fat cheese. A similar fat content in dry matter have Travnicki cheese 51.48% (Dozet et al., 1987).

Total proteins content was slightly lower, so that in sheep cheese it was 17:34% and 14:43% in cow cheese. Sensory properties (color, smell, taste) and the quality of cheese were good, according to Maćej et al., (2009). Milk of excellent quality that comes from animals that are fed with variety and quality grass on pastures that are at the altitude of 1000 to 1500, contributes the quality of cheese .

Conclusion

-Sjenica-Pester plateau with a healthy, wealthy and grazing land has excellent natural conditions for growing cattle, sheep and goats and milk production.

-The milk from this area has good chemical composition and its processing creates high-quality dairy products

-For a long time, the milk is predominantly processed in the very famous Sjenica cheese, and because of simple technology and relatively low cost, is of great importance in the nutrition of the population and is an important commercial product

-As a result of specific technologies, chemical composition of Sjenica cheese is characterized by a high content of water and fat in dry matter, so cheese belongs to a group of soft cheese, actually full-fat cheese, which places them into products with high energy and nutritional value.

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Chemical and Fatty Acid Composition of Fat in the Sheep's Cheese of the Una –Sana Canton

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Abstract

The aim of this study was to evaluate chemical composition and contents of fatty acid of fat in sheep's chees of the Una –Sana Canton. Fatty acid contents of cheese was determined by gas chromatography. Amount of water, dry matter, fat, crude protein was respectively: 54.54%, 45.46 %, 23.00%, 16.94 %. Contents of total n-3 fatty acids expressed as mg/100 g of chees was 430.10, and contents of total n-6 fatty acids was 644 mg/100 g of chees. Contents of CLA (conjugated linoleic acid) was 496.80 mg/100 g of chees. The values of 1.50 obtained for the ratio n-6/n-3 fatty acids is recommended guideline for the human diet.

Keywords: Sheep's cheese, chemical composition, fatty acids contents

Introduction

Food products used in human nutrition should meet the nutritional requirements while containing nutrients that benefit the body. Among the basic nutrients, it is worth noting the amount of fats and particularly the dietetic value of fats, which is determined mainly by the fatty acid profile. In addition to meat products, the main sources of animal fats are milk and milk products. Preliminary findings indicate that the fat content and fatty acid profile of ruminant milk depend on a number of genetic, physiological and environmental factors, especially nutrition (Pakulski at al., 2006). Milk and dairy products, mainly cheese, are usually associated with high levels of long-chain saturated fatty acids, mainly palmitic (16:0) and stearic (18:0) acids (German and Dillard, 2006). In the case of ewe's milk and cheese, higher values of medium-chain triacylglycerols, made up of fatty acids with 6–10 atoms of carbon, especially capric acid (10.0), are characteristic of their lipids (Assenat, 1985).
These volatile fatty acids are usually released during cheese ripening, although only at low levels, and are responsible for the characteristic flavor of ewe's and goat's cheeses (Fernandez-Garcia at al., 2006; Prandini at al., 2007).

In spite of the high levels of saturated fatty acid in milk fat, milk and cheese are known to play an important role in human nutrition and, more recently,were also recognized as a source of biologically-active substances (Collomb at al., 2006; Prates and Mateus, 2002).
Conjugated isomers of *cis*-9,*cis*-12 octadecadienoic acid (linoleic acid), commonly known as conjugated linoleic acid (CLA), are a family of positional and geometric isomers of linoleic acid, with conjugated double bonds, i.e., double bonds separated by a single carbon-carbon linkage rather than by the usual methylene group (Collomb at al., 2006).

A large number of reports refer to the potential beneficial effects on health of CLA, mainly in animal models of human diseases and in cultures of various types of cells (Lin at al., 1995; Sampelayo at al., 2007; Whale at al., 2004). Some of the CLA isomers (*cis*-9,*trans*-11 and *trans*-10,*cis*-12) exhibit interesting biological activities that include anticarcinogenic, anti-obesity, antidiabetogenic, anti-atherogenic, immunomodulation and modulation of bone growth (Belury, 2002).

It is well established that milk and milk products are one of the major dietary sources of CLA. No research has been done in Bosnia and Herzegovina on the efficiency of processing sheep's milk into different types of cheese and comparison of their dietetic and health properties.

Materials and Methods

Sheep's chees was made by local producer, by traditional techniques, all based on the utilization of fresh raw milk, from animals reared in traditional farming systems based on grazing. Milk for the production of the cheese was curdled with rennet "Vlašićka maja" for 40-60 minute at room temperature. The experiment was carried out from July to mid-October. Eight cheese samples were collected at their minimum ripening time of 30 days. Cheese samples were transported under refrigerated conditions. All samples were kept frozen at −20 ∘C until they were

analyzed. Chemical analyses (water, dry matter, fat, crude protein) were performed by AOAC methods (2000) in the Laboratory of Biotechnical faculty, University of Bihać. Specialist analysis of the fatty acid's profile was carried out in the Food Institute "Emona", Ljubljana (Slovenia). For analysis of fatty acids composition we used in situ preparation of fatty acid methyl esters in food (Park and Goins, 1994). The content of fatty acids was determined using gas chromatography (Agilent Technologies model 6890 N with a FID detector and Supelco Omegawax 320 column, 30 m x 0.32 mm x 25 μm). All data was analyzed by the software package Statistica. The results are given as mean and standard deviation.

Results

The chemical composition of the sheep's cheese samples is shown in the Table 1.

Table 1. Chemical composition of the sheep's chees (n=8)

Composition	Moisture %	Dry matter %	Fat %	Crude protein %
Mean	54.54	45.46	23.00	16.94
Standard deviation	0,97991	0,98425	0,61653	0,44776

In the Tables 2. and. 3 are shown the contents of fatty acids in the samples of chees.

Table 2. Contents of fatty acids in the sheep's chees (n=8)

Fatty acid	mg/100g fat (Mean)	mg/100 g of chees (Mean)	Standard deviation
C 10:0	4.32	993.60	7.399
C 11:0	0.06	13.80	0.506
C 12:0	3.04	699.20	21.098
C 12:1	0.10	23.00	1.513
C 13:0	0.08	18.40	1.086
C 13:1	0.23	52.90	2.594
C 14:0	11.85	2725.50	43.866
C 14:1	0.37	85.10	0.613
C 15:0	1.25	287.50	4.789
C 16:0	26.81	6166.30	92.232
C 16:1, *c+t*	1.57	361.10	8.691
C 17:0	0.84	193.20	10.852
C 18:0	11.23	2582.90	65.956
C 18:1, *c+t*	29.74	6840.20	30.693
C 18:2, *c+t*, n-6	2.54	584.20	9.954
C 19:0	0.12	27.60	1.825
C 19:1, *c+t*	0.16	36.80	1.460
C 18:3 *c,* n-3	1.39	319.70	3.688
C 18:2 *c,* n-7	2.16	496.80	17.358
C 20:0	0.49	112.70	2.330
C 20:1, *c+t*	0.12	27.60	2.051
C 20:2, n-6	0.07	16.10	0.709
C 20:3, n-6	0.03	6.90	1.188
C 21:0	0.13	29.90	1.509
C 20:4, n-6	0.15	115.00	1.571
C 20:3, n-3	0.02	4.60	0.458
C 20:5, n-3	0.12	27.60	0.505
C 22:0	0.24	55.20	2.765
C 22:1, *c+t*	0.02	4.60	0.820
C 22:2, n-6	0.02	4.60	1.031
C 23:0	0.13	29.90	3.073
C 22:5, n-3	0.20	46.00	0.589
C 24:0	0.12	27.60	0.801
C 22:6, n-3	0.14	32.20	0.674
C 24:1	0.05	11.50	0.621
C 25:0	0.03	6.90	1.680
C 26:0	0.10	23.00	0.662

Table 3. Contents of fatty acids (mg/100 g of chees)

Total n-3 fatty acids	430.10
Total n-6 fatty acids	644.00
n-6/n-3	1.50
Monounsaturated fatty acids	7440.50
Polyunsaturated fatty acids	1573.20
Saturated fatty acids	13986.30
Unsaturated fatty acids	9013.70
Unsaturated/Saturated	0.64
Polyunsaturated/Saturated	0,112

Discusion and Conclusion

The average water content was 54.54% (Table 1). Hilma at al. (2011) obtained 55.20 % water and Turkoglu at al. (2003) obtained 52.25 % water in orgu cheese. Considering the fact that dry matter content of cheese the indicates its nutritive value, sheep's cheese from Una-Sana Canton is one the valuable, nutritious cheese types.

The average fat content of cheese samples was 23.00% (Table 1); Mangia at al. (2011) established 28.85% fat in Pecorino cheese, and Pakulski at al. (2006) 20.14 % fat in sheep's cheese. The average crude protein content of cheese samples was 16.94 % (Table 1); in orgu cheese, content of protein was 19.96 % (Turkoglu at al., 2003). Akyuz et al. (1998) reported that orgu cheese samples collected from Diyarbakir contained, 15.83% protein and Ozdemir et al. (1998) reported that protein contents of orgu cheese samples collected from Diyarbakir Karacadag region, a southeastern city of Turkey was 21.69 %.

The CLA content described is relatively medium (2.16 mg/g of total fat, Table 2) when compared with the values reported in the literature for milk and dairy products, which range from 3.4 to 10.7 mg/g of total fat (Dhiman and Nam, 2005). In a study on dairy products from Italy, values of 8.11 mg/g of total fat, for Fontina Valdostana cheese, a cow's milk cheese, were reported (Prandini at al., 2007). The same author described for a ewe's milk cheese (Pecorino cheese) values of 7.77 mg/g of fat. Other values described in the literature, for different types of cheese, are: 3.59–7.96 mg/g (Lin at al. 1995), 5.05–5.39 mg/g (Werner at al., 1992), and the highest values, of 16 and 19 mg/g of fat, were reported for Feta Greek cheeses (Zlatanos at al., 2002).

The ratios of n-6/n-3 and polyunsaturated/saturated fatty acids which are nutritional indexes widely used to evaluate the nutritional value of fat for human consumption, were calculated and are presented in Table 3. Within the polyunsaturated fatty acids, the n-6/n-3 ratio should not exceed 4.0 (British Department of Health, 1994). n-6/n-3 ratio was 1.50 (Table 3) and it is recommended guideline for the human diet.

Current nutritional recommendations are that the polyunsaturated/saturated fatty acids ratio in human diets should be above 0.45 (British Department of Health, 1994); however, the values of 0.112 obtained for the relation polyunsaturated/saturated fatty acids were consistently below the recommended guidelines for the human diet.

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Impact of Cultivar and Processing Stage on the Distribution of Polyphenols in Apples and Their Juices

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Abstract

This research was undertaken to investigate the differences in content of individual polyphenol compounds among peel and pulp of three traditional apple cultivars from Bosnia and Herzegovina and two international varieties. The other aim of the study was to monitor and compare the distribution and changes of polyphenols troughout the different stages of apple juice production (apple – raw juice – final cloudy and clear juice). Quantitative analysis of phenolic compounds was carried out by using high-performance liquid chromatography with diode-array detection. Among individual polyphenols, chloregenic acid, epicatechin, phloretin and 4-*p*-coumaroylquinic acid were predominant in analysed apples and their juices. The obtained results showed significant differences in polyphenols content between traditional and international apple cultivars, where traditional varieties (cv. Prijedorska zelenika and Limunika) showed significantly higher level of these compunds comparing to international cultivars. Furthermore, screening of apple cultivars revealed large differences in polyphenols amounts depending on the part od apple, where those components were dominantly present in the apple peel. The results generated from the analysis indicated that there is notable decreasing trend in the content of polyphenols during apple juice production, which is dominantly observable in the case of clear juices rather than in cloudy apple juices.

Keywords: Polyphenols, distribution, apples, juices.

Introduction

Apple is a fruit of great medical importance because of rich antioxidant profile due to the high content of bioactive components, such as polyphenols. The content of polyphenols in apple is directly dependent on numerous factors, such as cultivar, part of apple (peel or pulp), maturity stage, harvest and storage conditions and type of processing as well (Boyer and Liu, 2004; Mehrabani et al., 2011). Since the apples are increasingly consumed in the form of various products, preservation of polyphenols during apple processing is of particular importance. According to Grimi et al. (2011), every cell wall disintegration (by cutting, milling, grinding etc.) is leading to decrease in the content of polyphenols, where the loss is higher in the presence of oxygen and appliance of thermic treatments such as pasteurization. Considering the great sensitivity of polyphenols during the processing, the aim of this study was to investigate the distribution of these compounds in different apple juice products (intermediate or raw juice, cloudy and clear juice). Another aim of this study was to determine the differences in content of individual polyphenols among traditional apple cultivars from Bosnia and Herzegovina and international apple cultivars, and among apple peel and pulp as well.

Material and Methods

Fresh apples were collected from certificated on farm" collection (Goražde, B&H). In this study, 30 kg per following apple cultivars were used: Butulija, Limunika, Prijedorska zelenika (traditional cultivars) and Golden delicious, Idared (international cultivars). Apple maturity was determined by iodine-starch test. After harvest, the samples were immediately transferred to the Laboratory of Food Technology at the Faculty of Agriculture and Food Sciences in Sarajevo and used for juice production. Before processing into juices, representative apple samples (peel and pulp) were taken, frozen in liquid nitrogen and kept (-20ºC) until analysis. Production of cloudy apple juice included the following operations: inspection, washing, separating stems, milling, pressing. The obtained raw juice was sampled for the analysis, and the

rest amount of juice was divided into two parts for further processing into cloudy and clear juice. Production of cloudy juice included filling the raw juice into sterilized glass bottles, pasteurization (78ºC, 10 minutes), and cooling. Production of clear juice included depectinization of raw juice by pectolitic enzymes (50ºC, 1 hour), clafirication by addition of bentonite and gelatin (1 hour), decantation, filtration by filter pump, filling into sterilized bottles, pasteurization and cooling. Both cloudy and clear juice samples were taken after cooling and kept (-20º) until analysis. The analysis of individual polyphenols in apple and juice samples were carried out at Biotechnical faculty, Department of Agronomy, University of Ljubljanja, Slovenia.

Extraction and analysis of individual polyphenols

The extraction of individual phenolic compunds consisted of homogenizing sample (10 g for pulp, 5 g for peel and juice) with extraction solution (methanol containing 3 % formic acid and 1 % 2,6-di-tert-butyl-4-methylphenol – BHT for preventing degradation of polyphenols) in an ultrasonic ice bath (1 hour) before centrifuging at 10.000 rpm for 7 min at 0ºC. The supernatant was filtered trough the Chromafil AO-45/25 polyamide filter (Macherey-Nagel, Düren, Germany) into a vial. HPLC analysis was preformed with the Surveyor system with a diode array detector (DAD), controlled by a Chrom-Quest 4.0 chromatography workstation software system (Thermo Scientific, San Jose, CA). The column used for the separation was a Gemini C_{18} (150 x 4.6 mm; Phenomenex, Torrence, CA) maintained at 25ºC. The elution solvents were bidistilled water with 3 % acetonitrile and 0,1 % formic acid (A) and acetonitrile with 3 % bidistilled water and 0,1 % formic acid (B) at the flow rate at 0.6 ml min^{-1} during 45 minutes. The used gradient method was described by Marks et al. (2007). According to Bakhshi and Arakawa (2006), the phenolic compounds (chlorogenic acid, procyanidine B1, procyanidine B2, 4-*p*-coumaroylquinic acid) were analysed at 280 nm, flavonols (quercetin 3 – rutinoside, glucoside, galactoside, rhamnoside, arabinoside, xyloside) at 350 nm and anthocyanins (ideain) at 530 nm. All polyphenols were identified by their retention times and the use of external standards. Quantification of individual phenolic compounds was achieved according to concetrations of corresponding external standard and expressed in mg kg^{-1} of fresh weight (FW).

Statistical analysis

For determining the impact of cultivar and processing stage on the distribution of polyphenols in apples and their juices, descriptive analysis, followed by one-factorial analysis of variance (ANOVA) and post hoc Tukey test were used at siginificance level $p<0.05$ (using Past 2.17b program).

Results and Discussion

The results obtained in this study (Table 1) revealed significant differences in content of individual polyphenols among traditional and international apple cultivars, and among different parts of apple (peel and pulp) as well. Generally, traditional apple cultivars showed greatly higher content of individual polyphenols in both apple peel and pulp, where cv. Prijedorska zelenika had the highest content of total polyphenols in apple peel and pulp (2505 and 941 mg kg^{-1} FW), followed by cv. Limunika, while international cultivar Idared had the lowest content of polyphenols in peel and pulp (963.8; 46.8 mg kg^{-1} FW respectively).

The content of polyphenols in apple peel was notably higher comparing to the apple pulp. These results are in accordance with Renard et al. (2007) and Mikulič-Petrovšek et al. (2009), who found generally higher content of individual polyphenols in apple peel than in the pulp. Furthermore, according to Lata et al. (2009) apple peel contains three to six times more idividual polyphenols than the pulp and the loss in the content of total phenols in apple fruit is a result of apple peel removal, which is obtained in this study as well. Among quantified individual polyphenols in apple peel and pulp, the most abundant were chlorogenic acid, phloretin, epicatechin and procyanidine B2, while quercetins were recorded in lower amounts. Similar results are reported by Tsao et al. (2003), where chlorogenic acid and phloretin glycosides were found to be predominant in apple fruits (both peel and pulp).

Table 1. Average content of individual polyphenols in apple peel and pulp (mg kg^{-1} FW)

Compound	Butulija		Limunika		Prijedorska zelenika		Golden Delicious		Idared	
	P	*Pu*	*P*	*Pu*	*P*	*Pu*	*P*	*Pu*	*P*	*Pu*
Proc -B1	63.32[b]	6.17[b]	62.07[b]	38.87[a]	132.32[a]	67.14[a]	11.24[c]	6.14[b]	3.45[c]	3.46[b]
Proc -B2	92.69[b]	30.56[bc]	225.2[a]	48.58[b]	109.64[b]	140.3[a]	97.81[b]	4.19[c]	79.64[b]	1.10[c]
Catechin	18.43[b]	6.75[ab]	47.99[a]	6.59[ab]	55.82[a]	17.47[a]	57.1[a]	1.61[b]	49.94[a]	2.44[b]
Epicatechin	154.98[bc]	42.49[b]	298[a]	45.03[b]	274.46[b]	99.4[a]	325.85[a]	14.35[bc]	129[c]	11.13[c]
Chlorogenic A.	217.58[b]	55.37[c]	355.3[a]	224[b]	415.04[a]	300.6[a]	404.15[a]	2.26[d]	108.32[c]	3.03[d]
Phloretin	459.17[a]	5.93[b]	182.3[b]	28.9[b]	628.92[a]	262.5[a]	95.44[b]	18.89[b]	148.29[b]	12.85[b]
Phloridzin	172.39[b]	6.58[c]	93.65[c]	10.39[b]	254.81[a]	37.97[a]	139.93[b]	4.03[c]	83.98[c]	6.88[bc]
Ideain	427.18[a]	-	345.7[b]	-	24.45[c]	-	0.32[c]	-	15.53[c]	-
Q-rutinoside	86.49[a]	0.48[a]	113.88[a]	0.49[a]	4.9[b]	0.53[a]	51.17[ab]	0.014[b]	6.87[b]	0.219[b]
Q-galactodise	291.27[a]	0.63[b]	246.6[ab]	0.32[c]	196.26[b]	1.00[a]	275.47[ab]	0.17[c]	106.62[c]	0.28[c]
Q-glucoside	143.14[ab]	2.27[b]	198.03[a]	1.28[c]	29.37[c]	3.06[a]	124.71[b]	1.23[c]	27.16[c]	1.41[c]
Q-arabinoside	261.33[a]	1.28[b]	186.48[a]	2.78[a]	205.84[a]	2.91[a]	220.84[a]	1.52[b]	78.15[b]	1.64[b]
Q-rhamnoside	172.21[ab]	0.86[d]	236.1[a]	2.36[c]	135.54[b]	7.33[a]	151.96[b]	5.71[b]	111.09[b]	1.81[c]
Q-xyloside	60.49[a]	0.37[c]	40.62[b]	0.6[b]	37.53[b]	0.84[a]	44.41[ab]	0.38[c]	15.74[c]	0.509[bc]
Total	2621	159.7	2632	410.2	2505	941	2000	60.5	963.8	46.8

* Abbreviations : *P* (Peel), *Pu* (Pulp), Proc (Procyanidine), A. (Acid), Q (Quercetin 3 -)
** Different letters in columns for each polyphenolic compound indicate significantly different values at p < 0.05.

Table 2. Average content of individual polyphenols in raw, cloudy and clear apple juice (mg kg^{-1} FW)

Compound	Butulija			Limunika			Prijedorska zelenika			Golden Delicious			Idared		
	R	*Clo*	*Cle*	*R*	*Clo*	*Cle*	*R*	*Clo*	*Cle*	*R*	*Clo*	*Cle*	*R*	*Clo*	*Cle*
Proc B1	12.9[b]	14.4[b]	-	18.3[a]	20.7[a]	-	21.1[a]	22[a]	16.3[a]	4.7[c]	4.8[c]	4.2[b]	7.7[c]	8.5[c]	6.3[b]
Proc B2	18.3[a]	5.6[bcd]	-	10.8[b]	11.5[a]	-	15.7[a]	6[bcd]	5.9[a]	3.1[c]	4.5[b]	4.7[a]	8.3[b]	9.3[c]	7.4[a]
Catechin	13.1[a]	17.7[c]	-	13.9[a]	11.3[bcd]	-	8.3[a]	6.6[b]	12.7[a]	9.9[a]	3.0[ab]	7.5[b]	9.3[a]	13.9[c]	10[ab]
Epicatechin	67.1[a]	49.4[a]	-	29.6[b]	18.6[b]	-	57.8[a]	60.5[c]	32.2[a]	4.0[c]	6.4[d]	4.1[b]	5.5[c]	1.7[d]	1.9[b]
Chlorogen. a.	155[b]	160[a]	-	216[a]	195[a]	-	254[a]	264[c]	222[a]	53[c]	59[b]	28[b]	74[c]	87[b]	50[b]
Phloretin	4.6[b]	4.3[a]	-	5.7[ab]	4.9[a]	-	7.3[a]	5.8[ad]	2.5[a]	1.8[c]	1.6[c]	0.6[b]	5.3[ab]	2.9[ac]	0.7[b]
Phloridzin	7.3[cd]	6.3[dc]	-	10.3[c]	8.2[c]	-	18.9[a]	21.1[b]	19.1[a]	5.2[d]	5.8[d]	4.1[c]	14.9[b]	16.6[a]	11[b]
4-*p*-cq. acid	128[b]	134[a]	-	214[a]	206[c]	-	199[a]	206[c]	153[a]	50[c]	55[b]	48.4[b]	52[c]	59[b]	45[b]
Q-galactoside	1.48[b]	1.26[a]	-	1.39[b]	1.27[a]	-	2.5[a]	2.3[d]	1.4[a]	0.8[bc]	0.2[b]	0.5[b]	0.6[c]	0.7[c]	0.3[b]
Q-glucoside	2.7[ab]	2.5[a]	-	2.1[b]	1.8[c]	-	3.2[a]	2.9[a]	1.9[a]	0.6[c]	0.6[c]	0.5[b]	0.6[c]	0.6[b]	0.3[b]
Q-arabinoside	1.8[bc]	2.0[a]	-	3.2[a]	3.1[c]	-	2.2[b]	2.2[ad]	1.4[a]	1.3[cd]	1.3[ab]	1.3[ab]	1.2[d]	1.3[b]	0.8[b]
Q-rhamnoside	1.3[c]	1.6[a]	-	2.8[b]	2.1[a]	-	4.2[a]	4.2[d]	2.8[a]	3.3[ab]	3.2[b]	2.4[ab]	0.8[c]	0.9[c]	0.6[b]
Q-xyloside	2.2[a]	1.7[a]	-	0.6[b]	0.6[bc]	-	0.4[b]	2.4[d]	1.8[a]	0.3[b]	0.2[b]	0.3[b]	0.4[b]	0.3[bc]	0.1[b]
Total	416	401	-	529	485	-	595	606	473	138	146	107	181	203	134

*Abbreviations: *R* (Raw juice), *Clo* (Cloudy juice), *Cle* (Clear juice), Proc (Procyanidine), Chlorogen. a. (Chlorogenic acid), 4-*p* -cq acid (4-*p*-coumaroylquinic acid), Q (Quercetin 3 -).
** Different letters in columns for each polyphenolic compound indicate significantly different values at p < 0.05.

The results presented in Table 2 are revealing significant differences among different types of juices made from traditional and international apple cultivars. As observable, juices made from traditional apple cultivars, especially cv. Prijedorska zelenika, had overall higher content of individual polyphenols comparing to those made from international cultivars. The most dominant individual polyphenols in juices were chlorogenic acid and 4-*p*-coumaroylquinic acid, followed by epicatechin and procyanidine B2. These results are in accordance with those reported by Van der Sluis et al. (2002), who found that chlorogenic acid is easily transferred from raw material into the juice due to its high water solubilty, in comparison with other polyphenolic fractions. Among apple juices, the highest content of polyphenols was recorded in

raw juice, ranging from 181 to 594 mg kg^{-1} FW. Due to the further exposition of raw juice to atmospheric oxygen and high temperatures, decreasing trend in the polyphenols content is observable in the case of cloudy and clear juice, ranging from 146 to 607 mg kg^{-1} FW and from 107 to 474 mg kg^{-1} FW respectively. Significant loss of polyphenols was determined in clear apple juices, as a result of additional processing operations, such as depectinisation and clarification. The results obtained in this study are in accordance with results reported by Olk et al. (2010) and Quoc et al. (2011).

Conclusions

This investigation demonstrates that the content of individual polyphenols in apples are directly dependent on cultivars and notably affected by the part of apple fruit (peel and pulp) as well. The decreasing trend of initial polyphenols content occured by removal of apple peel from the pulp. Furthermore, apple processing into juice (raw-cloudy-clear) resulted in losses of polyphenolic compounds, compared to the integrated fruit. Juices made from traditional apple cultivars showed higher content and stability of individual polyphenols, compared to those made from interantional cultivars. Likewise, the loss of polyphenols was dominantly observable in the case of clear juices rather than in cloudy apple juices. The results of this study indicate a rich genetic potential of traditional apple cultivars which may be used for polyphenolic enriching of various fruit products made from international apple cultivars.

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Scrutinizing the Working Conditions in Greenhouses Within the Frame of Ergonomic Criteria

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Abstract

Ergonomics is defined as "the physical environment in the study area made available to people as the process. In this sense, ergonomics, with a multidisciplinary approach, is a set of shared workspaces. The greenhouse is one of the agricultural production areas that requires intensive labor activities. This sector labourers work under time pressure depending on hand-arm- body strength in improper postures at long-hours. Therefore, based on heavy labor constitutes the most important factor of production; ergonomic working conditions for the sake of ensuring productivity at work is very important. Non-ergonomic conditions; especially tillage, maintenance, harvesting and such jobs have become more apparent during the study. There are very few studies from Turkey focusing on ergonomic obstacles of greenhouses and examining the anthropometric data on labours in this field.

In this study, suggestions have been made as a result of examining the context of the current state of ergonomic criteria greenhouse production environment in order to make such an environment available to labourers of greenhouses. For this purpose, different greenhouses with diverse usages have been investigated and the obtained data has been examined within the context of ergonomic principles. Some recommendations have been submitted in order to encounter certain problems.

Keywords: Ergonomics, greenhouse, technical characteristics of greenhouse

Introduction

Ergonomics can be basically defined as "the harmonisation of the physical environment to that of the humans"(Anonymous, 2012a). In the contemporary industrial age, the increasing relationship between machines and humans have made it compulsory that such physical environment conditions as human-harmonized environment, furniture, machine, ofice and so on are created. With an approach and discipline that holds "human" as the focus, to increase the satisfaction and productivity of the humans in an environment every detail has a crucial importance from the colour, sound and illumination of that particular environment to tables, chairs and the technical equipments used in the medium (Barlı et al., 2009). Thus, humans realize their abilities and how to use them in an efficient manner which prevents the exhaustion caused by the excessive force during work (Anonymous, 2012b).

As it is known, the agricultural production fields necessitate intensive labour. In Turkey, workers in the field of agriculture work at long hours under the stress of time limitation in improper postures that are not appropriate with the hand-arm-body power. This situation becomes more apparent in women workers during tillage, maintenance, harvesting and such procedures. There is no study in Turkey that examines the anthropometric data regarding the workers in agricultural enterprises. Existing few studies are not enough to make an overall interpretationof the ergonomical problems of the workers in agriculture (Anonymous, 2011). Greenhouse workers spend %80 of their time in the greenhouse while working on slotting, planting, plant maintenance or pruning, harvesting or applying pesticide to plants. This process is highly demanding and includes labour that is hard to control in terms of ergonomics. Workers face health threats especially as a result of the dust cloud produced during soil cultivation, exhaust gases from the machines, the chemical respiratiration of workers during, pesticide, spraying and fertilization, the lack of protective clothing, greenhouse inner heat, the lack of a proper humidity and air conditioning and even trays and cultivation tables that are not made

according to standards. Humans, as a part of their nature, focus on the best of the conditions. Hence, the ordinary relationship between the productivity in work and working conditions requires the evaluation of the ergonomical problems of workers in greenhouses and what applications could be made as a result of this evaluation. This study aims to determine the ergonomical problems of greenhouse workers, evaluate their working conditions and examine the possible ergonomical precautions for workers.

Material and Methods

This study is a descriptive research modelled as a survey which aims to obtain the remarks of the workers in the greenhouse sector through a questionnaire. The population of the research is formed of the workers working in medium and large scale greenhouse enterprises in the district of Bayındır in the city of Izmir. Sampling was used with this purpose. Within the frame of the study, 63 workers from 32 different greenhouse enterprises which produce ornament plants (seasonal, evergreen/tree-bush shaped outdoor ornamental plants, indoor ornamental plants, cut flowers and ground cover plants) were interviewed face to face. A survey developed by the researchers entitled "Greenhouse Workers Working Conditions Questionnaire" was carried out in order to obtain data (based on ergonomic checkpoints in agriculture organized by International Ergonomics Association (Eds. Niue, S. And Kogi, K.)). The survey consists of two sections: Section I. general information about the workers and Section II. The problems of the workers in terms of work management, physical environment and health conditions. The questionnaire consists of twenty questions developed with the general information of the greenhouse workers (education, work hours, level of income, social security conditions) in order to determine their problems regarding work positions, length of work hours, break hours, health conditions and such.

Results and Discussion

This part consists of the research data obtained from the survey. According to the data, within all greenhouse workers in the survey, %32,0 of them have been working in this sector for 1-3 years, %20,8 of them for 4-7 years, %30of them for 8-14 years, %17,0 of them for 15 years and more. %54,7 of the participants of the survey have stated that they are the owners of the greenhouse enterprise while %7,6 stated being permanent workers of greenhouses and %37,7 stated that they were seasonal workers. The level of income was distributed in the survey as %45,3 between 600 and 800 TL, %26,4 between 800 and 100 TL, %9,4 between 1000 and 1200 TL, %7,6 between 1200 and 1400 TL, %11,3 above 1400 TL. %64,1 of the workers stated having social security and %54,7 of them were from BAĞKUR (Turkish social security organization for artisans and the self-employed) and %45,3 were from SGK (Turkish Social Security Institution). %35,9 of the workers stated that they did not have any social security.% 50,9 of the greenhouse production fields were between 500-4500 m^2 while %43,4 was between 5000-10000 m^2, %37,7 between 10000-15000 m^2 and %1,9 had a greenhouse field larger than 15000 m^2. %67,9 of the production fields were reserved for indoor-outdoor ornamental plants and evergreen/tree-bush form plants while %32,1 was reserved for seasonal plant production. Greenhouses more than 1000 m^2 ground field in the greenhouse classification made according to their magnitudes which are formed as a result of one or more collateral greenhouses are called large greenhouses (Yüksel, 2004). Considering investment costs, modern glass and plastic greenhouse enterprises with a minimum magnitude of 25-30 decare need to be thought as closed areas (Kendirli 2012). Even though regional greenhouses can be counted as generally being medium-large scale greenhouses, they produce in many small and simple independent structures instead of one or more large greenhouses in one single field. Any agricultural activity cause loss of labour and time which decreases productivity in work. Despite the fact that Bayındır is one of the most important ornamental plant centers in Turkey, only few large scale enterprises use automation system in irrigation. While products are being prepared for cultivation and filled-carried in bags, only basic hand tools and equipments are used. With the recent developments, new arrangments are being made in pot cultivation to carry the pots to the work places or to

carry the workers to the plant area via conveyor bants in order to increase productivity in work (Anonymous, 2014a).

The second section of the survey displays the work management, physical conditions and health conditions of the greenhouse workers within the frame of ergonomical criteria. As a known fact, workers can work productively in working conditions that make them feel comfortable and each time they are affected by any environmental stress, this productivity is affected adversely. Therefore, it is important to know their tolerance limits in times of various stress cases (Erkan, 1997). Within this context, in order to determine the physical environment, the participants were asked to answer the question "Were do you carry out plant production?". The answers stated that they did not carry out their plant production on cultivation tables, ground pillows or ground trays and completely produced (%100) in bags or pots. %20,8 of the workers, average per day, worked for 6-8 hours while %54,7 of them worked for 8-10 hours, %11,3 for10-12 hours and%13,2 for 12-14 hours. It is determined that %92,5 of the workerstook regular breaks during work hours, however %7,5 took no breaks at all. %9,4 of the workers who had break hours stated that this break was once in every hour, %11,3 stated as having a break once in every two hours, %30,2 once in every three hours and %49,1 once in every four hours. %3,2 of the workers stated that the length of the break hours is 5-10 minutes while %18,9 stated it is 10-15 minutes, %13,2 stated it is 20-25 minutes and %64,1 stated it is 30-45 minutes. In a study by Earle-Richardson et al., (2006), it is stated that agriculture workers need to have 5 minutes break per hour and according to the difficulty of the labour, at least 20 minute breaks per day should be given (Callejón-Ferre et al., 2009). Inappropriate working conditions and excessively long work hours cause demotivation and exhaustion in workers which lead to a decrease in productivity. In addition, unhealthy working conditions affect the respiration, circulation, muscle and nervous system, energy metobalism and morale condition of the workers. These conditions causes higher accident rates (Hayta, 2007; Perez-Alanso et al., 2011). %47,2 of the workers stated that they suffer from an illness caused by working conditions while %52,8 of them stated having no such illness. Of those who stated having an illness, %20,8 declared having muscle-skeleton illnesses (waist-back-neck, joint-arm-leg pains and such) while %9,4 stated having cuts and bruises (caused by tools and equipments), %26,4 having muscle exhaustion, %9,4 having dermatitis (agricultural pesticide, fertilizers, allergic conditions and such), %11,3 having migraine (excessive amount of light and intense temperature), %9,4 having respiration problems (due to agricultural pesticides and fertilizers), %7,6 bug bites and %5,7 declared having no illness. While %77,4 of the workers having such illnesses declared that they did receive any medical treatment, %22,6 stated receiving treatment. All of the workers stated that it is easier to work while sitting around the cultivation trays. The questions and answers in order to determine the greenhouse workers' working conditions in terms of ergonomic conditions have been given table 1.

Table 1. The questions and answers related to the conditions of the greenhouse workers in terms of working positions

How many hours do you work on foot or while sitting within your work hours?	2-8 h On foot (%20.8)	3-5 h while sitting (%13.2)	5 h on foot -5 while sitting (%28.3)
When you are on foot or while you sit, do you receive any support to help you out (from a stool, rock, pot, case)?	Yes (%1.9)	No (%98.1)	Sometimes (%0)
What is the average height of this support that you use?	5-20 cm (%32.1)	20-30cm (%58.5)	30 cm> (%9.4)

Ergonomical threats such as improper working positions, working in the same posture for a long time, carrying heavy weight, uncomfortable sitting places, carrying harvested products with cases cause serious waist and back pains (Perez-Alanso et al., 2011). The usual placement of the plants on the natural ground soil pose a troublesome case for the greenhouse workers during plant maintenance activities. However, with the placement of these plants to a higher level labour can be easier and worker productivity can increase (Anonymous, 2014a). European Union Counsil Guidelines, arranged for the agriculture sector, has been prepared for the sake of workers who suffer from serious waist and back problems which declares certain health and

security necessities in the transportation of weights that carry partial waist and back injury risks for workers. %60 to %90 of the population suffers from back pains during a lifetime (Lehtela, 2005). It may not be important that the sitting places used for a short period of time are not produced ergonomically. Nevertheless, for workers who work all day under the force of productivity, sitting surfaces must support the body weights and this support must be designed carefully. Usually, the height of the sitting places is accepted as 38 cm for men and 35 cm for women (Anonymous, 2014b). The answers of the participants to the questions asked to them in terms of the problems they have in the work place and their satisfaction of the working conditions are stated as such; %18,9 declared having no social security, %13,2 stated having long work hours,%41,5 stated that tools and equipments inadequate, %11,3 declared that health conditions were not appropriate, %15,1 stated that they were satisfied by the working conditions. It is worth mentioning that all workers satisfied by the working conditions were owners of enterprises.

Suggestions

In order to have productive results in greenhouses, apart from the agricultural tools and equipmants used in greenhouses, internal arrangements in greenhouses, plants as the target of the issues of greenhouse building techniques, the necessities of the agriculture workers who use these tools need to be taken into consideration. Responsible institutions and corporations must carry out researches regarding this standardization in greenhousing and must provide these facilities to the workers as efficiently as possible. Mechanization should gain acceleration in agriculture and in cases where human labour is compulsory work fields and equipments must be appropriate in terms of health, security and working conditions. The materials used in human centered work fields necessitate appropriate anthropometric data in order to be ergonomical. To create such a medium, periodical data must be obtained by creating pilot greenhousing areas. In greenhouse labour that requires workers to stay on foot or to sit down, in order to be ergonomical, certain supports (stools, chairs) that are appropriate to the anthropometric characteristics of the workers must be provided. To prevent muscle-skeleton system pains short termed breaks should be given within work hours. In order to ensure productivity by lowering the loss of time and labour, instead of many small scale greenhouses, appropriately built modern greenhouses with large ground fields less in number yet connected to each other via service tracks must be built.

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Tree Cadastre as a Tool of Preserving of Urban Green Area

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Abstract

Trees in the cities are exposed to extreme living conditions. The physiological changes such as drying of buds and shoot at the margin of the tree top and partial or complete loos of assimilation organs were come on the trees. Thus weakened trees were easier subject to disease and pest attacks resulting in a positive correlation between the strength of the attack with the weakening of the biological potential of the tree. All those reduce ecological and aesthetic value of trees. In order to reduce the negative effects there is a need of making tree cadastre that would incorporate all the information about every single tree in the city. This tree cadastre becomes a tool of preserving of urban green area and making recommendations which species are the best for planting in urban areas. The pilot project to establish a tree cadastre included three categories of green area in city of Mostar: central park, avenue and city district. In the field, all trees are planned to be recorded, measured height and breast diameter, estimated age, vitality. These and all other observations are planned to be integrated in cadastral card with photos for each tree. The exact positions are marked by GPS and recorded on a map of Mostar in the GIS system. Also with simple search it will be possible to find out how much some tree species are present in Mostar, kind of health, where they are, and see their photos.

Keywords: Mostar, tree cadastre, green area

Introduction

Trees in parks, alleys, groups or single have important role in designing the layout of an urban environment. Its role is multidimensional and has impact on aesthetical, social and ecological aspects, like: forming comfortable surroundings, air purifying, noise reduction, temperature extremes modification, air gas mix balance improvement etc. At the same time, trees are exposed to several biotic and abiotic factors which impact their health status (Matošević 2003, Diminić i Hrašovec 2005, Tomiczek i dr.2008). Urban trees are, for the difference to those in natural habitats, developed in the soil exposed to stress, high density and different types of pollution. On top of these difficulties, urban trees are exposed also to specific negative atmosphere impacts (snow, wind, rain, etc). These negative impacts are higher in cases of trees suffering from lack of correct and professional tree top shaping, as well as in cases of trees weakened by disease or pest attacks. Resistance to negative impacts is dependent on tree type, age, trunk characteristics, and quality of agrotechnic measures applied, as well as combined influence of temperature, wind and snow. Biological characteristics of a tree type defining the look and shape of the tree top and thus its resilience to mechanic strain (Balenović 2012).

Purpose of this pilot project, among others, is to stress the importance of making inventory and systematic of trees and green surfaces in the city of Mostar and all the advantages of doing so. Forming a tree GIS could also be a first relevant step in building the overall city information system. Once set up, the tree cadastre become the basis for maintenance dynamics planning and precise indicator of realistic status of public green surfaces and trees in certain area. Its development is long process of collecting and processing the data, but results can be useful almost immediately, since the data entry is done for upfront defined sectors. Besides, this or similar practice of inventory systems is applied in almost all European cities. Estimated number of trees in public spaces in city of Mostar is around 15.000.

Current analysis of green surfaces and trees in city of Mostar shows number of weaknesses. The first is lack of systematic approach in necessary activities, particularly in tree maintenance (replacement planting not planned, putting down not planned, misalignment with other urban and architectural measures like street maintenance, etc.). Second most important weakness is lack of complete and transparent database which should contain all the trees in the city as well as all the green surfaces where the trees are positioned.

Material and methods

In support of implementing this project, in May and Junhe 2014 inventory of trees is done in three locations in the city: city park Zrinjevac, Kralj Zvonimir alley and in district bordered by Zvonimirova, Tvrtkova, Zagrebacka and Radiceva streets. Inventory was performed by on site visits, taking field photography, geodetic base plans where all the inventoried trees are screened and entered in accurate

position, and analysis official urban planning documentation. Field visit was comprised of tree type identification, allocation of the ID number for each tree, satellite positioning done by handheld GPS device, tree age estimation, breast diameter and circumference measurement, tree top diameter measurement, tree hight measurement, etc. On top of it the qualitative assessment was done for each tree through health status observation, decorative quality assessment and maintenance and care suggestions.

Taking in account the fact that assessments are done empirically, assessment criteria were required to be equal with all observers involved. To achieve criteria alignment, observers were working on assessments together for a period of time. Methodology applied in observing the tree status is in line with British standard (Čurovic 2013). Through vegetation analysis and status assessment, 4 categories are defined:

1. A category – high quality trees (to be kept)
2. B category – trees with limited quality (to be kept with specific care measures)
3. C category – low quality trees (replanting with significant care measures)
4. R category – low quality trees (for putting down)

In green surface GIS every entered and positioned object is described with as many attributes as possible, like ID, Latin name, protection category, diameter of the trunk and top, height, age, space positioning, inclination, bark damage, repair action needed, protection suggestion and photo of each individual object.

Results

Based on defined research method, measurements and parameter assessments are performed on 498 trees. Tree categorization based on prior described criteria is shown in table 1, 2 and 3 and in figure 1. Comparison of percentage presence of categories is presented.

Table 1. Categorization of trees in the city park Zrinjevac

	Latin name	Σ	A	B	C	R
1.	*Acer sacharinum*	1			1	
2.	*Aesculus hippocastanum*	3	2	1		
3.	*Albizia julibrissin*	12	4	7	1	
4.	*Brussonetia papyrifera*	10	2	5	1	2
5.	*Catalpa bignonioides*	3	1	2		
6.	*Cedrus atlantica*	17	1	15		1
7.	*Celtis australis*	12	10	2		
8.	*Cercis siliquestrum*	6	6			
9.	*Cupressus arizonica*	3		2	1	
10.	*Cupressus sempervirens*	83	28	38	13	4
11.	*Ficus carica*	1		1		
12.	*Fraxinus ornus*	3	1	1	1	
13.	*Ginkgo biloba*	3	3			
14.	*Laurus nobilis*	3			2	1
15.	*Ligustrum japonicum*	1			1	
16.	*Magnolia grandiflora*	1	1			
17.	*Morus nigra*	3	2	1		
18.	*Olea europea*	4	4			
19.	*Paulownia tomentosa*	2		2		
20.	*Pinus nigra*	1	1			
21.	*Pinus sylvestris*	10	7	3		
22.	*Pittosporum tobira*	3		3		
23.	*Platanus x acerifolia*	8	4	4		
24.	*Prunus domestica*	1		1		
25.	*Prunus serulata*	17		17		
26.	*Quercus ilex*	15	11	4		
27.	*Robinia pseudoacaccia*	15	8	4	1	2
28.	*Sophora japonica*	38	4	20	10	4
29.	*Tilia argentea*	18	13	5		
30.	*Tilia cordata*	3		2	1	
31.	*Tilia platyphyllos*	14	11	3		
	Σ	314	**124**	**143**	**33**	**14**

Table 2. Categorization of trees in the street Kralja Zvonimira

	Latin name	Σ	Categorization of trees			
			A	B	C	R
1.	*Celtis australis*	3	3			
2.	*Tilia argentea*	52	12	26	12	2
3.	*Tilia platyphyllos*	48	17	21	7	3
4.	*Melia azzedarach*	2				2
5.	*Cupressus sempervirens*	1				1
	Nedostaje	6				6
	Σ	112	**32**	**47**	**19**	**14**

Table 3. Categorization of trees in the district bordered by Zvonimirova-Tvrtkova-Radićeva-Zagrebačka streets

	Latin name	Σ	Categorization of trees			
			A	B	C	R
1.	*Acer negundo*	18		5	12	1
2.	*Aesculus hippocastanum*	1		1		
3.	*Albizia julibrissin*	4		2	2	
4.	*Cedrus atlantica*	1		1		
5.	*Cedrus deodara*	3	2	1		
6.	*Cercis siliquestrum*	10	1	2	5	2
7.	*Cupressus arizonica*	2		1	1	
8.	*Cupressus sempervirens*	7	4	3		
9.	*Fraxinus ornus*	4		1	2	1
10.	*Pinus nigra*	1			1	
11.	*Pistacia lentiscus*	5		4	1	
12.	*Platanus orientalis*	4	4			
13.	*Populus pyramidalis*	1			1	
14.	*Populus sp*	1				1
15.	*Prunus avium*	1			1	
16.	*Robinia pseudoacaccia*	4	1			3
17.	*Tilia argentea*	5	5			
	Σ	72	**17**	**21**	**26**	**8**
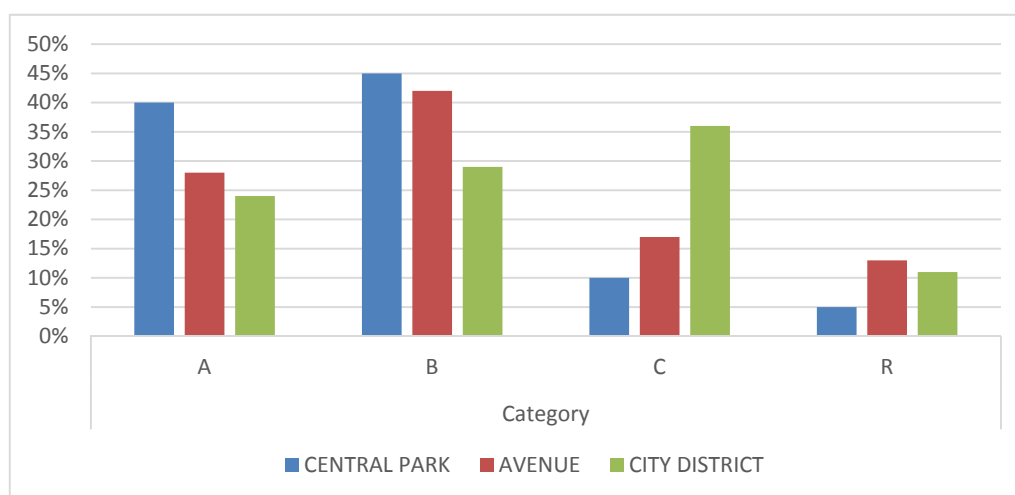
Figure 1. Comparison of percentage presence of categories

Discussion

Tree inventory in three locations showed that vitality is seriously deteriorated with majority of trees, hence most of them put in lower categories. Out of total of 498 observed trees, 173, or

35% is put in A category and represents high quality trees, which require protection. 211 trees, or 42% are in B category, with limited quality and adequate care measures are necessary for their maintenance. 78 trees or 16% is in C category, low quality, requiring significant repairing measures or quite often even replacement planting. Low quality trees in category R are present in 36 cases (7%).

Analysis of each location separately, it shows that A and B category are most present in the Park and Alley, while C category is most often in the District and R category in the Alley and District. Hence, it appears that the optimal conditions for the tree growing are in the Park. In the Park 31 types of trees are found, while there are 5 types in the Alley and 17 in the District. Some of types are repeating on all locations, so in total 38 types are observed.

Important point of attention is the fact that in all three locations the trees are planted 40 or more years ago. In the City Park Zrinjevac in recent years there were some renewal activities and some damaged trees are treated or replaced. Some species originally planted were not adequate for specific local conditions of Mostar, so they died and disappeared from the Park. Some remedial activities were periodically performed also in the Alley, but similar activities are necessary to be done again, particularly planting on empty spots and replacement of trees that represent the danger for the passing traffic. The trees in the District, in general, are in worst state, even though it was expected they would be in the best state. The reason for actual situation is in total absence of any care and remedial measures for number of years.

GIS base of tree Cadastre contains Cadastre plan and GPS screened coordinates of the trees. Final data processing for observed trees will be done in web based application, hence accessible to larger number of users.

Conclusion

Majority of inventored trees are requiring certain remedial measures, primarily trimming and elimination of dried branches, treating trunks and root systems. Some trees have deteriorated static, due to inadequate branch trimming, so they require measures to prevent falling down. In addition, removal of dry trees with low decorative value is needed, since they represent danger for people. These positions should be planned for replacement planting.

Continued Tree Cadastre implementation is suggested in the rest of green surfaces in city of Mostar as well as continuous following of status of trees and regular update of the Cadastre with fresh observations, so it can serve as powerful tool for planned maintenance and care for City green surfaces.

Following species are suggested for the urban areas of Mostar: *Celtis australis*, *Cercis siliquestrum*, *Cupressus sempervirens*, *Pinus* sp, *Quercus ilex*, *Prunus serulata*, *Tilia* sp. These species demonstrated to be most fit for local conditions over long period of growing.

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The Analysis and Comparison of Green Areas of Three Mosques in Sarajevo

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Abstract

The green areas in the immediate vicinity of the mosques were formed under the strong influence of oriental style, and during the reign of the Ottoman Empire in Bosnia and Herzegovina they were the only public green areas. Those green areas represent the valuable document of culture and time in which they were formed, and given the fact that they are one of the most specific and recognizable elements of Sarajevo, it is necessary to give them the full attention and care. The aim of this paper is to analyze presence, composition and condition of garden elements which are distinctive to the oriental green areas - water, color and scent - in green areas around three mosques in the city of Sarajevo: Havadže Duraka mosque (Baščaršija mosque), Ali Pasha's mosque and Dobrinja mosque and monitor the change of appearance of these green areas, depending on the time and place when they were formed.

Keywords: Mosque, green area, Sarajevo, garden elements

Introduction

In the early-day Sarajevo, the mosques have represented the cultural, educational and social center of the neighborhood. Aside of their primary function as the place for prayer, the mosques have also been the center of social activities (Bećirbegović, 1999). The mosques, and the green areas around them, also have the role of forming the aesthetical image of the settlement. The courtyard of the mosque is usually enclosed by a tall wall, with a prominent entrance. This physical barrier around the religious object and is formed to achieve the peaceful ambience which allows the uninterrupted prayer. The green areas around mosques are formed under the impact of oriental garden style, depicting the "Earthly Paradise" – a combination of elements which symbolizes a serene place that shows "eternity and peace" (Fatos, A., 2011.)

Three basic elements of oriental garden art include water, color and scent (Ljujić-Mijatović & Mrdović, 1988). On the green areas around mosques, water has two functions: aesthetical, as the element with strong ornamental effect, and useful, because it is used for washing prior to the prayer (Mujezinović, 1976). Larger mosques usually have sadirvans or fountains in their courtyard, and smaller mosques mostly have drinking fountains (Maletić, 1965). The color is mostly provided by annual flowers and tiles and the scent by various species of flowering plants including the fruit trees (Ljujić-Mijatović & Švrakić, 2006). Tall trees or trees with broad crowns such as linden, poplar or cupress are also planted next to the mosque, often accompanied by ivy, vine or some other climber (Mujezinović, 1976). The most prominent architectonical elements of oriental gardens are cobblestone paths and water elements: drinking fountain or sadirvan.

During the reign of Ottoman Empire, the green areas around mosques were the only public green areas, because green areas in Bosnia and Herzegovina during that period were exclusively formed around private houses (Ljujić-Mijatović & Švrakić, 2007).

The aim of this paper is to analyze botanical and architectural elements in green areas of three mosques located in the city of Sarajevo (Havadže Duraka Mosque, Ali Pasha's Mosque and Dobrinja Mosque) in aesthetical and functional sense and compare their appearance in relation to the typical ornamental-style green area.

Material and Methods

The research work of this paper was conducted on the green area of three mosques in Sarajevo, created in different time periods and located in different parts of the city.

The plants were identified using the determination key (Domac, 2002) and the available literature regarding ornamental shrubby and woody plants (Šilić, 1973, 1990). The presence and condition of architectonical garden elements was also analyzed. The research was performed during June and July 2014.

Results

Havadže Duraka Mosque (Baščaršija Mosque)

The plant material registered on the green area of Baščaršija Mosque is presented in table 1:

Table 1: Floristic composition of green area of Baščaršija Mosque

SPECIES/CULTIVAR	No.
Trees	
Chamaecyparis lawsoniana (Murr.) Parl.■	2
Elaeagnus angustifolia L.	1
Malus sylvestris (L.) Mill.	1
Populus nigra L. 'Italica'	2
Shrubs	
Buxus sempervirens L. ■	34
Rosa × hybrida L.	42
Thuja occidentalis L. ■	1
Climbers	
Vitis vinifera L.	2

■ – evergreen

A small stone fountain is located in front of the Baščaršija Mosque. In the immediate vicinity of the fountain there is a pergola with vine (*Vitis vinifera* L.). All paths are covered with cobble.

Ali Pasha's Mosque

The plant material registered on around Ali Pasha's Mosque is presented in table 2:

Table 2: Floristic composition of green area of Ali Pasha's Mosque

SPECIES/CULTIVAR	No.
Trees	
Acer pseudoplatanus L.	5
Aesculus hippocastanum L.	2
Betula pendula Roth.	10
Cedrus atlantica (Endl.) Manetti ex Carr. ■	1
Chamaecyparis lawsoniana (Murr.) Parl.■	1
Elaeagnus angustifolia L.	1
Fraxinus excelsior L.	1
Malus sylvestris (L.) Mill.	1
Morus alba L. 'Pendula'	2
Picea pungens Engelm. 'Glauca' - ■	12
Prunus cerasifera Ehrh. 'Atropurpurea'	1
Prunus serrulata Lindl. 'Kanzan'	1
Quercus robur L.	1
Robinia pseudoacacia L.	
Tilia cordata Mill.	2
Shrubs	
Buxus sempervirens L. ■	3
Chaenomeles japonica (Thunb.) Lindl. ex Spach	2
Forsythia × intermedia Zab.	5
Ilex aquifolium L. ■	2
Juniperus horizontalis Moench ■	1
Ligustrum ovalifolium Hassk.	2
Symphoricarpos albus (L.) Blake	6
Syringa vulgaris L.	4
Taxus baccata L. ■	10

■ – evergreen

On the very entrance to the Ali Pasha's Mosque, there is a sadirvan with seven radially arranged tubes, and a small stone cup-shaped fountain is located behind the Mosque. The front entrance to the Mosque is tiled with cobble, while all other paths are covered in concrete.

Dobrinja Mosque

The plant material registered on the green area of Dobrinja Mosque is presented in table 3:

Table 3: Floristic composition of green area of Dobrinja Mosque

SPECIES/CULTIVAR	No.
Trees	
Chamaecyparis lawsoniana (Murr.) Parl.■	3
Magnolia × soulangeana Soul. – Bod.	1
Picea abies (L.) Karsten ■	1
Tilia cordata Mill.	3
Shrubs	
Buxus sempervirens L. ■	14
Juniperus horizontalis Moench ■	8
Rosa × hybrida L.	19
Thuja occidentalis L. ■	22
Annual flowering plants	
Begonia semperflorens Link & Otto	-
Dianthus barbatus L.	-
Pelargoium zonale (L.) L'Her.	-
Petunia × hybrida hort. ex E. Vilm.	-
Tagetes patula L.	-

■ – evergreen

In front of the Dobrinja Mosque, there is a large octangular fountain decorated with brown, white and yellow tiles. All paths around this mosque are made of concrete, except those around the fountain, where the blocks made of sand have been placed.

Discussion and Conclusion

Havadže Duraka Mosque (Baščaršija mosque)

Located in the center of the Old Town, in Baščaršija, this mosque was built by a certain hojja Durak in 1528 and is one of the oldest mosques in Sarajevo. Its construction had a significant impact on the economic development of the Sarajevo bazaar (Mujezinović, 1976). There are 8 plant species on the green area of Baščaršija Mosque: 4 trees (1 evergreen and 1 deciduous), 3 shrub species (2 evergreen and 1 deciduous) and one climber. The most numerous floristic element is the rose shrub (*Rosa × hybrida* L.) which ensures the color and scent, and boxwood (*Buxus sempervirens* L.) which provides the aesthetical effect during the entire year. There are no annual flowers in this green area, but since there are numerous well located rose shrubs, their presence is not necessary. A small stone fountain located in front of the Baščaršija Mosque has the satisfactory aesthetical effect, as well as practical value. The pergola with vine (*Vitis vinifera* L.) accentuates the architectural values of this mosque. All paths are covered with cobble, which is the typical element of ornamental gardens (Ljujić-Mijatović & Švrakić, 2008).

Ali Pasha's Mosque

This mosque is located in an area that represents the border between the "old" and "new" part of Sarajevo. It was built in 1561, when the Ottoman architecture was in full bloom in Bosnia and Herzegovina, as a legacy of Buda bey Hadim Ali Pasha, and is one of the most beautiful domed mosques (Mujezinović, 1976). In 2005, Ali Pasha's Mosque was declared a national monument of Bosnia and Herzegovina. The green area around it has been modified several times, and the current layout was created by a landscape architect Smiljan Klaić in 1939. A total of 24 plant species were registered on the green area of Ali Pasha's Mosque: 15 tree species (3 evergreen and 12 deciduous) and 9 bushes (4 evergreen and 5 deciduous species). The evergreen species ensure the beautiful appearance of this green area throughout the year, and the color and scent

are provided by a presence of flowering trees and shrubs. This green area also has no annual flowering plants. The sadirvan, located on the entrance to the mosque, and a small stone cup-shaped fountain both have exceptional aesthetical effect. A cobble path is found only in front of the mosque, and all other paths behind it are covered in concrete.

Dobrinja Mosque

The newest of three mosques which are the object of this research is the Dobrinja Mosque, built in 2004 with the support of Saudi High Commission. It is surrounded by a large green area, enclosed by a metal fence. A total of 13 plant species were registered on the green area around this mosque: 4 trees (2 deciduous and 2 evergreen), 4 shrubs (3 evergreen and 1 deciduous) and 5 species of annual flowers. The relatively young and undeveloped plant material, especially the boxwood (*Buxus sepmervirens* L.), which was planted very sparsely, doesn't fulfill its ornamental function. The satisfactory appearance of this green area was accomplished by planting a number of American arborvitae (*Thuja occidentalis* L.), linden (*Tilia cordata* Mill.) and rose shrubs (*Rosa × hybrida* L.). In front of the mosque, there are several flowerboxes with annual flowers, which provide color and scent to this area. In front of the Dobrinja Mosque, there is a large octangular fountain decorated with brown, white and yellow tiles, which has the satisfactory aesthetical effect and practical value. All paths around this mosque are made of concrete, except around the fountain, where the blocks made of sand have been placed.

Analysis of green areas of three mosques in Sarajevo leads to the following conclusions:

The green area of the oldest mosque - Baščaršija Mosque - has all the elements which are typical for oriental-style gardens. It is enclosed by a tall stone wall, the deciduous trees and shrubs provide shade, evergreens ensure aesthetic effect throughout the year, and the climber accentuates the architectonical elements of mosque and its green area – pergola and a fountain. Numerous rose shrubs provide the color and scent.

The major part of a green area around Ali Pasha's Mosque is changed into a park, in which trees and shrubs have been planted in large, irregular groups. This green area lacks the wall around it, but the mosque itself has been partially hidden by the flowering species (*Malus sylvestris* (L.) Mill, *Prunus serrulata* Lindl. 'Kanzan') which have been planted close to it. This green area has no annual flowering plants, but the oriental style is reflected in water elements and a cobblestone path.

Out of three investigated green areas, the one around Dobrinja Mosque looks the least appealing, partially because of relatively young and undeveloped plant material, which, in present condition, doesn't fulfill ornamental or any other function. The choice of extremely popular American arborvitae (*Thuja occidentalis* L.), for a main evergreen element does not make this green area stand out from nearby parks or other green areas in the neighborhood. The marble flowerboxes and tile-decorated fountain in the front provide the oriental-style garden elements (water, color and scent), but their overall appearance is somewhat cold, especially in combination with concrete paths and metal fence around the mosque.

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Greenways on the Urban Design and A Sample From Kocaeli

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Abstract

One of the most significant components of urban ecosystems is greenways. Greenways are ecological, recreational and cultural / historical linear open spaces that are for use. Protecting the relationship between man and nature, making cities livable places and improving the quality of humans' life are being contributed by them. In this study; a sample from the city of Kocaeli has evaluated and made recommendations emphasis on greenway concept, design principles and functions. According to the results, the road where converted from an abandoned railway route into a pedestrianized zone is a qualified greenway because of the lineaments, binding, allowing recreational activities, creating habitats for various creatures, contributing ways to urban ecosystems. However, transportation which is focused on vehicles around this road is still going on and this situation leads to disruption on the greenway network. These recommendations are presented for the elimination of deficiencies.

Keywords: Urban landscape ecology, greenway, urban greenway, designing of urban greenway

Introduction

Planning and urban design practices are important means of creating livable cities. Urban design is both a kind of art and a process of producing spaces and places that build and enhance the comfort and infrastructure of the city with its parts and its characteristics, style, architecture and aesthetics; communication among the citizens; their chance of participation in decision making process and the activities; the relationship between historical background and the city itself for the purpose of improving urban quality by preserving the natural texture. (Anonymous, 2009). Standards of living in a city depends on education and employment opportunities; sufficiency in affordable residence and transportation; living environment that supports life of a person and an urban landscape, aesthetic qualities of which are dominant (Arslan et al., 2004). In urban areas in our country, there are problems in the relationship between the built environment and people. In today's cities, which are formed by improper housing, the number of green spaces has decreased while the number of housing has increased. This situation is an important factor in the deterioration of the ecological balance in cities. Forming a background of an innovative "design" and "planning" that aims preserving and developing the natural, cultural and historical assets that a city owns, is of great importance. One of these approaches is greenways.

Material and Methods

The concept of "greenway", written sources that enable examining the characteristics of the concept and documents, photos and observations of an obsolete railroad passing through Kocaeli downtown constitute the main material of this study. In the conclusion of the study the data from field analysis and literature search with its assessment have been synthesized.

The Results of the Study

Greenway

According to Fabos (2004), greenways are the integrity of *networked linear open spaces* which are planned, preserved and managed for the purpose of ecological, recreational, cultural and historical use. According to Fabos (1995) again, interconnected land route and railroad corridors having various width within a network, should also be included in the greenway system (Tan, 2004). On the other hand, according to Little (1990), the word "green" is derived from green belt and "way" from ways with beautiful scenery, for the description of "greenway" (Culcuoglu, 1997). Greenways are linear corridors that link natural corridors such as riverbanks,

ridges, valleys; canals, ways with beautiful scenery or parks that extend along the railroads and have been transformed for recreational use; natural reserve areas, cultural objects or historical sites to either one another or to residential areas (Arslan et al., 2004). These mentioned areas have been either designed or left with their natural characteristics for pedestrians and bikers. Greenways are linear open spaces that link parks, natural areas and areas with historical or cultural characteristics to one another or to residential areas. They should be approached as a synthesis of natural and cultural effects in landscape planning practices (Flink and Searns, 1993). Greenways, which envisage the creation of a system by linking together open green spaces of different characteristics easily and enable various kinds of recreational activities and also need less space when compared with conventional non-linear parks, are supported by environmental protection institutions and those who are concerned with the issue (Arslan et al., 2004). When compared with green belt and parkway, greenways have a broader meaning since they include not only downtowns and surroundings but also preserved areas, historical areas and natural areas that link the cities (Kurduoglu, 2002).

Basic Features of Greenways, Their Classification, Functions and Planning Stages

According to Ahern (1995) the key features of greenways can be grouped under the following 5 main titles (Culcuoglu 1998):

Key Features of Greenways	
Linearity	Spatial forms are linear. Linearity supports the recrative practices such as hiking and biking
Cohesiveness	Link the city to the wild, human to the nature and a kind of wildlife to the other by relating to landscape structure at every scale.
Multifunctionality	Can be multifunctional including being ecological, recreational or cultural.
Sustainability	Greenways support the concept " sustainability" within sourcing /protection balance
Contribute to landscape planning	Create a different spatial strategy by providing the opportunities of networked linear open space systems.

According to Ahern (1995), greenways can be classified into the following 5 groups in terms of their purpose:

- Greenways related to biodiversity
- Greenways related to water sources
- Greenways with recreative purposes
- Greenways for protection of historical and cultural sources
- Greenways that assume control on urban development

The benefits of greenways can be summarized as follows: (http://www.greenways.com; Kurduoglu, 2002).

•**Recreation**: They provide the opportunity of outdoor recreation.

•**Transportation:** They provide alternative transportation routes. They also allow people to walk short distances within the city.

•**Health**: They are effective in reducing the risk of various diseases because they provide people with activities such as hiking, jogging and biking etc.

•**Economical**: They are tourist attracting places.

•**Education:** They are some kind of outdoor classrooms.

•**Environmental Protection**: They are important areas in terms of protecting and increasing the value of the natural environment.

•**Flood / Floodplains Management**: They have the effect of reducing the impact of floods.

•**Quality Life**: They offer the opportunity of quality life in residential areas.

Greenway planning is similar to planning of other protected areas. The first step to take here, is specifying the link opportunities between the areas that worth preserving (Hocker, 1987). Green path planning consists of three stages (Flink and Searns, 1993) ;

Planning stages of greenways

Inventory and analysis stage: The stage of assessing the natural and cultural sources of the corridor

Conceptual Plan: The stage where the aims an objectives are specified

Final Masterplan: The stage where the issues such as professionally prepared dvelopment processes, standards belonging to private parcels and detailed price forecasting are dealt with

Success in planning can only be possible by creating the organization that supports natural and cultural landscape characteristics, enables sustainable use of resource values belonging to the area and emphasizes the principle of cohesiveness among ecological systems.

An Example from Kocaeli

The aim of greenway planning is to ensure continuity of natural areas that are lost, isolated or increasingly fragmented in metropolitan scale through protection; to provide people with accessible linking roads of natural, cultural and built-up environment and create proper spaces for various kinds of recreational activities.

The area which is located in Kocaeli downtown and was transformed into a hiking path from a railroad after the earthquake in 1999 has the characteristics of a greenway due to *linearity*, *cohesiveness, multi-functionality, sustainability and contribute to landscape planning* key features of the greenways. The mentioned area stands among the high density structures spreading without leaving space in Kocaeli downtown and it is for public use. The Railroad Street is one of the busiest streets at the city center and it runs in the east-west direction. The part that has been transformed into hiking path has a space of 27.000m² with 10 m width and 2700 m length between Anitpark and Cumhuriyet Street.

Greenways and green corridors are environmental quality enhancing practices and preservationist approaches. Mentioned area is a greenway having preservation and recreational purposes. To mention about its preservation dimension, the area preserves the registered monumental plane trees, the railroad remaining from the republic period and the plants of that period. As for its recreational dimension, the area provides hiking path, playfield and recreational and group activity opportunities. It also links natural areas, housing zones, historical and cultural environment, shopping facilities and residential areas to one another, which is one of the important functions of greenways, and provides people with safe access routes.

In addition to monumental plane trees (*Platanusorientails*L.) planting date of which extends over 1890s, plants of 51 genus and 57 species belonging to 33 families were planted after the transformation of the railroad into hiking path (Akdeniz et al., 2013). In spite of having some design problems due to plant and outfit elements, with its current status, the area is a park, where people enjoy spending time, with linear characteristics providing people with opportunities for some activities (Figure 1).

Figure 1. A sample from Kocaeli for greenways

Conclusion and Recommendation

Ongoing vehicle transportation in this area causes some troubles with the greenway network. The popular demand of the people using this area is that the area be planned for pedestrian traffic and completely pedestrianised. The area suddenly ends in front of the central bank at the city center without any warning signs. It is necessary for the area to be reorganized to reach the shore in the direction of the central bank in order to fulfill its function properly as a greenway. During this reorganization process, the traces of the previous cultural periods shouldn't be removed, on the contrary they should be emphasized.

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Ecological Approach in the Design of Open and Green Spaces

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Abstract

Increasing environmental problems, which threaten the future and leads to destruction of ecosystems by moving away from the target of sustainable cities. As long as human being stays alive, he will need nature and resources increasingly. However these resources and nature is not infinite. Sustainable cities is possible with the ecological planning and ecological design. Open and green spaces designed in consideration of the ecological approach, the integration of urban dwellers with nature to reduce the consumption of energy and resources, to spread the use of environmentally friendly technologies, providing biological comfort, increasing the awareness of environmental protection and related alike issues such as these.

In this context, this study ecological approach in the design of urban open and green spaces have been analyzed and recommendations are developed dramatically. With specified criterion and recommendations, which have an important place in the city is quite open and green areas of the ecological approach in the design of these spaces and will provide huge gains for the whole city.

Keywords: Open and green spaces, sustainability, ecological design criterion

Introduction

Open and green spaces are one of the most important component of urban. In the perspective of ecologic approach the urban green spaces are evaluated "as pieces of nature saved in the fate of urban development" (Cranz, 1989). Open and green spaces are healthy antidotes to the crowd and polluted cities. Accordingly, urban green orients itself to the image of nature by mirroring nature (Bingöl, 2006). Open and green spaces − consisting of ecological and people oriented − offer various values range of ecological, biological, social and psychological benefits for human well-being. In the morphological sense, open spaces are opposite of built-up areas. Specifically, the term open space identifies the urban green spaces, which are publicly accessible, unbuilt areas such as parks, plazas, streets, community gardens, and greenways preserving public life in it (Bingöl, 2006).

Understanding of the natural resources importance and sustainable planning have significant impact in the design of open and green spaces. In the design of these spaces, one of the main topics that needs to be intagrated to design process is ecology. Ecological open and green space design has become crucial expressly in cities due to the impact of increase in population and unplanned urbanization.

Ecological design defines as any form of design that minimizes environmentally destructive impacts by integrating itself with living processes. Ecological design is an integrative, ecologically responsible design disciplin. It helps connect scattered efforts in green architecture, sustainable agriculture, ecological engineering and other fields. It provides specific ways of minimizing energy and materials use, reducing pollution, preserving habitat and fostering community, health and beauty (Ryn and Cowan, 1995).

Urban health should be understood better and ecology should be integrated into planning process in accordance with the criterions in order to sustain the gains, to build up to process of sustainable cities and to reduce the negative effects of urbanizm. In this study, considered the approaches to open and green spaces from the point of their ecologic gains and specified criterions.

Table 1. Comparison of Conventional Design and Ecological Design

ISSUE	CONVENTIONAL DESIGN	ECOLOGICAL DESIGN
Role of Nature	Design must be imposed on nature to provide control and predictability and meet narrowly defined human needs	Includes nature as a partner: whenever possible, substitutes nature's own design intellicence for a heavy reliance on materials and energy
Underlying metaphors	Machine, product, part	Cell, organism, ecosystem
Level of Participation	Reliance on jargon and exoerts who are unwilling to communicate with public limits community involvement in critical design decisions	A commitment to clear discussion and debate; everyone is empowered to jion the design process
Types of Learning	Nature and technology are hidden; the design does not teach us over time	Nature and technology are made visible; the deign draws us closer to the systems that ultimately sustain us
Response to Sustainability crisis	Views culture and nature as inimical, tries to slow the rate at which things are getting worse by implementing mild conservation efforts without questioning underlying assumptions	Views culture and nature as potentially symbiotic; moves beyond triage to a search for practices that actively regenarate human and ecosystem health

Materials and Methods

The main material of the study is concept of ecology and open-green spaces. In this context, materials include theoretical foundations of materials, Turkish and foreign literature concerned with method and results.

The ecological approach has been adopted in this study. Criterions are determined for sustainability of open-green spaces with ecological point of view.

Results

Ecological criterions in the design of open and green spaces related with important goals. In the study these designated goals are; preserving natural resources and energy efficient design. The main philosophy of preserving natural resources is to increase the welfare of the human being by using topografic structure, sunshine, wind, humidity, soil and flora. Energy efficiency is the goal to reduce the amount of energy required to provide products and services (URL-1). All these goals are the conditions that people appropriate oneself to pay of minimum amount of energy. İt is obvious that, it can be contribute considerable benefits to country's economy, aesthetic and health when to take notice of ecological design ciriterias.

Within this study, to achieve the goals in open and green spaces, improvable criterions has specified under two headings: structural applications and plant applications.

Table 2. Ecological Criterions for Structural Applications

Applications	Ecological Criterions
Structural Applications	Designing of structures with simple type and compact form Routing of structures with optimal configuration Resistant and low heat absorption surface coatings Using of renewable energy sources Choosing appropriate land and utilizing the topography correctly Waste decomposition Biogas production Automatic watering systems Rain water storage Economical lighting systems and solar lambs Increasing bike roads

Designing of structures with simple type and compact form is important for energy conservation. Structures must be formatted as to provide the minimum heat gain on hot days and maximum heat gain on cold days. Spaces should be as small as possible by using efficiently and should be large enough to meet users needs.

Routing of structures with optimal configuration adds ecological characteristics to structures. Spaces locations must be determined according to level of heat needing

Surface coating materials properties, especially thermal properties, influence energy consumption greatly.

Structures with high thermal performanced surface coatings preserve energy and therefore they are energy efficient structures. Using resistant materials in buildings, makes it more resistant and longevous to various factors. Resistant materials will delay the renewal requirements, thus provides resource efficiency.

Renewable energy utilization in structures with passive and active methods are solar and wind energy, geothermal energy, hydrogen and biomass energy. (Esin and Yüksek, 2009). Using of this kind of energy is less polluting than other types of energy to the environment and reduces the needs for limited resources.

Location of structure is a determining factor of solar radiation, air temperature, air movement, climatic elements and micro-climate conditions. Mass of cold air in the winter and mass of hot air in the summer are collected in pit and flat areas. In sloped lands, gained solar energy decreases in summer and increases in winter. Slope of the land, sunny hours and latitude of the land is an important factor for thermal issues (Olgyay, 1973; Altunkasa, 1987; Yeşilkaya, 2005; Yılmaz, 2005).

Energy conservation with an appropriate design by increasing solar gain is possible. Under construction with minimal excavation is used for preserving the topography, surviving habitats and sustainability of natural contours.

Attempt reducing water consumption, storing runoff water for use in irrigation and measures such as re-evaluation of the purified waste water may increase the effectiveness of water in the natural resource conservation targeted design (Calkins, 2005). Provision of re-use by decomposing solid waste the ecological footprint can be reduced. Household waste and garden waste should be considered as compost, it also being provided recovery which avoids the use of chemical fertilizers and soil quality can be maintained, as well. (Calkins, 2005).

Biogas is considered to be a renewable source of energy. Since it often produced from materials that form sewage and waste products, the only time it will be depleted is when we stop producing any waste. It is also considered to be non-polluting in nature. The production of biogas does not require oxygen, which means that resources are conserved by not using any further fuel (URL-2).

Water efficiency can be achieve with water-efficient irrigation projects in open and green spaces. Water consumption can be reduced effectively by designing efficient automatic watering system. Energy conservation will be greatly when lighting systems with renewable energy is available.

Transportation network for access to open-green spaces and in these areas, harmful effects of vehicles to the environment will be reduced by increasing the use of bicycle paths.

Table 3. Ecological Criterions for Plant Applications

Applications	Ecological Criterions
Plant Applications	Selection of native and adapted plants Shading Wind corridor Windbreak Increasing of air quality Preventing of heat island Xeriscape

Sustainability of plants should be provided by selecting native and adapted plants in plant applications. Consideration of prevailing wind direction, selection of suitable plant species and location can be prevented unwanted cold winter winds and refreshing summer breeze effect can be exploited. Windbreaks with shrubs and trees also provides shading when they reach sufficient height. One of the most important functions of plants to improve air quality and to prevent the formation of heat islands is possible with plant applications.

Xeriscape is defined as "quality landscaping that conserves water and protects the environment." There are seven principles associated with xeriscape: Planning and design, soil improvement, appropriate plant selection, practical turf areas, efficient irrigation, use of mulches, appropriate maintenance (URL-3).

Discussion and Conclusion

Open and green spaces with their intense usage and functions are one of the most important areas fort he city. It is seen that, existing open and green spaces are established without attention of these criterions. While energy consumption, which is one of the prior reasons of global warming, has been reducing, the pressure on alive caused by impurity can be also reduced at the same time in open and green areas that designed by clarified ecological criterions. Consumption of natural resources will be reduced and the quality of existing resources will be protected.

The ecological approach identified in the study is also effective in providing bio-comfort in open and green spaces. In order to ensure the bio-comfort in spaces, environmentally damaging methods are used. It is impossible to mention about ecology, sensivity and sustainability at the areas which is been using harmful methods to the environment or cannot be provided bio-comfort. Natural bio-comfort is in an inverse relationship with the ecological pressure. All targets and criterions which are needed to improve living conditions would be possible with ecological approach.

If we are to create a sustainable world – one in which we are accountable to the needs of all future generations and all living creatures – we must recognize that our present forms of agriculture, architecture, engineering and technology are deeply flawed. To create a sustainable world, we must transform these practices. We must infuse the design of products, buildings, and landscapes with a rich and detailed understanding ecology (Ryn and Cowan, 1995).

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Post-Harvest Usage of Invasive Aquatic Weeds for Economic Profit

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Abstract

Aquatic weeds are the plants which live in, on or edge of the wetlands. These plants are natural parts of aquatic systems. Aquatic weeds are divided into four categories based on their growth form and features: free floating, rooted floating, submerged and emergent plants. They constitute a great feeding and breeding storage and habitat for other living aquatic forms. Aquatic weeds can be tolerated when they are in small numbers. Nevertheless, particularly in summer, by their invasive character, they have such an excessive growth that they become a nuisance. Uncontrolled amounts of these plants may cause eutrophication and serious damages by blocking sun lights into water. Controlling these weeds is relatively easy in small amounts of water such as little ponds. However, it is quite difficult in larger ponds, lakes and wetlands. Harvesting is an effective mechanical control method for aquatic weeds with periodically repeats. On the other hand, a large amount of plant waste appears after harvesting. The usage of these wastes is important for environmental protection, not to mention the economical profit potential it holds for local communities.

In this study; aquatic weeds' threats, the control methods of these invasive species and different utilizations of post-harvesting wastes of these aquatic weeds will be investigated. In local and global scales; multiple samples from different industries for post harvesting utilization of these weeds will be presented and discussed through economic and environmental perspectives.

Keywords: Aquatic weeds, post- harvest usage, wetlands, economic profit

Introduction

Water is the most important life source for all living beings throughout earth. The existence of many life forms is directly related to the existence of fresh water. Nevertheless, towards recent years of 2000's, global warming conditions, uncontrolled growth of industrialization and urbanization have formed a mass pressure in natural resources, especially to the fresh water supplies. Today, degradation and pollution of fresh water resources is a very significant problem in many areas of the world. This is because accessing, keeping and using the fresh water for surviving is now more difficult and more important than before.

Access to safe freshwater is now regarded as a universal human right (United Nations Committee on Economic, Social and Cultural Rights, 2003) and the Millennium Development Goals include the extended access to safe drinking water and sanitation (UNDP, 2006). Sustainable management of freshwater resources has gained importance at regional (e.g., European Union, 2000) and global scales (United Nations, 2002, 2006; World Water Council, 2006), and 'Integrated Water Resources Management' has become the corresponding scientific paradigm (IPCC, 2007).

On the other hand, except the human-induced wastes, some elements of nature like aquatic weeds may constitute a threat for clean water resources. Controlling the growth and the sprawl of these aquatic weeds/aquatic plants has a significant importance in especially tropic and semi-tropic regions which are already difficult to reach and keep fresh water supplies.

Aquatic weeds are typically categorized into four main groups depending on their growth habit. These are: emergent, free floating, floating leaf and submerged weeds. Emergent weeds have both the stems and leaves above the waterline and often grow on the fringes of ponds and waterways. Free floating weeds are not attached to the soil in any way but can still have root systems. Floating leaf weeds are rooted into the soil with long stems that stretch to the water surface where the leaves float. Submerged weeds are rooted into the soil and all parts of the plant are completely submerged under the water. (Blanchard et al, 2009).

Advantages and disadvantages of aquatic weeds in aquatic systems

Aquatic plants are the essential components of healthy aquatic systems. Like all plants they photosynthesize; they transform CO_2 to O_2 and they use the sun, water and many elements for proliferation.

The roles of aquatic plants for aquatic environments may be listed as below;

1. Microscopic plants (algae) form the base of the aquatic food chain. Also called "phytoplankton" (or, plant plankton), these plants are eaten by zooplankton (or, microscopic animal plankton). In return, zooplanktons are eaten by small fish, which are eaten by larger fish, and so on up the food chain to humans and other top predators.

2. Larger algae and flowering plant (macrophytes) provide habitat and shelter for fish, fish food organisms, waterfowl, and other wildlife.

3. Macrophytes provide food for insects, waterfowl, and mammals such as musk-rats and beavers. However, bass, bluegill, and catfish do not, as a rule, eat macrophytic vegetation.

4. Since all plants, including those that grow underwater, produce oxygen as they photosynthesize, they are the major source of oxygen for aquatic animal life.

5. Rooted plants stabilize shorelines and bottom sediments. They absorb nutrients and filter pollutants from runoff, which improves water quality.

6. A diverse aquatic plant population adds beauty to a water body. Many people recognize and appreciate the aesthetic value of aquatic vegetation, whether in a backyard fishpond, around a retention pond, or along the shoreline of a large lake (Lembi, 2009).

By these benefits on aquatic systems and their aesthetical visual qualities, they are mostly preferable plants for ponds and wetland management plans. Otherwise they can still compose many undesirable problems for the fresh water resources which are also aquatic systems. As a known fact, the water loss by transpiration on the plant bodies is caused by a loss of clean water and in addition certain aquatic plants which have an invasive character may increase in excessive amounts.

Excessive aquatic plant growth can lead to several common problems which can be listed as such:

1. Too much vegetation can impair recreational activities such as swimming, fishing, and boating.

2. Excessive plant growth can provide an excessive degree of shelters for small fish and reduce predation. This leads to an overpopulation of prey fish.

3. An overabundance of aquatic plants and algae can reduce oxygen levels in the water, which can contribute to fish kills. Vegetation-related fish kills can occur in the summer or winter.

4. Certain algae impart foul tastes and odors to water. This is an extremely important concern for the managers of municipal and private drinking water sources.

5. Excessive plant growth can impede water flow in drainage ditches, irrigation canals, and culverts and cause water to back up.

6. Excessive plant growth can trap sediment and debris, gradually filling in bodies of water. When the plants die and fall to the bottom, they accelerate this process.

7. Aquatic weed growth can provide the quiet water environment that is ideal for mosquito larvae development.

8. Excessive plant growth lessens aesthetic appeal and lowers property values.

9. Invasive plant species such as Eurasian water milfoil and purple loosestrife can completely destroy stands of native vegetation. This can have adverse effects on the animals that depend on the native vegetation for habitat and food (Lembi, 2009).

In order to prevent these negative effects of uncontrolled aquatic weeds, some control methods can be used in aquatic systems such as ponds or wetlands.

The most effective control methods for aquatic weeds are; (i) Dredging and deepening the pond, (ii) Harvesting (manual or mechanical removal) weeds, (iii) Manipulating water levels, (iv) Shading, dyeing, (v) Installing pond bottom liners, (vi) Using biological controls, (vii) Using chemical controls (Helfrich, 2009).

Different control and treatment methods are suitable for different aquatic weed species due to their presence places in aquatic systems (Shelton and Murphy l989). Economic considerations and local environmental conditions are the other circumstances for selecting control methods. By considering sensibility of the aquatic systems, chemical uses may not be appropriate solution for controlling aquatic weeds. Mechanical control methods can be preferred for keeping aquatic systems healthy. On the other hand, the mechanical control methods-harvesting has a negative aspect. After removal, a huge quantity of plant waste generates another pollution danger for environment. Creating different possibilities for post-harvest usage of these wastes with ecological and economical perspectives will be a big step for sustainability of wetlands, ponds and lakes.

Post-harvest usage of invasive aquatic weeds

Aquatic plants have different ingredients changing with different species but commonly; they have a little amount of protein, carbohydrate and a big cellulose percentage. They have an oil ratio changing between 0 .63% and 0.20% dependent to the species (Saka et al., 2014). These ingredients ranges makes aquatic weeds profitable for post-harvest utilizations. There are many possibilities of post- harvest usage for economic income.

Possible uses for aquatic weeds (example: Water Hyacinth) are;

a. **Paper:** Water hyacinth fibre alone does not make a good quality of paper. To make a good paper blending of waste paper or jute is necessary.

b. **Fibre Board:** Physical properties of water hyacinth based fibre board are sufficiently good for partition wall and ceiling.

c. **Yarn & rope:** The fibre from the stems can be used to make ropes.

d. **Charcoal briquetting:** For a plant to produce 40 tons per day briquetting an area of 12 hectares would be required for drying of water hyacinth, daily requirement 1300 tons of wet water hyacinth, relatively high temperature with low humidity.

e. **Bio-Gas/Bio-diesel:** Testing is going on for producing bio-gas from water hyacinth. There is still no firm consensus on the design of an appropriate water hyacinth biogas digester (Das, 2011). In one study; the potential of biogas production from water hyacinth, water lettuce and water fern is examined (Enaboifo and Izinyon, 2013). The purpose of another study was to review the energy situation in Zimbabwe as well as the possibility of producing biogas from water hyacinth. In this study it was found out that the option of biogas production as a way of energy exploration using water hyacinth may not only sustain the energy availability but also improve environmental sustainability by improving the social, economic and physical well-being of the environment (Kunatsa and Mufundirwa, 2013). In another study the fatty acid compositions and oil ratios of some aquatic plants have been investigated for comparing with the bio-diesel proparation plants like sunflower, canola, etc. As a result, the oil ratios of aquatic plants were found to be very few but their compositions were as good as energy plants (Saka et al, 2014)

f. **Animal Food:** A study was conducted to explore the fatty acid composition of four aquatic weeds, namely *Salvinia cuculata, Trapa natans, Lemna minor* and *Ipomoea reptans* collected from water bodies of Assam, India. It has been observed that C24:1 (Cis-15 Tetracosenoic acid) followed by C16:1 n-3 (9-Hexadecenoic acid) are the predominant fatty acids in these aquatic weeds and among them, Ipomoea reptans and Trapa natans contain higher proportions of C18:2 and C18:3 PUFA. The ratio of saturated fatty acid to unsaturated fatty acid is extremely low in the case of all four plants and they contain a predominant proportion of highly unsaturated fatty acids (HUFA), essential for the growth and proper performance of fish (Mukherjeea, 2010). Approximately same results have been obtained in phytoremediation plants project in İzmir, Turkey, too; once again revealing the low oil ratio with a good fatty acid composition (Saka et al, 2014)

Conclusion

In the end, it is possible to say that the aquatic plants are double sided plants. They are an indispensable part of natural aquatic systems. They clean the water, they make a shelter for other living forms and they feed them. On the other hand, they duplicate their green parts in a couple of days. With their incredible growth, they shade and corrupt the chemical composition of water. They may cause a total loss of all living forms in an aquatic system. This is because controlling aquatic weeds is indispensable in fresh water resources in order to protect the spill. The mechanical control is the most preferred and costly effective control system, however, it can also cause a huge plant waste and an environmental problem. Recycling these plant wastes for paper, furniture, animal food, yarn and rope, biogas/bio-diesel production or charcoal briquetting and fibre board preparation is an economic solution with many benefits for environmental production. These recycling projects can be useful especially in the drought areas which cannot tolerate any loss of water. As seen in this research it is possible to gain economic incomes while protecting the environment and wild life.

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Miniaturk Recreation Area and the Evaluation of User Views about Miniaturk's Landscape

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Abstract

Miniature park consists of small scale models of buildings and attractive landscaping areas.Miniature park is located within public open green spaces and didactic functions in addition to provide recreational activities. Miniatürk is the first miniature park in Türkiye. his area is 60,000 m2 width and 02.05. Was opened to visitors in 2003.In this area, which is an open air museum, Turkey and the Ottoman geography selected from 122 works are on display.There are different areas such as, a small shopping center, a playground, train, chess and maze area etc. except for the model area for visitors.Model areas and other sections designed in conjunction with each other is a small landscape areas. In this study, visitor's reviews for the field of landscape features of Miniaturk that importance as a showcase of Turkey were evaluated. The questionnaires were applied to 100 selected visitors randomly. The area of landscape persperctives and the general expectation of visitors has been evaluated and made recommendations.

Keywords: Miniaturk, recreation, landscape, user view

Introduction

A miniature park is defined as a landscape space where miniature buildings or models are displayed and it is open to the public. Like all public green spaces, miniature parks meet the recreational needs of the visitors and support their development with the didactic and informative outdoor museum characteristics. There are approximately 35 miniature parks all around the world. First miniature park was put into service in 1929 in Bekonscot, in the northwest of England. Then followed Madurodam, Netherlands. Some miniature parks serve with didactic and informative purposes while some serve commercially as private business like Disneyland, which was put into service in 1955. In Turkey, Miniaturk, which includes the works bearing the traces of a 3000-year history from ancient age to Byzantine and from Seljuk to Ottoman, was opened 11 years ago, in 2003, at the shore of Golden Horn by Istanbul Buyuksehir Belediyesi Kultur A.S (Istanbul Metropolitan Municipality). With the models added in recent years, the total number of works displayed is 126 (Osmanoğlu 2005., Türeli 2006., Kutay ve Kesim 2008., URL-1., URL-2., URL-3).

The aim of this study is assessing the viewpoints of the visitors of mentioned miniature park which receives thousands of tourists per year and has gradually rising importance. In addition, the study specifies negative and positive sides of the area in terms of landscape   and brings forward suggestions.

Materials and Methods

The working site of the study is Miniaturk (Figure 1). Miniaturk, is situated in Sutluce, Istanbul, parallel to the north shore of Golden Horn. It covers a total area of 60.000 m^2 with 15.000 m^2 of model area, 40.000 m^2 of open space, 3.500 m^2 of covered area, 2.000 m^2 of pools and waterways and a parking lot with a capacity of 500 vehicles. The park contains 126 pieces of 1/25 th scale models picked from Turkey and Ottoman territories. 59 of these structures are from Istanbul, 55 from Anatolia and 12 from Ottoman territories that today lie outside of Turkey.

Figure 1. A view of the working site (URL-4).

There are 3 main parts in Miniaturk where significant structures from Anatolia, Istanbul and Ottoman architecture are being displayed. These parts are separated by small landscape spaces and the visitors are guided by a route that enables visitor circulation in the park. In addition to models displayed in a concept of outdoor museum, different spaces are designed for the visitors in order to make them spend good time in Miniaturk. An amphitheater with a capacity of 400 people, shopping center, helicopter tour simulation of Turkey- Istanbul, Miniland playground for children, excursion train, the storytelling tree, chess and maze are some of these spaces (Kutay ve Kesim, 2008., URL-4., URL-5).

Survey method was used in order to assess the perception of visitors related to Miniaturk's landscape and develop suggestions. Surveys were applied to randomly picked 100 people face to face between the years 2013-2014 from May to July. SPSS analysis software was used to evaluate the survey results.

Results

Visitor profile

Visitor profile according to survey results is summarized in Tablo 1. It is understood that 52 % of the visitors are female and 48 % are male. The majority of the visitors, with a rate of 28 %, are between the ages 21 and 30. A minor group, with a rate of 5 %, consists of those who are between the ages 61 -70 and over 70. When their educational status is analyzed, the results show that 32 % are postgraduate, 23 % are university, high school and their equivalents graduate and 3 % are illiterate.

The survey figures that the visitors of Miniaturk are of different occupational groups. The majority, with a rate of 34 %, are of students, 22 % from private sector, 11 % retired, 10 % public servants, 9 % self-employed and 8 % housewives and from other occupational groups. Workers form the smallest group with a rate of 1 %. In terms of level of income, 33 % of the visitors earn more than 2000 ₺, which is the highest rate. Minimum income is stated to be between 201 and 500　₺　with the rate of 6 %.

Tablo 1. Visitor Profile of Miniaturk

Age (%)								
Unanswered	10 years under	10-20 years	21-30 years	31-40 years	41-50 years	51-60 years	61-70 years	70 and over
-	5	12	28	19	12	14	5	5
Education level (%)								
Unanswered	Illiterate		Primary school	High school	Vocational school	University		Postgraduate
	3		9	23	10	23		32
Occupation (%)								
Unanswered	Worker	Civil servant	Retired	Self employed	House wife	Student	Private	Other
-	1	10	11	9	8	31	22	8
Monthly income (%)								
Unanswered	101-200 ₺	201-500 ₺	501-1000 ₺		1001-1500 ₺	1500-2000 ₺		2000 ₺ and more
-	10	6	7		14	30		33

Visitors' opininon about Miniaturk's landscape

According to frequency of the visit results most of the visitors, with a rate of 76 %, visit the park for the first time. 13 % state that they visit for the second or third time. On the other hand, 6 % of the visitors state that they frequently visit the park. Most of the visitors, 48 %, state their reason for visit as curiosity; 35 % on recreational purpose and 17 % as group guides.

While 77 % of the visitors state that they know what landscape means, 14 % say "partly" and 9 % have no idea about landscape. 59 % like the landscape where 39 % say "likely". However, 2 % of the visitors state discontent about landscape.

Positive and negative sides of the landscape is also assessed through the survey. The results reveal that the most positive aspect, with the rate of 59 %, is the opportunity to see all historical structures in Turkey at a time. 28 % of the survey participants state that the models successfully resemble the real ones. 13 % state the ratio between the use of models and plants to be balanced. As for the negative sides, insufficient shade elements get the highest rate, 31 %. Respectively the other negative aspects can be listed as, irregular positions of models and insufficient use of plants, 23 %; insufficient use of outfit elements, 21 % , and   models' not reflecting the characteristics of the real ones, 2 %. When the participants are asked about the maintenance of the park area, 53 % states "sufficient", 23 % "partly sufficient" and 24 % "insufficient".

As for the suggestions about the landscape of the park, 60 % suggest that more shade elements and more scanted tree species should be used. 22 % suggest that the park should have more frequent rest areas on the excursion route. 10 % suggest a larger parking lot and 8 % suggest playgrounds for children. 84 % of the participants find Miniaturk-like places useful. However, 13 % state it to be partly useful and 3 % useless.

Discussion and Conclusion

Here, the visitor profile of Miniaturk has been studied and positive and negative aspects of the park have been evaluated in parallel with the visitors' opinions.

It has been understood from the survey results that majority of the visitors are female and the visitors mostly consist of university and high school students. The survey reveals that females have much time on week days for visit when compared with males. It also figures that students form the most crowded visitor groups since they mostly have the opportunity to visit the park

with school tours in crowded groups. The results also show that most of the visitors visit the park for the first time. This is particularly due to the curiosity of inhabitants of other cities and foreign tourists against Miniaturk.

That the models in Miniaturk are not classified according to historical, functional or regional characteristics cause some perceptional problems (Kutay and Kesim 2008). Indeed, our study reveals that the visitors are aware of what landscape is and they state their discontent about the landscape of the park. However, they consider finding the opportunity of seeing all historical structures in Turkey at a time as a positive aspect. On the other hand, the participants find irregular positions of models as a negative aspect.

Insufficiency in shrub use between the models in terms of quality and quantity causes deficiency in being verisimilitude in terms of model-surface balance (Ozdemir, 2004; Kutay and Kesim 2008). Hence, in our study the visitors state lack of shade elements such as plants and rarity in rest areas on the excursion route to be negative aspects.

Consequently, when Miniaturk, which is a center of attraction not only for domestic but also foreign tourism, is evaluated in parallel with the visitors' opinions, it is obvious that some problems are waiting to be solved. To that end, particularly a re-planning of the models to form a circulation is suggested. Balance between vegetative and structural materials should be established. In addition, plant materials that will cast shadow and outfit elements that will provide visitors with recovery opportunities should be sufficiently included. Besides, expanding examples of such designs nationwide would be useful and is suggested as the general opinion of the survey participants.

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Determining the Recreational Opportunities of Ege University Campus with Regards to the View of Landscape Architecture Students

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Abstract

The aim of the study is to determine the awareness and satisfaction of students towards recreational opportunities at Ege University campus by using an on-site questionnaire. The other main aims are putting forward recommendations for improving the recreational opportunities and determining alternatives. With this purpose, the study is considered in four main sections, namely, data collection, development of questionnaire form, findings, evaluation and synthesis. After an initial search of the literature, a questionnaire form that evaluates the awareness and satisfaction of the students' on recreational opportunities was prepared. In order to compare the awareness level, the questionnaire was conducted to 1st, 2nd, 3rd and 4th year students of Landscape Architecture of Ege University where the period of undergraduate study is four years. "Simple Random Sampling Method" was used in determination of the number of the students on which questionnaire would be conducted, 95 % confidence level and 5 % sampling error were taken as basis in the calculations. In the calculation, according to the total number of students which is 305 was used as "Population Size (N)" and the number of students on which questionnaire would be conducted was determined as 217 at the end. It was aimed to put forward the students' awareness and satisfaction of the subject by means of these questions. The literature studies on the subject and the information found from the questionnaires were analyzed and finally, recommendations to improve the existing opportunities and to create new opportunities for the research area were made.

Keywords: Recreation, awareness-satisfaction, Ege University, campus, Izmir

Introduction

Recreation is an event which a person re-accesses his / her deteriorating integrity with desired activities in order to live a healthy life and to work efficiently (Özkan, 1981). All of the factors performed for the purpose of reaching recreation, or in other words, brought people recreation are called recreational activity (Özkan, 2001). Recreation activities that are originated by human and these human-made actions are classified in various ways depending on time, place and also on many different features (Müderrisoğlu and Uzun, 2004). Regardless of their definitions and types, recreational activities are considerably important for individual and community health in terms of psychological, social and physical aspects. For this reason, recreational areas and activities integrated into our daily occupation fields shape the lives of individuals and also support their developments.

Recreations of university youth and their participations to recreational activities take place within the scope of the possibilities offered to them by universities in a semi-organized manner during their graduate educations. In this regard, universities are also able to assume a directive position to make their students' extracurricular time well (Balcı, 2003). Social and cultural activity areas in educational institutions, that shape the future of societies and train qualified individuals, are places in which students with different cultural, ethnic and social structure spend most of their extracurricular times throughout education process, and hence are of vital importance for their social interactions and developments (Erçevik and Önal, 2011).

This study had the following purposes: to determine the awareness and satisfaction of students towards recreational opportunities at Ege University Campus, to determine the problems about the existing recreational facilities of the study area, to put forward recommendations for improving the recreational opportunities, to determine the alternatives for creating the new recreational opportunities, to guide the universities which have the similar features.

Material

The main materials of the research are the outdoor and indoor places within the boundaries of the Ege University Campus as well as recreational opportunities provided by these places. Ege

University is located in Izmir Bornova province, and consists of indoor and outdoor places that are being used for the purpose of education, culture, sports, and social services etc.

Today, there are 14 Faculties, 9 Institutes, 6 Academies, 1 State Turkish Music Conservatory, 8 Vocational Schools, 5 Departments and 27 Application and Research Centers of Ege University. As of 2011-2012 academic year, Ege University has a total of 50,993 students, including 46,245 undergraduate-graduate students and 4,748 post graduate students as well as more than 3,135 academic and 4,000 administrative staff (Ege Üniversitesi, 2014). In addition to the research area, literary and visual sources related to the subject, layout plans and maps belonging to the research area, originally prepared questionnaires for the research, statistical software used for analyses and graphical presentations comprise the other research materials.

Methods

Research method is formed of four main stages as subject/problem identification, data collection, findings and analysis, conclusion and suggestions. In the first stage, previous scientific studies related to the subject were examined by drawing a conceptual and theoretical framework regarding the research topic. Within this scope, research method was determined and data collection phase as the second stage was started. In this stage, Ege University was investigated with the aspect of recreational opportunities; the outdoor and indoor places within the campus and also educational, socio-cultural and sporty-based recreational opportunities provided by these places were specified. In the second part of the data collection stage, questionnaires which would be performed on students were prepared and trial questionnaires were conducted. Questionnaire form was finalized in accordance with the feedbacks derived from the trial questionnaires and the aforementioned questionnaires were carried out to all grades from first to fourth. "Simple Random Sampling Method" was used in determination of the number of the students on which questionnaire would be conducted, 95 % confidence level and 5 % sampling error were taken as basis in the calculations. In the calculation, according to the total number of students which is 305 was used as "Population Size (N)" and the number of students on which questionnaire would be conducted was determined as 217 at the end. The findings obtained as a result of data collection were computerized in the findings and analysis stage of the research. Statistical analyses of the data derived from the research were completed by producing data sets with the help of SPSS V.22.0. In the last stage of the study, suggestions are given to improve the existing recreational opportunities and also to offer new alternatives.

Findings

During data collection within the research, the overall analysis of Ege University campus was primarily performed. The data obtained in this context is listed below;

▪ It was established on about 3700 acres area having a flat topography within the borders of Bornova district in 1955. Due to growth of the city, the campus has currently been located in the city center and also in the intersection of Ankara-Istanbul itineraries. Due to these roadways, the campus has exhibited a quadripartite structure. It has a dispersed settlement model and considering the neighborhood relations, development opportunities of the campus are limited.

▪ The campus has a multidisciplinary academic structure and there are numerous faculties, (Medical, Agricultural, Science, and Engineering etc.), high schools, vocational training schools, departments, institutes and research - application centers.

▪ Of the transportation types; underground, bus, taxi, private vehicle, and bicycle transportations are all available in the campus that has an organic relation and a nested structure with the city in terms of benefitting from there. From the aspect of activity areas, it contains a wide variety of opportunities such as, education - teaching - research, management, shelter (Credit and Hostels Institution, Student Village, Staff Housing), socio-cultural facilities (Green Pavilion, 55 Ege Winter Garden, Cinema Campus, etc.), sports, health, shopping, eating-drinking (dining halls and cafeterias), production and so on.

▪ The works of repair and restoration of old buildings and incorporation of new recreation areas according to the requirements have been carrying on throughout the campus that has been mostly complete its development process.

The findings obtained as a result of the questionnaire study are listed below;

▪ The questionnaire was conducted with 217 students (78.8 % female, 21.2 % male) in the Landscape Architecture Department of Agriculture Faculty in Ege University. A total of 13 questions in the type of multiple-choice, open-ended and conditional were posed to the students who participated in the questionnaire. The distribution of each grade respondents was carried out proportionally and homogenously according to their class sizes. 26.3 %, 21.2 %, 25.3 % and 27.2 % of the attendees were formed of respectively first, second, third and fourth grades.

▪ The distribution of the students based on their residence statuses varied as 14.3 % Credit and Hostels Institution, 45.2 % student house, 24.4 % with their family, 5.1 % E.U. student village, 9.2 % private hostel and 1.8 % other. Also, it was determined that the majority having 77 % percentage came to Izmir for the purpose of university education and that 88.9 % of the students were living apart from their family.

▪ 33.6 % of the students stated that they can conveniently access to the recreational facilities across the campus and 51.2 % of the students responded the question as partially.

▪ The answers to the question of "how user profile of the recreational facilities across the campus should be" were distributed as; 50.2 % student and academic staff, 28.0 % only students, 19.4 % combination of students, academic staff and citizens.

▪ It was determined that the majority of the participants with the rate of 68.7 %, responded the question whether or not there was any place whose absence being felt in terms of recreational facilities across the campus as "none", and rest of the students pointed out that the place / facility whose lack felt mostly was a concert area. Also, they underlined the issue of increasing need for the opportunities as pharmacy, outdoor museum, outdoor library, aquapark, pond, ice skating, resting areas, closed spaces, shaded areas and transportation. For the lacking recreational opportunities/places that were listed above, 53 % of the students indicated that they benefit from the city, 38.5% occasionally use urban opportunities and 8.5 % do not take any advantage from the city. When the responses to the posed question regarding "whether or not there was any problem experienced in terms of benefitting from recreational opportunities across the campus" are examined, it has been seen that the great majority with the rate of 80.6 % stated that they did not have any difficulties. Besides, the most given answers by the rest of the students were; because of being unaware of the activities, not having enough time, by the reason of activities' coinciding with course hours and due to financial impossibilities.

▪ In the 10th question of the form, 40 education, socio-cultural, sporty based recreational opportunities / facilities within the borders of campus were listed, and the students were asked to evaluate each item from the aspects of awareness and usage state, the reason if it is not being used, frequency of use and qualification status. According to this, the vast majority of the participant students between 96 % and 100 % indicated that they are aware of Botanical Garden, Indoor Swimming Pool, Indoor Gym, Library, Green Pavilion, Cinema Campus, Botanik Cafe, Ziraat Cafe, Forum Bornova Shopping Center, Kipa Shopping Center and large lawn sitting areas. The least known places among the listed ones are found to be hobby gardens (29.4 %), Ord. Prof. Muhittin Erel Lecture Amphitheatre (25.6 %), May 20 Amphitheatre (25.9 %), Republic Educational and Cultural Center (15.7 %), Kort Cafe (24.2 %), Wellness trail (28.2 %).

▪ When the reason of some places that are already known but not being used was investigated, it was observed that sporty based places such as particularly indoor and outdoor swimming pools, indoor gym and tennis courts etc. are not being used due to lack of time and lack of interest about the sports activity; the socio-cultural based places such as 20 May Lecture Theatre, Republic of Education and Culture Center, Culture-Art House etc. are not being used due to lack of any organization in those places or students' not being informed about organizations; many cafes such as Lal Cafe, Campus Cafe etc. are not being used because of their far location to the border of Agriculture Faculty; the education and culture based places such as Ethnography Museum, Museum of Paper and Book Arts etc. are not being used due to the fact that the students' not having any opportunity yet, lack of time or the places' not being interesting and also the Guest House was stated as not being used since it was not needed yet. It was determined that the most frequently used place among the aforementioned places was Ziraat Cafe (every

day) with the rate of 65.5 %, the cafeterias were the most used places by students across the campus and the other sporting, educational and socio-cultural based places were substantially used (60 % - 85 %) once or twice in a year. Among the listed places, Forum Bornova Shopping Center (70.4 %) and Kipa Shopping Center (73.5 %) were mostly found sufficient by students. Levels of other places' competence were close to each other and varied between 40 %-50 % as satisfying or partially satisfying. It was specified that the most insufficient places across the campus were student shopping center (23.3 %) and Cinema Campus (20.1 %).

▪ In the question which examined the overall level of recreational opportunities of the campus, 46.5 % of the students gave 3 and 35 % gave 4 points out of 5. The rate of the students who gave full points to the question was limited to 5 %.

Discussion

As a result of the study;

▪ It has been concluded that, among the recreational opportunities of the campus, the students have high awareness for the opportunities that are located close to their faculties and on the other hand an opposite status is valid for the places that serves for preprogrammed activities.

▪ It was determined that the students have satisfaction about the overall recreational facilities of the campus; but also it has been concluded that, even though they are satisfied, they still spend most of their spare times left from the educational activities at the cafes, whereas they spend very limited or none of their time for the sporty or socio-cultural activities. Also the participants have indicated; the outdoor recreation spaces are the most needed ones among the lacking spaces, the negative effects of climatic factors should be disposed and the accessibility problems of the campus should be solved.

Concordantly, even though there are enough recreative opportunities in the campus, it is obvious that there should be more effort to incite the students to attend recreational activities. Considering students' responses as "they use the places close to their faculties, they don't use the places around the Medical School and the reasons why they don't use some places are the distance and the lack of time"; it can be concluded that the transportation-access systems within the campus should be re-organized and also the required solutions should be put forward to improve pedestrian comfort. On the other hand, the socio-cultural activities shouldn't be limited only to Spring Fests but instead those activities are needed to be allocate homogeneously over the year and also for students to be aware of these activities, more effective announcement system than the current one (hanging the announcements on limited number of information-communication boards etc.) is needed to be performed. The recreational facilities and the amenities on the campus are needed to be introduced especially to the preparatory and first grade students within the framework of the orientation program and studies on promoting the recreative opportunities instead of educational facilities to the students are need to be organized. Furthermore it is so important to increase recreational activities on the unused/less used outdoor spaces and to revise all the outdoor spaces on the campus to ensure climatic comfort.

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Determination of Nutritive Value of Sweet Potato Aerial Parts and Some Associated Weed Plants in Potato Fields

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Abstract

The objective of this study was to determination of nutritive value and metabolizable energy of sweet potato aerial parts and some associated weed plants in potato fields. The samples of sweet potato aerial parts and its assotiated weed plants were taken randomly from 9 potato fields in ardabil province of Iran. The associated weed plants that investigated were Redroot pigweed (*Amaranthus retroflexus),* Commom lambsquarters (*Chenopodium album*) and European bindweed (*Convolvulus arvensis).* Samples of whole of aerial parts and each of associated weed plants were analyzed for dry matter, organic matter, crude protein, ether extract, and ash content by proximate analysis and for oranic matter digestibility (DOM) and metabolizable energy (ME) content by gas test method. The protein content of commom lambsquarters were significantly higher than other plant samples in potato feilds (P<0.01) but the highest DOM was observed for european bindweed (P<0.01). Also, the metabolizable energy content was sinificanly higher in european bindweed samples (P<0.01). The results showed that the aerial parts of sweet potato and the associated weed plants have the relatively high dry matter digestibility that indicate their high nutritive value.

Keywords: Nutritive value, sweet potato, aerial parts, weed plants, potato field.

Introduction

Sweet potato is one of the five most important food crops in the world (Phuc et al., 2001). Traditionally, sweet potato was grown exclusively for the production of the tubers and the aerial parts was considered as a waste (Ruiz et al., 1980). But sweet potato can be grown as a dual-purpose crop. The aerial parts of the plant could be fed to livestock, whereas the tubers used for human food (Karachi, 1982). Scott (1992) reported that in developing countries sweet potato vines are mainly used as an animal feed wherever they are produced. Dry matter (DM) production potential per hectare of certain varieties of sweet potato aerial parts can be as high as 4.3–6.0 ton per crop (Dominquez, 1992) with 11–17% crude protein and the digestibility is >62% (Ruiz et al., 1980). Sweet potato forage could, therefore, be an important resource as ruminant livestock feed and some of its characteristics such as high yield, palatability and crude protein content make it a suitable protein supplement for animals receiving low quality forage in the dry season or in the winter (Aregheore, 2004).

weeds are a common component of pasture and crop production fields and limited information is available on their forage quality (Bosworth et al., 1980). The assotiated weed plants in a crop production field may be grazed by or harvested and fed to the animals together with the main crop as a animal feed. Therfore, The objective of this study was to determination of the nutritive value of sweet potato aerial parts and some associated weed plants in potato fields.

Materials and Methods

In 2013, from august to september, the samples of sweet potato aerial parts and its assotiated weed plants were taken randomly from 9 potato fields in ardabil province of Iran. The associated weed plants that investigated were Redroot pigweed (*Amaranthus retroflexus),* Commom lambsquarters (*Chenopodium album*) and European bindweed (*Convolvulus arvensis).* The Samples of whole of aerial parts and each of associated weed plants were analyzed for dry matter, organic matter, crude protein, ether extract, ash content (AOAC, 1990), nutral detergent

fiber (NDF) and acid detergent fiber (ADF) (Van Soest et al., 1991). Digestible oranic matter (DOM), digestible organic matter per dry matter (DOMD), metabolizable energy (ME) and net energy for lactation (NE_l) contents of samples were estimated by the equations that suggested by Menke and Staingass (1988) based on gas production method. for gas production method, samples (200 mg) were weighed into 100 ml calibrated glass syringes with pistons lubricated with Vaseline. Buffered mineral solution (Menke and Steingass, 1988) was prepared and placed in a waterbath at 39 ◦C under continuous flushing with $CO2$. Rumen fluid was collected after the morning feeding from two ruminally fistulated, nonlactating, nonpregnant Holstein cows fed a total mixed ration with forage to concentrate ratio of 60:40 that was balanced based on NRC (2001) recommendations for maintenance requirements twice (7:00 and 18:00 h) daily. Rumen fluid was pumped with a manually operated vacuum pump and transferred into two pre-warmed thermos flasks, filtered through four layers of cheesecloth and flushed with $CO2$. Rumen fluid was added to the buffered mineral solution, which was maintained in a water bath at 39 ◦C, and combined. All handling was under continuous flushing with $CO2$. About 30 ml of buffered rumen fluid was dispensed into syringes containing the feeds. After closing the clips on the silicon tube at the syringe tip, syringes were gently shaken and tubes opened to remove gas by pushing the piston upwards to achieve complete removal of gas. The clip was closed, this initial volume recorded, and syringes placed in a water bath at 39 ◦C. Every 2 h, a gas reading for each syringe was recorded and syringes were gently shaken. Metabolizable energy and digestible oranic matter content were estimated using 24 h gas production as well as the CP, fat, and ash contents of the feeds as described by Menke and Steingass (1988).

The obtained data were analyzed by using the GLM procedure of SAS (2003) as a completely randomized design by following model and the significant differences were declared at *P*< 0.05:

$$y_{ij} = \mu + T_i + e$$

y_{ij} : dependent variable
μ : overall mean
T_i : treatment effect (the plant samples)
e : random error

Results and discussion

There were significant differences between the samples in the chemical composition parameters (P<0.01) (table 1). The relatively low DM content of the aerial parts of sweet potato forage found in this trial is consisted with those of Orodho et al. (1993) and Aregheore (2004). As shown in table 1, all of the four plants had medium levels of CP and commom lambsquarters had significantly higher protein than other plant samples. Protein is essential in all livestock diets, but protein requirement varies with each type of animal, so a diet with 14 percent CP is sufficient to meet protein requirements of nonlactating cows, ewes, does and feedlot lams and calves (NRC, 2001; NRC, 2007). The CP content of the aerial parts of sweet potato measured in this trial is consisted with those of Nicholson et al. (1978) and Aregheore (2004). Low levels of ether extract were measured in the four forage plants but european bindweed had greter fat content than others. Redroot pigweed had significantly more NDF and ADF content than other samples and the lowest NDF content was measured in potato aerial parts (P<0.01).

As shown in table 2, there are significant differences between the samples in the estimated energy content and digestibility based on gas production data (P<0.01). The ME content, and also the NE_l content, in the european bindweed was greater than other forage sources in the potato fields. The highest DOM, also, was estimated for european bindweed. Bosworth et al. (1980) reported that redroot pigweed has 64-73 percent in vitro DOM in different vegetative stages. Dutt et al. (1982) conducted research examining the quality of weedy (contained 15 percent dandelion, yellow rocket (*Barbarea vulgaris*), and white cockle (*Silene latifolia* ssp. *alba*) with the remaining 85 percent consisting of grass and alfalfa) and weed-free hay and the

effects of individual weed species on hay quality. There were no differences in animal intake or digestibility between the weedy and weed-free hay, but crude protein was slightly decreased in the weedy hay.

Table 1. chemical composition of sweet potato aerial parts and some assotiated weed plants

	Potato aerial parts	Redroot pigweed	Commom lambsquarters	European bindweed	SEM	P value
Dry matter	15.20[c]	35.20[a]	23.80[b]	23.20[b]	0.44	**
Orgnic matter	79.66[c]	86.58[b]	80.85[c]	89.88[a]	0.30	**
Crud protein	16.37[ab]	15.16[b]	17.95[a]	14.60[b]	0.68	**
Ether extract	0.76[c]	1.01[c]	2.80[b]	3.66[a]	0.27	**
NDF	34.30[b]	42.40[a]	41.66[a]	36.69[b]	0.47	**
ADF	24.51[a]	24.80[a]	23.93[ab]	22.62[b]	0.46	**
Ash	20.33[a]	13.42[b]	19.15[a]	10.12[c]	0.26	**

ns: not significant, *$P \leq 0.05$,** $P \leq 0.01$
[a, b] Least square means in a in a raw with differing letters differ significantly (P<0.05).

Table 1. matabolizable energy, net energy and organic matter digestibility of sweet potato aerial parts and some assotiated weed plants

	Potato aerial parts	Redroot pigweed	Commom lambsquarters	European bindweed	SEM	P value
ME (MJ/Kg DM)	7.81[c]	9.36[b]	7.99[c]	9.81[a]	0.05	**
NE$_l$ (MJ/Kg DM)	3.91[d]	5.09[b]	4.09[c]	5.42[a]	0.03	**
OMD (%)	54.24[c]	63.75[b]	55.20[c]	66.31[a]	0.35	**
DOMD (%)	44.42[c]	58.46[b]	44.71[c]	59.81[a]	0.29	**

ns: not significant, *$P \leq 0.05$,** $P \leq 0.01$
[a, b] Least square means in a in a raw with differing letters differ significantly (P<0.05).

Conclusion

Based on the obtained results, all forage species in the potato fields had relatively good energy and digestible matter contents. The protein content of commom lambsquarters were significantly higher than other plant samples in potato feilds, but the highest DOM was observed for european bindweed. Also, the metabolizable energy content was sinificanly higher in european bindweed samples. The obtained results showed that the aerial parts of sweet potato and the associated weed plants have the relatively high dry matter digestibility that indicate their high nutritive value. Also, sweet potato forage and other weed plant in the potato fields can provide cheap feed source in the diets of ruminants in combination with other forages.

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Distribution of *Papaver* Species from the Macrantha Section in Ardabil Province of Iran

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Abstract

Macrantha section includes of the *P. orientale*, *P. pseudo-orientale* and *P. bracteatum* species. This study was conducted to study the distribution of these species in Ardabil province of Iran and characterization of them through chromosomal studies.Accordingly, in the spring and summer of 2012 seeds of these species were collected from natural habitats. Survey of different habitats of Ardabil province showed that these species are growing in five regions of this province in the mountains with an altitude of 1749 to 2995. Chromosomal studies on more than 50 plant samples collected from the studied area showed that the chromosome number of the plants are 2n=42 and therefore belong to the *P. pseudo-orientale* species.Only in the Meshgin Shahr region plants were found with the chromosome number of 2n=28, belonging to the *P. orientale*. The results showed that in Ardabil province the *P. pseudo-orientale* is the dominant species of the Macrantha section of *Papaver* genus which has capsules with or without bracts. The cluster analysis of populations divided them into two main groups: G1 population of the *P. orientale* located in the first group and the populations of *P. pseudo-orientale* being in the second group were divided into four subgroups.

Keywords: Biodiversity, chromosomal variation, medicinal plants, papaveraceae,

Introduction

The Papaveraceaefamily polarizes the special attention for its pharmaceutical, ornamental and alimentary valences (Bara *et al.*, 2007). *Papaver* genus with more than 120 species belongs to the Papaveraceae family that due to their numerous and valuable alkaloids are the most important medicinal plants in treatment of chronic pains (Mihalik, 1998). The *Papaver*genus based on morphological traits and capsule characteristics is divided into 11 intra genus sections (Kadereit, 1988). Species of *P. bracteatum*, *P. orientale* and *P. pseudo-orientale* belong to the Oxytona or Macrantha section. *P. bracteatum* is a plant with red petals, with bracteated capsules. The dominant alkaloid in this species is Thebaine. The*P. orientale*has no bracteate but *P. pseudo-orientale*has capsules with or without bracteate and are often confused with *P. bracteatum* (Mihalik, 1998). The *P. pseudo-orientale* is ahexaploid plant with chromosome number of 2n=42, *P. orientale*is tetraploid with 2n=28 and *P. bracteatum* is a diploid species with chromosome number of2n=14 (Lavania & Srivastava, 1999) and the chromosome number is one of the key methods to identify these species from each other. This study was conducted to study the distribution of these species in natural ecosystems of Ardabil province of Iran and characterization of them through chromosomal studies.

Materials and Methods

In order to study the distribution of different species of Macrantha section in the *Papaver* genus in Ardabil Province of Iran, seeds of these species were collected from natural habitats in the summer of 2012. The geographic position and altitude of growing siteswas recorded using GPS device. For chromosome studies, at least 50 plants from each population were used individually to count the number of chromosomes.Plant seeds were soaked for germination in Petri plates on filtered paper, moistened with distilled water in darkness, at room temperature (22-24°C). The root tips were pretreated in 0.05% solution of colchicine for 2.5 h at room temperature before they were fixed in chromic acid -Formalin (1:1 v:v) at 4°C for 25 h. Staining with Hematoxylin has been done as described earlier by Asghari-Zakaria *et al.* (2002).

Chromosome measurements including long arm, short arm, and chromosome lengths, arm ratio index, relative length of chromosome and total form of karyotype (Huziwara, 1962) were

made from 5 enlarged well-spread metaphase cells for each population, using Micromeasure software (Reeves, 2001). The nomenclature of chromosomes followed Levan *et al.* (1964). For grouping of populations based on chromosomal characteristic principal components analysis and cluster analysis based on Euclidean distance and UPGMA method using the MINITAB software.

Results

Investigation of different habitats of Ardabil province showed that *Papaver* species belongs to the Macrantha section, growing in five regions including parts of Khalkhal, Meshghin Shahr, Nir, Hir and Sarein district under special ecological conditions in the mountainous with relatively cold climates and1749 to 2995 m altitudes.Thegeographic coordinates and altitudes of locations collected these species are shown in Table 1. Chromosome studies in more than 50 plant samples from each region showed that the number of chromosomes in G1 was2n=28 and in other populations were 2n=42 (Figure. 1). According to chromosome number it was revealed that the G1 population belongs to the *P. orientale*species and other populations belong to *P. pseudo-orientale*. There were two pairs of metacentric and 12 pairs of submetacentric chromosomes in G1 population with the relative length ranged between 5.62 to 8.71 percent. The arm ratio of chromosomes ranged from 1.33 to 2.34. Other populations had chromosomes with arm ratiosbetween 1.22and3.23. Most of the populationshad submetacentric and metacentric chromosomes,however, in three populations collected from Sarein region acrocentric chromosomes were also observed. There were no differences among populations in terms of total form of karyotype (Table 2).

Table 1 - Geographic location of the collected species collected belong to the genus *Papaver* Macrantha

Region	population	Number of plants	Latitude	Longitude	Altitude
Mesghin Shahr	G1	60	N 38°.5039	E 47°.5041	1749
	G2	54	N 38°.1934	E 47°.5109	2701
	G3	50	N 38°.2044	E 47°.5341	2766
	G4	50	N 38°.1917	E 47°.3049	1755
Sareyn	G5	80	N 37°.0907	E 47°.5732	2115
	G6	54	N 37°.1102	E 47°.5433	2719
	G7	50	N 37°.1208	E 47°.5307	2995
Khalkhal	G8	56	N 37°.3533	E 48°.3853	2083
	G9	52	N 37°.3532	E 48°.4045	2230
Hir	G10	50	N 37°.0117	E 48°.3349	2449
	G11	54	N 37°.0240	E 48°.3238	2325
Nir	G12	70	N 37°.5914	E 47°.5353	1888

The first three components of the PCA explained 88.2 % of the variation of variables. The first component accounted for 45.3 percent and the second component explained 31.1 percent of the total variation. Biplot diagram of the populations showed that the G1, G8, G9, G5 and G7 were separated from other populations by the second component and G1, G11, G10 and G12 populations were separated from other populations through the first component. G1 population was distinguishable from other populations by both components. In cluster analysis, the population was divided into two main groups: the G1 population of *P. orientale* was placed in the first group and the all populations of *P. pseudo-orientale* were separately owned to the second group. Dendrogram cutting at the Euclidean distance equal to 15, separated the populations of *P. pseudo-orientale* in four distinct subgroups in which G2, G3 and G4 populations from Meshgin Shahr region with G6 population from Sarein region were placed in one group, G5 and G7 populations from the Sarein region together with G8 and G9 populations from Khalkhal in the second group, G10 and G11 populations from Hir stand as third group and G12 population was placed in fourth group (Figure 2).

Table 2. Karyotypic characteristics of 12 studied populations of *Papaver*

Pop.	KF	RCL (μm)	(%) RRL	RAR	S (μm)	L (μm)	TLC (μm)	TF%	ST
G1	24sm : 4m	3.45-5.36	5.62-8.71	1.33-2.34	1.67	2.73	61.64	34.17	2A
G2	36sm : 6m	3.43-5.92	3.38-5.81	1.30-2.57	1.59	3.23	101.41	33.05	2A
G3	38sm : 4m	3.21-6.09	3.26-6.20	1.39-2.62	1.50	3.17	98.16	32.11	2A
G4	38sm : 4m	3.54-6.78	3.56-6.11	1.38-2.75	1.61	3.29	102.69	32.93	2A
G5	34sm : 6m :2ac	3.24-6.65	3.56-5.72	1.56-3.23	1.71	3.08	100.80	35.52	2B
G6	34sm : 4m :4ac	3.37-6.85	3.86-5.92	1.41-3.11	1.56	3.37	103.63	31.70	2B
G7	34sm : 6m :2ac	3.48-6.75	3.18-6.17	1.56-3.07	1.74	3.47	109.44	33.36	2A
G8	34sm : 8m	3.21-6.20	3.26-6.12	1.51-2.66	1.72	3.13	101.85	35.36	2A
G9	34sm : 8m	3.26-6.36	3.45-5.98	1.47-2.74	1.69	2.98	98.28	35.82	2A
G10	34sm : 8m	3.54-5.98	3.66-5.78	1.35-2.65	1.51	2.95	93.63	33.82	2A
G11	36sm : 6m	3.62-5.56	3.90-6.11	1.52-2.32	1.52	2.89	92.53	34.41	2A
G12	32sm : 10m	3.14-5.51	3.76-5.80	1.22-2.25	1.58	2.90	94.18	35.25	2A

KF (Karyotype formulae), RCL (range of chromosomes length), RRL (range of chromosomes relative length), RAR (range of chromosomes arm ratios), S (average length of short arms), L (average length of long arm), TLC (Total length of haploid set of chromosomes), TF% (total form of karyotype) and ST (Stebbin's asymmetry category)
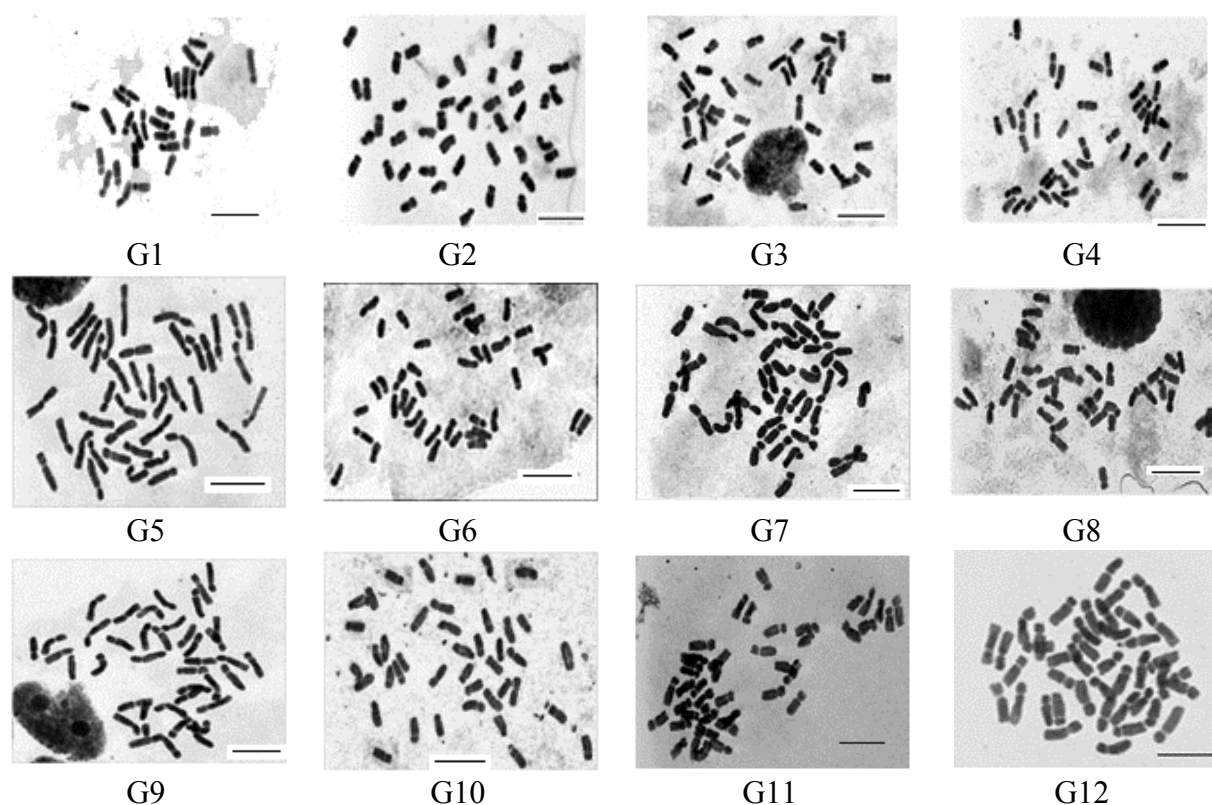
Figure 1. Metaphase cells in some of the sampled plants of *Papaver*species within the Macrantha section (scale line=10 μm).

Discussion

Conservation of genetic resources of medicinal plants and their cultivation to extract raw materials of drugs and also to obtain useful information from the genetic diversity and taxonomic characteristics of these species requires accurate identification and collection of them from natural habitats (Reid and Bennett, 1999). Rezai Ossaloo (2004), by analyzing chromosome

number in *Papaver* species from Macrantha section collected from East Anatolia of turkey reported 42 chromosomes in the most cases.

The basic chromosome number (x) in most species of *Papaver* including species of *P. pseudo orientale, P. bracteatum, P. dubium, P. glaucum* and *P. rhoeas* is x=7, but x=6 in *P. pavoninum* and x=11 in *P. somniferum,* was also observed (Bara et al., 2007). It has been reported that the karyotype of *P. pseudo-orientale* consisted of fifteen pairs of sub metacentric chromosomes, four pairs of metacentric chromosomes and two pairs of acrocentric chromosomes (Lavania & Srivastava, 1999). However, in the present study, only in three of the populations acrocentric chromosomes were observed (Table 2). Based on Stebbins karyotype asymmetry categories (Stebbins ، 1971), the G5 and G6 populations from Sarein region placed in 2B category where other populations placed in 2A category. Lavania and Srivastava (1999) stated that *P. pseudo-orientale* classified in 2B class.
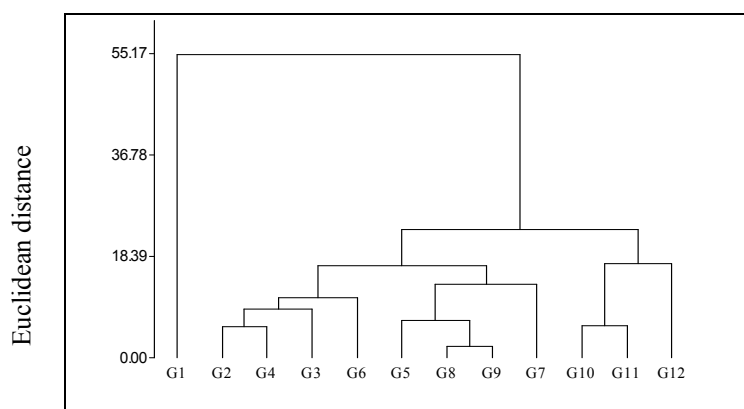
Figure2. Dendrogram of different populations in cluster analysis using square Euclidean distance based on UPGMA method.

Conclusion

This study showed that *P. pseudo-orientale* is the dominant species of the *Papaver* species within the Macrantha section in Ardabil province of Iran, that has bracteated or non bracteated capsules which often confused with *P. bracteatum* species. However, chromosomal analysis in this study showed that the number of chromosomes in the most of collected plants were 2n=42 irrespective of having bract or lack of it.

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In vitro Induction of Polyploidy in Sorghum bicolor

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Abstract

In this study the effect of different colchicine concentrations (0.025, 0.05, 0.1 and 0.2%) and its treatment time (8, 24 and 48 h) on survival of shoot tips of *Sorghum bicolor* and its *in vitro* polyploidy induction was investigated as a factorial experiment based on completely randomized design with three replications. Polyploidy induction confirmed by chromosome counts, size and number of stomata and other morphological characters. By assessment the different media, it was revealed that the suitable medium for regeneration of shoot tips in *Sorghum bicolor* is MS medium supplemented with 0.1 mg l^{-1} IBA (indole-3-butyric acid) and 1 or 2 mg l^{-1} BAP (6-benzylaminopurine) or 2 mg l^{-1} TDZ (thidiazuron). In addition, MS medium supplemented with 1 mg l^{-1} NAA (1-naphthaleneacetic acid) and 0.5 or 1 mg l^{-1} IBA lead to maximum rooting of plantlets. With increasing colchicine concentration and its treatment duration, explants survival and their rooting considerably decreased. The results revealed that 0.1% concentration of colchicine with 48 h of treatment established the maximum amount of the *in vitro* induced tetraploid plantlets. The derived tetraploids had bigger stomata with lower density.

Keywords: Colchicine, polyploidy, shoot tip culture, sorghum bicolor, stomata

Introduction

Polyploidy is one of the most interesting and controversial areas of plant biology with numerous applications in plant breeding (Dhooghe *et al.* 2010). Polyploid plants in comparison with diploid varieties may be show a superior phenotype such as increased drought tolerance, apomixis, pest resistance, plant biomass and changes in the quality and concentration of the active compounds. This increases their chances in selection programs in plant breeding (Shahriari Ahmadi *et al.* 2008). In many plants, polyploidy is often associated with increased cell size, that leading to greater production of vegetative and reproductive organs (Byrne *et al.* 1981).

Tetraploid varieties of sorghum with the ability to produce larger vegetative organs, flowers and fruits than their diploid varieties, produced higher yield (Quinby 1974). On the other hand, the possible higher levels of sugar in these varieties will have more advantages for biofuel production. In this regard, production of polyploid varieties in plants such as sorghum could help to increase the production of biofuels. Therefore, in this experiment, we used an in vitro method for doubling of chromosomes in sorghum bicolor for establishment of tetraploid plants and comparing these plants with diploid ones.

Materials and Methods

Shoot regeneration and rooting

The seeds of KFS2 sorghum cultivar were obtained from Karaj Seed and Plant Improvement Institute, Iran. Shoot tips ($\approx$10 mm) were isolated from 3-day-old seedlings and used as explant.

In order to determine the best combination of plant growth regulators for growth induction of shoot tips, explants were cultured on MS medium (Murashige and Skoog 1962) supplemented with IBA (0.1 mg l^{-1}) and BAP (0.5, 1 or 2 mg l^{-1}) or TDZ (1 or 2 mg l^{-1}). Also, the effect of MS medium supplemented with different auxins (2,4-D: 1 and 2 mg l^{-1}; IBA: 0.5 and 1 mg l^{-1} or NAA: 1 and 2 mg l^{-1}) individually and in combination with BAP (0.5 and 1 mg l^{-1}) on rooting of plantlets was examined. The pH of the medium was adjusted to 5.8. The cultures were incubated at 25 °C with a 16-h photoperiod of cool white fluorescent light (400–500 lx).

Induction of polyploid plantlets

The effect of different colchicine concentrations (0.025, 0.05, 0.1 and 0.2%) and exposure time (8, 24 and 48 h) on survival of explants and polyploidy induction was investigated as a factorial experiment based on completely randomized design with three replications. Shoot tips

as explants were immersed in filter sterilized colchicine solutions for different exposure times, then rinsed in sterile distilled water for three times. Explants were cultured on MS medium supplemented with 0.1 mg l^{-1} IBA and 1 mg l^{-1} BAP. MS medium supplemented with 1 mg l^{-1} IBA and NAA was used for rooting of plantlets. Ploidy level was evaluated through stomata characteristics (the number and size of stomata cells) and chromosome counts. Statistical analysis was performed based on completely randomized design with three replications using SAS software Version 9.1.

Results

Shoot regeneration and rooting

After five days of culture, explants growth in most media was initiated (Fig. 1A, B and C). The percentage of shoot regeneration has been significantly affected by different hormonal combinations. Shoot tip explants cultured on hormones free MS medium did not showed any growth and shoot production. The MS media supplemented with 0.1 mg l^{-1} IBA and 1 or 2 mg l^{-1} BAP or 2 mg l^{-1} TDZ were the most suitable for shoot regeneration (Fig. 2A).

About ten days after establishment of plantlets, rooting induced on some of the tested media (Fig. 1D and E). Analysis of variance revealed significant effects of the hormonal components on rooting of plantlets. Rooting was not observed on hormones free medium. Maximum percentage of root induction was obtained on MS medium supplemented with 1 mg l^{-1} NAA and 0.5 or 1 mg l^{-1} IBA. According to the results, application of BAP alone, or in combination with IBA or 2,4-D, repressed root induction. Therefore, cytokinins completely inhibit rooting in sorghum. Increasing NAA alone or in combination with IBA from 1 to 2 mg l^{-1} reduced rooting percentage (Fig. 2B).

Induction of polyploid plantlets

The results showed the significant effects of colchicine concentration and exposure duration, and their interactions on explants surviving. The highest rate of surviving (50%) was achieved in 0.025% colchicine for 8 h, and surviving of explants was reduced to 3.33% at 0.2% colchicine with 48 h treatment time (Table 1). Treatment with colchicine, caused a reduction in explants growth and root induction. On the other hand, treated plantlets were shorter than their diploids with deformation and more number of leaves (Fig. 1F and G).

Chromosome counting on root tips or leaf samples of the regenerated plantlets confirmed chromosomes doubling in some of the plantlets (Fig. 3). With increasing treatment time, the frequency of tetraploidy induction in regenerated plants increased. The results revealed that 0.1% concentration of colchicine with 48 h was appropriate for the in vitro induction of tetraploid plantlets. Tetraploid plantlets were not observed at 0.025% colchicine concentration for 8 h of treatment due to the lack of colchicine effect and at 0.2% colchicine concentration for 24 and 48 h due to the mortality of explants (Table 1). The size and number of stomata in regenerated tetraploid plantlets were significantly different as compared with diploids (Fig. 4).

Table 1. Survival rate and tetraploidy percentage as affected by different concentrations of colchicine and treatment time

Colchicine concentration	Survival rate (%)			Tetraploidy induction (%)		
	8 h	24 h	48 h	8 h	24 h	48 h
0	70[a]	63.33[b]	60[b]	0[e]	0[e]	0[e]
0.025	50[c]	40[d]	26.67[fg]	0[e]	1.67[de]	5[bc]
0.05	40[d]	33.33[e]	16.67[i]	3.33[cd]	5[bc]	6.67[b]
0.1	30[ef]	23.33[gh]	10[j]	5[bc]	6.67[b]	10[a]
0.2	20[hi]	6.67[jk]	3.33[k]	5[bc]	0[e]	0[e]
LSD$_{0.05}$		6.57			2.48	

Different letters show significant differences at (P ≤ 0.05)
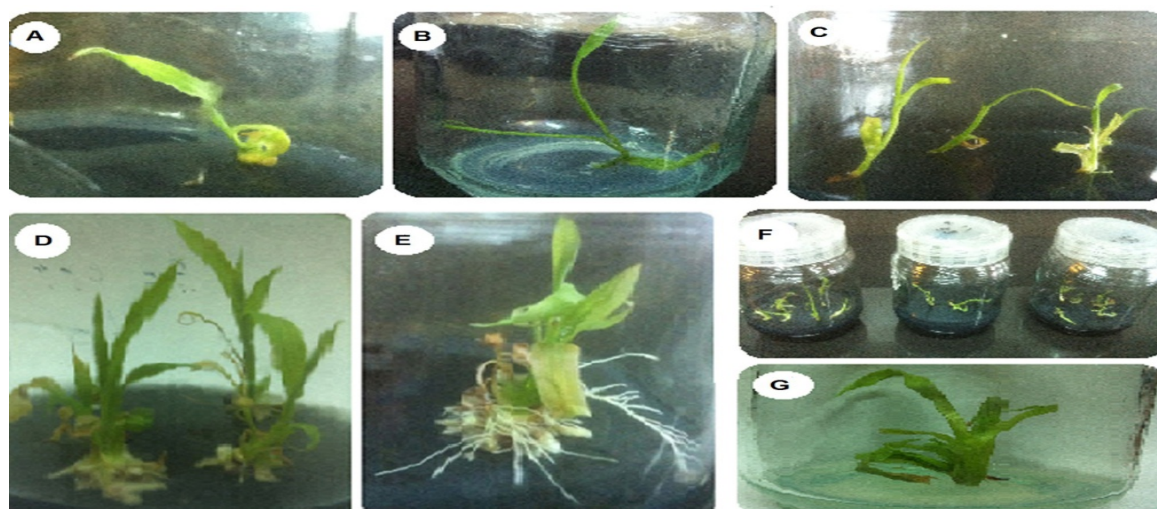
Figure 1. In vitro culture in sorghum. A, B and C: Shoot regeneration from shoot tip explants in MS medium supplemented with 0.1 mg l^{-1} IBA and 1 mg l^{-1} BAP; D and E: Root induction and development in MS medium supplemented with 1 mgl^{-1} IBA and 1 mg l^{-1} NAA; F and G: Different growth stages in explants treated with colchicine.
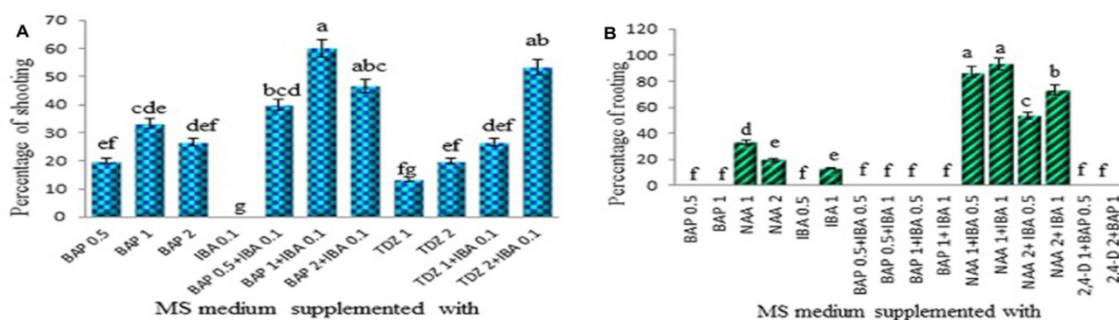
Figure 2. Interactive effect of shoot induction and rooting with different combination of growth regulators in sorghum. A: Percentage of shoots induction; B: Percentage of root induction, different letters show significant differences (P ≤ 0.05).

Discussion

Direct shoot regeneration through shoot tip culture is much faster and removes the callus phase and the incidence of somaclonal variation (Rout *et al.* 2006). With the aim of in vitro polyploidy induction through treatment of shoot tips with colchicine, it was needed to select an appropriate medium for regeneration and rooting of shoot tip explants. By examination of the different mediums, it was revealed that the suitable medium for shoot regeneration of shoot tips is MS medium supplemented with 0.1 mg l^{-1} IBA and 1 or 2 mg l^{-1} BAP or 2 mg l^{-1} TDZ. This showed that the low concentration of IBA in combination with BAP or TDZ, were needed for shoot regeneration of sorghum. Shan *et al.* (2000) and Aparna and Rashid (2004) demonstrate that TDZ is an important hormone for regeneration of cereal and grass species and to produce multiple shoots. Sorghum regeneration is affected by genotype (Baskaran and Jayabalan 2005), may be due to changes in gene expression, which depends on spatial and temporal repartition of physiological stages (Vasil and Vasil 1986). Auxins involved in organogenesis and cell division of meristems, are important in shoot regeneration (Gaspasr *et al.* 1996) and often used in combination with cytokinins for plant regeneration (Pola *et al.* 2007). In addition, in this research, MS medium supplemented with 1 mg l^{-1} NAA and 0.5 or 1 mg l^{-1} IBA lead to maximum percentage of rooting in plantlets obtained from shoot tip culture of sorghum. However, MS medium containing NAA alone has been introduced as the best rooting medium in sorghum (Pola and Sarada Mani 2006).

With increasing colchicine concentration and its treatment duration, explants survival showed considerable reduction and deformed plantlets were created. In addition, rooting of plantlets considerably affected and mostly decreased. The results revealed that 0.1% concentration of colchicine with 48 h of treatment established the maximum amount of the in vitro induced tetraploid plants. Inverse relationship between the concentration of colchicine and survival of explants has been previously reported (Kermani *et al.* 2003, Chen and Gao 2007).
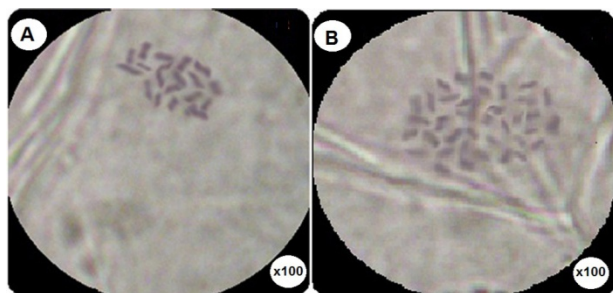
Figure 3. Chromosomes number in sorghum. A: diploid plantlet (2n=2x=20); B: tetraploid plantlet (2n=4x=40).
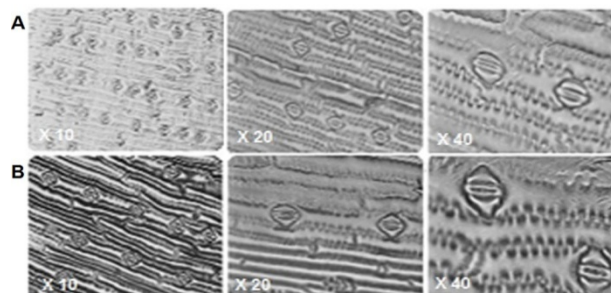
Figure 4. Difference in stomatal size and number between diploid and tetraploid sorghum plantlets. A: adaxial stomata in control plantlet; B: adaxial stomata in tetraploid plantlet.

Conclusion

We obtained tetraploid sorghum plantlets through shoot tip culture under in vitro conditions, which confirmed by chromosome counting, stomata size and number and other morphological characters.

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The Effects of Municipal Sewage Sludge Application on Soil Salinity, pH, Inorganic N, P and Heavy Metal Concentrations in Four Different Soils

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Abstract

This research was carried out to determine the effects of sewage sludge levels on four major soil types (texture, lime differences) properties such as reaction (pH), electrical conductivity (EC), available N (NH_4 and NO_3), P and DTPA extractable microelement and heavy metals. Results are given as relatively changed according to the application doses and incubation time. Five different sludge levels (0, 40, 80, 120 and 160 tons ha^{-1}) were applied. 150 days incubation period of experiments have been conducted.

Generally, pH reduced and EC value increased according to the level of sludge application. NH_4-N, NO_3-N, available P and DTPA extractable heavy metal amounts increased with application rate of sewage sludge. NO_3-N content increased according to time of incubation while NH4-N content decreased in noncalcareous and sandy texture soil. Results were found statistically significant. Other examined parameters varied according to soil properties and incubation periods.

Keywords: Sewage sludge, soil properties, plant nutrients, heavy metal, incubation,

Introductıon

Sewage sludge application on agricultural soils is recommended in order to recycle nutrients and organic matter. However, this practice may cause ecological and human risks. There may be drawbacks as persistent organic pollutants (POPs) and potentially toxic elements (PTEs) are present in sludge. The toxic heavy metals commonly present in sludge are in particular Cd, Hg, Pb, Zn, Mo, Ni, Cr and Cu (Corey et al., 1987). Excessive application of sewage sludge to soil has been found to increase the bioavailability of heavy metals. The main factors controlling mobilization of metals in soil are pH, redox conditions, organic matter, and texture (Kabata and Pendias 1986, Alloway 1990).

On the other hand, N and P was added to soil with the application of sewage sludge. Nutrient content of the soil should be considered. And nutrient supplement to soil should be calculated. Especially mineralization of organic N is one of the main factors governing the annual amount of sewage sludge applied to agricultural purpose (Gilmour and Skinner, 1999). Excessive application of sewage sludge to soil increased the NO_3-N and P content of soil. This may create environmental risk depending on soil properties. For this soil properties are very important such as such as pH, organic matter content, redox potential, as well as the amount of the applied dose of sewage sludge in terms of availability of plant nutrient or prevent of heavy metal toxicity.

Incubation experiment was carried out to evaluate the effect of application of sewage sludge on four different soil properties and heavy metal bioavailability depending on the soil types end of the incubation periods.

Materıas and Methods

Municipal sewage sludge provided storage area from a wastewater treatment facility in Bursa city. The sludge was left to dry for three months and provided that Class B sludge according to the US EPA standards.

Sludge was added to the soils at the rates of 0, 40, 80, 120 and 160 tons ha^{-1}. Soils were placed in plastic pots in a controlled incubation chamber, using an aerobic nonleached procedure, at 25 ± 2 ^{0}C. Soils were evaluated at the end of the 150 days of incubation. The physical and chemical properties of these soils and municipal sewage sludge were determined by recommended methods and results are given in Table 1.

According to the soil analysis; the soil I was characterized by high lime content, Soil II high clay content, Soil III clay loam texture and Soil IV was characterized by a sand texture.

Table 1. . Characteristics of the soils and sewage sludge

Properties	Soil 1	Soil II	Soil III	Soil IV	Sludge
Texture	C	C	CL	SCL	-
Sand, %	24.60	35.08	22.58	55.91	-
Silt, %	22.99	16.67	45.84	18.76	-
Clay, %	52.41	48.25	31.58	25.33	-
pH	8.03	7.79	7.95	7.92	6.24
EC, $\mu S\ cm^{-1}$	601	260	296	301	3.86
Lime, %	35.45	0.39	5.78	2.17	-
Org.matter., %	1.70	1.76	2.49	1.52	73.26
% N	0.157	0.137	0.164	0.123	5.73
NH_4-N, mg kg^{-1}	13.36	5.42	3.70	2.82	654.32
NO_3-N, mg kg^{-1}	10.07	0,95	7.47	12.24	trace
Avai. P, mg kg^{-1}	6.02	20.18	19.16	6.68	3612.8
Exc. Na, g kg^{-1}	0,105	0,112	0,154	0,096	0.117
Exc. K, g kg^{-1}	0,266	0,454	0,152	0,320	0.515
Exc.Ca, g kg^{-1}	7,112	6,640	5,131	2,640	0.118
Exc. Mg, g kg^{-1}	0,810	0,920	0,413	0,295	0.134
Org. C, %			-		42.49
C:N ratio			-		7.41
DTPA Fe, mg kg^{-1}	10.92	11.34	52.92	10.92	103.8
DTPA Mn, mg kg^{-1}	8.187	10.52	2.100	7.179	44.54
DTPA Cd, mg kg^{-1}	0.026	0.036	0.136	0.041	0.22
DTPA Cr, mg kg^{-1}	0.014	0.013	0.031	0.020	1.19
DTPA Ni, mg kg^{-1}	1.270	3.350	0.961	0.817	48.46
DTPA Pb, mg kg^{-1}	trace	trace	trace	trace	5.21
DTPA Cu, mg kg^{-1}	1.537	2.925	6.352	14.48	43.18
DTPA Zn, mg kg^{-1}	1.413	0.674	4.786	0.706	320.4
Total P; %			-		2.463
Total Na, %			-		0.158
Total K, %			-		0.646
Total Ca, %			-		2.331
Total Mg, %			-		0.825
Total Fe, %					0.763
Total Mn, mg kg^{-1}					308.8
Total Cd, mg kg^{-1}					5.87
Total Cr, mg kg^{-1}					503.5
Total Ni, mg kg^{-1}					131.6
Total Pb, mg kg^{-1}					34.74
Total Cu, mg kg^{-1}					181.9
Total Zn, mg kg^{-1}					819.5

Result and Discussion

Soil properties were significantly affected by dosage and incubation time, and there were significant differences in soil properties among the four sludge treatments. Results are given as relative changed according to the application doses and incubation time. Generally soils pH decreased with end of the incubation according to the application sludge (Figure 1).

FD: First day of the incubation, ED: End of the incubation
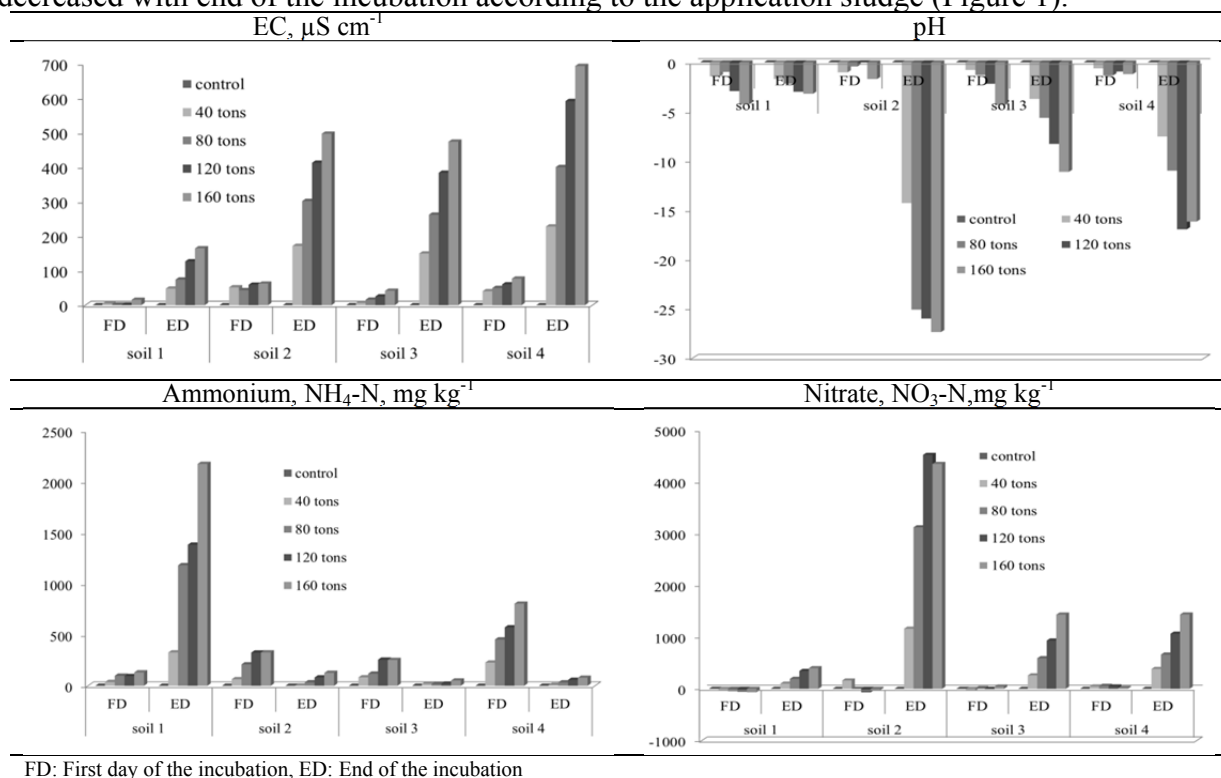
Figure 1. The relatively change of pH, EC and inorganic N value depending on soil properties

The decrease in pH in all soils may be due to the formation of organic acids during the mineralization of sludge, either due to the volatilization of ammonia or to increases in nitrification the end of the incubation. The maximum amount of change was seen in the Soil II. The soils are listed in the following way in terms of changes in pH; Soil II> Soil IV> Soil III>Soil I. this condition may be related to the lime content of soils (Table 1).

The EC values increased significantly with increasing sludge application. The highest EC values were observed on end of incubation and in the 160 tons ha^{-1} application level for all sludge treatments. The maximum amount of change was seen in the Soil IV. The soils are listed in the following way in terms of changes in pH; Soil IV> Soil II> Soil III>Soil I. this condition may be related to the texture and lime properties of soils.

The levels of NO_3-N and NH_4-N in the soil increased as a result of application of sludge in the four soils (Figure 2), with the largest change occurring in the Soil 1. The concentration of NH_4-N decreased in the end of the incubation. In contrast, the amount of NO_3-N mineralization increased with time. The soils are listed in the following way in terms of changes in NH_4-N; Soil I> Soil VI> Soil II>Soil III. And NO_3-N; Soil II> Soil VI> Soil III>Soil I .Available P content increased with increasing sludge treatment for all soils. However, P availability decreased with time of incubation except soil II. These changes are related to the properties of soil (Table 2). The soil ranked Soil I> Soil II> Soil III>Soil VI in terms of available P content in percentage changes (Figure 2).

FD: First day of the incubation, ED: End of the incubation
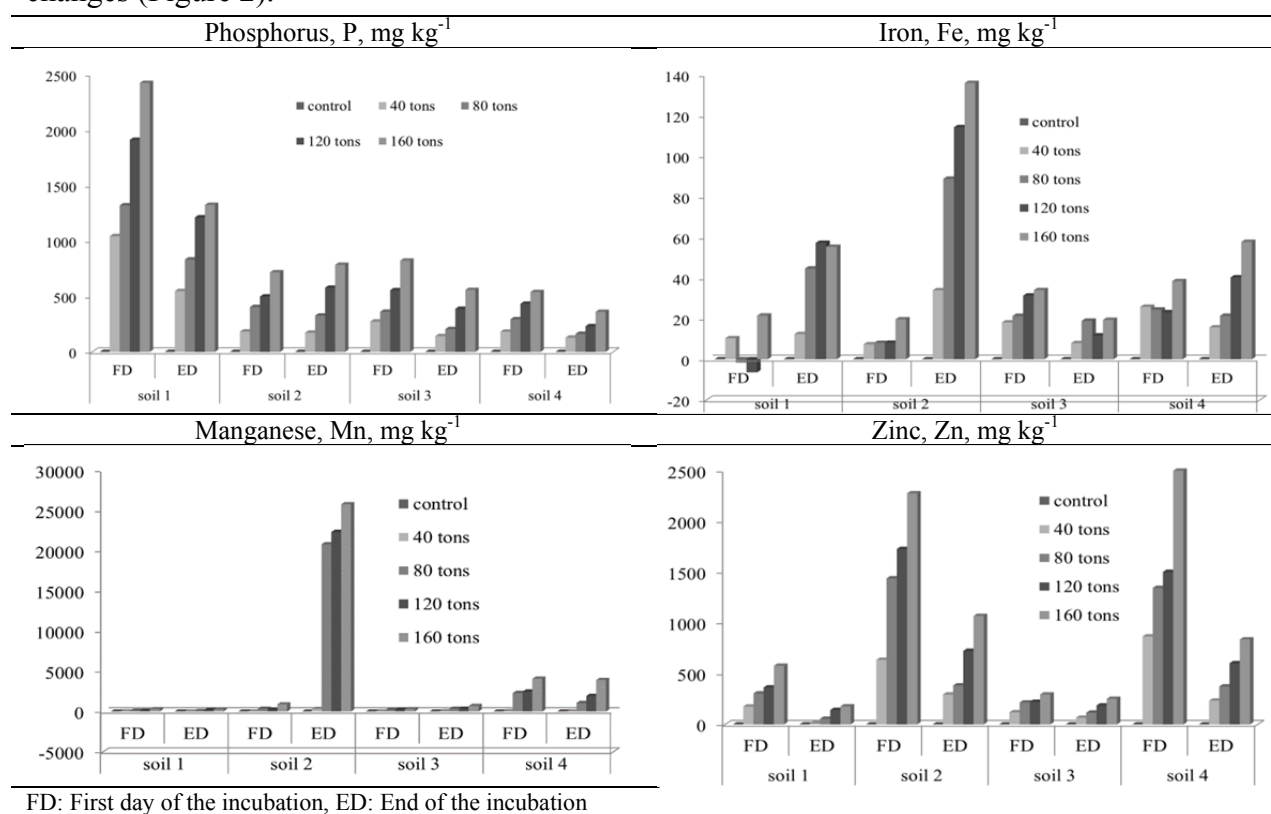
Figure 2. The relatively change of available P, Fe, Mn and Zn value depending on soil properties

Sewage sludge applications were increased DTPA extractable heavy metals content in examined soils (Figure 3 and 4). Relatively changes in the amount of DTPA extractable Fe, Zn, Mn, Cu, Ni, Cr and Cd contents were found particularly remarkable. DTPA Fe has changed between 19.39 % and 135.96 % according to the application doses in the beginning and end of incubation. The soil ranked Soil II> Soil VI> Soil I>Soil III in terms of percentage change. The relatively change of Zn has been more pronounced than DTPA-Fe specially in Soil I and Soil 2 because of low lime content. Manganese contents increased depending on the application level, especially in the Soil II. This condition may be caused by excessive decrease of soil acidity. pH value has decreased from 7.42 to 5.27 during to the incubation. DTPA-Cu content increased in the end of the incubation when compared with the first day of the incubation. Similarly DTPA-

Cd, Cr and Ni content also increased in the end of the incubation when compared with the first day of the incubation except Soil I. In general, the mobility and availability of heavy metals are controlled by adsorption and desorption characteristics of soils (Krishnamurti et al., 1999).
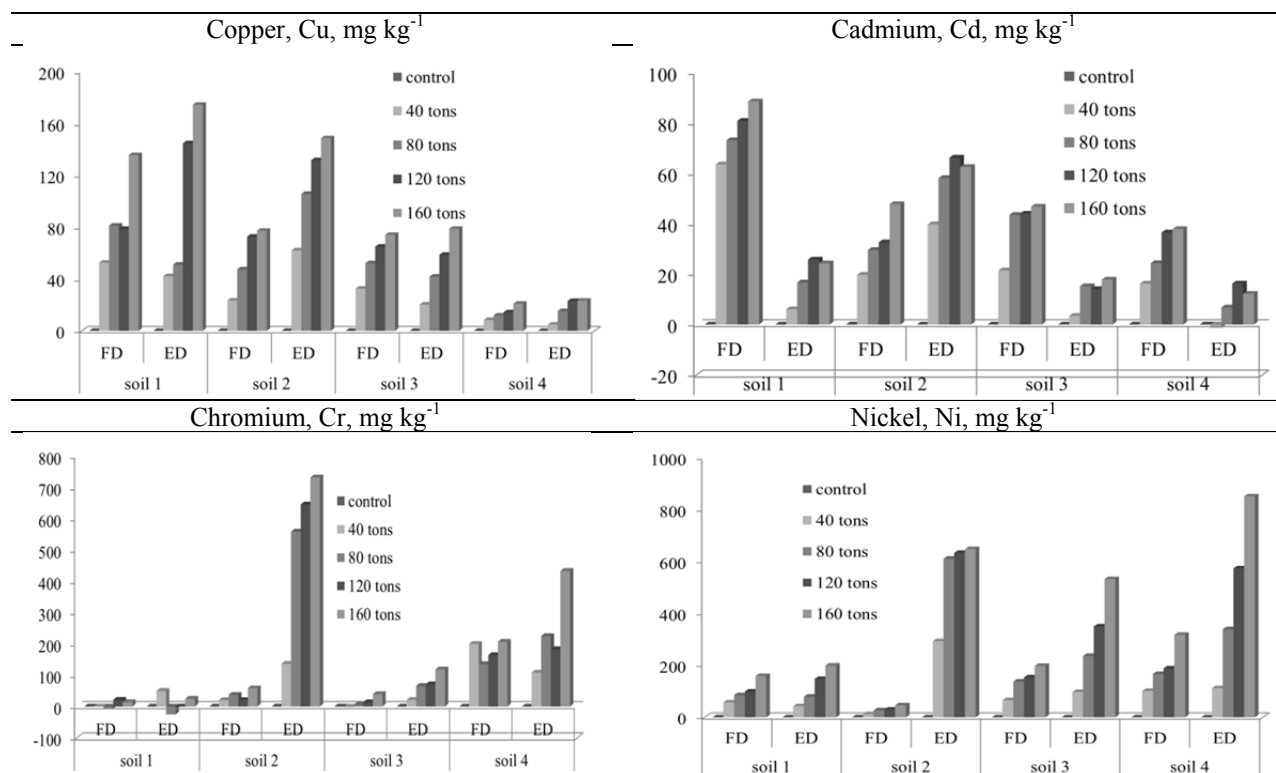
FD: First day of the incubation, ED: End of the incubation

Figure 3. The relatively change of available heavy metal value depending on soil properties

Conclusion

Our study results demonstrated that, increasing sewage sludge application to different soils were significantly changed salinity, pH, inorganic N, available P and DTPA-extractable heavy metals content when compared with the first day and end of the incubation. Therefore soil characteristics should be taken into before the application of sewage sludge. The relative change of soils properties should be monitored when sludge applied to the soil. High lime content soils should be preferred to application of sewage sludge. We must be careful the application of sludge to the soil IV with sandy texture and without lime content.

Acknowledgement

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Effects of Foliar and Soil Nitrogen and Zinc Treatments on Zinc and Iron Concentrations of Wheat Grains

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Abstract

The present study was conducted under greenhouse conditions to investigate the effects of foliar and soil nitrogen (N) and zinc (Zn) treatments on zinc accumulation of wheat grains. Two different nitrogen doses (200 and 500 mg kg^{-1}N) and two zinc doses (0.1 and 1 mg kg^{-1} Zn) were applied to soil. For foliar applications, only the flag leaf was immersed into 0.5% $ZnSO_4$ and 0, 0.1, 0.5 and 1% urea solutions containing 0.01% surfactant (Tween) and leaves were remained 20-25 seconds in these solutions. Immersion of the leaves in the solutions was repeated 6 times with a single day intervals. Plants were harvested at grain maturation and grain samples were analysed for N, Zn and Fe. Results revealed in general that N and Zn-nutrition had significant effect on grain Zn and Fe concentrations. When the plants were supplied with sufficient Zn, both soil and foliar nitrogen treatments increased grain Zn concentrations. It was concluded that sufficient Zn and high N rates promoted Zn and Fe uptake and also their re-mobilization from the vegetative tissues into grains.

Keywords: Nitrogen, zinc, iron, wheat, remobilization

Introduction

Micro nutrient deficiencies influence more than threebillionpeople worldwide and they are considered as serious health problems (Hotz and Brown, 2004; Çakmak et al., 2010).In recent studies carried out under controlled conditions, it was indicated that nitrogen treatments might improve Zn and Fe concentrations of grains and Zn and N treatments might have synergic impacts in increasing Zn concentration of grains (Shi et al., 2010). There are various physical and molecular mechanisms influenced by nitrogen nutrition status, thus N-nutrition is the most significant component of Zn and Fe-enrichment of feed stuff (Çakmak et al., 2010).It was discussed in literature that several nitrogenous compounds like amino acid and nicotianamine might form chelate with Zn and transported through phloem (Grusak et al., 1999; Von Wiren et al., 1999). These nitrogenous compounds may also play a role in Zn transport from the root regions to shoots of plants. Increasing nitrogen treatments result in increasing total free amino acid content of leaves and these amino acids induce Zn transport through phloem (Caputo and Barneix, 1997).

The present study was conducted to investigate the effects of zinc and nitrogen treatments on micro element accumulation in wheat grains.

Material and Method

Eskişehir-Sultanönü soils known with their Zn-deficiency were used in greenhouse experiments (Table 1).Adana-99 bread wheat seeds were used as the plant material of the study. Plastic pots were used in experiments and each pot was filled with 2800 g soil. Two different nitrogen doses (200 mg kg^{-1} N and 500 mg kg^{-1}N) and zinc doses (0.1 mg kg^{-1}Zn and 1 mg kg^{-1} Zn) were used in experiments. As basic fertilizer, 150 mg kg^{-1} N in the form of $Ca(NO_3)_2$,100 mg kg^{-1} P in the form of KH_2PO_4, 2.5 mg kg^{-1} Fe in the form of FeEDTA and 20 mg kg^{-1} S in the form of $CaSO_4$were applied to each pot.

To each pot, 12 seeds were sown and the number of seeds was then thinned to 6 after germination and to 5 after a short interval (2-3 days).Finally number of plant in each pot was thinned to 4 for experimentalimplementations over flag leaf.Tillers were also cut to have 4 main

Effects of Foliar Nitrogen and Zinc Treatments at Grain-Filling Period on Nutrient Transport to Wheat Grains

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Abstract

The present study was conducted under field conditions to investigate the effects of late-period foliar spray (after flowering; early milk-stage and early dough-stage) of nitrogen and zinc on grain concentrations of zinc (Zn), iron (Fe) and nitrogen (N) of wheat. There were six different foliar treatments as of: control (-Zn and -Urea), only Zn, only Urea, first Zn + than Urea, first Urea + then Zn and Zn + Urea together. Foliar spray of 0.5% $ZnSO_4$ solution was realized together with 0.5% Urea in the same solution.

The experiments were conducted under field conditions at three different locations. There were not significant differences among the grain N concentrations of the foliar treatments at all three locations. However, foliar Zn treatments greatly increased grain Zn concentrations in all three locations. Zinc and Zinc-Urea combined treatments had significant effects on grain Zn and Fe concentrations. Single Urea treatments did not have clear effects on grain Zn and Fe concentrations. Effects of treatments on grain yield were also found to be significant at all three locations.

Keywords:Wheat, nitrogen, zinc

Introduction

Majority of both world and Turkish population experience problems related to Zn-deficiency.There is an urgent need today to enrich Zn-contests of wheat and other plant grains commonly consumed by humans.Based on model studies, enrichment of cerealgrainswithZn has beenshownto be a promisingwaytoreducechilddeaths in India (Stein et al., 2007). Development of new cultivars with high Zn contents or the use of Zn-fertilizers are the two significant practices to enrich the Zn-contents of grains(Pfeiffer and Mc Clafferty 2007; Çakmak 2008).However, Zn-enrichment of wheat grains are restrained because of lack of knowledge about various physiological process such as1)rootuptake, 2) root-to-shoottranslocation (viaxylem), 3)phloemtransport, 4) remobilization (retranslocation) of Znfromsourcetissuesintodevelopingseedsand 5) seeddeposition of Zn.Literatures provide increasing evidences about possible effects of nitrogenous fertilization on plant nitrogen mechanisms of the above mentioned factors. In recent studies, it was indicated that nitrogen treatments might improve grain Zn and Fe concentrations and Zn and N treatments had synergic impacts in increasing grain Zn concentration of durum wheat (Shi et al., 2010).

In this study, effects of late-period (after flowering) nitrogen and zinc treatments on grain nutrient content of bread wheat grown under field conditions of Çukurova with regular bottom fertilizers were investigated and the question of "which fertilizer should initially be applied or not to be applied for better nutrient transport of the grain" was tried to be answered.

Material and Method

Adana-99 bread wheat commonly cultivated in Çukurova was used as the plant material of the present study. Field experiments were carried out over the experimental fields of Eastern Mediterranean Agricultural Research Center during the 2009-2010 growing season; at Doğankent (1 location)and Hacıali(2 locations).Soil physicochemical characteristics of these locations are provided in Table 1.

Table 1.Soil physicochemical characteristics of Hacıali and Doğankent locations.

Location	Texture (%)				pH	Salinity	Lime	Org.Mat.	P_2O_5*	K_2O*	Zn*
	Salt	Silt	Clay	Class	(1:2,5)	(mmhos cm⁻¹)	(%)	(%)	(kg da⁻¹)		(mg kg⁻¹)
Hacıali 1	7,50	43,07	49,43	SiC	7,70	0,27	14,2	1,92	3,63	135,4	0,35
Hacıali 2	24,80	39,00	36,20	CL	7,68	0,27	12,3	1,75	3,23	85,5	0,36
Doğankent	32,47	31,37	36,50	CL	7,87	0,36	12,3	2,04	3,02	105,7	0,27

*Available

In experiments carried out with regular bottom fertilizers, wheat sowing was performed with a combined grain drill. Sowing rate was set as 450 grain/ m^2. Six different treatments were carried out in randomized block design with 4 replications. Together with sowing, 6 kg P_2O_5/da(42-44% Triple Super Phosphate) and6 kg N/da (46%Urea) were applied and additional 10 kg N/da (46% Urea) was provided at tillering period. Foliar implementations of 0.5% $ZnSO_4$ solution and 0.5% Urea were also performed (about 1.2 liter/$7m^2$).Foliar treatments were performed after the flowering period, during the milk stage (Zadoks 73) and early dough stage (Zadoks 83).The treatments were as follows;Control (-Zn and – Üre); Only Zn treatment; OnlyUrea treatment; firstZn + then Urea treatment; first Urea + then Zn treatment; Zn + Urea together treatments.

Harvested grains were subjected to N, Zn and Fe analyses. Variance analysis was performed and significant factor means were compared by Duncan and LSD tests. The * and ** significance levels correspond to significance levels respectively of P<0.05 and P<0.01.

Results and Discussion

Foliar zinc and nitrogen treatments were performed after flowering, early milk stage (Zadoks 73) and early dough stage (Zadoks 83) and variance analysis over resultant data is provided in Table 2.

Table2.Variance Analysis Table for Foliar Zinc (0.5% ZnSO4) and Urea (0.5%) Treatments on grain Nitrogen (%), Zinc, Iron Concentrations (mg kg^{-1}), Grain Yield (kgda^{-1}) of Adana-99 Bread Wheat at Hacıali 1, Hacıali 2 andDoğankent Locations.

Source of Variation		Grain N Concentration (%)					
		Hacıali 1 Loc.		Hacıali 2 Loc.		Doğankent Loc.	
	SD	Means of Squares	F Pr.	Means of Squares	F Pr.	Means of Squares	F Pr.
Reputation (A)	3	0.056	5.8671	0.001	0.2886	0.049	1.0834
Treatments (B)	5	0.023	2.4151	0.002	0.3914	0.037	0.8288
Error	15	0.010	-	0.005	-	0.045	-
CV (%)		6.07		3.44		10.34	

Source of Variation		Grain Zn Concentration (mg kg^{-1})					
		Hacıali 1 Loc.		Hacıali 2 Loc.		Doğankent Loc.	
	SD	Means of Squares	F Pr.	Means of Squares	F Pr.	Means of Squares	F Pr.
Reputation (A)	3	2.778	0.1407	19.486	1.9912	33.389	2.8006
Treatments (B)	5	771.367	39.0675**	1137.675	116.2540**	575.367	48.2600**
Error	15	19.744	-	9.786	-	11.922	-
CV (%)		10.54		6.86		10.03	

Source of Variation		Grain Fe Concentration (mg kg^{-1})					
		Hacıali 1 Loc.		Hacıali 2 Loc.		Doğankent Loc.	
	SD	Means of Squares	F Pr.	Means of Squares	F Pr.	Means of Squares	F Pr.
Reputation (A)	3	1.611	0.1857	4.153	2.9960	71.685	9.7356
Treatments (B)	5	29.500	3.3995*	6.875	4.9599**	7.697	1.0454
Error	15	8.678	-	1.386	-	7.363	-
CV (%)		8.99		3.64		7.70	

Source of Variation		Grain Yield(kgda^{-1})					
		Hacıali 1 Loc.		Hacıali 2 Loc.		Doğankent Loc.	
	SD	Means of Squares	F Pr.	Means of Squares	F Pr.	Means of Squares	F Pr.
Reputation (A)	3	2197.597	2.2142	1217.389	0.3833	1496.500	2.3379
Treatments (B)	5	3584.275	3.6114*	6688.067	2.1058	6215.767	9.7106**
Error	15	992.497	-	176.089		640.100	
CV (%)		3.70		8.26		7.94	

* Significant at P< 0.05, ** Significant at P< 0.01
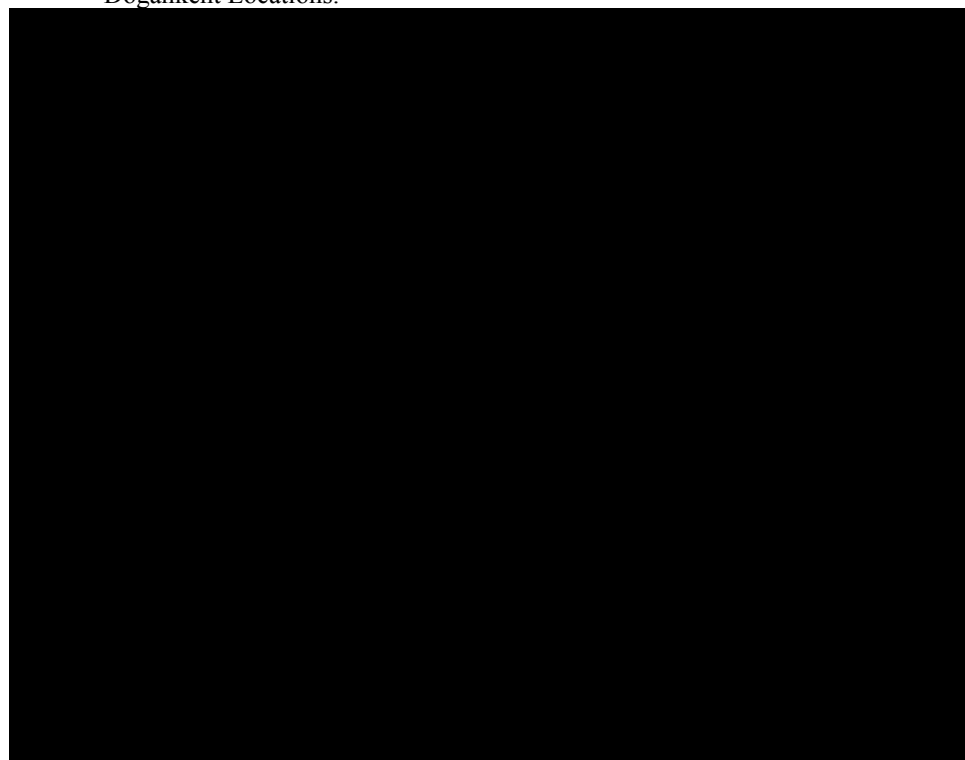
Effects of treatments on grain N concentration at all three locations were found to be significant (Table 3).Previous studies indicated the efficiency of nitrogen treatments under sufficient zinc conditions. Effects of nitrogen treatments on Zn-mobility is partially dependent on Zn-supplementation of wheat (Kutmanet al., 2010a,b).Zinc transfer to grain, loading onto phloem, availability of chelates for long-distance transfers, discharge from phloem

(accumulation in grain) and transfer from xylem to phloem can all constitute the limiting factors (Garnett and Graham, 2005; Çakmaket al., 2010a,b). In those processes, high N-supplementation may induce grain Zn accumulation through increasing of transporters or chelating agents. Together with increased N-supplementation, Zn and Fe concentrations of wheat grains also increased under field conditions (Çakmaket al., 2010 b). In case of sufficient Zn is available in plant growth ambient, both soil and foliar nitrogen treatments enriched the Zn contents of the grains (Kutmanet al., 2010a,b).

Foliar Zn treatments also increased grain Zn concentration in all locations. Single Urea treatments did not have significant impacts on grain Zn and Fe concentrations (Table 3). Zinc is relative mobile micronutrient in phloem and is transported during grain fill and aging periods (Marschner 1995). In a study carried out with bread wheat over sandy ambient, majority of Zn content during grain maturation period was coming from the Zn entered into plant tissues right after the pollination (Garnett and Graham 2005).

Foliar single Urea treatments did not have significant effects on grain Zn and Fe concentrations (Table 3). Since the soil zinc concentration (Table 1) was below the threshold value (0.5 mgkg⁻¹), effects of urea treatments were not observed. Concentrations of the compounds effecting Zn transport and chelate formation such as nicotinamine, peptides and amino acids may be effected by plant N nutrition of the plants. High N treatments may significantly increase the nitrogenous compound sources of leaves and phloem (Caputo andBarneix, 1997; Rubio-Covarrubias et al., 2009). Öztürket al. (2011) carried out a study and reported that while N and S nutrition of plants grown under insufficient Zn conditions did not affect Zn intake and mobilization, enriched N and S nutrition under sufficient Zn conditions significantly increased Zn intake and mobility.

Table 3.Effects of Foliar Zinc (0.5% ZnSO4) and Urea (0.5%) Treatments on Grain Nitrogen (%), Zinc, Iron Concentrations (mg kg⁻¹), Grain Yield (kg da⁻¹)of Adana-99 Bread Wheat at Hacıali 1, Hacıali 2 and Doğankent Locations.

With regard to Fe concentrations, while the effects of treatments were found to be significant at Hacıali 1 andHacıali 2 locations, the effects of treatments at Doğankent location were not significantly different from each other but still had significant impacts. While zinc andzinc+urea treatments had significant effects on grain Zn and Fe concentrations, single urea treatments did

not have significant effects (Table 3).Increasing Zn and N treatments increased grain Zn concentrations by 50% and endosperm Zn concentration by 80% (Kutmanet al., 2011). In was reported based on foliar Zn supplementation that high N treatments increased endosperm Fe concentration by 100% and the chelating agents and transporters acting in Zn and Fe transport in plants were either the same or similar (Haydon and Cobbett, 2007)

Effects of treatments on grain yield were found to be significant at Hacıali 1andDoğankent locations. Zinc treatment (2nd treatment) and zinc + urea treatments (4, 5, 6th treatments) increase kernel yields. Compared to control treatment, foliar single urea treatments decreased the grain yields (Table3).Foliar zinc and urea treatments during grain fill period may either not prevent or partially prevent yield losses based on deficiency levels of these nutrients. Foliar N and Zn treatments during grain fill period are also insufficient in preventing yield losses but they had positive impacts on N (VargaandSveenjak, 2006) and Zn concentration of the grains(Yılmaz et al., 1997; Çakmak, 2008).Yılmaz et al. (1997) reported in a study that soil, foliar or combined Zn treatments improved plant and grain Zn concentrations and grain yields.

In conclusion, significant differences were not observed among kernel N concentrations of three locations. Foliar Zn treatments increased grain Zn concentration in all three locations. Zinc and zinc + urea treatments had positive impacts on grain Zn and Fe concentrations and single urea treatments did not have significant effects on grain Zn and Fe concentrations. Moving from this point further, it can be stated that combined application of zinc and urea had positive impacts in increasing grain microelement and yield.

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Effect of Some Microbial Preparations on *Tuta absoluta* (Lepidoptera: Gelechiidae)

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Abstract

Calgard® and Calraid® microbial preparations contain spores of Fusarium spp. fungi, and they are a combination of microorganisms, alkaloids and metabolites. Aforementioned preparations work on the nervous system of pests to immobilize and kill them in a short time.

This present study aimed to find out effects of Calgard® and Calraid® to Tomato leafminer, *Tuta absoluta* (Lepidoptera: Gelechiidae), which is a key pest of tomato.

For this purpose, egg-laying of mated female adults of the pest on tomato with 6-7 leaves was provided. Larvae, reaching the third- or fourth-stage after hatching were used in the experiment. As a control to compare with the microbial preparations, distilled water was used, and in the experiment, recommended dosages (10 g/l) were applied by dipping, spraying and residual methods. Also, the effects of microbial preparations on the pest were evaluated according to mean number of survival individuals at the 1, 3, 5 and 7 DAA (Days After Application).

As a result of the study, microbial preparations began to impact on *T. absoluta* at the 3 DAA and they affected on the pest in all three methods was determined. The lowest effect of Calgard® according to the control was obtained as 42.00% at the 1 DAA by residual method. The highest effect of Calgard® was occurred as 100.00% from the 3 DAA in residual method, from the 5 DAA in dipping and spraying methods. The lowest effect of Calraid® on *T. absoluta* with 9.50% was obtained at the 1 DAA by dipping method. The lowest effect of Calraid® with 100.00% was found at the 7 DAA by spraying method. Consequently, according to the data obtained, Calgard® and Calraid® microbial preparations have an effect on *T. absoluta* and can be used within the scope of environmentally friendly integrated pest management (IPM) programs in controlling the pest has been understood.

Keywords: Calgard®, Calraid®, tomato, tomato leafminer, *Tuta absoluta*

Introduction

Rapidly increasing cultivation techniques and input technology from the beginnings of agriculture to the present day has led to a significant rise in plant protection problems. In addition to, pests have taken an important place in plant protection problems and control activities performed against these pests have become inevitable in agroecosystems. The control activities against Tomato leafminer, *Tuta absoluta* (Lepidoptera: Gelechiidae) which is a key pest in tomato cultivation have also become inevitable in Turkey. García-Marí and Espul (1982) reported that *T. absoluta* was transported from Chile to Argentina in 1964. Gates Clarke (1962) recorded some microlepidopter attacked *Solanum lyratum*, which are from Gelechiidae family and moreover, there were many Gelechiid fed on the plants from Solanaceae family, one of which was tomato leafminer. As for Turkey, the first record was made in İzmir in 2009 (EPPO, 2010; Kılıç, 2010). For reasons such as ease of use, requirement of less knowledge and labor, rapid result possibility and easier control; chemical methods, as in the control of other pest, have been also used more frequently and widely to control this pest which leads to important loses in tomato cultivation. Chemical usage, however, can have an adverse effect on national economy, human health and environment. So that, studies have been conducted on development of alternative control methods, one of which is microbial control contained in biological control. Entomopathogenic fungi among all of them have an important place. Also, they can be used in pest control has been known since the 19th century (Erkılıç and Uygun, 1993). Eken and Demirci (1997) suggested in the study on use of fungi in biological control to pest that more than 500 fungus species that can infect insects were described and moreover, insects in all biological stages are susceptible against entomopathogenic fungi.

Aforementioned reasons above, the study aimed to determine effects of Calmyte® and Calraid® microbial preparations on *T. absoluta* and potentials of these preparations to be used within the scope of integrated pest management.

Material and Method

Main materials of the study are Calmyte[®] and Calraid[®] microbial preparations, *Tuta absoluta* which is a key pest of tomato. These microbial preparations contain spores of *Fusarium* spp. fungi and they are a combination of microorganisms, alkaloids and metabolites. Aforementioned preparations work on the nervous system of pests to immobilize and kill them in a short time.

The production of *T. absoluta* used in the experiment conducted on tomato plants in a controlled climate room conditions at temperature 25±1ºC, relative humidity 60±5% and photoperiod 16:8 h. Therefore, egg-laying of mated female adults was provided on tomato with 6-7 leaves. Larvae, reaching the third- or fourth-stage after hatching were used in the experiment. Recommended dosages (10 g/l) of microbial preparations were applied by three methods; dipping, spraying and residual. In dipping method, 5 larvae placed into a small piece of net were submerged in the solution of microbial preparation for 5 seconds. As for spraying method, the solution of microbial preparations were applied by spray tower with 1 bar pressure, so that 2 mg solution per cm^2 on tomato leaf on which there are 5 larvae. As regards residual method, tomato leaves were submerged in the solutions of each microbial preparation for 5 seconds. Then, these leaves were kept in a bright place for a while to dry in a manner without exposure to direct sunlight. After drying, 5 larvae were put on each of tomato leaves. Afterward, larvae with tomato leaf in petri dishes at the base of which located blotting paper were kept in a climate chamber set to temperature 25ºC, relative humidity 60% and photoperiod 16:8 h in all three methods. As a control to compare with the microbial preparations, distilled water was used and also, assessments were done according to live individual counts at the 1, 3, 5 and 7 DAA (Days After Application). The experiment was arranged in a completely randomized pot design with 10 replicates for both microbial preparations in all three methods. To analyze the data obtained from the experiment, Tukey test applied after One-Way ANOVA, using SPSS[®] (Version 15.00, November 2006, SPSS Inc., Chicago, IL, USA.).

Results

Mean numbers of live individuals at the 1 DAA by dipping method of Calgard[®] and Calraid[®] were respectively 2.00 and 3.60 (Figure 1).
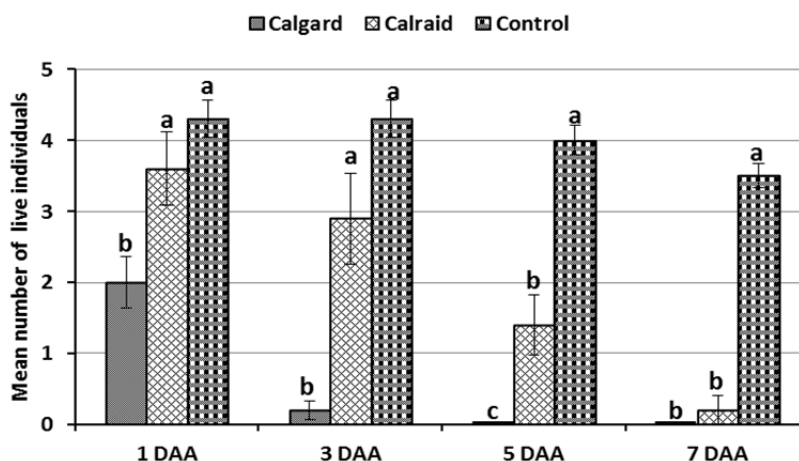
Figure 1. Mean numbers (± standard error) of live individuals at the 1, 3, 5 and 7 DAA by dipping method of Calgard[®] and Calraid[®] microbial preparations. Vertical bars designated by the same letter at the same day do not differ significantly (p>0.05; n=5) according to a Tukey test.

As for these means at the 3 DAA, they were found respectively 0.20 and 2.90. While Calgard[®] was significantly different from the control at the 1 and 3 DAA, Calraid[®] was not found different. The control (4.00), Calgard[®] (0.00) and Calraid[®] (1.40) took place in the separate statistical groups at the 5 DAA by dipping method. However, Calgard[®] (0.00) and Calraid[®] (1.40) at the 7 DAA were located in the same statistical group, but found in different statistical group from the control (Figure 1).

Mean numbers of live individuals at the 1 DAA by spraying method of Calgard® and Calraid® were respectively 2.20 and 3.20. Mean number of live individuals in the same day for the control was 5.00. Mean numbers of live individuals were determined as 0.10, 3.20 and 4.50 respectively at the 3 DAA of Calgard® and Calraid® and control. All three applications were included in the separate statistical groups. As for the mean numbers at the 5 DAA, they were found as 0.00, 0.10 and 3.80. Mean numbers of live individuals at the 7 DAA were identified as 0.00 for Calgard® and Calraid®, and they took place in different statistical group from the control (Figure 2).
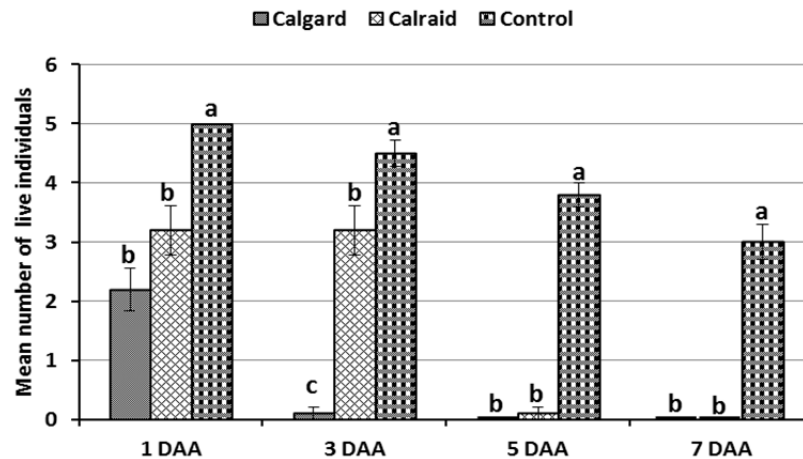
Figure 2. Mean numbers (± standard error) of live individuals at the 1, 3, 5 and 7 DAA by spraying method of Calgard® and Calraid® microbial preparations. Vertical bars designated by the same letter at the same day do not differ significantly ($p>0.05$; $n=5$) according to a Tukey test.

Mean number of live individuals at the 1 DAA of Calgard® by residual method was 2.90 and this preparation took place in a different statistical group from both Calraid® and the control (Figure 3).
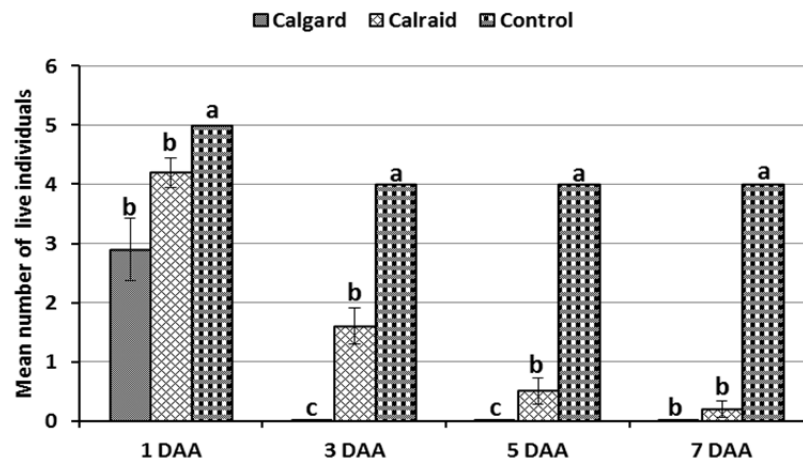
Figure 3. Mean numbers (± standard error) of live individuals at the 1, 3, 5 and 7 DAA by residual method of Calgard® and Calraid® microbial preparations. Vertical bars designated by the same letter at the same day do not differ significantly ($p>0.05$; $n=5$) according to a Tukey test.

All three of the control (4.00 at the both days), Calgard® (0.00 at the both days) and Calraid® (respectively 1.60 and 0.50) were located in separate statistical groups according to mean number of live individuals at the 3 and 5 DAA by residual method. No difference was found between Calgard® (0.00) and Calraid® (0.00) at the 7 DAA, and the control (3.00) was involved in a different statistical group from them (Figure 3).

Discussion

Chemical methods are the most preferred method in controlling the pests. Producers prefer chemical methods for reasons such as easy usage, requirement of less knowledge and labor, and the possibility of rapid result. Moreover, the studies have been conducted on development of alternative control methods (Erkılıç and Uygun, 1993) because chemicals have adverse effects on human health and environment (Erkılıç and Uygun, 1993; Öncüer and Madanlar, 1993; Ay et al., 2005). As an alternative method, applications of microbial preparations were done in this present study. For this purpose dipping, spraying and residual methods were used in this experiment investigated effects of Calgard® and Calraid® on the third- or fourth-stage larvae of *Tuta absoluta*. Effects of microbial preparations on the pest have started from 3 DAA and they had an impact on the pest in all three methods. Moreover, it is possible to say that Calgard® was more effective on the pest than Calraid®. The lowest percentage effect of Calgard® was obtained as 42.00% at the 1 DAA by residual method. The highest effect of this microbial preparation was 100.00%. This percentage effect was achieved from the 3 DAA by residual method and from the 5 DAA by dipping and spraying method. The lowest percentage effect of Calraid® on *T. absoluta* was obtained as 9.50% at the 1 DAA by dipping method. As regards the highest effect of this microbial preparation, it was determined as 100.00% from the 7 DAA by spraying method. Entomoathogenic fungi can be used in controlling pests has been known since the 19th century (Erkılıç and Uygun, 1993). Besides, microbial preparation can be used easily in an integrated pest management program because they have low risk of adverse effect on non-target organisms, the possibility to use in combination with other biological control agents and can even be used with synthetic chemicals in most instances (Agrios, 2005; Uneke, 2007).

As a result, both of Calgard® and Calraid® have an impact on *T. absoluta* were determined according to the data obtained from this present study. To sum up, considering that microbial preparations have low risk for non-target organisms and can be used in combination with other biological control agents, Calgard® and Calraid® have a potential to be used within the scope of integrated pest management. Last of all, studies conducted on the development of environment-friendly agricultural activities should be continued for sustainable agriculture.

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Effect of Calmyte® Microbial Preparation on *Tetranychus urticae* (Acarina: Tetranychidae)

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Abstract

The present study investigated the effect of Calmyte® microbial preparation on *Tetranychus urticae* (Acarina: Tetranychidae). This microbial preparation specialized on *Tetranychus* spp. and other mites, containing spores of *Fusarium* spp. fungi, and it is a combination of microorganisms, alkaloids and metabolites. Aforementioned preparation works on the nervous system of pests to immobilize and kills them in a short time.

In this study investigated the effect of Calmyte® to *T. urticae*, dipping and spraying methods were used. In both methods, 3 different doses of the microbial preparation were used, including 0.25 g/100 ml, 0.125 g/100 ml and 0.0625 g/100 ml. As a control to compare with the microbial preparation, distilled water was used.

As a result, according to the evaluation based on mean number of live individuals at the 1, 3, 5 and 7 DAA (Days After Application) of different doses of the microbial preparation, it was determined that all doses used in the experiments have an effect on the mite in both methods from the 3 DAA. The highest effect of the microbial preparation was obtained as 100.00% at the 7 DAA by spraying method at 0.25 g/100 ml dose, and the lowest effect was found as 27.59% at the 3 DAA by spraying method at 0.0625 g/100 ml dose. Consequently, according to the data obtained, Calmyte® microbial preparation has an effect on *T. urticae* and can be used within the scope of environmentally friendly integrated pest management (IPM) programs has been understood.

Keywords: Bio-insecticide, Calmyte®, bean, microbial preparation, *Tetranychus urticae*

Introduction

The problems related to pest insects, diseases agents and weeds indicating parallel tendency with the progress in agricultural production showed an increase. One of the most important of leguminous crops grown in Turkey is *Phaseolus vulgaris* L. (the common bean). Bean can be consumed as green and dry have been ranked as the third after chickpeas and lentils in terms of acreage and production amount (TÜİK, 2012).

One of the most important pets causes economic losses on bean is the two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae). The two-spotted spider mite is an important pest on the crops both in greenhouse and open field (Güven and Madanlar, 2000). Also, the mite can cause damage on ornamental plants, as well as pome and stone fruits (Düzgüneş and Çobanoğlu, 1983; Kasap, 2002; Uygun et al., 2002; Polat and Kasap, 2011). Determination, biology, distribution, ecological requirements, behaviors and damages of the pests has to be known for a successful control against them. While *T. urticae* causes directly thousands of lesion damages on leaves and leaf losses by sucking plant sap, indirectly decreases photosynthesis and carries virus to healthy plants (Uygun et al., 2002). All biological stages of the mite can be present simultaneously on the same host plant and the mite can feed on the same plant throughout all biological stages. Due to high reproductive rate, population level of *T. urticae* can be increased rapidly under suitable host plant and climate conditions. Chemical method is mostly preferred by producers in controlling the mite because it shows quick impact and applies easily without requirement of species identification (Öncüer and Madanlar, 1993; Ay et al., 2005). Chemicals used against the pest, which is a significant problem in agricultural areas, cause deterioration of the natural balance, environmental pollution and adverse effects on human health, directly or indirectly. Also, development of pest resistance to the chemicals is one of the most important problems in controlling the pest with chemical methods (Erkılıç and Uygun, 1993; Ay et al., 2005). Duo to being multivoltine, as well as polyphagous and high reproductive characteristics of *T. urticae*, resistance development of the mite is questioned after few acaricide applications (Stumpf and Nauen, 2002). Importance of alternative control methods was increased in recent years and microbial control is one of the alternative methods contained in biological

control. Moreover, entomopathogenic fungi can be used in pest control has been known since the 19th century (Erkılıç and Uygun, 1993). Eken and Demirci (1997) suggested in the study on use of fungi in biological control to pest that more than 500 fungus species can infect insects are described. Also, insects in all biological stages are also susceptible against entomopathogenic fungi is expressed. Microbial preparation can be used easily in an IPM program because they have low risk of adverse effect on non-target organisms, the possibility to use in combination with other biological control agents and can even be used with synthetic chemicals in most instances (Agrios, 2005; Uneke, 2007).

Aforementioned reasons above, the study aimed to determine the effect of Calmyte® microbial preparation on *T. urticae* in bean and a potential of this preparation to be used within the scope of integrated pest management.

Material and Method

Main materials of the study are Calmyte® microbial preparation, *Phaseolus vulgaris* and *Tetranychus urticae*. This microbial preparation specialized on *Tetranychus* spp. and other mites, containing spores of *Fusarium* spp. fungi, and it is a combination of microorganisms, alkaloids and metabolites. Aforementioned preparation works on the nervous system of pests to immobilize and kills them in a short time. In the experiment, 3 different doses of the microbial preparation were used, including 0.25 g/100 ml, 0.125 g/100 ml and 0.0625 g/100 ml. Also, all doses of the microbial preparation were applied by two methods; dipping and spraying. In dipping method, bean leaf on which there are mean 13 individuals of *T. urticae* was submerged in the solution of microbial preparation for 5 seconds. As for in spraying method, the solution of microbial preparation was applied by spray tower with 1 bar pressure, so that 2 mg solution per cm^2 on bean leaf on which there are mean 12 individuals of *T. urticae*. As a control to compare with the microbial preparation, distilled water was used in both methods. Afterward, treated-leaves in petri dishes at the base which located a thin sponge were kept in a climate chamber set to temperature 26ºC, relative humidity 60% and photoperiod 16:8 h. Assessments were done according to live individual counts at the 1, 3, 5 and 7 DAA (Days After Application). The experiment was arranged in a completely randomized pot design with 5 replicates. To analyze the data obtained from the experiment, Tukey test applied after One-Way ANOVA, using SPSS® (Version 15.00, November 2006, SPSS Inc., Chicago, IL, USA.).

Results

The effects of microbial preparations occur after the first 24 hours is generally known. In this present study, microbial preparation had no any impact after the first 24 hours too when dipping method was used. Mean numbers of live individuals at the 3 DAA by dipping method of 3 different doses of Calmyte® microbial preparation were respectively 3.40 and 2.60 at 0.25 g/100 ml and 0.125 g/100 ml doses, and located in the same statistical group. Mean numbers of live individuals at 0.0625 g/100 ml dose of the microbial preparation was 6.00 and this mean took place in a different statistical group from first two doses and control. Mean numbers of live individuals in the control at the 3 DAA was higher than one in all three doses and it was found statistically significant (Figure 1).

Mean numbers of live individuals at the 1, 3, 5 and 7 DAA by spraying method of 3 different doses of Calmyte® microbial preparation, including 0.25 g/100 ml, 0.125 g/100 ml and 0.0625 g/100 ml are given in Figure 2. No effect to the mite at the 1 DAA at all three doses by spraying method has been seen. The control took place in a different statistical group from all three doses according to live individual counts made during the experiment, except 1 DAA. Mean numbers of live individuals at the 3 DAA by spraying method at 0.125 g/100 ml and 0.0625 g/100 ml doses of the microbial preparation were respectively 7.20 and 8.40, and no statistically significant difference has been found between two. Mean number of live individuals at the 3 DAA by spraying method at 0.25 g/100 ml dose of the microbial preparation were determined as 2.60, and this mean number was located in a different statistical group from other two doses.

Mean numbers of live individuals at the 5 and 7 DAA at 0.125 g/100 ml and 0.0625 g/100 ml doses of the microbial preparation were in the same statistical group (Figure 2).
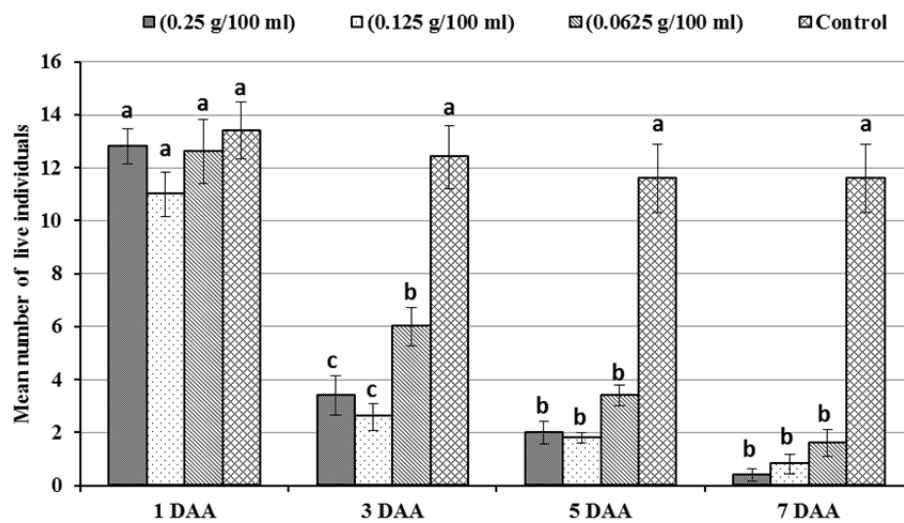
Figure 1. Mean numbers (± standard error) of live individuals at the 1, 3, 5 and 7 DAA by dipping method at 0.25 g/100 ml, 0.125 g/100 ml and 0.0625 g/100 ml doses of Calmyte[®] microbial preparation. Vertical bars designated by the same letter at the same day do not differ significantly (p>0.05; n=5) according to a Tukey test.
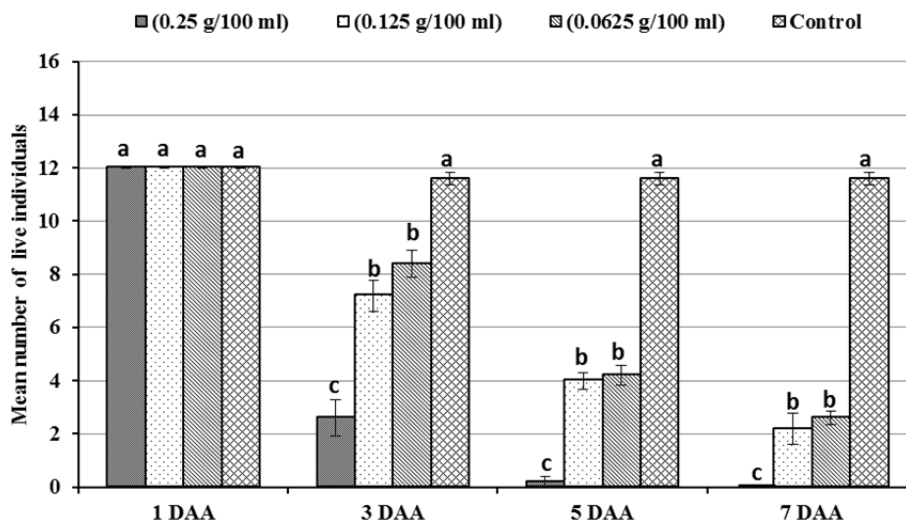
Figure 2. Mean numbers (± standard error) of live individuals at the 3, 7, 14 and 21 DAA by spraying method at 0.25 g/100 ml, 0.125 g/100 ml and 0.0625 g/100 ml doses of Calmyte[®] microbial preparation. Vertical bars designated by the same letter at the same day do not differ significantly (p>0.05; n=5) according to a Tukey test.

Effects of 0.25 g/100 ml dose of the microbial preparation on *T. urticae* in dipping and spraying method were not so different during the experiment. However, Effects of 0.125 g/100 ml and 0.0625 g/100 ml doses of the preparation at the 3 DAA by dipping method were found to be different from that by spraying method. Also, no significant difference was observed between the effects of these doses at the 5 and 7 DAA by dipping and spraying method too (Figure 1-2).

Discussion

As against other pest, chemical methods have been also mostly preferred in controlling *Tetranychus urticae* for reasons such as ease of use, requirement of less knowledge and labor,

rapid result possibility and easier control. However, this situation is creating the possibility of resistance development of the pest in a short time, as well as having adverse effects on human health and environment (Erkılıç and Uygun, 1993; Öncüer and Madanlar, 1993; Ay et al., 2005). Herewith, the studies have been conducted on development of alternative control methods which are constantly keeping pests under pressure and safer than chemical control (Erkılıç and Uygun, 1993). One of them is microbial control contained in biological control. The present study investigated the effects of 0.25 g/100 ml, 0.125 g/100 ml and 0.0625 g/100 ml doses of Calmyte® microbial preparation on *T. urticae* at the 1, 3, 5 and 7 DAA by dipping and spraying method.

According to assessments made by the number of live individuals at the 1, 3, 5 and 7 DAA of different doses of the microbial preparation, it is determined that the microbial preparation is effective on the mite from the 3 DAA in both methods. The highest effect was obtained as 100.00% at the 7 DAA by spraying of the microbial preparation at 0.25 g/100 ml dose. Moreover, the lowest effect was observed as 27.59% at the 3 DAA by spraying of the microbial preparation at 0. 0625 g/100 ml dose, except at the 1 DAA.

Consequently, Calmyte® microbial preparation has an impact on *T. urticae* is supported the data obtained from the present study. This last point should receive attention because it is important to have data on alternative methods to chemical control. The data explain that the microbial preparation has a potential to be used in integrated pest management. Last of all, studies on the development of alternative control methods to chemical control should continue at an increasing rate on behalf of environmental friendly agricultural activities.

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Comparison of Herbicide Application Methods for Weed Controlling in Corn Cultivation in term of Technical and Economical Aspect

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Abstract

Weed control is one of the most important components of a corn production system, especially for reducing yield and increase the costs of production. Controling weed in maize is managed by integration of various ways, crop rotation, mechanical methods, herbicide applications etc. Herbicides are preferred as a most effective techniques in Turkey and in many other countries. In herbicide applications post-emergence herbicides are commonly used for corn cultivation. The post-emergence herbicides applications are done by using domestic cone nozzles extensively in Turkey. But, making spraying by this type of nozzles are not effective, and moreover, are not controlling weed efficiently. In recent years, new generation nozzles and spraying equipment have been developed which allows low drift and high coverage and increased in chemical control of weeds. Especially standard flat fan nozzles are provides a high success in weed control. Another technique called band spraying is also used increasingly. Especially this technique consist more nozzle and these nozzles are making spraying in the same time and provide effective controlling of weed. Some prototype of general nozzles and band spraying techniques are developed by the project supported by TAGEM (numbered asTAGEM-BS-12/12-03/03-01). The purpose of this study is to compare both in point of application techniques and cost effective-economic analysis of these techniques.

Keywords: Herbicides application, Band Application, weed control, maize cultivation

Introduction

Corn is very important crop and can be used directly or indirectly for human consumption, for animal feeding and also for industry. Weeds compete with corn for water, nutrients, and light. They can also serve as alternate hosts for insects and diseases and their secretion of roots and leaves affect adversely to the corn plant. And also on the further stage of corn production, weeds emerge some difficulties for cultivating process and for harvesting (Froud-Williams, 2002; Anonymous 2004).). If there is no preventive measurement against weeds in corn production Yield losses can be reach to 37 % of its potential (Oerke and Dehn, 2004). It is critical to control weeds early in order to protect yields. According to Doğan et al. (2004), Yield losses in the main crop corn, for which corn is sown after spring frosts in March and April can be reach till to 40 % of its potential yield and in second crop corn, for which corn is sown after winter cereal harvest in June and July, can be reach till to 49 % of its potential yield. Therefore, for corn cultivation, taking preventive measurement against weeds is required. Herbicides are among the most effective measures to reduce weed infestation. In herbicide applications post-emergence herbicides are commonly used for corn cultivation. The post-emergence herbicides applications are done by using domestic cone nozzles extensively in Turkey. But, making spraying by this type of nozzles are preferred and suitable for application of insecticides because of size of their drops produced (<100 μm) (Bayat, 1998). Thereby, using by this type of nozzles are not controlling weed efficiently, producing high drift, and also has some environmental risks. Obtaining affective weed controlling farmers are applying more spraying and using high doses of herbicides because of using domestic cone nozzles. In recent years, new generation nozzles and spraying equipment have been developed which allows low drift and high coverage and increased in chemical control of weeds. The new generation nozzles like Standard Flat spray nozzles, Air induction nozzles Even flat fan nozzles and some band spraying techniques are used on herbicide application because of producing bigger drops than cone nozzles. Band spraying application techniques provide high success in chemical control of weed because they can send the solution of herbicides to directly target area (Coates, 1996). Especially in band spraying,

many nozzles are spraying herbicide solution in the same time, and this are making target areas more contaminated which make spraying successfully. The objective of this study is to compare both application techniques of new generation nozzles and some band spraying and broadcast techniques for application principals and cost effective-economical analysis of all these techniques.

Material and Methods

Field works of the research have been conducted in the experimentation area of Eastern Mediterranean Agricultural Research Institute, in Adana in 2013. The experiment was laid out in randomized complete block design (RBD) with five spraying methods with 4 replication on 24 parcels with control by using corn cultivar named P.34N24 belong to Pioneer in second crop season after wheat. The spraying methods (in 400 l.ha^{-1} volume which are common for farmer) used in the experimentation were: (1) Standard Flat spray nozzles application (Broadcast application- STFF: ST110-03-POM), (2) Air induction nozzles application (Broadcast application- AIN: IDN120-025 POM), (3) Even flat fan nozzles (Band application- EFN: ES-90-02 POM), (4) under leaf banding with air induction application (Band application- UBN: POM IS-80-025) and (5) Row application kit with multiple nozzles (Band application- RAK: ST80-025 POM). Each method used in the research was experimented at 400 l.ha^{-1} application volumes and plant height 15-30 cm of maize plants. In order to be able to perform other methods of spraying with the same prototype of sprayer, 4 separate booms with 3,5 m long spraying width which can be easily attached to on the same sprayer were produced. The nozzles were attached on the spraying boom 50 cm interval in broadcast (STFF, AIN) and 70 cm interval in spraying band applications (EFN, UBN, RAK). There was 5 m security zone between blocks and parcels.

For under leaf banding with air induction nozzles (UBN), the tails are attached vertically to boom with 70 cm interval in maize row and making spraying.(Figure 1)
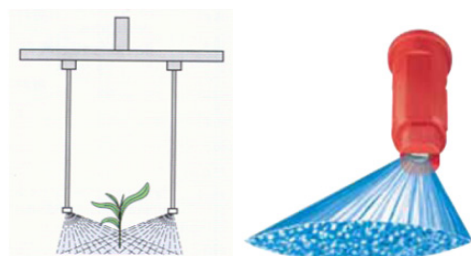
Figure 1.Schematic view of under leaf banding application

For row application kit with multiple nozzles (RAK), has 3 nozzles which are located one nozzle on the top, the others on the left and the right side respectively. These nozzles are making spraying in the same time and on the same target area. It can be seen in figure 2.
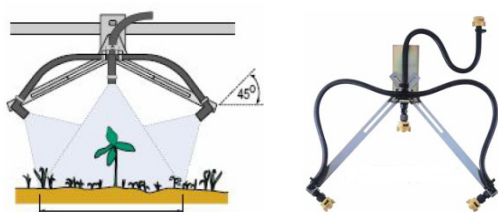
Figure 2. Schematic view of row application kit

In this research, the all herbicicide nozzles types was determined in term of droplet characterization. The caracterization was made by using laser measurement device (Malvern Spraytec -Open Spray) (Figure 3).

Figure 3. Droplet size measurements with Malvern Spraytec

The size and/or volume distribution of drops in a spray is typically expressed by the size versus the cumulative volume percent. The all nozzle types of droplet size distribution were determined in same pressure (2 bar) in a 60 second periods. Relative span factor (R) was determined for homogeneity coefficients of droplet size of each nozzles by using formula below (Equation 1).

$$R = \frac{Dv_{0.9} - Dv_{0.1}}{Dv_{0.5}} \qquad \text{(Equation 1)}$$

R: Relative span factor,
$Dv_{0.9}$: 90 percent of spray volume is in droplet smaller than this value
$Dv_{0.1}$: 10 percent of spray volume is in droplets smaller than this value
$Dv_{0.5}$: Volume median diameter (%50 of the volume)

Numbers of weeds in each applications parcel of experiment were counted to determine efficiency of the all methods for weed control after spraying. In each parcel 8 different point were determined for counting and each point accepted as target point and used a frame with a 0,15 m^2 (30X50 mm) size. To determine the efficiency we used Abbot Formula (Equation 2).

$$Efficiency(\%) = \frac{NumbersofWeedinControl. - NumbersOfWeedinApplication}{NumbersOfWeedinControl} \times 100 \ \text{.......}(Equation\ 2)$$

In this research we considered that spraying tank, the pomp, boom and the pipes were stable while nozzles equipment were our variables to analyzing for cost effectiveness. It is considered that the other all equipment were stable and cost analysis were made according to this information.

Results and Discussion
Summarized in Tables 1 and 2 are the results of the study. Droplet size distiribution for each methods can be seen in table 1. The data are showing the relation between pressure and size of droplets.

Table 1. Droplet size distiribution for each methods

Methods*	Pressure (bar)	Dv$_{0.1}$ (µm)	Dv$_{0.5}$ (µm)	Dv$_{0.9}$ (µm)	Relative Span
STFF	2	90,3	186,5	395,7	1,637
AIN	2	213,3	451,2	758	1,207
EFF	2	81,3	149,4	266,3	1,238
UBN	2	185	428,5	748,1	1,314
RAK	2	135,8	188,6	262	0,669

*STTF: ST110-03-POM; AIN: IDN-120-025 POM; EFF: IS-80-025 POM; UBN: ES-90-02 POM; RAK: ST80-015 POM

It can be seen in the table 1, the highest $Dv_{0,5}$ were obtained from AIN as 451,2 μm and the lowest $Dv_{0,5}$ were obtained from UBN as 149,4 μm. When it is looked for particle size, Relative span data were ranged from 0.669 to 1637. The best relative span was obtained from AIN and EFF respectively.

The mean of crop yield, control efficiency (%) and cost of each method ($ per 1 m boom) obtained from the methods applied were shown in table 2.

Table 2. The mean of crop yield, control efficiency and cost of each method

Method	Crop Yied (kg.ha^{-1})	Control efficiency (%)	Cost ($/1m boom*)
STFF	11407	69,0	21,16
AIN	11247	58,7	33,96
EFF	11020	60,4	16,13
UBN	10155	67,7	73,36
RAK	12520	80,0	121,86

*The economical analysis were made based on dolar Exchange rate of Central bank of T.R. (1$=2,15 TL).

As It is seen in Table 2, the highest crop yield was provided as 12520 kg.ha^{-1} from the RAK (row application kit with multiple nozzles) method. STFF (Standard flat fan nozzles) method was followed by 11407 kg.ha^{-1}. The weed control efficiency was obtained from RAK with highest value 80 %, and STTF and UBN were followed by 69 % and 67,7 % respectively. Maximum Cost ($/1m boom) were recorded from RAK (121,86$), whereas the minimum cost (16,13 $) were observed from EFF.

According to results of this research, Row application kit with multiple nozzles (RAK) had better performance than the other method applied for weed control efficiency and for crop yield. However, The RAK method was the most expensive one between the other methods because of manufacturing restriction in Turkey. On the other hand this new method have a prosperity due to weed control efficiency and positive effect on environment in the long term.

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Chemical Composition of Essential Oil of *Laurus nobilis* L. in Urla / Izmir - Turkey

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Abstract

Bay laurel (*Laurus nobilis* L.) belongs to the family *Lauraceae*, which comprises numerous aromatic and medicinal plants. *Laurus nobilis* L. native to Mediterranean regions is also known as sweet bay, bay laurel, Grecian laurel, true bay, and bay. Bay laurel has been used as a spice since antiquity, primarily because of its oil content. In Turkey, *Laurus nobilis* L. grows in the Marmara, Aegean and Mediterranean regions. In this study, essential oil content of trees in Urla – Izmir which is western part of Turkey was determined. The samples of two years old leaf were taken in June, July, August and September from 50 different genotypes. After collection samples were dried at room temperature and each sample was subjected to hydro distillation by Clevenger apparatus and analyzed by gas chromatography.

Seventy six compounds were found in the leaf and 33 of them were found in all genotypes. The major component was 1.8-Cineole and there were not significant differences between genotypes. The highest amount of this component was found in September.

Keywords: Bay laurel, daphne, *Laurus nobilis* L., essential oil

Introduction

Bay laurel or daphne (*Laurus nobilis* L.) stands within the Lauraceae family Laurus genus. Laurus genus has two species which are very similar to each other. While the motherland of daphne tree is Asia Minor and the Balkans, it is known that they have been found on the coasts of Mediterranean Sea in the ancient history. Being one of the characteristic plants of Mediterranean region today, spread area of daphne in the world is in entire Mediterranean countries (Spain, South France, Corsica Island in Italy, North Africa, Israel and Cyprus) with a Mediterranean climate and in Black Sea coasts of Russia and India where they are raised for cultivation (Acar, 1987). One of the important export products of Turkey, bay laurel constitutes 90% of the world exportation, in medicinal plants and NTFP (non-timber forest products). Being valuable for the essential oils inside, bay laurel leaves are used especially in chemistry and food; and also in perfumery, soap and medicine industries. Leaves increase in value as per the quality and quantity of essential oil (Göker and Acar, 1983). 20% of total bay laurel production is used in soap industry (Konukçu, 2001). Protective effects come from 1.8 cineol and eugenol derivatives. Besides, essential oil and oleoresin are used in perfumery industry. Fruit of bay laurel includes 25-30% of fatty oil which is used in the production of soap and paraffin (Acar, 1987; Akgül, 1993). There are odorous essential oils (Lauri aetheroleum) in the leaves of bay laurel plant. The amount of essential oil in the daphne leaf is 0,5-4.,69 % (Bozkurt et al., 1982; Anşin and Özkan, 1997); and 50 % of this oil includes cineol (Cengiz, 1979; Polat, 1998).

Essential oil content of the leaves are subject to change in accordance with the genotype, region and season. In this study, amount of essential oil among and its profile June-September in two years old leaves of daphne trees which grow naturally in Urla-Izmir were examined.

Material and Method

The samples of two years old leaves were taken in June, July, August and September from 41 different genotypes which are raised naturally in Urla-Izmir/Turkey. Samples were taken 3 times, 10 leaves per each time.

Among the air-dried leaves, essential oil was obtained by means of water distillation method using Neo-clevenger device; and the amounts were calculated in mL/100 g and determined in %

(Wichtl, 1971). The compounds of obtained essential oils are determined in the gas chromatography. For this reason, 1 µl extract was injected, compound leave durations were determined in the analysis conditions in table 1, and their amounts were calculated.

Table 1. Gas chromatography analysis conditions

GC/MSD Mass Selective Detector	
Column	HP Innowax column
Column Length	60 m
Column Inner Diameter	0,32 (mm) 0,25µm (film)
Carrier Gas	He
Gas Flow Rate	0,7 ml/min
Device	HP 6890 GC
Detector	5973 MSD
Amount of Injection	1 µ
Injection Block (Inlet)	150 C
Heat Program	70 C-1'//7 C/min//210 C-10'
Dilution Ratio	1/100 n-HEXANE
Library Used	Wiley 275 was compared with the original samples of ARGEFAR.

Results

Leaf essential oil amounts in the daphne trees differed statistically based on genotypes and periods; and genotype x period interaction was found to be important ($p < 0.05$). Tree 25 has the highest average essential oil amount (3.24%) and tree 22 has the lowest average essential oil amount (0.80%), accordingly. When we check the months, essential oil amount of leaves on daphne genotypes changed between 0.26-5.93% in June; between 0.67-3.73% in July; between 0.67-4.24% in August; and 0.67-3.67% in September. The average values of periods, it was found out that while the oil content has the highest average value in June, it decreases in time and comes to the lowest value in September. The average essential oil amount was 2.29% in June, 2.09% in July, 1.80% in August and 1.67%, in September. But it increased continuously in the genotypes 6, 10, 28, 34, 35, 39 and 40. Various changes have been in the other genotypes (Table 2).

With regard to the essential oil compounds of leaves, no statistical differences were found between both bay laurel genotypes and months ($p < 0.05$). After the oil analysis results, in total 76 different compounds were found in the essential oil of leaves. While 33 of them can be found on nearly every tree, the others are present on some of the trees sparingly. Outstanding compounds are 1,8 cineol (C5-Terpen oxide), alpha terpinenyl acetate (C3- Ester), alpha terpineol (C2-Alcohol), eugenol (C4-Fenol and fenol eter), sabinen (C1-Monoterpen hydrocarbon) and terpinen-4-ol (C2-Alcohol). Main compound was found out to be 1,8 cineol among the essential oil compounds in the two years old leaves of examined trees.

The amount of 1,8 cineol compound changed between 30.17 (#19) - 59.20% (#36) in June; between 39.88 (#38)-63.77% (#13) in July; between 40.44 (#5) - 69.01% (#19) in August; and between 7.96 (#31)-77.18% (#30) in September. The amount of alpha terpinenyl acetate compound changed between 8.93 (#26) - 33.96% (#19) in June; between 6.76 (#26) - 19.41% (#3) in July; between 2.71 (#5) - 22.43% (#40) in August; and between 7.18 (#26) - 20.95% (#2) in September. The amount of alpha terpineol compound changed between 0.92 (#36) - 7.55% (#26) in June; between 0.80 (#14) - 6.32% (#26) in July; between 0.94 (#14) - 5.75% (#9) in August; and 0.53 (#14) - 6.54% (#9) in September. The amount of eugenol compound changed between 0.62 (#8) - 5.66% (#27) in June; between 0.34 (#13) - 5.78 % (#41) in July; between 0.35 (#13) - 5.61% (#32) in August; and 0.53 (#14) - 5.27% (#41) in September. The amount of sabinen compound changed between 2.07 (#19) - 10.59% (#6) in June; between 1.89 (#19) - 8.98% (#41) in July; between 1.56 (#22) - 7.11% (#39) in August; and 1.18 (#12) - 6.68% (#41) in September. The amount of terpinen-4-ol compound changed between 2.07 (#19) - 10.59% (#6) in June; between 1.89 (#19) - 4.33% (#11) in July; between 1.92 (#22) - 5.48% (#24) in August; and between 1.98 (#34) - 6.33% (#10) in September.

Table 1. Essential oil content of bay laurel genotypes (%)

Genotype No	Essential Oil Content (%)				
	June	July	August	September	Average
1	1.48 l-n	1.84 j-m	1.78 k-o	1.41 h-k	1.63 p-r
2	3.21 d	1.60 op	1.75 l-o	1.18 l-n	1.94 kl
3	1.77 k	1.81 l-n	1.03 wx	0.81 q-s	1.36 uü
4	1.53 l	2.33 e-f	1.08 v-x	1.00 n-q	1.49 t
5	1.30 m-p	1.67 m-o	1.85 j-m	1.33 ı-l	1.54 r-t
6	2.25 f-h	1.60 op	1.46 q-t	1.43 h-j	1.69 o-q
7	2.17 g-ı	2.41 de	0.76 z	1.05 m-p	1.6 q-s
8	1.42 l-o	1.55 o-q	1.89 j-l	2.07 ef	1.73 no
9	1.83 jk	2.46 de	2.35 f	2.17 de	2.20 ef
10	2.02 ıj	2.02 g-k	0.82 y-z	0.67 s	1.38 u
11	1.29 n-p	1.37 q	1.55 p-r	0.88 p-r	1.27 ü
12	1.04 r	1.47 pq	1.24 u-v	0.88 p-r	1.16 v
13	4.35 b	1.65 m-p	1.93 ı-l	1.53 gh	2.36 d
14	3.57 c	2.57 cd	3.03 c	2.19 d-e	2.84 c
15	3.49 c	2.07 g-ı	1.67 m-p	2.00 ef	2.31 d
16	2.13 hı	2.14 f-h	2.15 gh	1.59 gh	2.00 jk
17	2.40 f	2.33 ef	2.42 ef	1.67 g	2.21 e
18	2.05 ı	1.83 k-n	1.64 n-q	1.67 g	1.80 mn
19	3.45 c	1.50 o-q	1.79 k-o	1.67 g	2.10 f-h
20	1.24 o-q	1.92 ı-l	1.67 m-p	1.17 l-n	1.50 s-t
21	2.33 fg	2.17 f-h	2.62 de	2.28 de	2.35 d
22	1.05 qr	0.67 s	0.67 z	0.79 rs	0.79 w
23	2.38 f	2.67 c	1.66 m-q	1.50 g-ı	2.05 g-ı
24	3.13 d	2.01 g-k	2.13 hı	2.1 de	2.34 d
25	4.51 b	2.00 h-l	3.33 b	3.13 b	3.24 ab
26	3.56 c	3.00 b	2.34 fg	3.67 a	3.14 b
27	1.39 l-o	2.00 h-l	1.51 p-s	1.33 ı-l	1.56 r-t
28	2.27 f-h	2.03 g-j	1.00 x-y	1.59 gh	1.72 n-p
29	0.26 s	2.51 c-e	2.69 d	0.96 o-r	1.61 q-r
30	5.93 a	2.94 b	3.08 bc	1.28 j-l	3.31 a
31	1.08 qr	3.73 a	1.00 xy	3.50 a	2.33 d
32	2.25 f-h	3.49 a	4.24 a	3.10 b	3.27 a
33	1.13 qr	1.00 r	1.15 ü-x-	1.00 n-q	1.07 v
34	2.78 e	2.51 c-e	1.32 s-v	1.23 k-m	1.96 jk
35	2.35fg	1.63 n-p	1.30 t-ü	0.85 p-s	1.53 r-t
36	1.76 k	1.60 op	1.82 j-n	2.00 ef	1.79 mn
37	2.27 f-h	1.83 k-n	1.21 ü-w	2.54 c	1.96 jk
38	2.36 fg	2.45 de	1.95 ı-k	2.76 c	2.38 d
39	2.08 hı	2.20 fg	2 h-j	1.13 l-o	1.85 lm
40	3.49 c	1.55 o-q	1.42 r-u	1.60 gh	2.01 h-j
41	1.49 lm	3.61 a	1.78 o-r	1.90 f	2.15 e-g
Average	2.29 a	2.09 b	1.80 c	1.67 d	1.96

Discussion

The amounts of leaf essential oil in 41 bay laurel genotypes raised in Urla, İzmir, Turkey in a natural population were found out different from each other; and the amounts differed between 3.24-0.80%. In different studies, it was indicated that the essential oil ratio of daphne leaves changes between 0.5 and 2.19 mL/100 g (Tanker and Tanker, 1976; Acar, 1987; Ceylan and Özay, 1990; Akgül, 1993). Leaf essential oil of genotypes changed between 0.26-5.93% in June; 0.67-3.73% in July; 0.67-4.24% in August and 0.67-3.67% in September. Average oil content has the highest in June, it decreases in time and comes to the lowest value in September. Acar (1988) found that the quantity of essential oil depends on the regional climate types, temperature index and annual amount of rainfall; and that if amount of essential oil increases with the increasing amount of rainfall. In a study in Aegean Region, researcher found the highest

essential oil amount in August. While in this study it was found that the months with the highest essential oil amounts were June and July; there are some genotypes with the highest amounts in August. Hence, Ceylan (1995) indicated that essential oil ratio in the plants increases in direct proportion to the temperature; and that those alterations change from plant to plant.

Total 76 different compounds were found in the essential oil of leaves. While 33 of them can be found nearly all trees, the others are present on some trees. 1,8 cineol, alpha terpinenyl acetate, alpha terpineol, eugenol, sabinen and terpinen-4-ol were found out to be the most important ones. Kılıç et al. (2004), were found that the main compounds of fresh daphne leaves are 1,8 cineole, alpha terpinenyl acetate, sabinen, alpha-terpineol, eugenol, beta elemen, beta pinen, alpha pinen. Hence, the flavor and taste of daphne leaf come from eugenol to a great extent. 1,8 cineole was found between 37.20-44.10% and linalool was found between 8.71-11.18% in the oil compounds of daphne leaves collected in Yugoslavia, Morocco, Spain and France (Zola et al., 1977). In the study, the highest 1.8 cineol amount was found out 61.69% in September. The highest amounts for alpha terpinenyl acetate (15.82%), for sabinen (6.56%) and eugenol (2.34%) were reached in June; terpinen-4-ol (3.16%) and alpha-terpineol (2.74%) were reached in September. In a study of Anaç (1986) on the leaves collected from grown trees in İstanbul, 1,8 cineol amount was found 40.62 and 42.70% in June, and July, respectively.

Conclusion

Urla-Izmir is an important natural Daphne population area. Here there are many individuals with different genotypes. It was found out that essential oil content which is one of the factors in determining the amount of Daphne, differ here. It was also revealed in this study that the difference here alters with genotype as well as the change in months. From this point of view, it is important to protect and reproduce the individuals with more leaf essential oil content. Besides, it is important to prefer the month with the highest content, in leaf collection works for obtaining essential oil.

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Effects of Aminoethoxyvinylglycine and Naphthalene Acetic Acid on Pre-Harvest Fruit Drop and Fruit Quality of 'Jersey Mac' Apples

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Abstract

The aim of this research was to determine the effects of pre-harvest aminoethoxyvinylglycine (AVG), naphthalene acetic acid (NAA) and AVG+NAA treatments on the pre-harvest fruit drop and fruit quality of 'Jersey Mac' apple. For this purpose, 125 ppm dose of AVG, 20 ppm dose of NAA and 125 ppm dose of AVG + 20 ppm dose of NAA were sprayed on the fruits 21 days before commercial harvest (DBH). Fruit maturity was delayed about 6 days in AVG and AVG+NAA applied fruits. The NAA-treated fruits were ripened after 3 days compared to control fruits. The pre-harvest drop was decreased with all applications. However, AVG and AVG+NAA-treated fruits were dropped less than NAA-treated fruits. All treatments increased the fruit size and fruit weight of 'Jersey Mac' apple. AVG and AVG+NAA increased the fruit firmness than NAA-treated and control fruits AVG and AVG+NAA applications also decreased ethylene production and the respiration rate of fruits. As a results, AVG treatments were determined to be more effective compared to only NAA treatment on pre-harvest fruit drop and fruit quality of 'Jersey Mac' apples.

Keywords: AVG (aminoethoxyvinylglycine), NAA (naphthalene acetic acid), pre-harvest fruit drop, fruit quality, apple

Introduction

Preharvest drop of apple is unpredictable and can result in severe economic losses in some years. Some commercially important cultivars are seriously affected by this problem, imposing a significant limitation on their profitability. This report of the effectiveness of plant growth regulator sprays in reducing preharvest drop led to much activity in developing these compounds as cultural tools. Many compounds have been investigated for this purpose (Marini et al., 1989) and several have been found effective. Three classes of compounds are most important in the history of chemical preharvest drop control: 1) Auxins and compounds with auxin-like activity, 2) SADH or daminozide, and 3) AVG, an ethylene biosynthesis inhibitor (Ward, 2004). NAA is an auxin-type growth regulator that primarily is used to reduce pre-harvest drop. NAA does not strengthen up the fruit attachment, but only prevents further loosening from the fruit stem. When it is used to reduce drop, it does not delay ripening. The result may be overripe fruit that have a shorter storage life if harvest is delayed (Curry, 20006; Kvikliene et al., 2010). AVG can reduce fruit ethylene production, reducing pre-harvest fruit drop and the incidence of premature fruit ripening on the tree (Amarante et al., 2002; Greene 2006; Robinson et al., 2006). In 'Golden Delicious' apples, AVG sprayed four weeks before harvest inhibited ethylene production, reduced preharvest drop, delayed fruit maturation on the tree and fruit ripening and softening during storage (Bramlage et al., 1980; Autio and Bramlage, 1982; Masia et al., 1998). 'Jersey Mac' is one of the most popular and commercially important apple cultivars in earlier apples. Unfortunately, 'Jersey Mac' is prone to fruit drop and to softening during storage and transportation. Due to early harvest time, 'Jersey Mac' fruits has not good quality (weight, firmness, colors etc.) at this time. The purpose of this investigation was to study the effect of NAA alone or in combination with ethylene biosynthesis inhibitor AVG and time of application on control of preharvest fruit drop and maintenance of on-tree fruit quality in 'Jersey Mac' apple.

Material and Methods

Field trials were conducted at the Eğirdir Fruit Research Station located at 37° 49' N latitude, 30° 52' E longitude and 926 m above sea level, Eğirdir Town in middle Lakes region of Turkey in 2013. 'Jersey Mac' apple trees grafted on M9 rootstock. The experiment was set up in a

randomized block design, with four replications and single tree per replicate. Treatments were performed 21 days before commercial harvest date. The trial scheme was following:

1) The untreated control (water plus 1% (v/v) Tween 20)
2) 125 ppm dose of AVG [15% ReTain (Valent BioSciences Corp., USA)] plus 1% (v/v) Tween 20
3) 20 ppm dose of NAA plus 1% (v/v) Tween 20
4) 125 ppm dose of AVG + 20 ppm dose of NAA plus 1% (v/v) Tween 20

Fruit drop was evaluated 3 times, at five days intervals. Cumulative drop rates (%) was expressed as percentage of total fruit yield. Fruits were harvested at a commercial stage of maturity each of treatments. Sample of 20 fruit of uniform size per replicate were assessed for maturity at each harvest date. The fruit width (mm) weight (g), fruit colour (measured with a Minolta Chroma Meter CR-300 using the CIE L*, a*, b*, h°, C*), fruit flesh firmness (N) (using a Lloyd LF Plus Universal Test Machine), and soluble solids content (%) (SSC) (using a digital Palette PR–32 Atago refractometer) were measured. Titratable acidity (%) (TA) was determined using a digital buret (Digitrate Isolab 50 m*l*). The measurement of the respiratory rate was done with a gas analyzer. The ethylene production rate was determined using gas chromatography with a flame ionization detector. (Gunes et al. 2001). Statistical analyses were performed with General Linear Model using SPSS (V.16; Statistical software, SPSS. Inc., USA). Mean separation was performed using Duncan's multiple range test at $P \leq 0.05$ level.

Results

Fruit Ripening and Harvesting

All treated fruits (AVG, NAA and AVG+NAA) were harvested later than control fruits of this study. While the control fruits harvested in 1 August 2013, AVG and AVG+NAA treated fruits harvested 7 August 2013, NAA-treated fruits also were harvested in 4 August 2013. Fruit maturity was delayed about 4-7 days in AVG and AVG-NAA applied 'Jersey Mac' fruits.

Fruit Yield and Cumulative Drops Rates

The effects of all applications on fruit yield (kg/tree) were not statistically significant at the 5 % level. However, the highest (20.66 kg/tree) of fruit yields apples was found AVG treatments. The effects of AVG concentrations on the pre-harvest fruit drop rates were statistically significant ($P \leq 0.05$). Compared to control treatment, AVG, NAA and AVG+NAA treatments significantly reduced the pre-harvest fruit drop rates. AVG and AVG+NAA treatments were found to be more effective in pre-harvest fruit drop control than NAA and control treatments. The highest pre-harvest fruit drop rates (%47.85) was found in control treatments (Table 1).

Table 1. Effects of AVG and NAA on yield and pre-harvest drop rates of 'Jersey Mac' apples

Treatments	Yield (Kg/tree)	Pre-harvest fruit drop (% no of total)
AVG	20.66	16.52b
NAA	14.72	38.93a
AVG+NAA	16.91	25.03b
Control	10.75	47.85a
P values	0.204	0.003

[a-b]: Values in a same column for each effect followed by different letters are significantly different (Duncan, $P \leq 0.05$)

Fruit Quality

Effects of all treatment on fruit width, fruit weight and fruit flesh firmness were given in Table 2. Effects of all treatments on fruit width, fruit weight and fruit flesh firmness were not statistically significant. The highest fruit width and fruit weight were 72.38 mm and 168.93 g with NAA applications. The lowest fruit flesh firmness was also observed NAA-treated fruits.

Table 2. Effects of AVG and NAA on fruit width, fruit weight and fruit flesh firmness of 'Jersey Mac' apples

Treatments	Fruit width (mm)	Fruit weight (g)	Fruit flesh firmness (N)
AVG	70.14	158.86	73.88
NAA	72.38	168.93	64.29
AVG+NAA	70.44	164.06	68.72
Control	68.37	147.40	66.71
P values	0.529	0.482	0.166

A significant difference was not observed among treatments with regard to SSC and in TA (Table 3). The effect of the treatments on ethylene production and respiration rate were found to be statistically significant among treatments groups ($P \leq 0.05$). The highest ethylene production and respiration rate were obtained at the control and AVG-treated fruits showed the lowest value (5.84 µL/kg.h and 10.73 µL/kg.h) (Table 3).

Table 3. Effects of AVG and NAA on SSC, TA, ethylene production and respiration rate of 'Jersey Mac' apples

Treatments	SSC (%)	TA (%)	Ethylene production (µL/kg.h)	Respiration rate (µL/kg.h)
AVG	8.23	0.54	5.84b	10.73b
NAA	8.47	1.94	62.02a	16.87a
AVG+NAA	8.47	0.53	35.98ab	16.59a
Control	8.80	0.61	66.83a	17.86a
P values	0.525	0.445	0.007	0.015

[a-b]: Values in a same column for each effect followed by different letters are significantly different (Duncan, $P \leq 0.05$)

While a significant difference between applications in terms of fruit colour L* and fruit color h° was not observed of this study, the difference in fruit colour a* (green to red colour development), fruit color b* (yellow ground colour) and fruit color C* were significant ($P \leq 0.05$) (Table 4). AVG treatments had the highest values of the fruit color b* and C*of the treatments while the highest fruit color a* values were observed at control fruits. The AVG and AVG+NAA treatments were decreased on fruit colour (a*, b*) and that the group was statistically different from other treatments (Table 4).

Table 4. Effects of AVG and NAA on fruit color (L*, a*, b*, C*, h°) of 'Jersey Mac' apples

Treatments	L*	a*	b*	C*	h°
AVG	57.61	-0.85b	33.58a	41.21a	82.33
NAA	53.10	5.35ab	28.76b	36.67b	71.88
AVG+NAA	55.48	3.17ab	29.63ab	38.62ab	74.51
Control	53.74	8.23a	27.71b	37.50b	66.29
P *values*	0.247	0.051	0.058	0.042	0.066

[a-b]: Values in a same column for each effect followed by different letters are significantly different (Duncan, $P \leq 0.05$)

Discussion and Conclusion

All treated-fruits were harvested later than control fruits. Fruit maturity was delayed about 3-7 days in NAA, AVG and AVG+NAA applied fruits. Our data was in agreement with previous reports on AVG treatments (Greene, 2006; Petri vd., 2006; Rath vd., 2006; WookJae vd., 2006; Kang vd., 2007; Whale vd., 2008). Similar to previous researches carried out with different apple species (Byers, 1998; Greene, 2005; Yuan and Carbaugh, 2007), AVG in present study was found to be effective in prevention of pre-harvest fruit drops of 'Jersey Mac' apple. Although all AVG treatments significantly reduced the pre-harvest fruit drop rates compared to control, the treatment of only AVG applied at 21 days before the anticipated harvest date was found to be more effective in drop prevention than the NAA and other treatments. Application of AVG to Japanese varieties of apples such as 'Tsugaru' and 'Sansa' have also resulted in reduced pre-harvest fruit drop and ethylene production, and delayed fruit maturation (Kondo and Hayata 1995; Chun et al. 1997; Park et al. 1999).

In our study, AVG applied increased fruit weight and fruit flesh firmness, while NAA applied reducing fruit weight and fruit flesh firmness. Likewise, Schupp and Greene (2004), Yuan and Li (2008), Escalada ve Archbold (2009) and Öztürk et al. (2012) stated that AVG treatments were found to be more effective in flesh fruit firmness than NAA treatments. As in many studies (Amarante vd., 2002; Kang vd., 2007; Whale vd., 2008; Çetinbaş et al. 2011), our study showed that the ethylene production and respiration rate were lower than that of control fruits and NAA-treated fruits.

It was reported that ethylene-inhibiting AVG treatments reduced red peel color formation of apples (Greene, 2005). Wargo et al. (2004) reported decreased reddish intensity (higher hue angle) with AVG treatments in apples. Retarding effects of AVG in a* values (red color formation) were observed in significantly AVG treatment. L* and hue angles were found to be higher than control fruits.

As a result, AVG was definitely effective to control pre-harvest drops, delayed fruit maturation and increased fruit quality of 'Jersey Mac' apples than NAA treatments.

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Effects of Aminoethoxyvinylglycine (AVG) on 'Williams' Pears Leaf Characteristics

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Abstract

The aim of this research was to determine the effects of pre-harvest aminoethoxyvinylglycine (AVG) treatments on the leaf area, leaf chlorophyll (Spad values) and nutrients components in leaf of 'Williams' cultivar pears. For this purpose ReTain® (AVG %15) within concentrations of 100, 125 and 150 ppm was applied as a spray 7, 21, 30 days before commercial harvest (DBH) over 2-year period in Eğirdir Fruit Research Station orchard. It was determined that leaf area was increased with 21 DBH AVG dosage treatments. The Spad values of 'Williams' pear leaf increased after AVG treatments and the highest Spad values were found in 7 DBH+150 ppm (46.92). Magnesium contents were observed significantly by only AVG application times ($P \leq 0.05$) in first experiment year. Overall results indicated that ReTain (15 % AVG) plant growth regulator is thought to have reducing and increasing effects on mineral substances for 'Williams' pear.

Keywords: AVG (aminoethoxyvinylglycine), leaf area, leaf chlorophyll, nutrients components, pear

Introduction

ReTain plant growth regulator is a commercial formulation of aminoethoxyvinylglycine (AVG). This compound is known to competitively inhibit the activity of the enzyme ACC (1-aminocyclopropanecarboxylate) synthase, ethylene-mediated ripening processes can be delayed (Olson et al., 1991; Jobling et al. 2003). Using conventional airblast spray equipment, ReTain is typically applied to apples 3-4 weeks before the first expected harvest of the untreated apples. AVG temporarily decreases ethylene production, reduces endogenous ethylene levels and delays fruit maturation and ripening as measured by various ripening indices. This delay can have a range of benefits depending on the tree, thereby optimizing the harvest process, fruit quality at harvest and fruit storage potential. Numerous studies and a decade of commercial experience have demonstrated that AVG reduces pre-harvest fruit drop, maintains green background color, and reduces maturity related disorders such as watercore.

To this day, so many studies have been done for delays fruit maturation, better fruit quality, better yield and postharvest preservation of the apples, pears, peaches, plums, sweet cherries (Wang and Dilley, 2001; Brackmann, 2007; Çetinbaş and Koyuncu, 2011, Çetinbaş and Butar, 2013). However, treated-AVG plant growth regulator on fruit trees, how to have an effect on the leaves that have not been studied. Likewise, Monge et al. (1994) stated that plant growth regulators affect the leaf mineral and chlorophyll. There are very few publications in recent years. For this reason, in this study was to determine the effects of pre-harvest aminoethoxyvinylglycine (AVG) treatments on the leaf area, leaf chlorophyll (Spad values) and nutrients components in leaf of 'Williams' cultivar pears.

Material and Methods

Twelve-years-old 'Akça' and eight-years-old 'Williams' pear trees planted in the Eğirdir, Fruit Research Station' s orchards in Eğirdir, Isparta-Turkey, were sprayed with AVG on fruit and leaf. Three levels (100, 125, 150 ppm) of AVG were applied 30, 21, 7 days before harvest day (DBH), 2011 and 2012. Each treated-fruit were sampled on the basis of uniform coloration and maturity. Same time each treated-leaf also was collected. The leaf area, the chlorophyll content and leaf mineral content were determined for twenty leaves showing average growth from the upper, middle, and lower parts of the outer canopy. The leaf area was measured by leaf area meter (KP-90 N Plane Meter, Japan) (Kim et al 2004). Leaf chlorophyll content was determined by Portable device chlorophyll meter (SPAD-502, Minolta, Osaka, Japan). To determine the mineral elements, leaf were dry ashed following the method of Pinta and DeWele (1975), and then P, K, Ca, Mg, Fe, Cu, Mn, Zn, B concentrations were determined by

Inductively Coupled Plazma Atomic Emission spectrometry (Perkin Elmer Optima, Germany) method. Nitrogen was determined by the Kjeldahl (Rerhardt, Germany) procedure. All trials were triplicated, and Duncan's multiple range test was used for significance.

Results and Discussion

The values of leaf area and chlorophyll in leaf of 'Williams' pear in Table 1 were given. Only in the first experiment year, the effects of AVG concentrations and treatment times on the leaf area and chlorophyll content of 'Williams' pear leaf were statistically significant ($P \leq 0.05$). It was determined that leaf area was increased with 21 DBH AVG dosage treatments. The Spad values of 'Williams' pear leaf increased after AVG treatments and the highest Spad values were found in 7 DBH+150 ppm (46.92). Çetinbaş and Koyuncu (2011) reported that the highest leaf area was found at 21 DBH-100 ppm AVG 'Monroe' peach fruits (in the first year), and leaves treated with 30 DBH-200 ppm AVG were larger than the other groups (in the second year). Same researchers expressed that total leaf chlorophyll of 'Monroe' peach (first year) was increased by AVG treatments, but in the second year it was decreased.

Table 1. The effect of AVG treatments leaf area and leaf chlorophyll content in 'Williams' pear, 2011 and 2012

Application time, d [1]	AVG concentrations	Leaf area (cm^2)		Leaf chlorophyll content (Spad value)	
		I.Year	II. Year	I. Year	II. Year
30 d	0	24.80a*	25.99	43.68b-d*	44.74
	100	23.99a	23.48	42.54cd	47.47
	125	22.90ab	23.11	43.51b-d	47.43
	150	21.77ab	28.69	42.65cd	46.27
21 d	0	19.95ab	19.98	42.64cd	44.58
	100	24.36a	22.37	42.29d	47.39
	125	23.15ab	21.57	45.71ab	46.69
	150	23.04ab	25.44	45.59a-c	47.39
7 d	0	22.05b	21.79	42.26d	44.61
	100	20.20b	20.34	45.45cd	45.56
	125	21.71ab	31.62	44.04a-d	44.44
	150	22.92ab	19.80	46.92a	47.94
Main effects (means)					
Time					
30		23.36	25.32	43.09	46.48
21		22.62	22.34	44.06	46.51
7		21.72	23.39	44.67	45.64
	AVG Conc.				
	0	22.27	22.59	42.86	44.64
	100	22.85	22.06	43.43	46.80
	125	22.58	25.44	44.42	46.19
	150	22.58	24.65	45.05	47.20
P values					
Time		0.146	0.380	0.163	0.547
Conc.		0.953	0.480	0.092	0.056
T x C		0.046	0.102	0.011	0.304

[1] days before harvest (DBH)
a-d*: With each column, values followed by the same letter are not significantly different $P \leq 0.05$ level according to Duncan's multiple.

AVG doses are statistically effective on nitrogen both years of experiment. ($P \leq 0.05$). Time x dose interaction was found to be significant on magnesium content in only second experiment year. AVG applications did not affect the calcium content in both years (Table 2). Iron and boron contents were influenced significantly by AVG concentrations and application times ($P \leq 0.05$) in both experiments year. Magnesium contents were observed significantly by only AVG application times ($P \leq 0.05$) in first experiment year (Table 3).

Table 2. The effect of AVG treatments on leaf mineral composition (nitrogen, calcium, magnesium) in 'Williams' pear, 2011 and 2012

Application time, d [1]	AVG concentrations	Nitrogen (%)		Calcium (%)		Magnesium (%)	
		I.Year	II.Year	I. Year	II.Year	I.Year	II.Year
30 d	0	1.79	1.76	2.51	2.67	0.44	0.44bc*
	100	1.93	1.95	2.84	2.88	0.54	0.58a
	125	2.01	1.98	2.83	2.88	0.45	0.46bc
	150	1.66	1.68	2.44	2.56	0.49	0.49bc
21 d	0	1.93	1.93	2.38	2.52	0.43	0.42c
	100	1.97	1.94	2.39	2.53	0.41	0.45bc
	125	2.04	2.05	2.72	2.98	0.42	0.46bc
	150	1.84	1.82	2.25	2.38	0.46	0.46bc
7 d	0	1.82	1.84	2.43	2.60	0.49	0.45bc
	100	1.99	1.99	2.37	2.45	0.49	0.52ab
	125	1.98	2.30	2.63	2.83	0.49	0.51ab
	150	1.83	1.91	2.92	2.97	0.48	0.49bc
Main effects (means) *Time*							
30		1.84	1.84	2.66	2.75	0.48a	0.49
21		1.94	1.93	2.43	2.60	0.43b	0.45
7		1.90	2.01	2.59	2.71	0.49a	0.49
	AVG Conc.						
	0	1.85bc*	1.85b*	2.44	2.59	0.45	0.44
	100	1.96ab	1.96ab	2.53	2.62	0.48	0.52
	125	2.01a	2.11a	2.73	2.90	0.45	0.48
	150	1.78c	1.80b	2.54	2.64	0.48	0.48
P values							
Time		0.378	0.181	0.368	0.679	0.015	0.072
Conc.		0.012	0.010	0.464	0.354	0.517	0.024
T x C		0.241	0.089	0.489	0.680	0.067	0.017

[1] days before harvest (DBH)

[a-c]*: With each column, values followed by the same letter are not significantly different $P \leq 0.05$ level according to Duncan's multiple.

In both experiment years, the highest nitrogen content (2.01 % and 2.11 %) was obtained from 125 ppm AVG concentration. The highest magnesium content was 0.58 % with 30 DBH+100 ppm, while the lowest magnesium content was 0.42 % with control AVG concentration at 21 DBH (Table 2). In both years, the highest iron contents were observed by 7 DBH+100 ppm and 125 ppm AVG applications. AVG applications had generally increases on the boron contents and the highest boron content was determined to be 7 DBH+100 ppm AVG application (Table 3). Different application periods and doses of plant growth regulators affected the content of mineral substances differently even from year to year in our study as well. Nitrogen takes part in the structure of organic compound such as amino acids, nucleic acids, enzymes, chlorophyll, ATP, and ADP. Fadhil (2007) that Ca amount increases with AVG treatments of 'Fuji', Mg amount increases only after 500 ppm treatment and both Ca and Mg amounts increase only after 1000 ppm AVG application on 'Granny Smith' variety. It was determined that AVG treatments affect nitrogen, manganese and iron contents and this effect was noticeably seen in 150 ppm AVG treatment of 'Jersey Mac' apple (Butar, 2013).

Conclusion

In this research, 4 different doses of AVG was applied to 'Williams' pears fruits and leaves by spraying method in the order of 30, 21, 7 days before the estimated harvest, and mineral content of leaf were determined at harvest time. Overall results indicated that ReTain (15 % AVG) plant growth regulator is thought to have reducing and increasing effects on mineral substances for 'Williams' pear.

Table 3. The effects of AVG treatments on fruit mineral composition (Iron, manganese, boron) in 'Williams' pear, 2011 and 2012

Application time, d [1]	AVG concentrations	Iron (mg/L)		Manganese (mg/L)		Boron (mg/L)	
		I.Year	II.Year	I.Year	I.Year	II.Year	I.Year
30 d	0	70.97a-c*	72.11a-d*	228.25	206.95	20.99c*	21.35cd*
	100	72.67ab	72.68a-d	189.77	190.34	24.36a	25.01a
	125	68.97a-c	69.81a-e	185.30	191.08	22.00bc	22.05b-d
	150	71.46a-c	73.77a-c	239.73	252.65	20.46cd	20.52cd
21 d	0	56.58bc	59.10d-f	153.57	183.57	18.71d	19.46d
	100	62.52bc	62.43c-f	145.29	154.46	21.86bc	22.86a-c
	125	66.18a-c	67.11b-f	128.82	197.05	21.27c	23.29a-c
	150	54.44c	54.87f	157.23	161.04	20.71cd	22.02b-d
7 d	0	63.09bc	56.41ef	160.73	167.40	18.63d	20.90cd
	100	80.83a	81.67a	152.70	168.65	24.91a	25.29a
	125	81.48a	81.34ab	216.37	219.76	23.64ab	24.44ab
	150	64.80a-c	66.66c-f	210.78	203.56	20.53cd	21.21cd
Main effects (means) *Time*							
30		71.02	72.09	210.76a*	210.25	21.95	22.23
21		59.93	60.88	146.23b	174.03	20.64	21.91
7		72.55	71.52	185.15a	189.85	21.93	22.96
AVG Conc.							
	0	63.55	62.54	180.85	185.97	19.44	20.57
	100	72.01	72.26	162.59	171.15	23.71	24.39
	125	72.21	72.75	176.83	202.63	22.30	23.26
	150	63.57	65.10	202.58	205.75	20.57	21.25
P values							
Time		0.006	0.010	0.006	0.069	0.240	0.488
Conc.		0.137	0.093	0.457	0.206	0.000	0.000
T x C		0.022	0.002	0.112	0.077	0.000	0.001

[1] days before harvest (DBH)

[a-f]*: With each column, values followed by the same letter are not significantly different $P \leq 0.05$ level according to Duncan's multiple.

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Effects of Different Fertilizer Application on the Yield of Izmir Tobacco

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Abstract

This research was carried out in 2012 at Torbalı district of İzmir with İzmir-Ozbaş tobacco variety was used. Two different composite fertilizers (8:16:24+%2Mg 4 and 7:14:21) and one plant nutrient (Terra-sorb) were applied on seedbed and field period and the effects of these application on yield were investigated. The trial was conducted on the basis of Randomized Completely Block Design. The plant number per decare, leaf number per plant, leaf width (cm), leaf length (cm), plant height (cm), dead and alive plant number per decare and yield were measured. Maximum plant height and leaf number were obtained 76.4 cm ve 26.0 respectively by using 8:16:24+%2Mg and 7:14:21 fertilizer. Tobacco yield was varied between 103-123 kg/da. In the experiment, 8:16:24+%2Mg composite fertilizer exhibited beter performance in terms of yield and yield parameters in both seedbed and field period.

Keywords: İzmir-Ozbaş,yield, fertilizer, tobacco

Introduction

Being an economically-important plant both in Turkey and abroad at present, tobacco provides certain groups of people with employment opportunities from production to putting to good use and, because of complying with our country's ecological conditions and social structure, it has been produced in different regions of our country as a family farming for centuries (Ekren, 2007). The plant has been produced for 400 years and is a traditional cash crop. However, in recent years, there has been a decrease in the amount of production in our country. Annual production amount fell from 159.521 tons in 2002 to 45.398 tons in 2011. In parallel with the decline in production, yield decreased from 83.5 kg/da in 2002 to 54.9 kg/da in 2011 (Anonymous, 2011). The reasons of decrease in the amount of production and yield are soil structure, amount of irrigation, and fertilization. It is a well-known fact that oriental tobacco is sensitive to fertilization. However, it is possible to increase yield without sacrificing quality by means of fertilization programs to be applied to the areas the soil structure of which is known. Mineral fertilizers that contain nitrogen, phosphorus, and potassium are applied to tobacco and other crop plants. No decrease is observed in quality if potassium and phosphorus containing fertilizers are used adequately. However, strict attention should be paid while applying nitrogen-containing fertilizers. It is required to determine the amount, form and application time of nitrogen in such a manner to increase yield but not decrease quality in tobacco (Sekin, 1987). In this study, İzmir-Özbaş type tobacco was used to analyze the effects of 8:16:24+%2Mg and 7:14:21 fertilizers and Terra sorb plant nutrient on yield and yield components.

Materials and Methods

The study was conducted in Torbalı location of İzmir province in 2012. It included a total area of experiment of 1.6 da planted with İzmir Özbaş tobacco. As the design of experiment, Randomized Block Design was replicated 4 times. In the year of experiment, mean yearly temperature was 17.4°C. In June, July, and August, mean monthly temperature was measured as 27 °C, 30 °C, and 29.2 °C, respectively (Anonymous, 2012). Total annual precipitation was 820.2 mm; no precipitation was observed in summer. The soil sample taken from a depth of 0-20 cm was sandy-loamy and had a neutral pH. 0.6 g tobacco seeds/m^2 were planted on March 17, 2012. Seedlings were clipped for 3 times. On May 4, 2012, tobacco seedlings were transplanted in a plantation norm of 45x8cm. Upon transplantation, tobacco seedlings were irrigated with life water. Later on, they were hoed for 2 times on May, 22 2012 and June, 8 2012, during which

neither diseases nor pests were encountered. Harvest was completed after 4 runs on June 21, July 2, July 18, and August 15, 2012. In the experiment, 8:16:24+%2Mg and 7:14:21 fertilizers and Terra sorb plant nutrient were applied during seedbed and field periods (Table 1).

Table 1. Period of treatment with plant nutrient and fertilizers

Fertilizer/Plant Nutrient	Seedbed Period	Field Period
Control	-	-
Terra sorb	Onto the leaves immediately after germination (1ml/m2)	During transplantation together with life water (1lt/da)
7:14:21	Added to the seedbed compost (67 g/m^2)	During transplantation together with life water (15 kg/da)
8:16:24+%2Mg	1st treatment; by means of watering pot upon completion of germination (5g/m^2) 2nd treatment; by means of watering pot 2 weeks after the first treatment (5g/m^2)	During transplantation together with life water (8 kg/da)

In the study, factors like plant height (cm), number of plants (pcs./2.5m), number of leaves (pcs./plant), leaf height (cm), leaf width (cm), number of live and dead plants (2.5m) and yield (kg/da) were determined. Data were statistically evaluated based on a single factor using the statistical package TARIST according to Randomized Block Design (Açıkgöz et. al., 2004).

Results and Discussion

There are no statistical difference in terms of the characteristics analyzed (Table 2). In plant height, 8:16:24+%2Mg fertilizer had the highest value with a plant height of 76.4 cm. In terms of number of live plants, leaf width, and leaf height, the highest results were obtained from the plant nutrient Terra sorb. 7:14:21 fertilizer had the highest number of leaves (26 leaves). Data obtained from different sources demonstrated that plant height had a value between 40 cm and 180 cm depending on variety (Anonynous, 1981; Yazan, 1989; Uz, 1988; Şenbayram, 2006). In this study, plant height was determined to be between 66.1 cm and 76.4 cm. It is possible to state that it is in compliance with literature data. In the study, number of leaves differed from 23.0 to 26.0. In tobacco, number of leaves ranges from 17 to 100 pcs./plant according to variety, environmental conditions, and cultivation applications (Emiroğlu et. al., 1987; Er, 1994; Kara, 1993; Otan and Apti, 1989; Iantcheva and Iordanov, 1998; Gencer, 2001; Çamaş et. al., 1997). Our study proved leaf width and leaf height to be 7.5-7.8 cm and 14.6-16.4 cm, respectively. The results we obtained for leaf width are in compliance with those obtained by Otan and Apti (1989), İncekara (1979), Dölek (1984), Yazan (1989), and Karpat (1989). Şuben (1976) stated that, in the tobacco plants of the Aegean Region, leaf width and leaf height were 5-7 cm and 5-12 cm, respectively. However, Peksüslü (1998) found that leaf width ranged from 7.2 cm to 10.3 cm and leaf height ranged from 14.3 cm to 21.7 cm.

Table 2. Effects of plant nutrient and fertilizers on analyzed characteristics

Treatment	Plant height (cm)	Number of plants (pcs./2.5m)	Number of alive plants (pcs. /2.5 m)	Number of Dead Plants (pcs./2.5 m)	Number of leaves (pcs.)	Leaf width (cm)	Leaf height (cm)
Terra sorb	66.1	23.5	21.3	4.8	23.0	7.8	16.4
7:14:21	75.5	24.9	15.8	12.5	26.0	7.7	15.1
8:16:24+%2Mg	76.4	25.6	18.3	7.5	25.4	7.5	15.7
Control	68.5	26.6	18.5	8.8	24.1	7.5	14.6
Mean	71.6	25.1	18.4	8.4	24.6	7.6	15.4
LSD	ns	ns	ns	ns	ns	ns	ns

ns. not significant

As can be seen, yield in the 1st stalk position and yield in the 2nd stalk position are statistically significant at a significance level of 1% (Table 3). The highest yield (126.6 kg/da) was observed in the fertilizer 8:16:24+%2Mg. On the other hand, yield vales given by the plant nutrient Terra sorb and the fertilizer 7:14:21 were 117.8 kg/da and 115.6 kg/da, respectively. Different researchers reported that dry leaf yield in the tobacco plants of the Aegean Region ranged between 80 kg/da and 250 kg/da (Otan et. al., 1989; Er, 1994; Uz, 1997; Trajkosiki et. al, 2003, Şenbayram, 2006). The yield values attained in our study are in compliance with the data given for the tobacco plants of the Aegean Region.

Table 3. Yield values of plant nutrient and fertilizers (kg/da)

Treatment	Yield in the 1st stalk position	Yield in the 2nd stalk position	Yield in the 3rd stalk position	Yield in the 4th stalk position	Total yield
Terra sorb	27.3^b	29.8^{bc}	31.2	29.5	117.8
7:14:21	26.4^b	33.3^b	31.2	24.7	115.6
8:16:24+%2Mg	41.8^a	39.1^a	24.2	18.0	123.1
Control	27.0^b	26.8^c	26.2	23.2	103.2
Mean	30.6	32.2	28.2	23.9	114.9
LSD	0.803**	0.573**	ns	ns	ns

ns. not significant   **$p < 0.01$

Conclusion and Recommendation

For us, the fertilizer of 8:16:24+%2Mg is more suitable in terms of some characteristics analyzed and yield. Besides, we are in the opinion that it would be better to reproduce the existing study for 1 more year for yield and yield elements.

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Scientific Evidences (pro and contra arguments) on GM and Organic Food Production

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Abstract

The end of the 20th century has seen the shaping of a new framework in the food industry. Genetically modified (GM) food products and/or organically produced food products, are two controversial topics that raise many current debates between science and society worldwide. People are confused with susceptible topic which production method is sustainable and acceptable for future generations, and vulnerable with converse information's that are daily released. There are common misconceptions and unanswered questions about organic farming and GM food production, as this paper presented main arguments scientists and agriculturalists have pro and contra GM and organic food production in the scope of sustainability, environmental and health impacts. The main misconception is that organic produces are better for health. Apparently no serious study can prove that an organic produce is healthier. Indeed, the nutritional quality and taste depend on the way of producing. For agricultural economists, the development of agribusiness with implementation of new technologies brings the same number of problems as solutions.

Keywords: GMO, organic food, sustainability, environment

Introduction

Genetically modified (GM) food products and/or organically produced food products, are two controversial topics that raise many current debates between science and society worldwide. People are confused with susceptible topic which production method is sustainable and acceptable for future generations, and vulnerable with converse information's that are daily released.

The technological and economical promises brought by genetic modifications in the field of agronomy have attracted many producers and companies. By investing massively in research and development of Genetically Modified Organisms (GMO), the whole market of biotechnology is owned today by few corporations and become rising agribusiness. A lot of the research around GMO-crops are driven by the company sector and thus with market interests. At the same time, green lobbyists are driving a tough battle against GMO which undermines the public acceptance for public GMO research.

On the other hand, since the 1990's, organic produces have occupied a more and more important place in the market. Organic farming is growing out of the niche. From now on it receives political supports and it includes industrially processes. The current expansion of organic farming raises the question of its future in terms of markets and regulations. Although organic farming is recognized as one of the main forms of sustainable agriculture, its image is often idealized.

Scientific evidences on GM and Organic food production

GMO production

In the report by Greenpeace from 2008 ("Environmental and health impacts of GMOs: the evidence") it is argued that GMOs have a negative impact on biodiversity. These reports explain main environmental and health arguments against GMOs and claim these to be scientifically grounded. The main message in Greenpeace report concerning health effects of GM food is that independent scientific studies of the wholesomeness in GM crops, for humans and animals, are severely lacking.

A scientist from the Department of Plant Breeding and Biotechnology in the Swedish University for Agricultural Science has scientifically highlighted faults and inaccuracies from

Greenpeace report above. In this section you will find some of his thoughts, some critic regarding how Greenpeace have misinterpreted their references as well as examples of other articles that contradict the Greenpeace claims.

Regarding the issue of the negative effect of Bt-toxin the Greenpeace references are actually only saying that the monarch butterfly, as well as other butterflies, eat less, have lover weight and lover chance for survival if they are exposed to the pollen that contains Bt-toxin. Eriksson (2008) mean that these findings are neither surprising nor alarming since toxins tend to have this effect in general. And on the contrary of what Greenpeace are saying in the report there are several other studies that show that pollen from the most common Bt-corn hybrids actually have a negligible effect on the monarch butterflies. Hellmich *et. al.* (2001) found that the Bt-corn hybrids did not have a negative effect on the monarch caterpillars.

A reference that Greenpeace uses, Flores *et. al.* (2005), says that rests of Bt-crops is broken down slower in the soil than non-modified crops. This is an issue that there are divided views on. Tarkalson *et. al.* (2008) in their comparable study found that there was no difference regarding the break down period in the soil between GM-corn and conventional corn. In the arguments that claim that the herbicide Roundup can interfere with hormones the source that Greenpeace use has been, according to Eriksson (2008), criticized for exposing isolated cells in a way that would never happened in real life. On contrary there are several *in vivo* studies, for example Giesy *et al.* (2000) and Williams *et. al.* (2000), that have found that with levels of Roundup that you could expect in nature there are no harmful effects by any kind on animals.

The statement from Greenpeace around that the longest safety tests period in GMO is 90 days is inaccurate. This is nowhere to be found in the references that Greenpeace states and is thus a direct whim. On the other hand, in the article by Pryme and Lembcke (2003) that is used in this as a Greenpeace reference, you find that three of the studies that are presented have a test period of 91-150 days. In addition it can be mentioned that Eriksson (2008) means that it takes many years to get a GM-crop from the laboratory to the field trial and then to at last to be commercialized. One example is the Swedish company that has for ten years tried to get their industry potato with modified starch out.

Organic farming

From the scientific point of view there are no real proofs that organic produced foods are better for health. No serious study has succeeded in demonstrating scientifically that organic food is healthier (Houdebine, 2010; Durand-Parenti, 2011; Johnston, 2008). Multiple reviews (e.g. by AFSSA-The Association for French Studies in Southern Africa) show that the chemical and biochemical composition of organic produces differs only very little from the same conventional produces (Houdebine, 2010), concerning the nutritional differences and taste. When some nutritional differences exist, they are the result of a way of producing. For example, the nutritional quality of a chicken depends on the breeding conditions, which are not necessarily organic. (Houdebine, 2010; Durand-parenti, 2011).

At first sight, organic farming uses less chemical pesticides than conventional farming because, by its definition, organic farming is chemical free and encourages the use of alternative methods. But some chemical substances accepted in organic farming like copper and sulphur are far away from harmless. Even natural insecticides, like rotenone or pyrethrum, can be toxic.

From environmental safety and sustainability point of view there are also arguments against organic farming. Concerning pesticides and pollution, a major issue is the use of energy in organic farming. Mechanical weeding, which is a significant alternative to pesticides used by organic farmers, consumes a lot of petrol (Durand-parenti, 2011). Moreover Johnston (2008) reports the example of the production of a liter of organic milk, which requires 80% more land than conventional milk to produce. Thus, the production of a type of organic tomatoes in the United-Kingdom uses 25% more water than conventional production. Studies say that organic

farming generally uses 26% less energy than conventional farming to produce the same amount of food (Melchett, 2008).

Finally, we know that organic farming is, by its definition, GMO free. Contrary to a genetically modified crop, which is resistant to a parasite, an organic crop needs pesticides because of this lack of resistance. The results are a bigger use of pesticides and energy.

Important issue that appears in organic farming is area needed to produce natural pesticides and fertilizers. In his paper, Houdebine (2010) observes that there is no answer to the question whether it is possible to produce huge quantities of natural pesticides and organic fertilizers without using important areas at the expense of food crops. By contrast the use of intermediate crops and the biological pest control with beneficial organisms are really good innovations.

Discussion and conclusion

Global biotechnology market is led by powerful corporations, with support of governments worldwide. They led many projects to help developing and economy poor countries, but at same time we cannot omit to mention disturbing situations where introduction of GM crops led to the bankruptcy of many peasants, diseases contracted by peasants and also to the disappearance of little and middle-size farms, as discussed in the paper. We have to be vigilant in the future and governments have to limit the power of the food industry. Governments will have a key role to play in the future in order to control and limit the power on the food market, but also at same time to encourage the research and development sector. Governments also have to support small farmers who cannot actually resist to the power of food industry by establishing laws to protect and help them.

It would be unfair to forget the huge step that biotechnology has made for food production thanks to the wealth and resources of corporations they could indeed have an answer to the problem of how we will feed the growing population. It is undeniable that food corporations are extremely powerful and already control a large part of the food market. The questions that come are what is their aim, and is it to work for the world development or is it only to make a profit?

It is very important to notice that people have a too idealized image of organic farming. The main misconception is that organic produces are better for health. Apparently no serious study can prove that an organic produce is healthier. Indeed, the nutritional quality and taste depend on the way of producing. Furthermore, we have to consider all the forms of farming for the future of agriculture. The environmental issue of organic farming is linked to the "conventionalization" of organic farming. Changes which happen within organic farming (larger farms, specialization, opening of the market etc.), are threat for organic farming, as it was previously defined. Recommendation is to lead more empirical studies and to develop assessment methods. It would be interesting to conduct further research into how consumption of organic food affects people's future health. This would require a long term study that investigates if people that consume organic products since their childhood are healthier than others that do not consume such products. Furthermore, it would be interesting to find out how the production of organic animal food may affect the organic market in the next few years, since there is a rising organic product line for animals in Europe and the US.

From a democratic point of view it is very troublesome that international organizations distort information. For society to function at its best, people should build their opinion on facts and not propaganda, especially presenting claims without any reference. A negative public view makes it harder for public research to be funded and the acting of international organizations thus undermines the potential for society to benefit on GMO technology or organic farming.

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Biological and Productive Characteristics of Grape Variety "Red Traminer" in Vinegrowing Subregion of Niš

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Abstract

This study has been aimed to investigate growth, productivity and grape yield of the observed grape variety in the conditions of Niš vinegrowing subregion. Examinations were carried out in a collection vineyard of the Viticulture and Wine Production Center of Niš. Examinations continued three years (2004-2006). A detailed ampelographic description of Red Traminer was also provided according to O.I.V. descriptors. The obtained results point to possibility of successful growing Red Traminer in the vinegrowing subregion of Niš. The average grape yield varied from year to year depending on weather conditions. The highest grape yield was observed in the first year of investigation (2004), while the best wine quality was reached in the second year of the study (2005). Best vines of Red Traminer were selected for further studies and multiplication. On the basis of the obtained results it can be concluded that the form Red Traminer has shown positive productive properties in the conditions of Nis vine subregion.

Keywords: Ampelographic description, productivity, red traminer, variety.

Introduction

The occurrence of byotipes and forms within old grapevine cultivars is a well-known fact (***Keserer and Regner, 2003***). Traminer is an old European grape variety which still has a burden of unanswered questions and attracts attention of scientist in viticulture and enology. The variety, as well as its clones and subvarieties, is described by many researchers, and all of them pointed out to its great variability in quantitative and qualitative traits ***(Zirojević, 1974; Galet, 1998; Cindrić et al., 2000; Imazio et al., 2002; Kaserer et al., 2003; Santiago et al., 2007)***. The first written data about this variety go back to XV century (***Goethe, 1887***). There is an opinion that its origin is Tyrolese town Tramin in Italy, from where it spreaded to many European countries ***(Goethe, 1887)***. Traminer is a heterogeneous variety with several clones and subvarieties, and there are some disputes about them. Thus, according to botanical characteristics Gewürztraminer is identical to Red Traminer, but some researchers reported it as a separate variety ***(Pospišilova, 1981)***. In many papers ***Hillebrand (1984)*** did not mention Red Traminer but Gewürztraminer. On the contrary, ***Nemeth (1975)*** did not regard Gewürztraminer as a separate variety but as a variant of Red Traminer. Red Traminer with its more productive subvarieties is dominant, but those genotypes have weaker scent than that usually expected from Traminer ***(Zirojević, 1974; Cindrić, 2000)***.

This paper has been aimed to establish growth, productivity, grape yield, as well as quality of grapes, must and wine of the variety Red Traminer in vinegrowing subregion of Niš, which can improve knowledge about properties of this variety and its suitability for growing in the conditions of Niš subregion.

Material and Methods

The investigation has been carried out during the period 2004-2006 in the collection vineyard of the Center for Viticulture and Enology at Niš. This grape varieties' collection is located in vinegrowing subregion of Niš, characterized by moderately continental climate with average annual air temperature of $11.8^{o}C$ and average vegetational air temperature of $18.1^{o}C$. The absolute minimum of air temperature during the study was $-18.2^{o}C$.

The average annual precipitation amount in the observed period was 750 mm, 422 mm of which fell during vegetation. Soil type was eutric cambisol. The vineyard was established in 1995, with planting distance of 3x1.2 m (2777 vines per ha), which was universal value for the all varieties at this collection vineyard. Bud load per vine was 20 buds or 6.6 buds per m^2. The trial was set in random complete block design with four replications, and the data were processed by analysis of variance. Ampelographic description has been done according to the descriptor list of OIV. Resistance to Botrytis cinerea was estimated by means of OIV descriptor, Code 459: 1 – 3 very low resistance, 5 – medium resistance, 7 – 9 high or very high resistance. Must quality, presented through the average content of sugar and total acid, was determined on representative samples during the vintage. Oechsle scale was used to measure sugar content, while titration with N/4 NaOH was applied in order to measure the total content of acid. Microvinification and chemical analysis of wine were carried out in the enological laboratory of the Viticulture and Wine Production Center of Niš. The quality of the wine produced was determined based on the results of the chemical analysis and organoleptic assessment made by the wine tasting commission of the Faculty of Agriculture, University of Belgrade. The all observed parameters were determined by standard ampelographic procedures.

Results

Ampelographic description has been done according to the descriptor list for grape varieties and *Vitis* species by OIV and harmonized with its 2nd edition *(OIV, 2009)*.

Young shoot tip was fully open (001-5), with low anthocyanin coloration of prostrate hairs (003-3), high density of prostrate hairs (004-7) and semi-erect attitude (006-3). Mature leaf blade was small (065-3), circular (067-4), with three lobes (068-2) and dark green color (069-7). Petiole sinus was brace-shaped (080-2) and upper lateral sinuses were open (082-1). Density of prostrate hairs on main veins on lower side of blade was high (086-7). Petiole was slightly shorter than middle vein (092-3). Woody shoot was elliptic at cross section (101-2), red-violet colored (103-3), with short internodes (353-3). Flowers had fully developed stamens and gynoecium (151-3). Bunch was short (11.64 cm; 202-3), dense (204-7), with 93 grapes in average. Peduncle of primary bunch was short (2.17 cm; 206-1). Berries were short (220-3), uniform (222-2), broad ellipsoid (223-3) and red (225-3). Berry flavor is muscat (236-2). Single berry weight was low (503-3). Length of seeds was medium (242-5) and weight of seeds was very low (243-1).

Table 1. Phenological stages of grape variety Red Traminer development

Stage of development	Year of investigation			Average
	2004	2005	2006	
Bleeding sap	March 26th	March 30th	March 28th	March 28th
Time of bud burst	April 14th	April 17th	April 20th	April 17th
Beginning of flowering	June 5th	June 10th	June 12th	June 9th
End of flowering	June 14th	June 19th	June 21st	June 18th
Veraison	August 6rd	August 13th	August 11th	August 10th
Full berry maturity	September 11th	September 17th	September 14th	September 14th
OIV descriptors for phenological stages of Red Traminer development				
OIV Code	Elements of description			Score
301	Time of bud burst			3
302	Time of full bloom			5
303	Time of veraison			5
304	Time of full maturity of the berry			3

Phenological observation showed that beginning and duration of phenological stages depended on weather conditions of the investigated year (tab. 1).

The earliest bud burst was noticed in 2004 (April 14th), and the latest one in 2006 (April 20th). As average for the investigated period, flowering began at June 9th and ended at June 18th. Grape harvesting was carried out at September 14th.

Weather conditions significantly influenced number of developed shoots, differentiation of productive buds and development of productive shoots. Of the total buds, 16.94 gave developed shoots, and 12.61 of them were productive (tab. 2).

Table 2. Basic productivity parameters of grape variety Red Traminer

Parameter	Year of investigation			Average	LSD	
	2004	2005	2006		0.05	0.01
Buds per vine	20.0	20.0	20.0	20.0	--	--
Developed canes	17.58	16.08	17.17	16.94	0.57	0.76
% of developed canes	87.90	80.40	85.85	84.71	--	--
Productive canes	13.17	11.17	13.50	12.61	1.18	1.58
% of productive canes	74.91	69.46	78.62	74.33	--	--
Bunches per bud	1.03	0.64	0.99	0.89	0.14	0.19
Bunches per dev. cane	1.16	0.79	1.14	1.03	0.15	0.20
Bunches per pr. cane	1.55	1.16	1.43	1.38	0.13	0.18
Bunches per vine	20.50	12.83	19.83	17.72	2.73	3.66
Bunch mass	124.67	98.74	100.34	107.91	11.46	15.37

The lowest number of developed shoots was observed in 2005 as a result of the lowest count of activated buds, which was significantly lower than in the other two investigated years. Share of productive shoots in the total count of developed shoots was from 69.46% to 78.62%. The highest number of bunches per vine (20.50) was observed in the year with highest coefficient of production (2004). Bunch mass did not vary significantly among the investigated years. As the average, Red Traminer had 17.72 bunches of 107.91 g.

Grape yield depended much more on number of bunches than on bunch mass (tab. 3). The observed grape yield per bud, developed shoot, productive shoot and vine varied significantly at the level of P<0.01 among the investigated years.

Table 3. Elements of grape yield and quality of the variety Red Traminer

Parameter	Year of investigation			Average	LSD	
	2004	2005	2006		0.05	0.01
Yield per bud (g)	129.06	63.40	97.15	96.53	17.32	23.33
Yield per dev. cane (g)	146.48	79.26	112.96	112.90	18.95	25.41
Yield per pr. cane (g)	192.57	114.43	142.41	149.81	15.62	20.95
Yield per vine (kg)	2.581	1.267	1.942	1.930	0.346	0.464
Yield per hectare (kg)	7169	3521	5395	5361	961	1289
Pruned vine mass (g)	805.42	721.67	723.75	750.28	42.61	57.14
Sugar content (%)	23.02	19.12	20.68	20.94	--	--
Total acid content (g/l)	7.83	8.44	8.20	8.15	--	--

As the average for the investigated period, Red Traminer gave grape yield per vine of 1.930 kg and 5361 kg per hectare. The highest mass of pruned biomass (805.42g) was observed in 2004, with 17 developed shoots per vine and internode length of 8.07 cm. As the average for the studied period, must had 20.94% of sugar and 8.15 g/l of organic acids. In ecological conditions of vinegrowing subregion of Niš, Red Traminer gave wine having 12.67% of alcohol and 5.4 g/l of organic acids, with very pleasant and refreshing muscat flavor and taste, and average sensory score of 18.44 points.

Table 4. Resistance to *Botrytis cinerea* of grape variety Red Traminer (OIV 459)

Year of investigation	Score
2004	9
2005	7
2006	7
Average	7.6

During the observed period, Red Traminer showed a high level degree of resistance to gray mold caused by the fungus *Botrytis cinerea*. During the second (2005) year of investigation berry ripening was slowed down, because precipitation amount in August was higher regarding many-year average (88 mm), which caused a higher attack of the diseases during full berry maturity.

Discussion and Conclusion

Red Traminer showed positive agrobiological and technological properties and it could be successfully grown in the studied conditions.

Beginning and end of flowering dated slightly later than the date reported by ***Zirojević (1974)***, while berry harvest was carried out earlier than reported by the mentioned source.

Bunch mass observed in this investigation is lower than the one reported by ***Cindrić et al. (2000)*** for the conditions of vine district Fruška Gora. Grape yield depended much more on number of bunches than on bunch mass. The lowest grape yield was observed in 2005 and it was high-significantly lower than in the other two years of investigation. On the basis of the observed grape yield Red Traminer can be classified as a variety with low productivity.

Cindrić (2000) stated that the Red Traminer was more resistant to *Botrytis cinerea* than Gewürztraminer, which is confirmed by our study.

On the basis of the three-year investigation of vine variety Red Traminer in the conditions of Niš's vinegrowing subregion, we can conclude the following:

In the ecological conditions of Niš's subregion, bud burst was early, flowering was moderately late, and berry maturation was early. Twenty buds gave 17 shoots, 13 of them were productive, with 1.03 bunches per developed shoot, and 1.38 per productive shoot. One vine gave 18 bunches with the average 100 berry mass of 107.91 g. The average grape yield per vine was low, and amounted 5.361 kg.

Must had 20.94% of sugar and 8.15 g/l of total acid. It gave wine with 12.67% of alcohol and 5.4 g/l of total acid. The average degustation score was 18.44, which put the wine in the category of supreme quality wines.

Red Traminer showed a high resistance level to *Botrytis cinerea*.

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The Effects of *Peudomonas fluorescens* Bacteria Inoculation on Tomato Growth

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Abstract
The aim of this study is to investigate the effects of *Pseudomonas fluorescens* bacteria inoculation on seedling and plant growth. In this content, experiments were conducted in pots and viols with 'Albeni' tomato variety' seeds and seedlings.
At the end of the experiment, in seed and seedling period, plant and root length, fresh and dry weight and dry matter content parameters were researched at different inoculation applications. It is seen the plant growth parameters increased statistically significantly with applications.

Keywords: *Pseudomonas fluorescens*, microbial fertilizer, tomato

Introduction

Pseudomoas fluorescens bacteria that belongs to promoting plant growth root bacteria (PGPR) group contributes to increase yield in vegetables and some economically important crops by interrelation with plant roots (Gamliel and Katan, 1993; Bloemberg and Lugtenberg, 2001).

This bacteria group secret auxins, gibberellins and cytokinins and hence they are called plant growth promoting rhizobacteria (PGPR) (Haas and Défago, 2005). It is known that PGPR bacteria are effective on plant development by providing availability of plant nutrients in soil that is necessary for plants (Vázquez et al., 2000).

The present study was carried out to investigate the effects of treatment of *Pseudomonas fluorescens* on seedling and plant growth.

Material and Methods

Albeni tomato variety was used to evaluate the effects of *Pseudomoas fluorescens* bacteria on seedling and plant growth.

Tomato seeds were inoculated with this bacteria group during 2 hours in seedling growth experiment. This experiment was conducted with inoculated and non-inoculated (control) seeds with 4 replications regarding to randomized parcel design. Each viol (104 seedlings) was planned as 1 parcel. Seedling experiment was conducted in greenhouse with controlled conditions during 42 days and then experiment was terminated. Seedling length, fresh- dry weights and dry matter of roots and green parts were measured.

In plant growth experiment, 4 different applications exist such as: control- seed inoculated seedling – inoculation by irrigation- seed inoculation + inoculation by irrigation. Pot experiment was conducted as 4 applications and 4 replications with randomized parcel design. Each replication has 3 pots which contains 1.5 kg soil. Experiment soil has mild alkaline reaction (pH=7.4), any salt problem (< % 0.03), low organic matter (% 1,8); calcareous (% 4) character. It has loam structure and adequate K, Ca and Mg; and medium level of N, P, Fe, Zn, Cu and Mn.

Bacteria group applied in the experiment was mixed to irrigation water (1/500) after transplantation of tomato seedlings and seed inoculated (1/100) seedlings. Any application exists in control pots apart from standard irrigation. Transplanted seedlings were grown in greenhouse with 15-25°C temperature and 60-70 % moisture in 42 days (6 week).

Plant length, green part-root and total fresh weight were determined at the end of 6 weeked growth period. Dry weight and dry matter values were obtained in 65° C and 105° C respectively. LSD test was realized in group means via SPSS 15.0 pocket statistical program at p=0.05 level.

Results

Plant length was measured in seedling growth experiment. Plant length increased significantly with the bacteria application in comparison to control (Table 1).

Table 1. The effects of bacteria application on seedling and root length of tomato

Application / Dose	Seedling length (cm)	Mean (cm)	Root length (cm)	Mean (cm)
Control	12.05		9.64	
	13.71		10.90	
	13.43	13.36 b	10.66	10.40 b
	14.25		10.40	
Inoculation (1 /100)	14.89		11.85	
	15.83		12.77	
	15.32	15.04 a	12.16	12.04 a
	14.13		11.40	
LSD		1.117*		1.515**

Fresh and dry weights and dry matter content of roots and green parts increased statistically significantly with the bacteria inoculation (Table 2, 3,4).

Table 2. The effects of bacteria application on fresh weights (g / seedling) of tomato seedlings

Application / Dose	Green part (g)	Mean (g)	Root (g)	Mean (g)	Total (g)	Mean (g)
Control	16.06		11.63		27.69	
	18.28		13.40		31.68	
	17.91	17.66 b	12.06	12.59 b	29.97	30.25 b
	18.39		13.30		31.69	
Inoculation (1 /100)	18.84		13.94		32.78	
	21.10		15.03		36.13	
	20.42	19.73a	14.07	14.27 a	34.49	34.00 a
	18.58		14.04		32.62	
LSD		2.012*		1.084*		3.023*

Table 3. The effects of bacteria application on dry weights (g / seedling) of tomato seedlings (65°C).

Application / Dose	Green part (g)	Mean (g)	Root (g)	Mean (g)	Total (g)	Mean (g)
Control	1.98		1.32		3.30	
	2.27		1.51		3.78	
	2.23	2.21 b	1.43	1.44 b	3.66	3.65 b
	2.36		1.52		3.88	
Inoculation (1 /100)	2.36		1.53		3.89	
	2.88		1.80		4.68	
	2.68	2.59 a	1.67	1.63 a	4.35	4.22 a
	2.44		1.54		3.98	
LSD		0.353*		0.188*		0.539*

Table 4. The effects of bacteria application on dry matter rates (%) of tomato seedlings (105°C).

Application / Dose	Green part –dry matter rate (%)	Mean (%)	Root-dry matter rate (%)	Mean (%)	Total dry matter rate (%)	Mean (%)
Control	6.64		5.80		5.90	
	7.18		6.25		6.41	
	6.97	7.02 b	6.08	6.10 b	6.21	6.27 b
	7.32		6.28		6.59	
Inoculation (1 /100)	7.62		6.47		7.04	
	8.14		6.87		7.63	
	7.82	7.76 a	6.50	6.55 a	7.29	7.20 a
	7.46		6.37		6.86	
LSD		0.635 *		0.419*		0.703 *

It is thought that, *Pseudomonas fluorescens* bacteria inoculation may be useful to grow healthy seedlings because of its significant positive effects on seedling growth parameters. Some measurements for plant growing parameters were realized after transplanting at the end of 6 weeked growing periods. It is seen that, *Pseudomonas fluorescens* bacteria inoculations have significant effects on plant length, green parts, fresh and dry weight of root compared to control (Table 5, 6,7). Siddiqui et al., 2001 also reports similar results with this bacteria inoculation of tomato plant

Table 5. Plant lengths 6 weeks after *Pseudomonas fluorescens* bacteria inoculation.

Application		Plant Length (cm)	Mean
1	Control	40	39.25 b
		38	
		43	
		36	
2	Seed Inoculation	46	48.00 a
		52	
		52	
		42	
3	Inoculation with irrigation	44	44.00 ab
		42	
		48	
		42	
4	Seed Inoculation + Inoculation with irrigation	46	48.75 a
		52	
		54	
		43	
LSD			5.361**

Table 6 Effects of *Pseudomonas fluorescens* bacteria applications on fresh weight (g/ plant) of tomato plant

	Application	Fresh weight of green part (g)	Mean (g)	Root fresh weight (g)	Mean (g)	Total fresh weight (g)	Mean (g)
1	Control	235		44		279	
		224		42		266	
		247	230.00 c	46	43.00 c	293	273.00 c
		214		40		254	
2	Seed Inoculation	293		57		350	
		339		61		400	
		307	306.00 a	58	57.50 a	365	362.50 a
		285		54		339	
3	Inoculation with irrigation	275		51		326	
		265		49		314	
		282	271.50 b	53	50.50 b	335	322.00 b
		264		49		313	
4	Seed Inoculation + Inoculation with irrigation	295		56		351	
		325		60		385	
		332	311.25 a	62	58.25 a	394	369.50 a
		293		55		348	
	LSD		32.059**		4.269**		36.213**

Table 7. Effects of *Pseudomonas fluorescens* bacteria inoculations on dry weight (g/plant) of tomato plant (65°C)

	Application	Green part dry weight (g)	Mean (g)	Root dry weight (g)	Mean (g)	Total dry weight (g)	Mean (g)
1	Control	31.35		5.17		36.52	
		29.95		4.96		34.91	
		32.93	30.69 c	5.41	5.06 c	38.34	35.75 c
		28.54		4.70		33.24	
2	Seed Inoculation	39.16		6.70		42.86	
		45.10		7.07		52.17	
		40.83	40.82 a	6.72	6.68 a	47.55	46.75 ab
		38.20		6.24		44.44	
3	Inoculation with irrigation	36.56		5.90		42.46	
		35.23		5.86		41.09	
		37.50	36.09 b	6.24	5.94 b	43.74	42.03 b
		35.10		5.76		40.86	
4	Seed Inoculation + Inoculation with irrigation	39.23		6.49		45.72	
		42.16		6.95		49.11	
		43.23	40.89 a	7.09	6.71 a	50.32	47.61 a
		38.96		6.34		45.30	
	LSD	4.061**		0.448**		5.093**	

Dry matter rate of green parts and root has increased statistically significant in relation to *Pseudomonas fluorescens* bacteria inoculation (Table 8). As a result it is concluded that *Pseudomonas fluorescens* bacteria inoculation availed for dry matter deposit in plant.

Table 8. Effects of *Pseudomonas fluorescens* bacteria application on dry matter rate (%) of tomato plant (105°C)

	Application	Dry matter rate of green part (%)	Mean (%)	Root rate dry matter (%)	Mean (%)	Total dry matter rate (%)	Mean (%)
1	**Control**	6.71		4.79		5.90	
		6.30		4.50		5.55	
		6.90	6.45 b	5.07	4.64 c	6.13	5.67 b
		5.90		4.22		5.11	
	Seed Inoculation	6.80		5.65		6.46	
		7.60		6.30		7.22	6.65 a
		7.20	7.00 a	6.00	5.82 a	6.84	
		6.40		5.33		6.08	
3	**Inoculation with irrigation**	6.90		5.30		6.55	
		6.60		5.07		6.27	
		7.30	6.76 ab	5.61	5.19 b	6.94	6.42 a
		6.25		4.81		5.93	
4	**Seed Inoculation + Inoculation with irrigation**	6.95		5.79		6.60	
		7.20		6.00		6.84	
		7.60	7.06 a	6.33	5.78 a	7.22	6.71 a
		6.50		5.00		6.18	
	LSD		0.413*		0.539**		0.555*

Discussion and Conclusion

It is found that. *Pseudomonas fluorescens* bacteria inoculation contributed to plant growth and other growth parameters in addition to yield in a significant level. It is concluded that *Pseudomonas fluorescens* bacteria inoculation may be useful in Turkey's soil and growing conditions in view of mildly alkaline soil reaction, 15-25°C temperature and 15-20 % humidity in which this experiment was conducted.

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The Effect of Pro-Ca (Prohexadione Calcium) Application on the Shoot Growth and Fruit Characteristics of 'Scarlet spur cv.' Apple

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Abstract

In this study, the effects of prohexadione-Calcium % 10 (Pro-Ca) applications on the vegatative growth and some pomologic characteristics of the Scarlet spur apples, growing on MM 106 semi-dwarfing rootstocks were investigated. Trees were sprayed with the single application of 62.5, 125, 250 g/100 L water Pro-Ca in the annual shoots 5 cm with three weeks interval in the spring (Çıtak-Denizli region). Pro-Ca applications decreased the growth of annual shoots and shoot length of apple trees. Pro-Ca applications reduced the shoot length of apple trees. Parallel to developments in the reduction of shoot the distance between nodes is reduced. Three weeks intervals of application Pro-Ca applied shoot 125 and 250 g/100 L water dosage is more effective in terms of reducing the development. Apple fruits characteristics were not find effect by Pro-Ca applications. The Pro-Ca applications were found to be effective in controlling the vegetatif growth of apple trees.

Keywords: Prohexadione-calcium, 'Scarlet spur cv.', apple, vegetative growth control, fruit quality

Introduction

Prohexadione-Calcium is a recently developed plant growth retardant used in apple and other fruit trees (Greene, 1999; Roemmelt, et al. 2003). It was first used on rice and small grains in Japan and France and will be introduced for use on apple (*Malus* x *domestica*) in the United States and several European countries (Yoder et al., 1999; Costa, et al. 2001). Pro-Ca is an acylcyclohexanedione and acts on blocking 3β-hydroxylation (Rademacher, 2000) and prevents the biosynthesis of active GA's. This process is understood to happen late in the bio-synthesis pathway of gibberellins (Barcel, 2005). High rates of gibberellin biosynthesis stimulate excessive vegetative growth. Inhibitors of gibberellin biosynthesis retard growth and improve plant productivity and/or performance (Rademacher, 1991). Paclobutrazol, a gibberellin biosynthesis inhibitor, was used successfully on fruits trees to control growth and improve fruit quality, although it is not commercially available in the United States for this purpose (Greene, 1991; 1999). Of this, prohexadione-calcium appears to be particularly effective, and has potential for improving performance (Greene, 1999).

The purpose of this investigation was to determine the optimum concentrations of application of prohexadione-calcium %10 for controlling vegetative growth of apple trees, as well as the effects of Pro-Ca %10 on fruit quality.

Material and Methods

Experiments were carried out in Denizli-Çıtak located at 38°16' N latitude and 29°67' E longitude and 815 m above sea level, Denizli Province in Aegean region of Turkey. To determine the effect of Pro-Ca %10 on vegetatif growth control and fruit quality parameters of apples, 6-years old 'Scarlet spur' apple (*Malus domestica* Borkh) trees grafted on MM 106 rootstocks were selected and grouped into four blocks with 24 trees in each based on proximity in orchard and crop load. Trees were sprayed with the single application of 62.5, 125, 250 g/100 L water Pro-Ca %10 in the annual shoots 5 cm with three weeks interval in the spring. All spray solutions contained 'Spur' as surfactant [0.01%, v/v (Sumi-Agro, Turkey)]. Pulverized treatments were applied with a low pressure hand sprayer. For each treatment, three two were used in each block.

Fruits were harvested at commercial stage of maturity. Pro-Ca-treated fruits and untreated fruits were harvested separately and picked into specially designated bins. After each harvest pick, fruit was transported to the Fruit Research Station Laboratory of Horticulture Department.

The fruit width (mm), fruit length (mm) fruit weight (g) were determined by a digital scale sensitive to 0.01 g. Fruit colour was determined with a colorimeter (Model CR-300, Minolta) using the L*, a*, b*, C, h° scale. Flesh firmness was measured on two sides of equatorial line of each fruit using a press-mounted Effegi penetrometer (FT 327; McCormick Fruit Tech. Torino, Italy) with 11.1 mm tip. SSC [digital refractometer (Palette PR–32 Atago)] were measured. TA was measured using a digital buret (Digitrate Isolab 50 ml) by titration with 0.1 N NaOH up to pH 8.1, using 10 ml of diluted juice, and the TA was converted to malic acid.

The following observations and measurements were gathered:

Tree height (cm): The distance starting from the graft union to the end of the central leader measured in meters.

Canopy width (cm): Distance between the endmost shoots of the branches in 2 different sides, measured in meters.

Trunk diameter (mm): Diameter of the body, measured 10 cm above the graft union with stick.

Average number of shoots (No): Amounts of shoots for one year measured and recorded.

Average shoot length (cm): 3 piece of shoots length measured from the 4 different side of the tree measured with ruler.

Average shoot width (mm): 3 piece of shoots diameter measured from the 4 different side of the tree measured with stick.

Average internode length on shoots (cm): Shoots of the 3 piece of shoot counted from the 4 different side of the tree and average length between internodes founded.

Phytotoxicity and side effects: Starting from few days after the application to the end of the research, to test the phytotoxicity effects of Pro-Ca applications on leaf, shoot and fruit macroscopic observations are done on shoot, leaf and fruit. In addition to that, applications effects on bee activities are observed.

The experiment was set up according to the Split Plot experimental design with 4 replications and was assigned as two tree at each replication. The differences between the mean of the groups was determined by Duncan multiple range test. All analyses were performed with SPSS software package v.16.0 for Windows by General Linear Model (GLM) univariate test.

Results

The effects of Pro-Ca on the vegetatif growth of 'Scarlet Spur' apple cutivar are given in Table 1. The effects of Pro-Ca doses on canopy width (cm) were statistically significant at the 5 % level. The lowest canopy width was obtained with 250 g/100 L (168 cm). The effects of the Pro-Ca treatments on the tree height and trunk diameter were determined to have no difference statistically (Table 1).

Table 1. The effect of Pro-Ca doses on some vegetative growth in the 'Scarlet Spur' apple cultivar

Treatments	Tree height (cm)	Canopy width (cm)	Trunk diameter (mm)
Control	348	180b	66.86
62.5 g/100 L	343	215a	71.46
125 g/100 L	325	183b	64.58
250 g/100 L	306	168b	65.31
P values	0.165	0.005	0.221

[ab]: Values in a same column for each effect followed by different letters are significantly different (Duncan, $P \leq 0.05$)

Effects of Pro-Ca doses on shoot growth of 'Scarlet Spur' apple cultivar was given in Table 2. Effects of Pro-Ca doses on Average number of shoots, Average shoot length and Average internode length on shoot were statistically significant (p<0.05). The lowest average number of shoots (33.00) and the lowest average shoot length (16.78 cm) were found with 250 g/100L. 250g/100L Pro-Ca dose with a 60% reduced in average number of shoots, 42% reduced in

average shoot length and reduced 32% in average internode length on shoot when compared to control. Effects of Pro-Ca doses on average shoot width and average number of internodes on shoot were not statistically significant (Table 2).

Table 2. The effect of Pro-Ca doses on shoot growth in the 'Scarlet Spur' apple cultivar

Treatments	Average number of shoots	Average shoot length (cm)	Average shoot width (mm)	Average number of internode on shoot	Average internode length on shoots (cm)
Control	85.50ab	28.73a	3.75	14.30	1.98a
62.5 g/100 L	89.25a	28.05a	4.01	15.80	1.90a
125 g/100 L	61.50b	23.44ab	4.03	12.48	1.87a
250 g/100 L	33.00c	16.78b	4.25	12.58	1.35b
P values	0.000	0.026	0.299	0.186	0.007

[ac]: Values in a same column for each effect followed by different letters are significantly different (Duncan, $P \leq 0.05$)

Effects of Pro-Ca doses on the fruit width was were statistically significant (P<0.05) but the effects in fruit length, fruit weight, firmness, soluble solid content (SSC) and titratable acidity (TA) were not significant (Table 3). Nevertheless, the highest fruit length (65.49 mm), fruit weight (188.14 g), SSC (15.55%) and TA (0.33%) were observed in 125 g/100 L Pro-Ca (10%) dose (Table 3). The effects of Pro-Ca doses on fruit color characteristics were not found statistically significant (Table 4).

Pro-Ca neither had phytotoxic effects nor caused any damage to fruits, leaves and shoots or foliage at the doses of treatment tested.

Table 3. The effect of Pro-Ca doses on some fruit characteristics in the 'Scarlet Spur' apple cultivar

Treatments	Fruit width (mm)	Fruit length (mm)	Fruit weight (g)	Firmness (lb)	SSC (%)	TA (%)
Control	73.48ab	63.49	172.14	34.21	13.48	0.27
62.5 g/100 L	75.65a	64.60	174.80	31.11	14.80	0.29
125 g/100 L	75.52a	65.49	188.14	32.15	15.55	0.33
250 g/100 L	72.63b	62.30	167.97	31.33	14.23	0.27
P values	0.033	0.113	0.132	0.475	0.188	0.077

[ab]: Values in a same column for each effect followed by different letters are significantly different (Duncan, $P \leq 0.05$)

Table 4. The effect of Pro-Ca doses on some fruit color characteristics in the 'Scarlet Spur' apple cultivar

Treatments	L*	a*	b*	C*	h°
Control	36.15	25.26	13.82	28.86	28.21
62.5 g/100 L	35.51	25.65	14.13	29.32	28.43
125 g/100 L	35.58	24.55	13.36	28.02	28.01
250 g/100 L	36.35	24.81	14.00	28.53	29.00
P values	0.786	0.500	0.874	0.711	0.820

Discussion and Conclusion

It was found that Pro-Ca (10%) on 'Scarlet spur' apple decreased the shoot growth and increased the number of internodes. As in many studies, our study showed that the shoot growth was slower down than that of control trees (Greene, 1999; Yoder, 1999; Costa, 2001). The effect on fruit quality was neither positive nor negative in our study. However, Greene (1999) found that Pro-Ca (10%) application increased the flesh firmness in the 'McIntosh' apple cultivar.

As a result, the double treatment of Pro-Ca (10%) in 125 g/100L doses is most effective in shoot growth inhibition on 'Scarlet Spur' variety apples grown in Denizli-Çıtak. On the other hand, high dose treatments effectively suppress elongation growth. Pro-Ca (10%) applications, controlling vegetative growth of young trees, early fruitless and high quality products to obtain is important.

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Effect of Bud Loads on Mechanical Composition of Cluster and Chemical Content of Must in Victoria Table Grape Variety (*Vitis vinifera* L.)

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Abstract

The two-year experiment (2008 and 2009) on new introduced table grape variety Victoria was carried out in the commercial vineyard in the conditions of Nerezi vine district, Capljina Municipality. This study the influence of different bud load levels was investigate on grape quality of cv. Victoria under given environmental conditions. The experiment was conducted by random selection method in four variants with different bud load levels per grapevine (19, 24, 28 and 33 buds per grapevine), each variant being repeated four times with 6 vines repeating.
Variant II(24 buds per grapevine) had, in two-year experiment, the average value of the largest cluster weight (599.78 g), the cluster berry weight (573.25 g), and the mass of the cluster stems (12.5 g). The average content of sugar in the grape must was slightly higher in variants I and II (14 %) compared to other variants, while the highest average content of total acids had variant III (4,06 g/l).

Keywords*:* Cv. Victoria, bud load, mechanical composition of cluster, chemical content of must

Introduction

Table grapes are grapes which by their appearance, organoleptic properties, time of ripening and market value are more suitable for consumption while they are fresh as opposed to grapes grown for wine production (Cosmo, as cited by Kamnečki, 1969). Table grape variety Victoria is a cross created by Leopodatu Victoria and Coridei Gheorghe at the Romanian Institute of Horticultural Research by crossing the varieties of Cardinal and Afus-Ali. Real yield is 1,2. With trellising (wire and rebar) it can easily reach a yield of 20 t/ha (www.mih.hr/vino_product.asp, May 2010).

The subject of this study was to determine the influence of the load of fruiting nodes on yield and quality of grapes of Victoria variety. Victoria is an early table grape variety which ripens in mid-August. Clusters are large and provide high yields. Berries are very large with sweet and pleasant flavor and white or green to yellowish color (www.sauron.md/en/victoria, May 2010).

Material and Methods

The research was conducted in a production plantation located in Nerezi near Čapljina in 2008 and 2009. The trial vineyard is a part of the „Plantaže" doo Čapljina, planted in 2002. Plantation area is 50 ha. Plant spacing is 3 x 1.5 m, and the training method is single cordon. The study was performed on the table variety Victoria grafted onto the vine stock Berlandieri x Riparia Kober 5 BB. The trial was set by the method of random selection in four variants with different loads of vine, where each variant had four iterations with 6 vines in each of them. In both research years, pruning was performed in mid-February and the pruning method combined short and mixed pruning depending on the variant of the load of fruiting nodes on the vine.

The experiment included the following variants of pruning:

Table 1. Type of pruning depending on the bud load level

Variant	Pruning	Short sprouts	Long sprouts	Bud load level
Variant I	Short	3(5)+ 2(2)	0	19
Variant II	Mixed	3 (2)	3 (6)	24
Variant III	Mixed	2 (2)	3 (8)	28
Variant IV	Mixed	3 (2)	3 (9)	33

With the occurrence of technological maturity of the grapes, harvesting was performed and samples were taken for the mechanical analysis of the bunch. Clusters were taken from different parts of the vine.

Analysis of the mechanical composition and structure of the clusters was performed using the test method of the ampelographic commission, i.e. modified Prostoserdov's method, to determine the following indicators:

Composition of the cluster: cluster mass, mass of rachis in the cluster and berry mass in the cluster.

Analysis of sugar content in must was performed using Oechsl's mustmeter, and the read number of Oechsl degrees was translated into sugar percentage by Salleron table. Determination of the content of total acids in must was performed by the method of titration with 0.1 M solution of NaOH. The moment of neutralization was determined by using phenolphthalein indicator.

Environmental Conditions

Data of the Čapljina meteorological station were provided by the Federation hydro-meteorological institute for the analysis of the climate conditions.

Table 2. Basic meteorological factor in the Mostar vineyard

Parameter	1961 - 1990	2008	2009
Annual average air temperature (°C)	14.1	16.4	16.1
Average vegetation air temperature (°C)	18.83	21.54	21.63
Absolute minimum air temperature (°C)	-14.2	-5.8	-7.3
Absolute maximum air temperature (°C)	41	40.3	38.5
Temperature sum (°C)	4455	4615	4633
Rainfall during vegetation (mm)	518	448	332
Annual rainfall sum (mm)	1102	1030	1022
Duration of vegetation period (days)	239	240	245
Sunlight time (hours)	2287	2471	2412

Meteorological conditions in the studied years were above the multi-annual average values concerning air temperatures and quantity of rainfall. During both studied years, air temperature in the vegetation months were above the multi-annual average values, while the quantity of rainfall was far lower.

Results and Discussion

Mechanical composition of the cluster

An important ampelographic indicator of a variety is the mechanical composition of cluster and berry. Mechanical structure of the cluster varies within the same variety depending on growing conditions and applied agro-technical measures (Avramov et al. 1968).

Cluster mass

Statistical tests have shown that for each pruning variant observed by the year of experiment there is a statistically significant difference in the average mass of cluster between 2008 and

2009, i.e. in each variant of pruning, the experimental year factor had a significant impact on the increase of the value of parameter of average cluster mass in 2009.

The obtained results on the average cluster mass where there was a statistically significant difference between the experimental years, can be attributed to a considerably smaller number of clusters per vine in 2009 compared to 2008. Climatic conditions in relation to the formation and differentiation of nodes were substantially more favorable for the nodes that were developing in 2009 than for those in 2008.

Table 3. Average values of mechanical composition of the cluster and chemical composition of the must

		2008	2009
Cluster weight (g)	I	423,51[de]	663,63[ab]
	II	484,91[cd]	714,65[a]
	III	331,93[ef]	582,40[bc]
	IV	316,75[f]	663,63[ab]
Weight of berries in the cluster (g)	I	414,07[cd]	647,90 [a]
	II	474,83[bc]	671,73[a]
	III	323,80[de]	571,95[ab]
	IV	308,74[e]	650,05[a]
Weight of rachis in the cluster(g)	I	9,44[c]	10,48[bc]
	II	10,09[c]	14,90[a]
	III	8,13[c]	10,45[bc]
	IV	8,00[c]	13,58[ab]
Sugar content in must (%)	I	14,00	14,00
	II	14,13	13,88
	III	14,00	13,88
	IV	13,75	13,50
Content of total acids in must (g/l)	I	3,38[b]	4,33[a]
	II	3,38[b]	4,45[a]
	III	3,93[ab]	4,20[ab]
	IV	3,40[b]	4,08[ab]

Mass of berries in the cluster

Berry is the vine fruit and it consists of skin, pulp and seeds. The average mass of berries is an indicator which is generally consistent with the regularities set by the average cluster mass.

Observed by the years of research, in all pruning variants, there was a statistically significant increase in the average mass of berries in a cluster in 2009 compared to 2008, which confirms the significance of the year factor for the scope of indicator of the mass of berries in a cluster.

The results of this research are consistent with the literature data referring to the participation of berry mass in the cluster structure. They are also consistent with the studies carried out on the variety Victoria in northern Greece, where the participation of berry mass in the cluster structure amounted to 96.7 % (Mattheou at al., 1995).

The mass of rachis in a cluster

The results of testing the significance of differences indicate that there were no statistically significant differences in the average mass of rachis in a cluster by pruning variants in the years in which this study was carried out, with the exception of variant I in 2008, which had clusters with a statistically significantly lower mass of rachis (10.48 g) compared to variant II (14.90 g). However, a statistically significant increase in the mass of rachis was observed in the clusters in all pruning variants in 2009 relative to 2008.

The study results obtained for the table grapes varieties in northern Greece indicate that the share of rachis in the overall cluster structure reached 3.3 % in variety Victoria, 2.8% in Italia, 2.8 % in Afus-ali and 2.9 % in Muscat of Alexandria, which is consistent with the results of this study (Mattheou at al., 1995). The results of this study are also consistent with the literature data relating to the participation of rachis in the cluster structure.

Chemical content of must

Sugar content in grape must
According to data on the content of sugar in must shown in Table 3., the results of the analysis of variance indicate that there is no significant influence of either of the two observed experimental factors (pruning variant and year) on the specified indicator, nor is there a significant interaction between the factors.

Content of total acids in grape must
Observed by the years of research, some statistically significant differences were established in the average content of total acids in grape must in variant I (3.38 g/l in 2008 and 4.33 g/l in 2009) and variant II (3.38 g/l in 2008 and 4.45 g/l in 2009). The only factor which had a statistically significant impact on this indicator was the year factor.

Conclusions

1. Meteorological conditions in the years of the study differ from the multi-year averages both in terms of recorded air temperatures and precipitation. During both experimental years, air temperatures in the vegetation months were higher than the multi-year averages, while the amount of precipitation was considerably lower.
2. Average cluster mass was under a statistically significant influence of both the year conditions and the applied pruning variants.
3. Berry mass and rachis mass as indicators were consistent with the relations established in the analysis of the average cluster mass. The mass of berries in a cluster was statistically significantly influenced by both experimental factors (pruning and year), while the mass of rachis in a cluster was statistically significantly influenced only by the conditions of the year.
4. The sugar content in grape must was not influenced by either of the two observed experimental factors.
5. The content of total acids in grape must was under a statistically significant influence of the conditions of the year.

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The Impact of Substrate and Fertilization on Growth and Development of *Viola odorata* L.

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Abstract

In order to achieve more successful breeding of the sweet violet, special attention should be given to the substrate and fertilization since nitrogen affects the foliage mass, and phosphorus, calcium and magnesium affect the quality. Better results are achieved when plant species are grown in peat-based substrates than in soil-based. With the aim to obtain better information about selecting the most favourable substrate and the optimal dose of fertilizer, an investigation was conducted with five different types of commercial substrates, garden soil and soil from natural habitats and the foliar nutrition in four fertilization treatments (control, 0.1% NPK-Mg, 0.2% NPK-Mg and 0.2% NPK-Mg + 4% $MgSO_4$). Chemical analysis of the soil showed that the soil with less organic matter, higher pH reaction and richer in potassium compared to a commercial substrate. The results of the measurements show that the plants grown in soil were larger in diameter and height. Fertilization increased plant diameter by 6%, while plant height was not affected. Selection of the most appropriate substrate and optimal fertilization indirectly reduce the destruction of this nutritionally valuable and ornamental plant species in its natural habitats.

Keywords: Growing media, morphometric properties, colour of leaves

Introduction

Sweet violet is a well known medicinal, edible and ornamental plant which blooms with flowers of attractive scent early in the spring, in the conditions of continental climate (Erhatić et al. 2010). It grows wild in nature, in places exposed to sun, alongside hedges, river banks, on the edges of deciduous forests and in forest glades (Willfort 2002, Černicki 2006). It is wide–spread all across Croatia, along with the mentioned sppecies, Domac (2002) lists further 19 species of the same genus. Soils from natural habitats contain a significant amount of organic matter (6-11%). Organic matter has a positive effect on plant growth because it contributes to the improvement of the physical, chemical and biological soil properties, mineralization of nutrients and therefore, on the plant growth itself Makineci et al. (2007). Violets are usually found on soils with less phosphorus and larger potassium content (Makineci et al. 2007, Bagci et al. 2008). When growing plants in substrates, peat and compost based substrates gave the best results: the greatest height of plants, the greatest mass and leaf surface, the longest root. Substrates based on soil, however, gave the weakest results Erhatić et al. (2010).

The aim of this study was to investigate the influence of the substrate, fertilization and their interaction on some morphometric characteristics of sweet violet: plant height, diameter and colour of leaves and flowers.

Materials and Methods

In June 2009 plants have been propagated by dividing and 320 plants per soil or substrate type have been planted in two soil types (forest and garden soil) and five different substrates produced by mixing different basic raw materials (Table 1). During the research, violets were fertilized in four levels of fertilization: variant without adding fertilizer (C), "KRISTALON" - 0,1% NPK-Mg lower level (NPK-L), „KRISTALON" - 0.2% NPK-Mg higher level (NPK-H), „KRISTALON" - 0.2% NPK-Mg higher level with the addition of 4% $MgSO_4$ NPK-Mg). A two

factorial experiment was set in a randomized block design with four replications, and each combination was represented with 20 plants. During winter of 2010 and spring of 2011, the following morphometric properties of sweet violet plants were measured: plant height (cm), diameter of plants (cm) and colour of leaves and flowers. Leaf and flower colour was determined by the RHS colour chart. Fertilizer was applied only twice (June 9th and June 25th, 2011). Due to low temperatures and bad weather conditions it was not possible to fertilize the plants earlier. The effects of substrate, fertilization and their interactions were tested with a two-way variance analysis.

The results of analysis of manures and compost were statistically analyzed by SAS PC applications for Windows (SAS Institute Inc., Cary, NC, USA), Excel and StatSoft Statistica for determining the analysis of the variance (ANOVA).

Results and Discussion

Substrate analysis

The chemical properties of substrates and soils are shown in Table 1. The reaction of the substrates ranges from pH 5.5 to 5.8, and the pH of soils from 7.1 to 7.7. According to the measured pH reaction, the substrates are defined as mildly acidic, while the soils are neutral. Although this reaction is suitable for the cultivation of most plant species, it seems that the sweet violets prefer a higher pH so the plants grown in forest soil had the greatest diameter and maximum height. The measured electrical conductivity (EC) is in the range from 0.35 to 0.90 dS m^{-1}. Low EC can mean a low fertility, because of the low nutrient content, but on the other hand, a high salt concentration may indicate potential phytotoxicity. Since the desirable value of EC for media that are intended for breeding of plants, ranges from 0.5 to 1.8 dS m^{-1} (Kuo, 2004), we conclude that the substrates in the study are suitable for growing violets. The substrates and soils are rich in organic matter (Table 1). The content of basic macroelements in substrates varies in a very wide range (N 100-280 mg l^{-1}; P_2O_5 130-240 mg l^{-1} and K_2O 180-360 mg l^{-1}), and the soil is well supplied with nitrogen, poorly supplied with phosphorus and medium to richly supplied with potassium.

Plant diameter and height

Measurement results (Table 2) show a statistically important difference in plant diameter, depending on the type of substrate and the date of measuring (P<0.0001). The average maximum diameter of the plants independent of the measurement date was found on the forest soil (11 cm). Statistically significant difference in plant diameter was registered amongst substrates and fertilization treatments (Table 3). Plants grown on forest soil and garden soil had the biggest diameter, whilst those grown on commercial substrates had smaller diameters. Depending on fertilization, the best results were achieved using NPK-Mg treatment.

There is also statistically important difference between plant heights depending on substrates and measuring dates (Table 4). The highest plants were measured on forest soil (6 cm), and the shortest plants on garden soil (4 cm). After the fertilization, the highest plants were developed on forest soil (9 cm), and they showed a slight difference compared to the plants grown on the substrate S$_5$ (8 cm). Significantly lower plants were developed on the substrates S$_3$ and S$_4$, and they were comparable to the plants grown on the garden soil, and substrates S$_1$ and S$_2$. Different fertilization had no significant impact on plant height (Table 5). Dubsky and Sramek (2007) and Vukobratović (2008) state that better results of growth parameter (height and mass of plant) were achieved on peat-based substrates and compost rather than soil-based ones. The impact of foliar fertilization on flower height was researched by Ćustić and Poljak (1994) and it shows better results in the application of fertilizer.

Colour of leaves and flowers

The most common leaf colours before and after fertilization are 137A and 138A green and the most common flower colour was 86 A purple, which coincides with the research of Židovec (2009).

Table 1. Chemical properties substrates and soils

Substrates	pH_{H2O} (1:10)	EC dSm^{-1} (1:5)	Organic matter (%)	N mg l^{-1}	P_2O_5 mg l^{-1}	K_2O mg l^{-1}
Substrate 1	5.8	0.35	80	150	170	190
Substrate 2	5.8	0.60	90	280	200	360
Substrate 3	5.6	0.90	85	100	130	180
Substrate 4	5.5	0.45	80	210	150	270
Substrate 5	5.8	0.50	90	210	240	280
Soils	pH_{H2O}	pH_{KCl}	Humus (%)	N	AL-P_2O_5	AL-K_2O
				mg kg^{-1}		
Forest soil (F_s)	7.7	6.8	4.93	3.8	3.82	15.54
Garden soil (G_s)	7.1	6.5	4.57	3.5	3.47	68.95

Table 2. The diameter of the plants during the growing season of sweet violets per substrates before fertilization (cm).

Substrate/date	F_S	Gs	S_1	S_2	S_3	S_4	S_5	Average
14/10/2010	15	15	14	12	13	11	14	13 A
9/11/2010	13	11	12	10	12	11	13	12 B
15/12/2010	11	10	8	8	9	9	14	10 C
19/01/2011	10	9	7	7	8	8	11	9 DE
21/02/2011	10	9	7	7	8	7	9	8 FG
17/03/2011	10	9	7	6	8	7	8	8 G
15/04/2011	11	9	7	7	8	7	10	8 FE
12/05/2011	12	9	10	9	8	9	8	9 D
30/05/2011	12	10	11	8	11	9	10	10 C
Average	11 a	10 b	9 c	8 d	9 c	9 d	11 b	10

Means separation at 5% level; capital letters between date mean values, small letters between substrate types values.

Table 3. Diameter of sweet violet plants after fertilization performed on substrates (cm)

Substrate/ fertilizer	F_S	G_S	S_1	S_2	S_3	S_4	S_5	Average
Control	12 ns	13 ns	13 ns	11 ns	12 ns	11 ns	13 ns	12 B
NPK - L	14 ns	13 ns	13 ns	10 ns	12 ns	11 ns	14 ns	12 AB
NPK - H	12 ns	14 ns	11 ns	13 ns	12 ns	11 ns	11 ns	12AB
NPK-Mg	15 ns	12 ns	13 ns	11 ns	13 ns	11 ns	12 ns	12 A
Average	13 a	13 a	12 ab	11 b	12 ab	11 b	12 ab	12

Means separation at 5% level; capital letters between fertilizer mean values, small letters between substrate types values.

Table 4. Height of plants during the growing season of sweet violets per substrates before fertilization (cm)

Substrate/date	F_S	G_S	S_1	S_2	S_3	S_4	S_5	Average
14/10/2010	7	6	6	6	5	6	5	6 A
9/11/2010	5	5	5	5	4	6	5	5 C
15/12/2010	5	4	3	3	3	3	4	3 E
19/01/2011	5	3	3	3	3	3	3	3 F
21/02/2011	5	3	3	3	3	3	3	3 F
17/03/2011	5	3	3	3	4	3	3	4 E
15/04/2011	6	3	4	4	4	4	5	4 D
12/05/2011	6	4	6	5	6	5	6	5 B
30/05/2011	7	4	6	6	6	5	6	6 A
Average	6 a	4 d	4 c	4 bc	4 cd	4 bc	5 b	4

Means separation at 5% level; capital letters between date mean values, small letters between substrate types values.

Table 5. Plant height of sweet violets upon completion of fertilization per substrates (cm)

Substrate/ fertilizer	F_S	G_S	S_1	S_2	S_3	S_4	S_5	Average
Control	8 ns	7 AB	7 ns	7 ns	6 ns	7 ns	7 ns	7 ns
NPK - L	10 ns	7 B	8 ns	9 ns	7 ns	7 ns	9 ns	7 ns
NPK - H	8 ns	8 A	9 ns	7 ns	7 ns	7 ns	9 ns	8 ns
NPK-Mg	10 ns	7 B	8 ns	7 ns	7 ns	7 ns	8 ns	7 ns
Average	9 a	7 bc	8 bc	8 bc	7 c	7 c	8 ab	7

Means separation at 5% level; capital letters between fertilizer mean values, small letters between substrate types values.

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Effect of Deficit Irrigation on the Biomass Yield and Related Characteristics of Giant King Grass (*Pennisetum hybridum*)

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Abstract

This study was conducted in order to determine the effect of deficit irrigation on the biomass yield and some other yield components of giant king grass (*Pennisetum hybridum*) under greenhouse conditions in 2012. Four irrigation treatments were applied in the experiment, the first treatment was 100% of the field capacity (FC) as a control, and, the others were received 80%, 60% and 40% of the FC, respectively as deficit irrigation treatments. Results indicated that deficit irrigation significantly reduced the biomass yield and other growth parameters compared to the control. Average number of tiller per plant or crude ash and protein content decreased with decreasing irrigation level. The FC-80%, 60% and 40% treatments reduced biomass yield by 10%, 38% and 72% compared to control, respectively.

Keywords: *Pennisetum hybridum*, deficit irrigation, biomass yield, CP content.

Introduction

Water is one of the most important factors affecting plant growth and yield. In addition, water resources need to be used efficiently because of the increasing competition of the limited water resources between domestic, industrial and agricultural consumptions (Hassan et al., 2013). Water shortage is an issue of considerable concern in some region under Mediterranean climate where water supplies are limited, precipitation is low, and population growth is high. The water requirements of forage crops grown in those regions are quite high due to warm, semiarid climate which generates high rates of evaporative demand, limited precipitation, and mild winter temperatures that allow year round culture of forage crops (Bañuelos et al., 2011). Increasing plant production per unit of water is one of the greatest challenges facing the researchers especially in arid and semi-arid areas, which have limited water resources and in tropic and sub-tropics, characterized by hot dry weather.

Pennisetum hybridum is a high quality fodder grass with high output and high protein which was introduced from Colombia and South America into China. It is referred to as "king of grass" and has the aliases of king grass, emperor bamboo and giant elephant grass, as well as a Latin name of *Pennisetum purpureum* Schum. It belongs to angiosperm phylum, monocotyledoneae class, *Gramineae* family and *Pennisetum* genus. *P.hybridum* is a high yielding, high quality *Gramineae* fodder grass cultivated by hybridizing elephant grass with American *Pennisetum* (Anonym, 2011).

The *P.hybridum* growing straightly in a manner of cluster has tall plant, advanced root system, and is a perennial C-4 plant in the areas with adequate temperature (can not tolerate freezing temperatures). The plant has a height up to 4-5 meters and a length of 9-15 cm between the joints; there are 15-30 effective sprouts, and one axillary bud is grown on each joint and is encapsulated with leaves with a length of 60-150 cm and a width of 3-6 cm growing superposedly. The planting of *P.hybridum* like in China has the advantages of fast effect, long harvest period, as well as stable and high output. *P.hybridum* can be reaped in 2-3 months after being planted in spring and will keep growing with the reaping. It can be harvested 6-7 years and cut 4-6 times per year. The output per year for each hectare is up to 25-30 tons (Anonym, 2011; Geren et al., 2013). At present, the main application of *P.hybridum* in industry is being a fine quality fodder grass and a new raw material for feedstuff, papermaking and construction

material. As raw material for forage grass, *P.hybridum* is the best succulence for feeding ruminants, fowls and fishes. It has a large harvest amount per year and can be reaped for a long period. However, when *P.hybridum* is used as foodstuff directly, it has the disadvantages of difficult digesting absorption, poor palatability and low added value. As raw material for papermaking, *P.hybridum* is a fast-growing paper-making raw material with great potential and good papermaking performance. The *P.hybridum* has the advantages of long fiber length, high aspect ratio, good beatability, soft fibers, relatively high tearing strength and the like. It is suitable for preparing top grade paper pulp and dissolved pulp, and can be used as a raw material for papermaking instead of wood so as to save wood for the country. *P.hybridum* is a kind of excellent species for improving the degraded soil and application widely (Ma et al., 2012), and, its hedgerow technology in slope croplands plays an important role in increasing the systematic output, reducing the runoff, controlling the soil erosion and lessening non-point source pollution on the basis of the fewer input (Wang and Su, 2011).

Although studies in relation to cultivation techniques in *P.hybridum* have been realized, the agronomic and physiological responses to irrigation are scarce (Geren et al., 2013). There have been few studies performed on *P.hybridum* in Mediterranean region of Western Turkey. Therefore, the aim of this study was to investigate the effect of different water regimes on the growth and biomass yield of *Pennisetum hybridum* crop under Bornova region conditions.

Materials and Methods

This study was conducted at the greenhouse of Field Crops Dept., Faculty of Agriculture Ege University during 2012 season. Scions of *P.hybridum* were planted in plastic pots 25 cm filled with silty soil. The physical properties of soil used were (sand: 80.2%, silt:18.0%, clay:1.8%) and chemical properties were (pH:5.83, salt:0.03%, OM:2.27%, total N:0.092%, available $CaCO_3$, P, K were, 1300 ppm, 2.54 ppm and 40 ppm, respectively). The softwood cuttings (30 cm length) were selected from lower parts of *P.hybridum* rootstock, the additional leaves were trimmed and the cuttings dipped at 4000 ppm IBA concentrations of hormone for 3-4 seconds up to 10-15 cm height and then in fungicide; then planted in the pots (Saffari and Saffari, 2012). A fungicide was Benomyl and talc powder in 1:10 ratio. The recommended dose of NPK chemical fertilizers was applied for all pots in two equal doses (Geren et al., 2013). The first doses were added during the growing period till crop was 40-50 cm and the other ones were added during the growing period till harvest date. All the other agricultural practices needed during *P.hybridum* growth were done when required.

Four irrigation treatments were applied in this experiment. The first treatment was 100% of the field capacity (FC) as a control. The other treatments were received 80, 60 and 40% of the FC, respectively as deficit irrigation treatments. The deficit irrigation treatments were applied after two weeks from cultivation in the pots and continued till the end of the experiment. During the experiment, all of the pots were weighed daily, and the amount of water lost was replaced to maintain the soil water content by tap water (Farahani and Chaichi, 2012). Treatments were arranged in a complete randomized block design with three replicates.

Some characteristics measured in this experiment were plant height (cm), number of tiller (plant^{-1}) dry biomass yield (g plant^{-1}) and dry root weight (g plant^{-1}). All the parameters were measured at the harvest stage. Aboveground samples were air dried at 70°C for 24 h, then ground to fine powder and was taken for determination of the ash and crude protein content (Kjeldahl N x 6.25). All data were statistically analyzed using analysis of variance (ANOVA) with the Statistical Analysis System (SAS, 1990). Probabilities equal to or less than 0.05 were considered significant. If ANOVA indicated differences between treatment means, a LSD test was performed to separate them.

Results and Discussion

Data presented in Table 1 show that, the plant height of the *Pennisetum hybridum* plant was significantly affected by irrigation treatments. The plant height was significantly decreased with decreasing irrigation levels. The tallest plants were obtained by applying 100% FC (208.7 cm) while the treatment of 40% FC recorded the shortest plants (47.9 cm), respectively. The number of tiller per plant was significantly increased with increasing irrigation levels. The treatment of 40% FC gave (2.8) compared to (6.8) which obtained by 100% FC. The deficit irrigation negatively affected the dry biomass yield of *P.hybridum*. The biomass yield of *P.hybridum* per plant significantly decreased with decreasing FC level and reached its minimum values by applying 40% FC treatment (24.8 g plant⁻¹) (Table 1). Based on our experimental data, the content of crude ash and protein were decreased by decreasing the irrigation level from 100 to 40% FC. The highest values in this respect were recorded by applying 100% FC treatment however the lowest irrigation level (40% FC) gave the lowest ash (5.7%) and protein (5.9%) content (Table 1).

Table 1. Effect of deficit irrigation treatments on the yield and some yield characteristics of giant king grass (*Pennisetum hybridum*).

Irrigation levels	Plant height (cm)	Number of tiller (plant⁻¹)	Dry biomass yield (g plant⁻¹)	Dry root weight (g plant⁻¹)	Crude ash content (%)	Crude protein content (%)
FC-100%	208.7	6.8	87.4	25.1	8.9	9.9
FC-80%	197.6	5.5	78.5	24.5	8.2	9.5
FC-60%	71.1	3.5	54.5	17.3	7.1	6.9
FC-40%	47.9	2.8	24.8	12.6	5.7	5.9
Mean	131.3	4.6	61.3	19.9	7.5	8.0
LSD	4.95	1.21	3.86	2.12	1.48	0.83
CV(%)	2.45	17.09	4.10	6.94	12.85	6.66

In our pot study, water deficit decreased plant height, number of tiller, both dry biomass and root weights compared to control which applied of 100%FC. These morphological changes in growth can be considered as a morphological adaptation of the plant to water and environmental stresses to reduce transpiration and to induce a lower consumption of water (Banon et al., 2003; Farahani and Chaichi, 2012). One of the first signs of water shortage is the decrease in turgor which causes a decrease in both growth and cell development, especially in the stem and leaves. The growth of cells is the most important process that is affected by water stress and the decrease in the growth of cells leads to decrease the plant height. Growth reduction as a result of water deficit has been widely reported by many researchers (Rostamza et al., 2011; Hassan et al., 2013). Moreover, reducing both stomatal conductance and biomass from aerial parts could be involved in the ability of plant to resist drought conditions (Martyniak, 2008; Díaz-López et al., 2012). In the case of deficit irrigation, plants have mechanisms for preventing turgor loss such as stomata closure and osmotic adjustment accompanied by decreases in elasticity (Álvarez et al., 2009). Decreasing the dry biomass yield under water deficit could be a result of a reduction in the chlorophyll content, and consequently, photosynthesis efficiency, as reported by Farahani and Chaichi (2012).

Deficit irrigation had a negative effect on ash and protein content of *P.hybridum*. As a result of vegetative growth reduction, the absorption of nutrient elements could be decreased (Pascale et al., 2001). These results support the growth reduction obtained in our pot study at deficit irrigation because that effect may be resulted from a deficiency of nutrients, as our results shown, and that high irrigation level could compensate for nutrient deficiency (Silber et al., 2003). Inorganic material solutes involved in the plant osmotic adjustment may lead to a

decrease in leaf osmotic potential to maintain turgor and this is also an important adaptive mechanism in plants subjected to deficit irrigation (Farahani and Chaichi, 2012).

Conclusion

Considering overall results of our experiment, it could be concluded that deficit irrigation or water stress significantly decreases plant growth and yield. The severe water stress treatment (FC-40%) reduces the biomass yield by 72% compared to control treatment (FC-100%). High water stress can lower nutrient levels in the leaves and stem. The growth reduction of *Pennisetum hybridum* associated with water stress appears to be a consequence of a number of different effects of water stress on transpiration and other physiological characteristics. The FC-80% and FC-60% treatments reduced biomass yield by 10% and 38% compared to control, respectively. However, in spite of these results, further research is required to ascertain the optimal timing, frequency, duration and severity of deficit irrigation in *Pennisetum hybridum* cultivation under field conditions.

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Non-chemical Control of Slugs in Lettuce Using Plant Extracts

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Abstract

Vegetable suffer a great damages caused by slugs. In Croatia slug *Arion lusitanicus* Mabille, 1868 has become the most frequent species, which is very hard to control. Current control methods rely on molluscicides that are often ineffective and harmful to non-target organisms. In order to evaluate the efficacy of some non-chemical treatments based on plant extracts of rosemary, lavender, garlic and caffeine, laboratory experiment was conducted in February 2014. There were four replicates per plant extracts treatments and control. Specimens of *A. lusitanicus* were fed on treated lettuce leaves in flower pots for seven days. Food consumption (leaf damage in cm^2) was measured daily and data were subjected to ANOVA and Duncan's MRT (P=0.05). All plant extracts treatments were significantly different from the control from the first day onwards. On the first day after treatment feeding was not recorded on the coffee treatment. The effectiveness of coffee decreased by time. At the end of the experiment there was no significant difference between plant extracts treatments. Because the tolerance level to slug damages in lettuce market is effectively zero, these results indicate the need for integrated control of slugs.

Keywords: Lettuce, plant extracts, slug control, slugs

Introduction

Slug species *Arion lusitanicus* Mabille, 1868 has spread with an alarming rate in many sites in Croatia, where it is considered as a serious pest. It damages many vegetables and ornamentals but also oilseed rape, maize and sunflowers. In Central Europe, *A. lusitanicus* is the major pest slug species and the most sales of molluscicides in the home and garden market can be attributed to this species (Weidema, 2006). Current control methods for *A. lusitanicus* in Croatia rely on chemical molluscicides, that are often ineffective and can harm non-target organisms. In particular negative impact of methiocarb on beneficial Carabid species and earthworms is evidented. There were several investigation of non - chemical control of slugs in vegetable crops in Croatia, based on plant extracts use, but also on the use of parasitic nematode *Phasmarhabditis hermaphrodita* Schneider, 1859 (Grubišić et al., 2003; Grubišić et al., 2010; Grubišić et al., 2012; Grubišić et al., 2013) but also elsewhere in Europe (Glen et al., 1996; Glen et al., 2000; Grimm, 2002; Simms and Wilson, 2003; Speiser et al., 2001). Caffeine has been shown to kill and repel slugs and snails by Hollingsworth et al. (2002, 2003). Also the reduction of slugs feeding by use of the caffeine treatment was established by Simms and Wilson (2003). While Hollingsworth et al. (2002, 2003) suggested caffeine to be an "environmentally acceptable" alternative to metaldehyde and methiocarb, Simms and Wilson (2003) pointed at toxic effect of caffeine to earthworms. In prior investigations in lettuce conducted in Croatia (Grubišić et al., 2003) in the field experiment, rosemary and lavender mixture were used. Phytotoxic symptoms of mentioned treatments were evidented on lettuce plants in the field. Because of the often use of different herbs (rosemary, lavender, garlic) and caffeine in slug control by private vegetable producers and the lack of the exact results of their efficacy, the investigation of some plant extracts efficacy in slug control was carried in laboratory in February 2014.

Material and Methods

Laboratory experiment was performed in period February 19 to February 25 2014 in Zagreb, Croatia. There were five treatments in experiment: rosemary, lavender, garlic, caffeine and untreated control, and four replicates per treatment. Plant extracts were prepared by using 1 l of boiling water poured on rosemary (100 g of dry rosemary), lavender (5 g of lavender oil), garlic

(70 g fresh clove of garlic) and coffee (100 g of roasted coffee). Plant extracts mixtures were left 24 hours in a covered pot and were applied to lettuce leaves using hand sprayer next day. Slug species *A. lusitanicus* was chosen as the test species because it was the most abundant in a plastic tunel where lettuce was grown in that period of the year. Flower pots diameter of 10 cm were repleted by potting soil. In each flower pot one leaf of lettuce treated by plant extracts, or untreated leaf of control treatment, was put. In each flower pot one specimen of *A. lusitanicus* was placed and flower pot was covered by a lid. Food consumption (Fig. 1) was assessed by measuring of the lettuce leaf area eaten by slugs (using spreadsheet) in 7 days period after treatment. All data were subjected to ANOVA and Duncan's New MRT (P=.05). Simultaneously, monitoring of look and behavior changes of slugs in individual replicates was performed. For the purpose of interpreting the results, air temperature data measured in Zagreb were used.

Results

Overview data about food consumption of slug species *A. lusitanicus* in a laboratory experiment measured for 7 days, are presented in Figure 1. Food consumption with a different intensity caused by slugs was evidented on all treatments. On the first day after treatment, feeding was not recorded on the coffee treatment. The effectiveness of caffeine decreased by time. All plant extracts treatments were significantly different in relation to the control from the first day onwards. At the end of the experiment there was no significant difference between plant extract treatments. Mortality of slug specimens in plant extracts treatments and phytotoxic effect on treated lettuce leaves were not evidented.
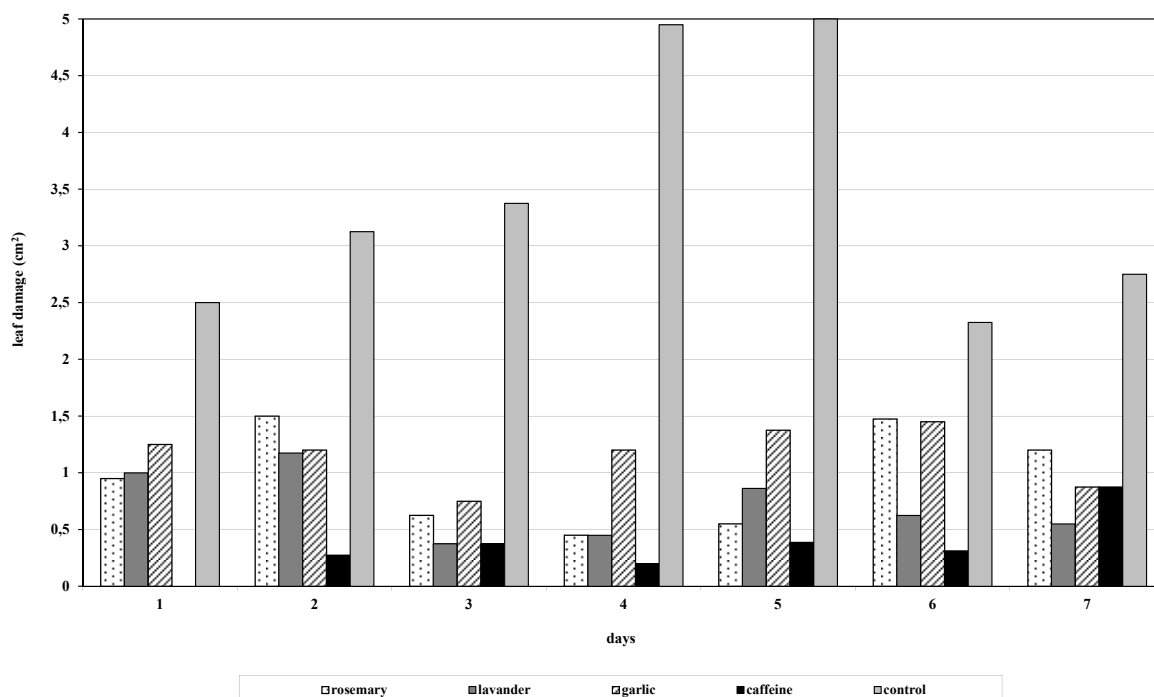
Figure 1. Mean food consumption of *Arion lusitanicus* in laboratory experiment.

Discussion and Conclusion

Food consumption with a different intensity caused by slugs was evidented on all treatments. Feeding of slugs on rosemary and lavender tratments was also evidented in prior investigation (Grubišić et al., 2003). In contrast to the results of the mentioned research, where phytotoxic effect of rosemary and lavender mixture on lettuce was evidented, in this investigation no phytotoxicity was evidented. In investigation of Grubišić et al. (2003) rosemary mixture was prepared by using 1 litre of water, 0.125 litre of vinegar and 5 g of lavender oil, what could be

the reason of phytotoxic effect. Also the results after rosemary and lavender treatment might be different because in laboratory experiment only leaves of lettuce were treated, while in the field whole lettuce plants were treated by plant extracts. Caffeine treatment did not cause yellowing of lettuce leaves while this effect was evidented by Simms and Wilson (2003) and Hollingsworth et al. (2002, 2003). This could be the consequence of different concentrations and cleanness of caffeine applied in experiments. Also no slug mortality was evidented in this research, what coincides with the results of Simms and Wilson (2003) but not with the findings of Hollingsworth et al. (2003) where caffeine at concentrations of 1 and 2% caused the mortality of slugs. The average temperature of 16.21 °C (ranging 15-17.5 °C) corresponded to temperatures favorable for the growth and development of slugs. According to research of Hollingswort et al. (2003) a feeding of slugs on cabbage treated by caffeine was reduced by 37-62%, so a significant feeding of slugs on the treated plants was evidented. Thus, caffeine did not completely prevent feeding of slugs on cabbage, what was shown also by the results of this study on lettuce. According to the achieved results it is evidented that alternative non-chemical treatments on the basis of rosemary, lavender, garlic and caffeine reduced feeding of slugs by leaves of lettuce. Damages were significantly lower than the damages that slugs made on the untreated lettuce leaves. None of the plant extracts stopped feeding of slugs, nor rejected them from feeding, so none of the plant extracts can fully protect lettuce from these pests. Therefore, non-chemical control of harmful slugs must be based on the integrated protection of vegetables that includes other available measures of control: cultural, mechanical and biological.

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Inventarisation and Evaluation of Autochthonous Genotypes of Almond (*Prunus amygdalus*) in the Area of Dubrave Plateau

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Abstract

The aim of this paper was inventarisation and evaluation of autochthonous genotypes of almond (*Prunus amygdalus*) in the area of Dubrave plateau, Bosnia and Herzegovina. This research presents a first step of determination and preservation of genotypes of this fruit type. Evaluation of autochthonous almond genotypes was done with IBPGR descriptor, describing and determining features of trees, leaves and fruit. Sample consisted of 30 leaves, taken from every tree. The research comprehended 16 bio-physical features of fruit in total: fruit size, fruit shape, ease of harvest, shell retention, shell colour intensity, marking of outer shell, suture opening of shell, shell consistency, softness of shell, kernel size, kernel colour intensity, kernel taste, kernel content (in %). From the aspect of market and marketing, the most important features of almond are softness of shell, kernel colour intensity, taste and shrivelling of kernel. Out of the total number of 13 individuals in this genofond, positive features such as soft shell, low percentage of twin kernels, optimal content of kernel, and sweet taste were determined for only two individuals (B6 and B7).

Keywords: Almond, evaluation, genotypes, inventarisation, individual

Introduction

On the territory of Bosnia and Herzegovina, almond has been unjustifiably neglected and very rarely investigated. There are no written records when the almond was transferred to the territory of Herzegovina, but it is known that, along with olive, it is one of the oldest fruit species in this area. By the 20th century, Herzegovinians grew almond mainly for their own consumption. The reproduction was mostly generative, which lead to a very heterogeneous population of almonds in this area. Pre-war research in Herzegovina led to the conclusion that almost the entire almond population is of generative origin (Manušev, 1978) and as such, they represent the true wealth of individuals of very different properties.

The aim of this research is inventarisation and evaluation of native genotypes of almond (*Prunus amygdalus* L.) in Dubrava plateau, which is the first step in the determination and preservation of genotypes with good fruit quality and good agronomic traits that may serve as a good basis for plant breeding.

Material and methods

Research was carried out over the period from February 2013 to September 2013, in the area of Dubrava plateau, municipality of Stolac. The research included 13 indigenous genotypes of *Prunus amygdalus*, highlighted in the following order (P1, Š2, Š3, K4, K5, B6, B7, B8, T9, T10, N11, A12 and A13). The research comprehended 16 bio-physical features of fruit: fruit size, fruit shape, easiness of harvest, shell retention, shell colour intensity, marking of outer shell, suture opening of shell, shell consistency, softness of shell, kernel size, kernel colour intensity, kernel taste, kernel content (in %), kernel shrivelling, twin kernels (in %), average fruit weight (in g), and leaf properties (average leaf length and width, as well as foliage density).

Thirty leaves and fruits of each tree were taken as a sample and examined in a laboratory. All the data obtained were processed by appropriate statistical - mathematical methods. Fruit characteristics were defined and described according to the standards prescribed in Almond descriptor, IBPGR (Table no. 1).

Table 1. Evaluation and scoring of the studied almond characteristics according to IBPGR descriptor

Kernel size	Kernel colour intensity	Kernel content (% yield)	Fruit size	Fruit shape	Shell colour intensity
1-extremely small	1-extremely light	1-extremely low	1-extremely small	1-round	1-extremely light
2-small	2-light	2-low	2-small	2-ovate	2-light
3-intermediate	3-intermediate	3-intermediate	3-medium	3-oblong	3-intermediate
4-large	4-dark	4-high	4-large	4-cordate	4-dark
5-extremely large	5-extremely dark	5-extremely high	5-extremely large	5-extremely narrow	5- extremely dark
Softness of shell	Shell retention	Marking of outer shell	Percentage of twin kernel	Kernel shrivelling	Kernel taste
1-extremely soft	1-extremely easy	1-without pores	1- none	1-wrinkled	1-bitter
2-soft	2-easy	2-pored	2- low	2-intermediate	2-intermediate
3-medium hard	3-medium difficult	3-densely pored	3-intermediate	3-slightly wrinkled	3-sweet
4-hard	4 difficult	4-scribed	4-high		
5-extremely hard					

Suture opening of the shell	Shell consistency	Foliage density	Ease of harvest
1-very wide	1-compact	1-low	1-low
2-open	2-partly eroded	2-intermediate	2-high
3-excellent seal (no openings)	3-extremely eroded	3-dense	

Results and discussion

Fruit research results

Individuals with an ovate fruit shape, high ease of harvest, easy shell retention, dark kernel colour intensity, pored outer shell, excellent seal of the shell, compact, medium-hard and hard shell dominate within the study of the tested genofond (Table 2). Čolić and Zec (2007) conducted a research on the territory of Serbia and registered individuals with oblong fruit and medium dark shell, while extremely light colour shells dominate in a study carried out in Turkey by Karadeniz et. al. (2003). Strikić et. al. (2010) conducted research in Croatia where genotypes with medium hard and pored shell predominate, while research in Turkey by Gercekcioglu and Gunes (2001) registered genotypes with a hard shell.

Table 2. Evaluation and scoring results of the fruit characteristics according to IBPGR descriptor

Individual	Fruit size	Fruit shape	Ease of harvest	Shell retention	Shell colour intensity	Marking of outer shell	Suture opening of the shell	Shell consistency	Softness of shell
P1	4	1	2	2	3	3	3	2	3
Š2	1	2	2	4	4	4 /2	3	3	4
Š3	5	3	1	1	4	3	2	1	2
K4	3	4	2	4	3	2	3	2	3
K5	3	3	1	2	1	2	2	1	3
B6	4	2	1	1	5	2	1	2	2
B7	3	2	1	4	4	1	1	3	2
B8	4	1	1	1	2	3	3	1	5
T9	5	2	1	4	3	2	3	1	5
T10	3	2	1	2	2	3	3	1	4
N11	2	1	1	2	4	1	3	1	4
A12	1	2	2	2	3	2	3	1	4
A13	3	2	1	2	3	2	2	1	3

Based on the research of almond fruit, 39% of the individuals have medium large fruit. Large fruit was recorded in the individuals Š3 and T9. In their research on the territory of Serbia, Čolić and Zec (2007) noted individuals with predominantly small fruit. Strikić et. al. (2010) came to the conclusion that medium-large and large almond fruits are equally represented on the area of Croatia.

Leaf research results

Based on the research results, it can be concluded that the genotype P1 has the longest leaves, with an average length of 14.6 cm, while the genotype A13 has the lowest average leaf length, which is 8.54 cm (Table 2). According to the research conducted in Herzegovina by Hadžiabulić et. al. (2011), leaf length ranges between 5.48 and 8.79 cm. The average leaf width ranged from 1.98 cm (B8) to 2.90 cm (P1). When it comes to the foliage (leafage), individuals with dense foliage predominate in the tested genofund.

Table 2. Results of the evaluation and scoring of leaf properties according to IBPGR descriptor

Individual	Foliage	Average leaf length (cm)	Average leaf width (cm)
P1	3	14,60	2,90
Š2	2	12,60	2,52
Š3	1	9,54	2,04
K4	2	12,44	2,71
K5	3	9,83	2,18
B6	3	12,22	2,21
B7	3	11,65	2,18
B8	2	8,94	1,98
T9	3	11,5	2,32
T10	3	9,98	2,04
N11	1	9,46	2,30
A12	1	9,71	2,13
A13	2	8,56	2,00

Kernel research results

Individuals with a medium dark kernel colour intensity, sweet taste kernel, low fruit yield, low percentage of twin kernels, medium-sized fruit with slightly and medium wrinkled kernel, predominate in this research.

Table 3. Results of evaluation and scoring of kernel properties according to IBPGRI descriptor

Individual	Kernel size	Kernel colour intensity	Kernel taste	Kernel content	Kernel shrivelling	Percentage of twin kernel	Average fruit weight (g)	Average kernel weight (g)
P1	3	4	2	2	2	2	4,90	1,45
Š2	2	3	3	4	2	2	2,46	1,50
Š3	5	2	3	2	2	1	5,48	1,75
K4	2	4	3	2	1	2	4,38	1,50
K5	2	2	2	2	3	1	3,46	1,10
B6	4	3	3	3	1	2	4,00	1,85
B7	4	3	3	3	1	2	3,60	1,80
B8	3	2	3	1	3	2	7,20	1,06
T9	4	4	2	2	3	1	6,50	1,56
T10	3	1	2	2	3	4	4,30	1,50
N11	1	3	1	1	2	2	5,86	1,11
A12	1	3	3	2	2	1	3,75	0,76
A13	3	2	2	3	3	3	4,4	1,85

According to the research conducted by Čolić et. al. (2009) on the territory of Serbia, individuals with small kernel predominate. When it comes to kernel shrivelling, Ak et. al. (2001) and Polat et. al. (2001) conducted research in Turkey and registered genotypes with predominantly medium-wrinkled kernel. Kernel content of the tested genotypes ranged from 14.72% for the B8 and 60.97% for genotype Š2. Čolić et. al. (2009) have realised that the yield of almond fruit in Serbia varies between 12.4% to 33.5%. According to Aslanta and Guleryuz (2001) research conducted in Turkey, the yield of almond fruit ranged between 14.66 and 26.81%. The individual B8 has the highest average fruit weight with kernel (7.2 g). The individual Š2 had the lowest fruit weight with kernel (only 2.46 g). The individuals B6 and A13 had equal, and at the same time maximum kernel weight (1.85 g). The individual A12 has the lowest average weight of a kernel, and it is only 0.76 g. Research conducted in Turkey by Aslanta and Guleryuz (2001) show that the average fruit weight with kernel ranges between 3.02 and 6.14 g, and the average kernel weight between 0.79 and 1.15 g. According to Ardjmand et. al. (2014), the average kernel weight in Iran ranges between 0.71 and 1.58 g.

Conclusion

Dubrava plateau is one of the localities where almond is grown massively in gardens. This large population of wild and partly cultivated almonds is characterized by significant variability in terms of biological and pomological characteristics. Among the studied genotypes, only two individuals (B6 and B7) have the essential properties such as a soft shell, a low percentage of twin kernels, optimized kernel content, and sweet taste. Isolated individuals provide a good basis for further processing, the production of new varieties and breeding. In the future, it is necessary to continue and intensify research on indigenous genotypes of almond and preserve them, because they represent a valuable natural and cultural heritage of the area, as well as the genetic material for breeding purposes.

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Assessment of Different Fertilizer Doses on Yield in Izmır Tobacco Variety Under Irrigated and Non-Irrigated Conditions

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Abstract
The research was carried out in Tavas-Denizli where is the important place for tobacco production in Aegean Region of Turkey, in 2012. This study was aimed to determined effects of the different fertilizers (Microalg, 15:15:15+ Ammonium sulphate and 8:16:24+%2 Mg) on the yield of İzmir-Ozbaş tobacco variety under both irrigated and non-irrigated conditions. The effects of different fertilizer on the Izmir-Ozbaş tobacco plant height (cm), number of the leaves (number/plant), number of the living plants (number/2m^2), number of the died plants (number/2m^2), leaf width (cm), leaf height (cm) and leaf yield (kg/da) were investigated. According to the results, the highest leaf width (7.1 cm) and leaf height (12.8 cm) were determined with 15:15:15+ Ammonium sulphate fertilizer application. Besides plant height, number of the leaf, leaf width and leaf height were increased which is irrigation treatment. Although irrigation was negative effect on the number of the died plant which is increased under the irrigation condition. Leaf yield was 78.9-130.9 kg/da in this research.

Keywords: Irrigation, fertilizers, İzmir-Ozbaş, tobacco yield and Aegean Region

Introduction

Tobacco plays a fundamental role in both national economy and social structure of Turkey. It is an indispensable source of income in terms of export and domestic consumption. In the world, Turkey is the sixth country in tobacco production with a proportion of 2.5%. The annual revenue generated by tobacco export is $400-500 million. So, with a share of 22.3%, tobacco maintains its importance among all agricultural products. Turkey is the leading country and has a share of 36% in total oriental tobacco production in the world. According to 2012 data, the total amount of tobacco production of our country is 69.300 tons. Of the said amount, 73% is produced by the Aegean Region, 13% by the Black Sea Region, 1% by the Eastern Anatolian Region, 5% by the Southeastern Anatolian Region, 5% by the Marmara Region, and 3% by the Mediterranean Region. Having a share higher than 60% in the total amount of national production, the Aegean Region has 1100 villages engaged in tobacco production and 50.000 tobacco producers. In 2012, the region produced 34.100 tons of tobacco and Tavas location had a share of 17.6% in the said amount (Anonymous, 2011). This study was conducted in Tavas, a production center playing a crucial role in region's tobacco production, using İzmir-Özbaş type tobacco to analyze the effects of different fertilizers and plant nutrients on yield.

Materials and Methods

The study was conducted in a farmer's field located in Sofular village, Tavas town, Denizli province in 2012. It included approximately 2000-2500 İzmir Özbaş type tobacco plants in parcels of 10x10=100m^2. As the design of experiment, Randomized Complete Block Design was employed. The experiment was performed under producer's conditions both with and without irrigation. Tobacco plants were irrigated by sprinkling water on June 30, 2012. The soil sample taken from a depth of 0-30 cm was sandy-loamy, had a mid-level alkalinity and was poor in nitrogen. Mean temperature of June, July, and August 2012 was measured as 28.7^{o}C. Total precipitation was 64.6 mm and mean relative humidity was 55.8% (Anonymous, 2012). On May 25, 2012, tobacco seedlings were transplanted in a plantation norm of 40x10 m by means of dibble. During vegetation, the plants were hoed for 2 times. Harvest was completed after 4 runs. Fertilizers and plant nutrition were applied during seedbed and field periods (Table 1).

Table 1. Period of treatment with plant nutrient and fertilizers

Fertilizer/Plant Nutrient	Seedbed Period	Field Period
Micro algae	Immediately after and 1 month after seeding	After transplantation together with life water and onto the leaves following the first harvest
15:15:15-Ammonium Sulfate	1st treatment; added to the seedbed compost 2nd treatment; by means of watering pot after seeding	Spreading 1 month after plantation
8-16-24+%2 Mg	1st treatment; by means of watering pot upon completion of germination 2nd treatment; by means of watering pot 2 weeks after the first treatment	During transplantation together with life water

In the study, plant height (cm), number of leaves (pcs./plant), leaf width (cm), leaf height (cm), total number of alive plants (pcs./ $2m^2$), total number of dead plants (pcs./ $2m^2$), and yield (kg/da) were observed. Statistical evaluation was performed using the statistical package TARIST according to Randomized Complete Block Design (Açıkgöz et. al., 2004).

Results and Discussion

Data on yield and characteristics were statistically analyzed and it was found that leaf width and leaf height were significant at a significance level of 5% (Table 2). The highest number of total alive plants and the highest number of total dead plants were produced by 15:15:15+Ammonium Sulfate fertilizer. Accordingly, the highest values in terms of leaf width (7.1 cm) and leaf height (12.8 cm) were obtained in 15:15:15+Ammonium Sulfate fertilizer. The highest plant height was observed in the control parcel with 49.9 cm. On the other hand, the lowest plant height was determined to be in 8:16:24+%2Mg with 20.1 cm. The plant nutrient of micro algae produced the highest number of leaves (32.0 leaves/plant). Although yield values ranged from 91.6 kg/da to 122.1 kg/da, the highest yield was obtained in 15:15:15+Ammonium Sulfate fertilizer.

Table 2. Effects of plant nutrient and fertilizers on yield and analyzed characteristics

Treatment	Number of alive plants (pcs./2 m^2)	Number of dead plants (pcs./2 m^2)	Leaf width (cm)	Leaf height (cm)	Plant height (cm)	Number of leaves (pcs.)	Total yield (kg/da)
8:16:24+%2Mg	2.5	1.3	5.6[b]	10.1[b]	20.1	22.0	91.6
15:15:15+ Ammonium sulfate	4.0	1.8	7.1[a]	12.8[a]	39.2	12.0	122.1
Micro algae	2.0	1.0	6.3[ab]	11.0[b]	26.8	32.0	104.0
Control	1.5	2.3	6.0[b]	11.1[b]	49.9	27.0	101.8
LSD	ns	ns	0.912**	1.802**	ns	ns	ns

ns. not significant   **$p<0.01$

As seen in Table 3, irrigation led to an increase in the values of the leaf width, leaf height, plant height, number of leaves, and yield. However, as an adverse effect of irrigation, the number of dead plants increased. Yield was 78.9 kg/da under non-irrigation conditions but reached 130.9 kg/da under irrigation conditions.

Table 3. Effects of irrigation factor on yield and analyzed characteristics

Treatment	Number of dead plants (pcs./2 m^2)	Leaf width (cm)	Leaf height (cm)	Plant height (cm)	Number of leaves (pcs.)	Total yield (kg/da)
Without Irrigation	1.6[b]	5.6[b]	12.3[b]	62.5[b]	24.9[b]	78.9[b]
With Irrigation	2.5[a]	7.0[a]	15.4[a]	71.4[a]	28.9[a]	130.9[a]
LSD	0.755*	0.645**	1.274**	3.973**	1.540**	1.868**

*p<0.05   **p<0.01

Different researchers (Anonymous, 1981; Ekren, 2007; Yazan, 1989; Uz, 1988; Şenbayram, 2006) reported that, in the tobacco plants grown in the Aegean Region, plant height ranged between 40 cm and 180 cm depending on variety. In case of tobacco, number of leaves ranges from 17 to 100 pcs./plant according to variety, environmental conditions, and cultivation applications (Otan and Apti, 1989; Er, 1994; Iantcheva and Iordanov, 1998; Gencer, 2001; Çamaş et. al., 1997, Ekren, 2007). Some researchers stated that leaf width and leaf height were 5-7 cm and 5-12 cm, respectively (Şuben, 1976; Otan and Apti, 1989; Yazan, 1989; Salman 2000; Korkmaz, 2006; Ekren, 2007). The effects of environmental conditions and cultivation applications on product yield and quality are significant. It is desired to increase yield without sacrificing quality in oriental tobacco. Trajkosiki et. al, (2003) reported that mineral fertilization was directly associated with and had a material effect on oriental tobacco yield and quality. It was proved by Otan and Apti (1989), Er (1994), Uz (1997), and Ekren (2007) that dry leaf yield ranged between 80 kg/da and 250 kg/da. As can be seen, the results attained in our study are in compliance with those obtained by the researchers mentioned above.

Recommendation

We believe that it would be better to reproduce the existing study, which we conducted in Sofular village, Tavas town, Denizli province in 2012, for 1 more vegetation period for both current and future condition of Aegean Region's tobacco production.

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Distribution of Tomato Moth (*Tuta absoluta*) in the South Region of Bosnia and Herzegovina

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Abstract

Tomato (Lycopersicum esculentum Mill.) is one of the economically most important vegetable species in Bosnia and Herzegovina (B&H). Under the climatic conditions of B&H the production of tomato is organized at open fields and in greenhouses. According to statistics at the state level the annually production of this valuable crop is 45.000 tons, whereas the south region of the country participates in the production with cca. 20.000 tons. Production of tomatoes depends on the proper selection of varieties in relation to climatic conditions, soil properties, proper fertilization, treatment and care of plants and the successful protection against pests and pathogens. In the past few years a very dangerous pest is threaten the production of tomato in the southern part of B&H. Leaf tomato moth (Tuta absoluta) was first reported in Višić (area of Herzegovina) in 2010, as well as in countries of the region (Croatia, Montenegro and Serbia). The aim of this research was to determine the dynamics of leaf moth in two different varieties of tomatoes grown in a protected environment at various locations in the southern part of B&H during the year of 2012. To monitor the leaf miner Csalomon pheromone traps were used. Adult insects were observed at both locations in the first decade of May. The highest number of leaf moths was found in August. According to implemented protection programs, differences in the intensity of pest attacks on both sites were accompanied and registered.

Keywords: Leaf tomato moth, *Tuta absoluta,* tomato, pheromone traps

Introduction

Tomato is one of the most represented culture types in the area of south Bosnia and Herzegovina. Considering the importance of this cultivation, the attention should be shifted to the process of choosing sorts, planting conditions as well as the protection of this culture.

Tomato leaf miner (Tuta absoluta Meyrick, Lepidoptera: Gelechidae) originated in South America. This specie was first described by Meyrick in 1917, and systematized as Phthorimaea absoluta. It's current name, Tuta absoluta Povolny first appeared in 1994 (Desneux et al. 2010). The first time it was spotted in Europe, was in Spain in 2006. Since then it has spread over a large number of Mediterranean countries. Thus, at the end of 2009 it was detected in Croatia for the first time (Gotlin et al. 2010.), and the following year it was detected in southern parts (Čapljina and Ljubuški) of Bosnia and Herzegovina. (Ostojić et al. 2010).

This pest causes great economical damage in tomato production, in enclosed spaces as well as in the open. Pests such as tomato leaf miner that have a high reproduction level and short evolution period, are resistant towards many chemical agents. Chemical treatment is of limited efficiency considering the biology of this insect (fast evolution, assimilating into the plant), as well as the resistance factor. Pheromone traps are used for early discovery. One of the possible solutions is suppression by pheromone traps where it is possible to track the appearance of insects and reduce imago number.

During vegetation process, pest has a larger number of generations in one year (6 in the open and up to 12 in enclosed spaces) which intertwine, so it is possible to find all developing and evolution stages of larvae in plantation. Damages that this moth makes could be from about 50%

up to 100%. Its life cycle depends on the temperature. At 14°C its development takes 76,3 days, at 19,7°C - 39,8 days and at 27,1°C it takes only 23,8 days (Barrientos et al. 1998; cit. Desneux et al. 2010). It spreads fast in damaged regions, and suppression from spreading may be complicated considering the developed resistance towards insecticides. Leaf miner's resistance towards active matters deltamethrin and abamectin is stated in Argentina (Lietti et al. 2005). For efficient control over this pest it is necessary to take all accessible measures – respecting the crop rotation, destroying the infected plants after harvesting, implementation of good tillage by setting pheromones for easier notice of the first moth flight and chemical substances application.

Materials and Methods

On selecting the planting material, a special attention is given to selection of the tomato hybrids which are represented in greenhouse production for years at the area of southern Bosnia and Herzegovina. Research was made in greenhouses of individual producers (500m^2 area), on two localities (Čapljina and Ljubuški) from March – August, 2012.

Tomato hybrid Matias was planted on the area of Ljubuški. It is an early hybrid containing large fruits intended for earliest spring and autumn production in greenhouses with and without heat. It is very adjustable to various kinds of cultivation. Tomato planting was made March 23, 2012. With the aim of suppressing tomato leaf miner over this hybrid, a chemical protection by insecticides with active matters (indoxacarb, emamectine benzoate, chlorantraniliprole, methoxyfenozide) was made. During vegetation period, four insecticide treatments were made: April 12 (indoxacarb 0,035%), May 5 (emamectine benzoate 0,15%), June 10 (chlorantraniliprole 0,025%), July 15 (methoxyfenozide 0,05%) in Ljubuški area.

In Čapljina region, Bella hybrid's transplants are planted on March 30, 2012. It is a kind of a hybrid that is characterized by high growth and large fruits and which is suitable for growing in protected areas but its adjust-ability also showed good results in open areas. It is reliable, shows resistance and gives good results when planted on soil with poor characteristics and in unfavorable conditions. Chemical protection for tomato leaf miners repression on this particular hybrid implied insecticide with active matters application (abamectin+lufenuron, emamectine benzoate, indoxacarb, methoxyfenozide). Four insecticide treatments were made in this area at following dates: April 20 (abamectin+lufenuron 0,1%), May 12 (emamectine benzoate 0,15%), June 15 (indoxacarb 0,035%), July 20 (methoxyfenozide 0,05%).

Methods for setting the experiment, space between plants (60x40cm), number of insecticide treatments were the same on both localities. Seed material of given hybrids was obtained from authorized distributors. Leaf miner's flight monitoring was made by Csalomon (Hungary) pheromone traps for the purpose of recording its presence.

Pheromone traps' inspection was made two days after the treatment was done, while the inspection of leaf and fruit damage on 10 experimental plants was made one day before spraying and five days after every treatment. Morphological characteristics of each stage of tomato leaf miner's development were noticed through individual observations on experimental parcels and by detailed analysis using laboratory equipment. Sample examination was made by microscope and binocular magnifier.

Results and Discussion

No presence of pests in the period of hybrid planting was recorded on traps. Seasonal activity of first units of leaf miner was spotted at the beginning of April on both localities (Čapljina and Ljubuški). However, an average number of units caught by each trap was low. First generation of pests ended its evolutionary cycle at the beginning of May. By noticing pests' presence, an

examination of 10 experimental plants was made before treatment, and five days after insecticide treatment on each occasion.

Recorded number of pests spotted during the experimental plants' inspection from area of Ljubuški is presented in Chart 1. Shortly after planting the hybrids, the inspection of plants showed no evidence of pests' presence. After noting first pests on traps, the process of counting and noting the present pests started, as well as the first treatment with insecticide whose active matter is indoxacarb. After the treatment was completed, the number of pests increased, thus the new treatment was approached by active matter of emamectine benzoate. Pests' number was recorded and presented in Chart 1, and a new treatment with a mixture based on active matter chlorantraniliprol began.
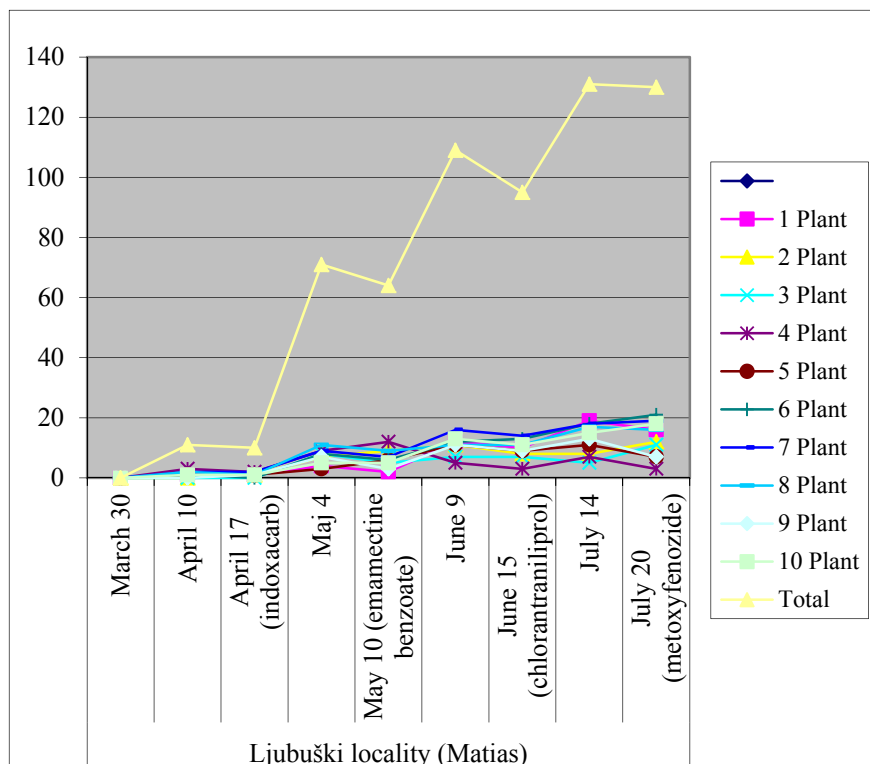
Pest number was lowered, but the emergence of new generations was noticed, so the fourth treatment was applied based on active matter metoxyfenozide. Pest number, as well as the new generation emergence was in constant increase and it culminated at the end of July and in August, as presented by Chart.

Chart 1.Pest number record before and five days after the treatment- Ljubuški

A chart made from experimental locality in Čapljina shows a situation very similar to that in Ljubuški. From hybrid planting and documenting, not the existence of pests, but the growth of a plant there is a first recording of pest units at April 19, after which the first treatment was made by combining active matters (abamectine+lufenuron). Pest number continued with a tendency of growth, and a new treatment by active matter emamectine benzoate started.

Chart 2. Pest number record before and five days after the treatment - Čapljina
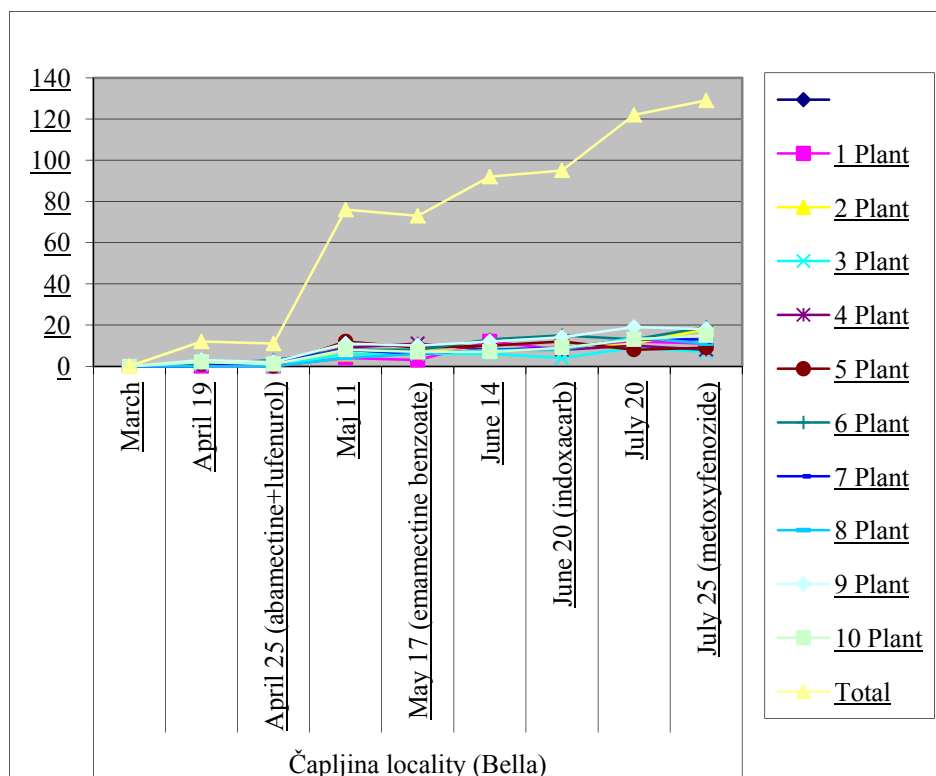
Pests numerousness was recorded and the process continued by appliance of indoxacarb. Pest number was increasing which is presented in Chart 2, and the fourth treatment was made by metoxyfenozide. After all the treatments were made, a high number of pests were documented in August.

Conclusion

With this experiment we found that tomato leaf miner is a pest with short development period, high propagation potential and a large number of generations. Its development rapidity and capability of merging with the plant complicates the protection circumstances from this pest. Active insecticide matters which were applied throughout this experiment showed some efficiency, but not an overall protection against leaf miner. However, because of the previously mentioned characteristics of a pest, in case of a frequent insecticide use, there is a possibility that a pest develops a resistance to above mentioned active matters too. That is why the chemical measures must obligatorily be combined with preventive hygienic measures as well as mechanical and biological ones.

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The Effect of Salinity on Leaf Chlorophyll Content of Satsuma Mandarin cv. Owari onto *Poncirus trifoliata* Rootstock

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Abstract

Salinity is a severe and increasing constraint on crop productivity. Salt stress occur in areas where soils are naturally high in salt and precipitation is low or where irrigation, hydraulic lifting of salty underground water. Salt stress is a major abiotic stress that can affect yield, plant growth, physiological and biochemical activities. The decline in photosynthesis due to salinity stress could be due to lower stomata conductance, depression in carbon uptake and metabolism, inhibition of photochemical capacity or a combination of all these factors.

Citrus known to be sensitive to saline conditions are threatened the most since the major growing areas are in the coastal regions. But the tolerance to salinity varies among different citrus species and depends on the rootstock.

In this study, effect of salinity on leaf chlorophyll content of satsuma mandarin cv. Owari onto *Poncirus trifoliata* rootstock was investigated. The trees were irrigated with five levels (0.65-2.00-3.50-5.00 and 6.5 dS m^{-1}) saline water. The result showed that there was clear effect of salinity concentration on the leaf chlorophyll amount of satsuma mandarins. Chlorophyll a, b and total were differed with salinity concentration, leaf age and periods.

Keywords: Salinity, satsuma mandarin, *Poncirus trifoliata*, leaf chlorophyll content

Introduction

Plant growth is adversely affected by various abiotic and biotic stress factors. Abiotic stresses cause losses worth hundreds of million dollars each year due to reduction in crop productivity and crop failure. Salt stress is a major abiotic stress. Salinity is a severe and increasing constraint on crop productivity. Salt stress occur in areas where soils are naturally high in salt and precipitation is low or where irrigation, hydraulic lifting of salty underground water. The salination existing in topographically low lying lands near the seashore is also affected by seawater intruding into coastal aquifers and mixing with fresh water coming from inland sources (Mc Kersie and Leshem, 1994). Salt stress can affect yield, plant growth, physiological and biochemical activities. The decline in photosynthesis due to salinity stress could be due to lower stomata conductance, depression in carbon uptake and metabolism, inhibition of photochemical capacity or a combination of all these factors (Anaç et al., 1998, Aksoy et al., 1999; Hepaksoy et al., 1999; Hepaksoy et al., 2002). Reduced photosynthesis under salinity is not only attributed to stomata closure leading to a reduction of intercellular CO_2 concentration, but also to non-stomata factors. There is strong evidence that salt affects photosynthetic enzymes, chlorophyll and carotenoids (Stepien and Klobus, 2006).

Citrus known to be sensitive to saline conditions are threatened the most since the major growing areas are in the coastal regions. But the tolerance to salinity varies among different citrus species and depends on the rootstock (Hepaksoy et al., 2002). Since all commercial citrus trees are grafted onto rootstocks, the salt tolerance of citrus trees can be associated with the ability of the root system to restrict the uptake and/or transport to saline ions to shoots (Levy and Syvertsen 2004). High concentrations of Cl- and/or Na+ in the leaves of citrus trees have been frequently related to nutrient imbalances and reductions in gas exchange and water relations (Walker *et al*. 1993).

In this study, effect of salinity on leaf chlorophyll content of satsuma mandarin cv. Owari onto *Poncirus trifoliata* rootstock was investigated.

Material and Method

A field experiment was established with Satsuma mandarin cv. Owari nursery trees, budded onto *Poncirus trifoliata* rootstock, spaced at 3 x 2,5 m between and on-row distance. The trees

were irrigated with five levels (0.65-2.00-3.50-5.00 and 6.5 dS m^{-1}) saline water. Irrigation, which started in June and continued until the onset of rains in October, was via drip system. The experiment had 3 trees per treatment with four replicates in a randomized block design.

To determine the chlorophyll content of leaf, samples were taken differently aged (young and old) leaves on the branches. Samples were taken at beginning of June (prior to irrigation) and beginning of November (after irrigation season). Chlorophyll content analysis was done according to AOAC (1995).

Results

Analysis of variance of the data showed that the effect of salt treatment, leaf age, sampling date and its interaction on chlorophyll-a, chlorophyll-b or total chlorophyll of leaves were significant.

Chlorophyll-a in old leaves were higher than young leaves at the beginning of June. Average chlorophyll-a of old leaves were 0,936 mg g^{-1} while young leaves were 0,674 mg g^{-1}. There was no difference between young and old leaves at the beginning of November. When 0,65 and 2 dS m^{-1} salt were applied chlorophyll-a content was high at the end of irrigation season. It was decreased by the salinity concentration at both young and old leaves. At the beginning of June the chlorophyll-a content of young and old leaves ranged 0,60-0,78 mg g^{-1} and 0,69-1,09 mg g^{-1} respectively. At the beginning of November the chlorophyll-a content of young and old leaves ranged 0,59-0,91 mg g^{-1} and 0,65-1,14 mg g^{-1} respectively (Figure 1).

Chlorophyll-b contents of young leaves were not affected by the salinity treatment but old leaves were affected and decreased by the application at the beginning of season. At the end of irrigation season the highest level of chlorophyll-b in old leaves was found at the lowest salinity treatment. Chlorophyll-b content of young leaves varied between 0,15 and 0,22 mg g^{-1} before irrigation season and 0,15 and 0,31 mg g^{-1} after irrigation season. It content of old leaves ranged 0,19-0,37 mg g^{-1} , and 0,15-0,31 mg g^{-1} respectively (Figure 2).

Total chlorophyll contents of old leaves were higher than young leaves at June but both leaf contents similar at November. Before irrigation total chlorophyll content of young and old leaves varied between 0,74 and 1,00 mg g^{-1}, and 0,87 and 1,45 mg g^{-1} respectively. After irrigation season, ranged 0,73 - 1,19 mg g^{-1} and 0,84-1,57 mg g^{-1} respectively (Figure 3).

Discussion

The results showed that there was effect of salinity concentration on the leaf pigment contents of Satsuma mandarin cv. Owari onto *Poncirus trifoliata* rootstock. In this present study, chlorophyll levels of young leaves lower than old leaves at the beginning of June due to young leaves have been occurred newly and they are not reached whole size so their chlorophyll synthesis do not reach maximum level and their chlorophyll contents less than old leaves. The oldest leaves start to develop chlorosis and fall with prolonged period of salt stress (Hernandez et al, 1995 and Hernandez et al., 1999; Agastian et al., 2000). Chlorophyll content in leaves was affected by salinity and this effect depends on the levels of salinity. By increasing salinity levels from 0,65 to 6,5 dS m^{-1}, chlorophyll a, b and total content decreased. This loss of chlorophyll content could be associated with accumulation of Na$^+$–and Cl$^-$ in the leaves.

Chlorophyll is the main color agent responsible for photosynthesis. Under adverse circumstances, the chlorophyll level is a good indicator of the photosynthesis function. It has been found that the chlorophyll level of trees decreases with aggravated salt stress (Rao and Rao, 1986) due to enzymatic chlorophyll degradation (Carter and Cheeseman, 1993; Xu et al., 2000). Also Melgar et al. (2008) were found that salinity decreased leaf chlorophyll *a* content in seedlings of Rangpur (*Citrus limonia* Osbeck).

Conclusion

Salinity is the major environmental factor limiting plant growth and productivity (Allakhverdiev et al., 2000). The detrimental effects of high salinity on plants can be observed at the whole-plant level as the death of plants and/or decreases in productivity. The results of this study showed that salinity stress had effect on total chlorophyll, chlorophyll a and b of satsuma mandarin cv. Owari leaves budded onto *Poncirus trifoliata* rootstock.
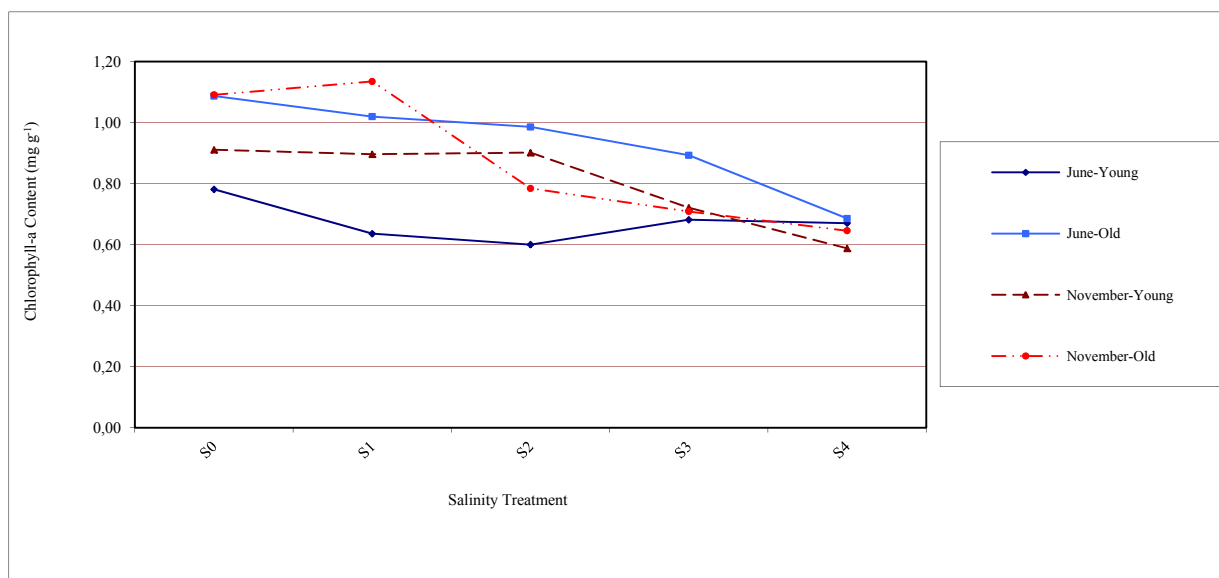

Figure 1. Chlorophyll-a content of leaves (mg g^{-1}).
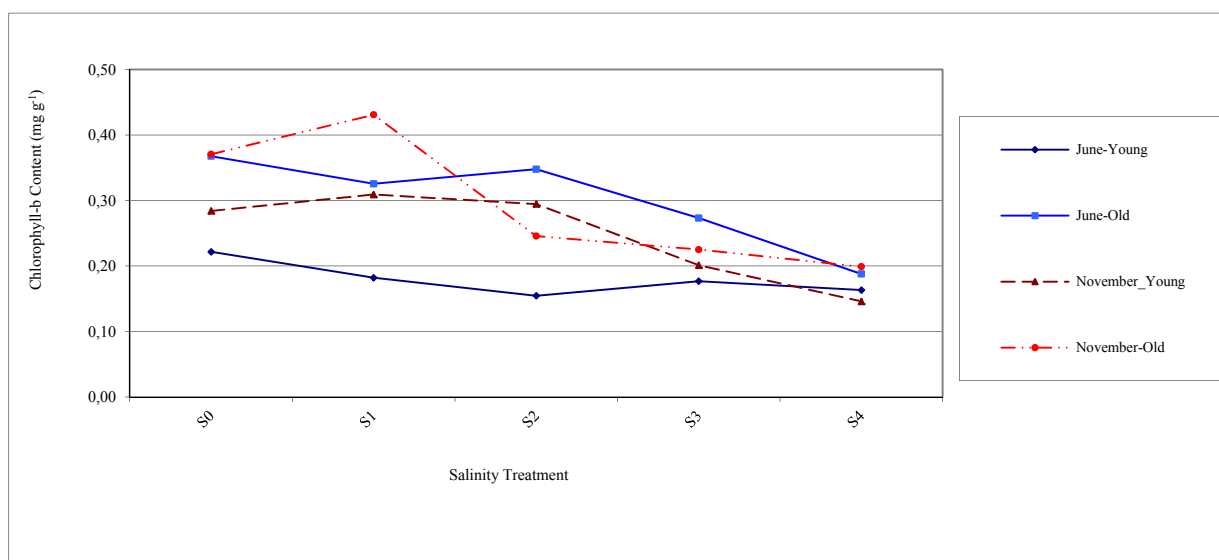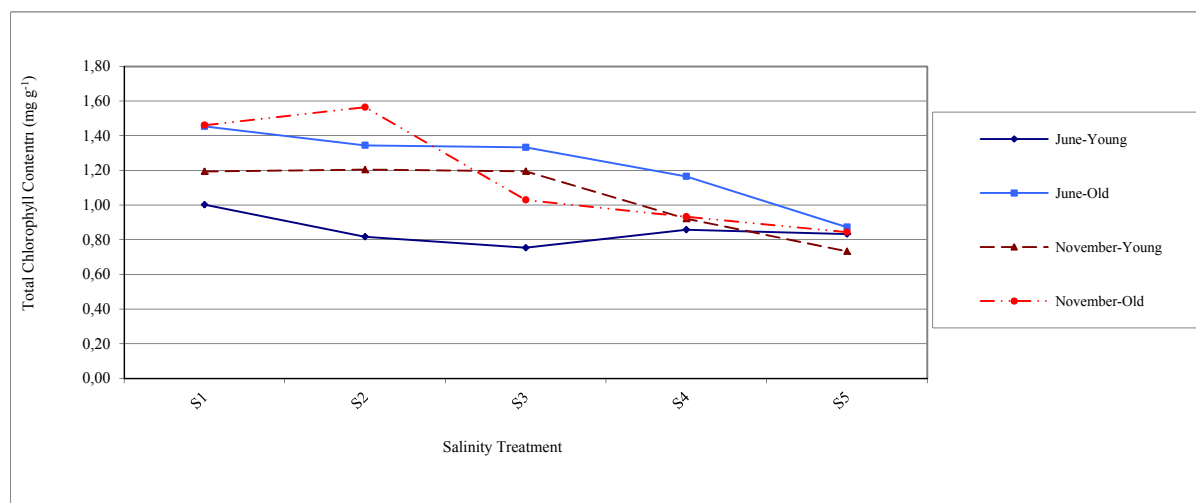

Figure 2. Chlorophyll-b content of leaves (mg g^{-1}).

Figure 3. Total chlorophyll content of leaves (mg g^{-1}).

Acknowledgment

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Performances of Some Maize and Sorghum Hybrid Cultivars in Different Soil Textures Under Mediterranean Conditions

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Abstract

In an attempt to investigate the agronomical performances of some maize (ÇT-1, Helen, C-955 and Brasco) and Sorghum hybrid cultivars (Hay-day, Grazer-N2, El-Rey and ES-526), a field experiment was conducted using randomized complete block design with four replications. Some agronomical characteristics such as plant height, fresh herbage yield, dry matter content and yield were determined at main crop season in the experimental fields with clayey soils of Ege University Agricultural Faculty in Bornova and silty soils of Odemis Training College/Izmir, Turkey during the years of 2005-2006. Results of the study indicated that the variation among cultivars were statisticaly significant and cultivar x soil texture (Locations) interactions for green and dry matter yield traits were also significant. Sorghum hybrid cultivars were superior than maize cultivars in terms of many aspects, mainly in light soil texture of Odemis location. Allthough maize cultivar C-955 was the tallest cultivar among the tested material, Sorghum hybrid cultivars Graze-N2 and El-Rey had better yield performances than the other tested material. Considering the significancy of interaction, it was also suggested that cultivar El-Rey had highest fresh and dry matter yields in light soils of Odemis location.

Keywords: Maize and sorghum hybrid, Mediterranean climate, soil texture, agronomical traits.

Introduction

Silage making is the cheapest way to supply high quality roughage for animal feed and Maize and Sorghum x Sudangrass hybrids are the most popular crops conserved as silage in large areas and grown worldwide. Mediterranean climatic factors of the Aegean region of Turkey provide most favourable conditions to grow those graminaes (Graybill et al., 1991; Avcioglu et al., 2003).

Maize has become the most popular silage crop in the country during last decade and the necessity of multiple cutting pratices in Sorghum and hybrids prevented these grasses to spread out in field production areas and to follow maize production in terms of cropping land area (Iptas and Avcioglu, 1997). Although the higher multiple cutting expenditures of sorghum family compared to maize cultivation, particularly sorghum**X**sudangrass hybrids have süperior characteristics in terms of forage quality, yield components and flexibility of usage in animal raising (Gucuk and Baytekin, 1999). It is a matter of fact that preferences for maize or sorghum and hybrid production are still a matter of discussion among the researchers and farmers (Avcioglu et al., 2009).

In this study, it was aimed to compare the agronomic performances of four maize and sorghum hybrid cultivars under Mediterranean conditions of Bornova and Odemis locations in different soil types for two years and to generate information for research workers and farmers.

Materials and Methods

The field studies were conducted during main crop growing season on a silty-clay loam soil with pH 7.80 at Bornova experimental farm in Ege University (27°13' E, 38°28' N) at 28 m above sea level, and on a sandy loam soil with pH 7.28 at Odemis Training College experimental fields (27°58' E, 38°13' N), 115 m above sea level under Mediterranean climatic conditions during the years of 2005 and 2006.

Four silage maize cultivars (ÇT-1, Helen, C-955 and Brasco) and four SorghumXSudangrass hybrid cultivars (Hay-day, Grazer-N2, El-Rey and ES-526) were tested in Bornova and Odemis locations representing heavy and light soil textures, respectively. The experimental design was a

factorial randomised complete block with four replications. Plot size was 2,8 m x 5,0 m =14,0 m^2 with 70 cm row spacing for maize and 20 cm for Sorghum hybrids. Sowing date was 20.04.2005 and 24.04.2006 for Izmir and 21.04.2005 and 25.04.2006 for Odemis in 2005 and 2006, respectively, and seedbeds were top dressed with 10 kg N – 10 kg P$_2$O$_5$ – 10 kg K$_2$O prior to sowing in each location and year. All plots were irrigated through the growing season between May to August, using 100 mm water for each application. All plots were cut at dough stage of maize and milk stage of Sorghum hybrids and samples were taken for plant height, green matter yield, dry matter content and yield measurements.

After anlyses of variance (Acikgoz et al., 2004), the least significant difference (LSD) test was performed using data for maize and sorghum hybrids for two-year means.

Results and Discussion

The overall results were summarized in Table 1. and 2. Experimental area is located in the Mediterranean zone of the country with quite mild winters and hot summers. Field studies were started in early spring with medium air temperature, and satisfactory moisture levels were experienced in the germination and emergence period, therefore stands were excellent.

Plant Height: Effect of soil texture (location) and soil texture x cultivar interaction on plant height characteristics were not significant, but cultivar effect (Table 1.). Although the plant height value differences among the cultivars and locations were not remarkably high, average height of maize cv. C-955 (251,27 cm) was significantly higher than many other cultivars of maize and sorghum hybrids tested, and cv. El-Rey's height (249,47 cm) was very similar to this genotype. Maize cultivar Brasco had lowest plant height (228,13 cm) among all other maize and sorghum hybrid cultivars. Avcioglu et al. (2003) pointed out similar results under Mediterranean conditions and some other researchers indicated that plant height characteristics of crops are mainly dependent on genotypic peculiarities under favourable environmental conditions (Salisbury and Ross, 1992; Demir and Turgut, 1999).

Green Matter Yield: The cultivar x location effect was significant on green matter yields in addition to significant main effects of cultivar and location (Table 1.). In general, sorghum hybrid cultivars performed far better than maize cultivars in both locations and sorghum hybrid cultivar El-Rey and Grazer-N2 produced higher green matter yields (47,97 t ha^{-1} and 44,64 t ha^{-1}, respectively) under light soil texture conditions of Odemis, while maize cultivar ÇT-1 and Helen had highly limited yields (20,39 t ha^{-1} and 20,12 t ha^{-1}, respectively) in same location.

Green matter yield results displayed that all tested sorghum hybrid cultivars had outstanding yield performances compared to most Bornova, probably due to the favourable growing conditions of light textured soils of Odemis location for this genus. These results were in agreement with Iptas and Avcioglu (1997) and Gücük and Baytekin's (1999) findings.

Table 1. Plant Height and green Matter Yield Traits of Silage Maize and SorghumXSudangrass Hybrid Cultivars in Different Locations

Cultivars		Plant Height (cm)			Green Matter Yield (t ha^{-1})		
		Bornova heavy soil	Odemis light soil	Mean	Bornova heavy soil	Odemis light soil	Mean
Maize	ÇT-1	237.57	250.00	243.78	9133	8651	8892
	Helen	239.15	238.50	238.83	8904	8251	8578
	C-955	245.07	257.47	251.27	9197	8717	8957
	Brasco	231.00	225.27	228.13	9355	8667	9011
Sorghum hybrid	Hay-Day	246.86	248.10	247.48	9675	15800	12738
	Grazer-N2	249.90	242.20	246.05	10008	16500	13254
	El-Rey	248.24	250.70	249.47	9500	18342	13921
	ES-526	244.55	232.47	238.51	9300	12950	11125
Mean		242.79	243.09	242.94	9384	12235	
LSD (% 5)	Cv= 9.54	Lo= ns	CvxLo= ns		Cv= 665	Lo= 332	CvxLo= 940

Dry Matter Content: Dry matter content of crops is a major and targeted characteristic for researchers and growers. Since it is the indication of biomass production except water content, dry matter percent can be considered as the most dependable trait to trace productive capacity of crops. Statistical analyses showed that cultivar effect was significant, although soil texture and soil texture x cultivar interaction were not (Table 2.). Dry matter content variation was also highly limited among maize and sorghum hybrid cultivars, sorghum hybrid cultivars having higher dry mater contents compared to maize cultivars. Iptas and Avcioglu (1997) released similar results. Highest content was recorded in cv. El-Rey (26,43 %) and cv. Grazer-N2 and cv. ES-526 (26,34 % and 26,30 %, respectively) followed this cultivar. Maize cultivar ÇT-1 had the lowest dry matter content (24,26 %) similar with the Brasco's 24,96 % dry matter content.

Table 2. Dry Matter Content and Yield of Silage Maize and SorghumxSudangrass Hybrid Cultivars in Different Locations

	Cultivars	Dry Matter Content (%)			Dry Matter Yield (t ha^{-1})		
		Bornova heavy soil	Odemis light soil	Mean	Bornova heavy soil	Odemis light soil	Mean
Maize	ÇT-1	24.96	23.55	24.26	2279	2039	2159
	Helen	26.16	24.38	25.27	2329	2012	2171
	C-955	25.32	26.39	25.85	2328	2300	2314
	Brasco	25.26	24.67	24.96	2362	2139	2251
Sorghum hybrid	Hay-Day	26.31	24.14	25.23	2542	3831	3187
	Grazer-N2	25.57	27.11	26.34	2562	4464	3513
	El-Rey	26.76	26.10	26.43	2546	4797	3671
	ES-526	26.25	26.34	26.30	2441	3420	2930
Mean		25.82	25.34		2424	3125	
LSD (% 5)	Cv= 1.29	Lo= ns	CvxLo= ns		Cv= 231	Lo= 115	CvxLo= 326

Dry Matter Yield: Main effects of cultivar and location on the dry matter yield traits of maize and sorghum hybrid cultivars were significant in addition to the significant effect of interaction (Table 2.). Since dry matter yield trait is a composit of dry matter content and green matter yield, having higher values compared to others, cultivar El-Rey and Grazer-N2 produced higher dry matter yields of 47,97 and 44,64 t ha^{-1}, respectively in light textured soil of Odemis. On the contrary, dry matter yields of maize cultivar Helen and ÇT-1 were lower than all other cultivars (2012 and 2039 t ha^{-1}, respectively) under same conditions of Odemis site. This finding was confirmed by many researchers stating that maize and sorghum cultivars respond differentially to agronomic techniques and soil conditions (Saglamtimur, 1989; Soya et al., 2000). We concluded that this variation occured most probably due to the diversity of genetic potantial of cultivars and better adaptation of sorghum hybrids to the light soil textures.

Conclusion

Results revealed that sorghum hybrid cultivars were süperior than maize cultivars in terms of yield aspects tested in the experiment under light soil conditions of Odemis location. We suggested that sorghum hybrid cultivars Grazer-N2 and El-Rey, should be recommended in Ege Region for silage production, and mostly preferred for better yield performance compared to maize.

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Determining the Greenhouse Fuel Consumption in Mersin Climate Conditions

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Abstract

Greenhouses should be heated if the temperature degree is less than 12 °C to get high quality yield. The heating allows the reduction of pesticide use. Therefore, it helps to make an environment friend production. In greenhouse production heating, necessary for providing convenient climate conditions for crop demand, has advantages on providing fast grow up and high quality products. It has high energy costs, however. The aim of this study is calculating the mean yearly fuel consumption for assessing the economic situation if greenhouses are heated. The mean fuel consumption was calculated for necessary heat request for a multi-span and single PE film covered (u=7 W/m^{2}K) block greenhouse which has design inside temperature t_{id} = 16 °C in Mersin. The values assumed as; the rate of the surface of greenhouse cover to the greenhouse floor area Ac / Ag= 1.33, design inside temperature t_{id} = 16 °C and the temperature increase by heat storage from day to night t_{st} =2 °C in calculations. The climate data used in calculations, obtained from DSİGM.

The yearly heat consumption (Q_{year}) was calculated as 41.7 (kWh/m^{2}year) for heated months in Mersin. The fuel's, used in determining the heat consumption, heat capacity as 10 kWh/l fuel oil and the heat system efficiency as 80% were considered. Assuming that the heating is necessary mainly during night hours in Mediterranean climate zone, the mean fuel consumption is $Q_{fuel\ oil}$=5.2 (l/m^{2}year) for the winter months in Mersin. In other study, it was found in Almeria (Spain) 4,4 (l/m^{2}year) and Catania (Italy) 5,8 (l/m^{2}year) respectively. As a result of this study, even though all locations are on nearly the same latitude, there are some differences between their fuel consumption values.

Keywords: Greenhouse heating, greenhouse fuel consumption, greenhouse heat request

Introduction

Yield increase can be provided in greenhouse with environment controlled agricultural production techniques. Adverse climate conditions can be controlled according to the crop needs via new techniques.

High humidity and low temperatures occur in non-climate greenhouses. These cause a decrease in product quality. In addition to these, large amount of chemical needs happen. Greenhouses must be heated when the temperature decrease below 12 °C for getting quantitatively and qualified yield (Zabeltitz, 1992; Zabeltitz, 2011).

The most important problems are low temperatures and high humidity levels in Mediterranean coastline non-heated greenhouses. Excessive chemical usage happens in low temperature and high moisture conditions (Zabeltitz, 2011; Stanghellini ve ark., 2003). High relative humidity causes crop diseases in non-heated greenhouses. In addition, it hampers 15% UV radiation due to condensation in greenhouse cover material's inner surface (Zabeltitz, 1986; Baytorun ve ark. 1993).

Material and Methods

It can be seen from the climate data of Mersin that the mean day temperatures are below 12°C at December, January, February and March (Table 1). However, simple heating methods are used just for frost protection in the majority of the greenhouses in Mersin.

Table 1. Mean temperatures (1982-2011) for Mersin (36º 34' N) (DSİGM)

Temperature ºC	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
Mean	10.8	11.4	14.1	18.0	21.8	25.5	28.2	28.7	26.3	21.9	16.2	12.1
Max. Mean	15.2	15.7	18.3	21.7	25.1	28.3	31.0	31.8	30.3	27.1	21.3	16.7
Min. Mean	7.1	7.5	10.0	13.9	17.9	21.9	25.0	25.4	22.2	17.7	12.3	8.5

Non-heated greenhouses cause decrease in yield. Table 2 shows the vegetable yields in Netherlands (modern heating technology greenhouse) and Spain (non heated greenhouse) as a Mediterranean country. According to the Table 2; significant differences can be seen between different climate conditions.

Table 2. Vegetable yields in Netherlands and Spain (kg/m^2) (Zabeltitz 2011)

	Tomato	Pepper	Cucumber
Almeria	9	6	9
Murcia	8	8	-
Hollanda	50	26	70

In this study, the heat energy requirement was determined with using Hallaire method (1950) considered Mersin climate conditions. The mean yearly fuel consumption was determined for assessing the economic situation if greenhouses are heated.

The heat energy requirement was determined using the mean temperatures. Hallaire (1950) developed a method for calculating the hourly temperatures and the mean day and mean night temperatures from the daily mean maximum and minimum temperatures (Hallaire, 1950).

The mean hourly temperature of the day is

$$t_h = t_{min-d} + f_d * A \qquad (1)$$

The mean night temperature is

$$t_{m-n} = t_{min-d} + A \frac{\sum f_n}{24 - d_1} \qquad (2)$$

The mean day temperature is

$$t_{m-d} = t_{min-d} + A \frac{\sum f_d}{d_1} \qquad (3)$$

t_h = Hourly temperature (ºC)
t_{min-d} = Daily minimum temperature (ºC)
A= $t_{max-d} - t_{min-d}$ = Difference of mean minimum and mean maximum day temperature (ºC)
$f_d \, and \, f_n$ = Coefficients depending on day length (Table 3)
d_1 = Day length (h)

Table.3 Coefficients f_d *and* f_n , depending on day length (Hallaire, 1950).

d_l	$\sum f_n$	$\dfrac{\sum f_n}{24 - d_l}$	$\sum f_d$	$\dfrac{\sum f_d}{d_l}$
7	8.21	0.48	4.25	0.61
9	6.0	0.40	5.67	0.63
11	4.5	0.375	6.99	0.635
13	3.45	0.31	8.10	0.623
15	2.51	0.28	9.29	0.62

$$\theta(month) = u * (A_c/A_g) * (t_{id} - t_{st} - t_{mn}) * n_n * n_d (Wh/m^2 month) \quad (4)$$

$u(W/m^2 K)$ = Overall heat consumption coefficient (Table 4)
A_c/A_g = Surface of greenhouse cover/ Greenhouse floor area
t_{id} = Design inside temperature (ºC)
t_{mn} = Mean night temperature (ºC)
t_{st} = Mean temperature (ºC)
n_n = Number of night hours
n_d = Numbers of days per heated month

The temperature increase by heat storage from day to night t_{st} can be assumed to be 1-2 ºC. The main influencing factors on the overall heat transfer coefficient u are the heating system and the cladding material of greenhouse (Zabeltitz, 2011). Table 4 shows the overall heat transfer coefficient u (W/m²K) for different cladding materials.

Table 4. Overall heat transfer coefficient (u) (W/m².K) for different cladding materials. Mean values of various measurements and calculations (mean wind speed 4 m/s and mixed heating system) (Von Zabeltitz 1982, 1986; Tantau 1983; Meyer 1981, 1982)

Cladding material	u (W/m².K)
Single glass	6.0-8.8
Double glass	4.2-5.2
Double acryl sheet (16 mm)	4.2-5.0
Single PE film	6.0-8.0
Double PE film	4.0-6.0
Thermal screen below single glass or film	3.2-4.8

The yearly fuel consumption was determined by the equation 5. In the equation; heat capacity of the oil (about 10 kWh/ oil) and the efficiency of the heater system (assumed to be 80%).

Fuel consumption;

$$Q_{oil} = Q_{year} /10 * 0,8 \quad\quad (5)$$

The climate data (1982-2011) used in calculations, obtained from DSİGM.

Results

Plants grown under protected cultivation are particularly adapted to average temperatures ranging from 17 to 27 ºC. Nisen et al (1990) suggest a threshold of the average night temperature to be 15-18.5 ºC for heat-requiring plants such as tomato, pepper, cucumber, melon and beans. The mean night temperature assumed 16 ºC in the process.

Table 5.Total heat energy requirement in Mersin (36° 34' N). Overall heat consumption coefficient regarded as u= 7 (W/m^2.K) and surface of greenhouse cover/ greenhouse floor area as A_C/A_G = 1.33

Months	t_{m-min}	A	d_l	$\dfrac{\sum f_n}{24 - d_l}$	t_{m-n}	n_d	n_n	Δt	Q_{ay} kW. h/m^2 ay
December	8.5	8.2	9.4	0.377	11.6	31	14.6	2.4	**10.1**
January	7.1	8.1	9.6	0.375	10.1	31	14.4	3.9	**16.2**
February	7.5	8.2	10.5	0.345	10.3	28	13.5	3.7	**13.0**
March	10.0	8.3	11.6	0.331	12.6	15	12.4	1.4	**2.4**
Yearly heat energy requirement (kWh/m^{2}year)									**41.7**

According to the results; the highest heat energy requirement is occur in January as 16.2 (kWh/m^{2}month). The yearly heat consumption (Q_{year}) was found as 41.7 (kWh/m^{2}year) for heated months in Mersin.

Discussion and Conclusion

Assuming that the heating is necessary mainly during night hours in Mediterranean climate zone, the mean fuel consumption is $Q_{fuel\ oil}$=5.2 (l/m^{2}year) for the winter months in Mersin. In other study, it was found in Almeria (Spain) 4.4 (l/m^{2}year) and Catania (Italy) 5.8 (l/m^{2}year) respectively. As a result of this study, even though all locations are on nearly the same latitude, there are some differences between their fuel consumption values.

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The Effect of Different Fertilizer Applications on Yield of Izmir-Ozbas Type of Tobacco

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Abstract
This reserch was carried out in Torbalı, İzmir in 2012 with İzmir-Özbaş tobacco variety. Three different fertilizers (microalg, ammonium sulfate and 10:20:20 composite) were used and the effect of fertilizers on yield and some yield parameters such as plant height (cm), leaf number per plant and leaf lenght (cm) were investigated. The experimental design was Randomized Completely Block Design with 4 replicates. The highest plant height (77.5 cm) and the highest leaf length (17.5 cm) were obtained bye 10:20:20 composite fertilizer application, whereas microalg fertilizer application gave the highest leaf number per plant (26.5). Among the yield and yield parameters the best result were obtained from 10:20:20 composite fertilizer applications.

Keywords: Tobacco, yield, composite fertilizer, microalg

Introduction

In spite of being a matter of increasing debate by reason of its adverse effects on health, tobacco is a crucial plant in terms of both the contributions it makes to our national economy and the employment opportunities it creates. In our country, tobacco is produced in a total of 5000 villages, 40% of which are located in Aegean Region, and 400.000 households are mainly dependent for their living on tobacco production (Ozguven et. al., 2005). From 1969 to 2002, tobacco production in our country was regulated by the Law No. 1177. However, the Law No. 4733 of 9 January 2002, also known as the "Tobacco Law", opened the era of contracted tobacco production. Since 2002, which is the effective date of the Law, total surface area and accordingly amount of production and yield values have decreased from year to year. Being 191.000 ha in 2002, total tobacco production area decreased to 97.179 ha in 2011. At the same time yield decreased from 83.5 kg/da to 54.9 kg/da (Anonymous, 2011). In parallel with the figures given above, Aegean Region, which produced more than 50% of all tobacco production in our country, experienced a decrease in amount of production and yield values. Compared to other crop plants, tobacco plant specific to the Aegean Region is less selective in soil requirements. In the majority of tobacco production areas of the Aegean Region, monoculture has been practiced for years. For this reason, nutrient values of the soil in such areas are below optimum values. As a result, a controlled and balanced fertilizer is required. The aim of this study is to evaluate the effects of 10:20:20 and ammonium sulfate fertilizers and micro algae plant nutrients on the yield of İzmir Özbaş type tobacco under field conditions.

Materials and Methods

The study was conducted in Torbalı location of Izmir province in 2012. It included a total area of experiment of 1.6 da planted with İzmir Özbaş tobacco. Experimental design was Randomized Complete Block Design with four replicates. In the year of experiment, mean yearly temperature was 17.4°C. In June, July, and August, mean monthly temperature was measured as 27°C, 30 °C, and 29.2 °C, respectively. Total annual precipitation was 820.2 mm; no precipitation was observed in summer (Anonymous, 2012). The soil sample taken from a depth of 0-20 cm was sandy-loamy and had a neutral pH and adequate levels of nitrogen and organic matters. 0.6 g tobacco seeds/m^2 were planted on March 17, 2012. On May 4, 2012, tobacco seedlings were transplanted in a plantation norm of 45x8cm. Upon transplantation, tobacco seedlings were irrigated with life water. Later on, they were hoed for 2 times, during which neither diseases nor pests were encountered. Harvest was completed after 4 runs. In the experiment, tobacco plants

were treated with ammonium sulfate and 10:20:20 fertilizers and micro algae plant nutrients during field period.

Table 1. Period of treatment with plant nutrients and fertilizers

Fertilizer/Plant Nutrient	Field Period
Micro algae	1st treatment; 3lt/da during transplantation together with life water 2nd treatment; 125ml/da onto the leaves following the first harvest
Ammonium sulfate	Spreading to the field 1 month before plantation (10kg/da)
10:20:20	During transplantation together with life water (15kg/da)

In the study, factors like plant height (cm), number of plants (number/2.5m), number of leaves (number/plant), leaf length (cm), leaf width (cm), number of live and dead plants (2.5m) and yield (kg/da) were determined. Data were statistically evaluated based on a single factor using the statistical package TARIST according to Randomized Block Design (Açıkgöz et. al., 2004).

Results and Discussion

As seen in Table 2, no statistical difference was observed as a result of data analyses. The fertilizer 10:20:20 produced the best results in terms of plant height, number of plants, leaf width, and leaf length. The highest number of live plants and the highest number of leaves were obtained from the micro algae. The number of dead plants reached the highest level with ammonium sulfate. Plant height ranged from 66.0 cm to 77.5 cm. Some researchers are in the opinion that plant height varies between 40 cm and 180 cm depending on variety and that different types of genes affect plant height (Anonymous, 1981; Yazan, 1989; Uz, 1988; Kara, 1993; Prasannasimharao, 1995; Esendal et. al., 1997; Çamaş and Esendal, 2001). In his experiment, Şenbayram (2006) treated two different types of Aegean tobacco with nitrogen and obtained a significant increase in the number of leaves. Compared to Akhisar-97, İzmir-Özbaş tobacco produced higher number of leaves in both experiments. In their study on oriental tobacco, Drossopoulous et al., (1997) and Cooke et. al., (2005) proved that the number of leaves increased by means of nitrogenous fertilizer. It was reported that, in the tobacco plants of the Aegean Region, leaf width and leaf length were 5-7 cm and 5-12 cm, respectively (Şuben, 1976). Salman (2000), in the study he conducted on post-harvest tobacco leaves in Gavurköy, stated that leaf width ranged from 2.8 cm to 3.4 cm and leaf length ranged from 5.4 cm to 6.4 cm. Peksüslü (1998) found that, in Ege 64, Karabağlar, and 6-1/A, leaf width was between 7.2 cm and 10.3 cm and leaf length was between 14.3 cm and 21.7 cm. For Korkmaz (2006), leaf length varied between 11 cm and 12.56 cm. As can be seen in the figures above, the data we obtained during our study are in parallel with the literature findings attained from different sources.

Table 2. Effects of plant nutrient and fertilizers on characteristics

Treatment	Plant Height (cm)	Number of Plants (pcs./2.5m)	Number of Alive Plants (pcs. /2.5 m)	Number of Dead Plants (pcs./2.5 m)	Number of Leaves (pcs.)	Leaf Width (cm)	Leaf length (cm)
Micro algae	74.2	23.2	21.8	5.3	26.5	7.6	15.4
Ammonium sulfate	66.0	24.4	18.0	7.5	24.7	7.7	15.4
10:20:20	77.5	24.5	20.5	3.8	23.7	8.5	17.5
Control	68.5	26.6	18.5	8.8	24.1	7.5	14.6
LSD	ns	ns	ns	ns	ns	ns	ns

ns. not significant

Table 3. The effect of plant nutrients/fertilizers on tobacco yield (kg/da)

Treatment	Yield in the 1st Stalk Position	Yield in the 2nd Stalk Position	Yield in the 3rd Stalk Position	Yield in the 4th Stalk Position	Total Yield
Micro algae	28.2[bc]	31.1	28.3	27.0	114.6[b]
Ammonium sulfate	34.7[ab]	27.0	32.3	19.5	113.5[ab]
10:20:20	28.7[a]	34.2	30.3	23.1	126.6[a]
Control	24.5[c]	26.8	26.2	23.1	103.2[c]
LSD	0.710**	ns	ns	ns	1.515*

ns. not significant   *p<0.05   **p<0.01

Table 3 shows that F value was found statistically important for 1st stalk position (p<0.01) and total yield (p<0.05). The highest yield (126.6 kg/da) was obtained from the fertilizer 10:20:20. On the other hand, ammonium sulfate fertilizer gave the lowest yield (113.5 kg/da). Different researchers reported that dry leaf yield in the tobacco plants of the Aegean Region ranged between 80 kg/da and 250 kg/da (Otan and Apti, 1989; Er, 1994; Uz, 1997; Ekren, 2007). By applying different doses of nitrogen, Şenbayram (2006) increased leaf yield per plant by 80% in his first trial and by 170% in his second trial.

Conclusion and Recommendation

The study demonstrated that the best results in terms of yield components and yield were obtained from the compound fertilizer of 10:20:20, followed by micro algae plant nutrient and ammonium sulfate fertilizer, respectively. We are in the opinion that it would be better to reproduce the existing study for 1 more year in terms of yield and yield elements and conduct it in other tobacco production locations of Aegean Region.

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Soil Analysis of Different Dose Gibberellic Acid (Ga₃) and Fertilizer Use in Sultani Çekirdeksiz Grape Variety and Analysis of Their Nutritional Value

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Abstract

The aim of this research is the examination of mineral nutrition uptake by foliar analyses in Sultani Çekirdeksiz (Sultana) applied of the different doses of fertilizer and gibberellic acid. This study was conducted own rotted Sultani Çekirdeksiz experiment vineyard at Manisa Research Station in Alaşehir province.

Five different GA3 and four different fertilizer doses including controls were applied on Sultani Çekirdeksiz in the completely randomized block design with split plots as three replications. Each replication had 6 vines. Applications were made for 3 years in 2010, 2011 and 2012 and nutrient values were identified with soil analysis.

The GA3 applications were 0, 35, 70, 140, 210 ppm and suggested dose for fertilization was determined by the soil analysis. Four doses were formed by multiplication of suggested dose and 0, 0.5, 1, 1.5 coefficients.

Soil samples were taken at flowering, verasion and harvest times and two different depths (0-30, 30-60cm). Total % N content was obtained by using kjeldahl methods, available P (phosphorus) by the method of Olsen spectrophotometer readings are made. Changeable K (potassium), Ca (calcium), Mg (magnesium) of 1 N ammonium acetate by the method of atomic absorption spectrometer reading is performed. Useful Fe (iron), Zn (zinc), Mn (manganese) and Cu (copper) according to the method of the amount of DTPA in Atomic Absorption Spectrometer readings were made. Results are obtained in mg kg^{-1}

Keywords: Sultani Çekirdeksiz, Gibberellic Acid (GA₃), fertilizer, soil analysis, macro and micro elements

Introduction

Our country is among important grape growing countries of the world with regard to production and area. According to the data in 2011, a total of 4.296.351 tons fresh grape are produced on a vineyard area of 4.725.454 in our country. Of this production, 2.268.967 tons are considered as table, 1.562.064 tons are considered as dried and 465.320 tons are considered for wining (Anonymous, 2011). A great deal of table grape production and almost all dried grape production are performed in the Aegean region. The most commonly cultivated grape type in the region is Sultani Çekirdeksiz. Sultani Çekirdeksiz grape cultivation is concentrated in Manisa, Denizli and Izmir. According to latest data, our table fresh grape export reached 240.083 tons in 2011 (Anonymous, 2012).

One of the most important cultural practices applied in viniculture is fertilization, and it has a distinct significance within cultural practices performed in order to increase productivity and quality. It was determined via studies conducted that consciously performed fertilization practices increase productivity and quality.

Gibberellic Acid (GA3) applications are needed to increase quality of table grapes. However, each type's reaction to GA3 differs. Among them, the type of Sultani Çekirdeksiz in particular gives a positive reaction to GA3 applications. Therefore, GA3 applications are commonly performed by producers to increase quality of table grapes.

Material and Method

This study was conducted in order to soil analyses and nutrient values of Gibberellic Acid (GA3) and fertilizer applications in different doses for grape type of Sultani Çekirdeksiz, which is cultivated in Alaşehir Yeşilyurt Enterprise of Manisa Viniculture Research Station Management. In the study, 4 different fertilizer doses including control and GA3 applications in 5 different doses were set up with 3 repetitions and as 6 vinestocks in each repetition according

to randomized blocks test design with split plots. Soil analyses and nutrient values were detected by performing applications for three years in 2010, 2011 and 2012.

In the test, GA3 applications (Chart 1) at 0, 35, 70, 140 and 210 ppm doses in total and zero-dose fertilizer, full-dose fertilizer, half-dose fertilizer and one and a half-dose fertilizer applications according to analysis results were performed in different periods of vegetation.

Chart 1. GA$_3$ Amounts Applied in the Test

Applications	Application Period				
	Length of Sumac 5-10 cm	Length of Sumac 15-20 cm.	Flowering (%50-80)	Grain Size (4-5 mm)	One Week Later
H0 (0 ppm)	-	-	-	-	-
H1 (35 ppm)	-	-	15 ppm	20 ppm	-
H2 (70 ppm)	15 ppm	-	15 ppm	20 ppm	20 ppm
H3 (140 ppm)	20 ppm	20 ppm	20 ppm	40 ppm	40 ppm
H4 (210 ppm)	30 ppm	30 ppm	30 ppm	60 ppm	60 ppm

Soil samples were taken at flowering, verasion and harvest times and two different depths (0-30, 30-60cm). Total % N (Kacar 1995) content was obtained by using kjeldahl methods, available P (phosphorus) (Olsen ve ark, 1965) by the method of Olsen spectrophotometer readings are made. Changeable K (potassium), Ca (calcium), Mg (magnesium) (Kacar, 1995) of 1 N ammonium acetate by the method of atomic absorption spectrometer reading is performed. Useful Fe (iron), Zn (zinc), Mn (manganese) and Cu (copper) (Lindsay ve Norvell, 1978) according to the method of the amount of DTPA in Atomic Absorption Spectrometer readings were made. Results are obtained in mg kg^{-1}

Results, Discussion and Conclusion

Examining soil nutrient contents in Tables 3, 4 and 5 shows that during the flowering period the average nitrogen content of the last three years were 0,08% for (0-30) cm and 0,06 for (30-60) cm, that the average N contents for both depths were of low class, that the average N contents during the veraison period were of medium class with 0,14% and 0,13%, and that the contents were once again of medium class during the harvest period with 0,11% and 0,10%. In studies conducted on vineyards in the Aegean Region, while Atalay and Anac (1991) reported 70% N to be poor and 20% N to be medium, Igret (1988) and Igret and Atalay (1992) reported inadequate with 76%, Yener et. al. (2000) reported 48% poor and 36% medium, Konuk and Colakoglu (1986) reported 88% inadequate and finally Kovanci and Atalay (1977) reported 58% to be inadequate. Examining soil nutrient contents in Tables 3, 4 and 5 shows that during the flowering period the average phosphorus content of the three years were 11,95 ppm for (0-30) cm and 7,72 ppm for (30-60) cm, that the average P contents for both depths were of medium class, that the average P contents during the veraison period were of medium class with 15,84 and 9,95 ppm and that the average P contents were once again of medium class during the harvest period with 17,24 and 11,75 ppm for the two depths. In studies conducted on vineyards in the Aegean Region, Atalay and Anac (1991) found P to be inadequate with 2,5% and medium with 20%, while Igret (1988) and Igret & Atalay (1992) reported it to be 96% inadequate, Yener et. al. (2000) reported 24% to be poor, 16% to be medium, Konuk and Colakoglu (1986) reported it to be 54% inadequate and Kovanci & Atalay (1977) reported it to be 30% inadequate.

Examining the soil nutrient contents presented in Tables 3, 4 and 5 indicates that while the average potassium values of the three years were 405,87 ppm for 0-30 cm depth and 398,28 ppm for 30-60 cm depth, that average K contents for both depths were of very high class, that they are also of very high class with 361,61 ppm and 368,57 ppm during the veraison period, and finally in the harvest period they were of high class with 316,00 ppm for 0-30 cm and 316,01 ppm for

30-60 cm depth. In studies conducted on vineyards in the Aegean Region, while Atalay and Anac (1991) reported K to be 28% inadequate, Igret (1988) and Igret & Atalay (1992) reported 48% inadequate, Yener et. al. (2000) reported 52% poor, Konuk and Colakoglu (1986) reported 48% inadequate and finally Kovanci and Atalay (1977) reported 50% to be inadequate.

Examining soil nutrient contents from Tables 3, 4 and 5 also shows that the average calcium values of the three years have been of high class with 3545 ppm and 3428 ppm for 0-30 cm and 30-60 cm depths respectively, that during the veraison period average Ca contents were of high class with 4082 ppm and 4016 ppm, and that during the harvest period average Ca contents were 3494 ppm for 0-30 cm and 3422 ppm for 30-60 cm depth, and thus of high class. In studies conducted on vineyards in the Aegean Region, while Atalay and Anac (1991) reported Ca to be 45% poor and 23% medium, Igret (1988) and Igret & Atalay (1992) reported it to be 4% inadequate, Yener et. al. (2000) reported it to be 68% poor, Konuk and Colakoglu (1986) reported it to be generally inadequate and finally Kovanci and Atalay (1977) reported it to be generally adequate. Examining the soil nutrient contents presented in Tables 3, 4 and 5 indicates that while the average magnesium values of the three years were 484,5 ppm for 0-30 cm depth and 495,4 ppm for 30-60 cm depth, that average Mg contents for both depths were of very high class, that they are also of very high class with 780,0 ppm and 814,1 ppm during the veraison period, and finally in the harvest period they were once again of very high class with 743,9 ppm for 0-30 cm and 773,4 ppm for 30-60 cm depth. In studies conducted on vineyards in the Aegean Region, while Atalay and Anac (1991), Igret (1988), Igret & Atalay (1992) and Yener et. al. (2000) reported Mg to be at a generally adequate level, Konuk & Colakoglu (1986) reported it to be 86% inadequate and Kovanci and Atalay (1977) reported it to be adequate and high.

Examining the soil nutrient contents presented in Tables 3, 4 and 5 indicates that the average iron contents of the three years were 4,12 ppm for 0-30 cm depth and 3,66 ppm for 30-60 cm depth, that the average Fe contents for both depths were of the critical class, that during veraison period they were of adequate class with 6,62 ppm and 3,656 ppm, and finally in the harvest period they were once again of adequate class with 4,50 ppm for 0-30 cm and 4,91 ppm for 30-60 cm depth. In studies conducted on vineyards in the Aegean Region Atalay and Anac (1991) reported 45% Fe to be generally inadequate, Igret (1988) and Igret & Atalay (1992) reported 64% to be adequate and Yener et. al. (2000) reported it to be 24% deficient and 28% critical. Examining the soil nutrient contents presented in Tables 3, 4 and 5 indicates that the average zinc contents of the three years were 0,78 ppm for 0-30 cm depth and 0,60 ppm for 30-60 cm depth, that the average Zn contents for both depths were of the critical class, that during veraison period they were of adequate class with 0,75 ppm and 1,10 ppm respectively for 0-30 cm and 30-60 cm depth, and finally in the harvest period they were of the critical class with 0,62 ppm for 0-30 cm and 0,50 ppm for 30-60 cm depth. In studies conducted on vineyards in the Aegean Region, while Atalay and Anac (1991) reported Zn to be 30% deficient and 50% critical, Igret (1988) and Igret & Atalay (1992) reported it to be 88% inadequate and Yener et al. (2000) reported it to be 56% inadequate and 24% critical. Examining the soil nutrient contents presented in Tables 3, 4 and 5 indicates that the average manganese contents of the three years were 5,97 ppm for 0-30 cm depth and 5,21 ppm for 30-60 cm depth, that the average Mn contents for both depths were of adequate class, that during veraison period they were of adequate class with 8,03 ppm and 7,35 ppm, and finally in the harvest period they are once again of adequate class with 5,28 ppm for 0-30 cm and 4,43 ppm for 30-60 cm depth. In studies conducted on vineyards in the Aegean Region Atalay and Anac (1991) reported Mn to be adequate, Igret (1988) and Igret & Atalay (1992) reported it to be 28% inadequate and 52% critical, while Yener et. al. (2000) reported it to be adequate. Examining soil nutrient contents in Tables 3, 4 and 5 shows that during the flowering period the average copper content of the three years were 3,84 ppm for (0-30) cm and 2,79 ppm for (30-60) cm, that the average Cu contents for both depths were of adequate class, that the average Cu contents during the veraison period were of adequate class with 3,73 and 3,91 ppm and that the average Cu contents were once again of adequate class during the harvest period with 2,79 and 2,42 ppm for the two depths.

Table 3. Nutrient Values of 0-30 cm and 30-60 cm Deep Soil Samples for the Flowering Periods of the Years 2010, 2011 and 2012

Fertilizer Dose	N %		P ppm		K ppm		Ca ppm		Mg ppm		Fe ppm		Zn ppm		Mn ppm		Cu ppm	
AVE.	0,08	0,06	11,95	7,72	405,87	398,28	3545	3428	484,5	495,4	4,12	3,66	0,78	0,60	5,97	5,21	3,84	2,79
MİN.	0,12	0,08	26,94	16,7	626,6	638,7	3999	3902	528,5	546,5	9,12	8,73	1,5	1,13	9,53	8,89	8,51	7,33
MAK.	0,05	0,03	4,26	3,57	284,4	264,4	2835	2580	443,9	434,4	1,27	0,64	0,13	0,12	2,31	2,29	1,94	0,91
Table 4. Nutrient Values of 0-30 cm and 30-60 cm Deep Soil Samples for the Veraison Periods of the Years 2010, 2011 and 2012																		
AVE.	0,14	0,13	15,84	9,95	361,61	368,57	4082	4016	780,0	814,1	6,62	6,56	0,75	1,10	8,03	7,35	3,73	3,91
MİN.	0,27	0,24	50,38	32,08	568,10	618,40	4405	4568	1598,0	1739,0	12,05	10,75	2,05	2,48	9,34	9,77	5,77	6,80
MAK.	0,06	0,04	8,07	2,78	243,10	231,30	3743	3629	391,0	391,4	2,67	4,01	0,29	0,55	6,06	4,10	2,46	2,07
Table 5. Nutrient Values of 0-30 cm and 30-60 cm Deep Soil Samples for the Harvest Periods of the Years 2010, 2011 and 2012																		
AVE.	0,11	0,10	17,24	11,75	316,00	316,01	3494	3422	743,9	773,4	4,50	4,91	0,62	0,50	5,28	4,43	2,79	2,42
MİN.	0,19	0,17	55,65	21,61	546,20	491,00	3786	3871	1652,0	1743,0	8,09	9,29	1,35	1,07	7,20	6,51	5,11	4,14
MAK.	0,06	0,02	5,33	4,44	178,70	182,70	3241	2889	389,3	389,2	1,99	2,39	0,20	0,17	3,45	2,55	1,80	1,12
Limit Values	0,09-0,17		7-20		200-250		1440-2867		117-200		4,5<		1<		1 <		0,2 <	

Differences observed between the values indicated with similar letters or not used letters are not important according to %5 Duncan test.

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Environmental Risk Phytoaccumulation of Arsenic in *Spinacea oleracea* and *Lactuca sativa*

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Abstract

Pollution of the environment, particularly the soil, appears to be one of the major contemporary issues. In addition, many studies point to the involvement of ecological risk of heavy metals into the food chain through edible plants like *Spinaceae oleraceae* and *Lactuca sativa*. This paper presents the results of the ex situ application of phytoacumulation on the soils of contaminated terrain using the plant species of spinach (*Spinacea oleracea*) and lettuce (*Lactuca sativa*). Sequestration of arsen from the soil by these plant species was observed through phytoaccumulation factor – PF and limit values (mg/kg). The main task and objective of this research was to establish the level of accumulation of toxic element As from the soil by plants and to calculate the PF factor of transfer. The experiment was set up in the control conditions where the soil from eight contaminated locations was placed in the experimental containers. The AAS method was used to analyze heavy metal in plant material and soil. PF factor values ranged from 0.1 to 1.0 which indicates that the spinach and lettuce plants rechargeable moderate compared to arsenic.

Keywords: Phytoaccumulation, *Spinaceae oleraceae*, *Lactuca sativa,* arsenic

Introduction

The environment in general comprises everything that surrounds us: soil, air, water, biodiversity, etc. Nowadays, pollution of environment and primarily of soil, poses one of the most pressing issues in Europe. The European Commission has identified eight major threats to soil (Thematic Strategy for Soil Protection Communication COM/2006/231) which, besides erosion, organic matter decline, flooding, landslides, salinization, compaction, loss of biodiversity and change of use, also include soil pollution.

Kisić (2012) states that polluted soil is a soil whose contents of harmful substances have increased due to human or natural activities to the levels which may be dangerous to humans as well as to the production of plants and animals. The occurrence of polluted soil always brings a high environmental risk of heavy metals entering the food chain. According to Bašić (2008) the dominant point of origin or the „starting point" of entry of heavy metals into the food chain is soil. It has been established that Cd, Hg, Pb, As, Cr and Tl are toxic to plantsand dangerous to the health of consumers (heterotrophs), condition of biosphere and stability of the terrestrial and semi-terrestrial ecosystems *(Bergmann, 1992)*.

Translocation of heavy metals into the plants is tracked through the translocation coefficient which varies in different plant species depending on the metal (Kloke et al. 1984, 1994). In different sources the accumulation factor is referred to as accumulation factor (Khan, 2001), enrichment coefficient (Zgorelec, 2009), enrichment ratio (Chesworth, 2008), translocation coefficient (Fismes et al., 2005), transfer factor (Dobrin et al., 2004), phytoaccumulation factor (Zurayk, 2002), soil-plant transfer coefficient (Adriano, 2001), bioaccumulation factor (Sanborn and Brodberg, 2006), biological adsorption coefficient (BAC) (Malayeri et al., 2008) or uptake coefficient (Sinha and Singh, 1976).

According to Kloke et al. (1984) edible plants such as *Lactuca sativa* and *Spinacea oleracea* have a great ability to accumulate heavy metals (Table No. 1), hence they were selected for this experiment. The PF factor in *Lactuca sativa* and *Spinacea oleracea* in relation to Ni and Cd was researched in BiH (Veladžić et. al., 2013). These two species are widely used in nutrition in Bosnia and Herzegovina, for example in the preparation of traditional dishes (spinach pie) and various salads.

The legislation of Bosnia and Herzegovina governs the allowed content of harmful and hazardous substances in soil (Official Gazette of the F BiH No. 72/09) as well as some contaminants in foodstuffs (Official Gazette of BiH No. 37/09).

Table 1. Ability of some edible plants to accumulate heavy metals

High	Medium	Low	Very low
Lactuca sativa *Spinacia olerac.* *Beta vulg.v. cicla* *Cichorium end.* *Lepidium lapatif.* *Daucus carota*	*Brassica o. acephala* *Brassica ol.capitata* *Beta vulgaris rubra* *Brassica rapa* *Raphanus sativus* *Solanum tuberos.*	*Zea mays* *Brass. oler. italica* *Brass. oler. botrytis* *Brass.ol. gemmifera* *Apium graveolens* *Rubus sp. i Fragaria sp.*	*Phaseolus sp.* *Pisum sativum* *Cucumis melo* *Lycopers. esc.* *Caps. annum* *Solanum m.*

Arsenic in soils and plants

Arsenic (As) was first documented by the alchemist Albertus Magnus. It is an amphoteric metalloid in the Va group of the periodic table of elements, whose atomic mass is 74,9216 and atomic number 33. It is accounted among toxic elements (Šaćiragić, 2000). According to Conti et. al., (2000) all heavy metals and metalloids in large amounts are toxic, and the boundary separating the essential from the toxic elements depends on the concentration of the element and the quantity taken in by food.

Arsenic is found in all environment media, while its largest reservoir is the lithosphere (Matschullat, 2000). According to Fitz and Wenzel (2002), the arsenic concentration levels in environmental media are usually below 10 mg/kg. Accessibility of As to plants depends on the levels of pH, as well as the contents of iron, aluminum and calcium (Šaćiragić, 2000).

Limit values for arsenic, depending on soil texture, are 10 mg/kg for sandy soils, 15 mg/kg for powdery-loamy soils and 20 mg/kg for clayey ones (Official Gazette of the F BiH, No. 72/09). Permissible concentration of arsenic in vegetables is 0.30 mg/kg of moist matter (Official Gazette of BiH No. 37/09).

Material and methods

Soil taken from eight contaminated sites was transferred to the control containers and sown with *Lactuca sativa* and *Spinacea oleracea*. At the end of the vegetation period, plant material was sampled and samples were prepared for analysis (Images 1-4). The analysis of the plant material was performed by AAS method in the Federal Institute of Agriculture in Sarajevo, while soil analyses were made in the PAM Institute (Institute for Soil Science, Agrochemistry and Melioration) at the Faculty of Agricultural and Food Sciences in Sarajevo.

| Image No 1 | Image No 2 | Image No 3 | Image No 4 |

The phytoaccumulation factor is calculated according to the following formula: $PF = \dfrac{C_{plant}}{C_{soil}}$

Where:
C_{plant}– denotes concentration in plant residues at the end of the experiment (mg/kg)
C_{soil}–denotes concentration in soil prior to the experiment (mg/kg)

Levels of PF:

High accumulator plants	PF between 1 - 10
Moderately accumulator plants	PF between 0.1 – 1.0
Low accumulator plants	PF between 0.01 – 0.1
Non accumulator plants	PF < 0.01

Results

Total content of arsenic (As) in edible plants in relation to the limit values are shown in charts No. 1 and 2.
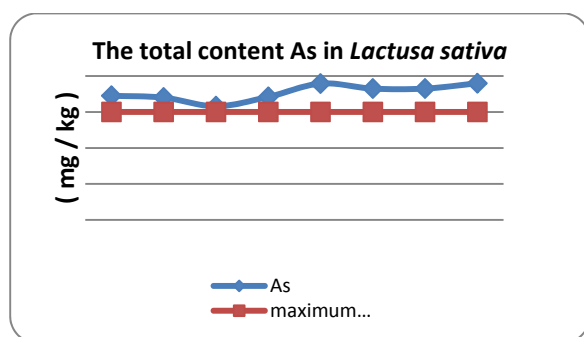

Chart 1. As concentration in *Lactuca sativa*
(mg/kg) in relation to the limit values
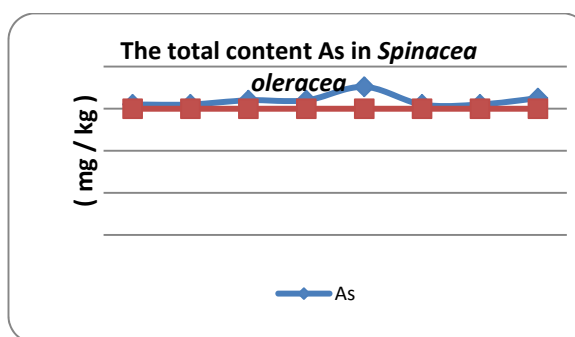
Chart 2. As concentration in *Spinacea oleracea*
(mg/kg) in relation to the limit values

The content of As in the tested moist plant material at all sites was slightly above the limit values and ranged from 0.31 to 0.35 mg/kg in *Lactuca sativa* and from 0.32 to 0.38 mg/kg in *Spinacea oleracea*.

The resulting values of phytoaccumulation factor – PF (Table No. 2) show that the selected edible plants of *Lactuca sativa* and *Spinacea oleracea* are low accumulator plants for arsenic. The PF values ranged between 0.01 and 0.05 (for *Lactuca sativa)* and between 0.02 and 0.05 (for *Spinacea oleracea).*

Table 2.Levels of PF coefficient for As in *Lactuca sativa* and *Spinacea oleracea*

Location	*Lactuca sativa* PF$_{As}$	*Spinacea oleracea* PF$_{As}$
Locaton 1	0,02	0,02
Location 2	0,02	0,02
Location 3	0,05	0,05
Location 4	0,02	0,02
Location 5	0,03	0,04
Location 6	0,02	0,04
Location 7	0,02	0,02
Location 8	0,01	0,04

Discussion and conclusion

In BiH *Lactuca sativa* and *Spinacea oleracea* are used for human consumption in a variety of traditional dishes, such as spinach pie, as well as various salads. These edible plants can serve as an indicator in the assessment of potential environmental risk of phytoaccumulation of arsenic (As) in them. These plants also have a high abilityto absorb heavy metals from the soil.

Given that the total content of arsenic (As) in edible plants of *Lactuca sativa* and *Spinacea oleracea* was only slightly above the permissible values, they have proven to be poor/low accumulator plants. Levels of PF ranged between 0.01 and 0.05 for *Lactuca sativa* and between 0.02 and 0.05 for *Spinacea oleracea.*

Based on the obtained results it can be stated that *Lactuca sativa* and *Spinacea oleracea* pose an insignificant environmental risk when it comes to the entry of arsenic in the food chain through these plants.

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Results of Maize Production and Maize Processing in Hungary

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Abstract

During the examination of the cultivation treatments, it was concluded that the highest yield was obtained as a result of autumn ploughing, but its effect largely differs in the irrigated and the non-irrigated treatments.

In years with smaller, average precipitation supply or when the precipitation was higher than average, higher plant numbers were more favourable. Under drier conditions, but especially in several consecutively dry years, a lower plant number can be recommended which is not higher than 60 thousand per hectare. In the case of favourable water supply, 70–80 thousand plants per hectare can be used.

The yield increasing effect of fertilisation was significant in the case of both non-irrigated and irrigated conditions, but it was much more moderate in the non-irrigated treatment.

Irrigation is not enough in itself, because if it was not accompanied by intensive nutrient management, yields started to decline.

Although the quality parameters of maize are hereditary, these can be modified by ecological and agrotechnical factors. The main factors which have a significant influence on yield and quality are fertilisation and N supply.

Keywords: Maize, yields, large – scale use

Introduction

Maize production in Hungary has noble traditions and significant results. This sector is also important worldwide, not only in Europe. The sowing area of maize is relatively stable, it is between 1.2–1.3 million hectares. Yield was very low (2–3 t ha^{-1}) between 1900 and 1950. The subsequent five decades showed exceptional tripling in maize yield (6–8 t ha^{-1}) due to genetic development, general use of hybrid sowing seeds, increase in fertiliser use, field water management, high production technology standards and outstanding expertise.

Fertiliser use per one hectare of agricultural area in Hungary was the highest in the mid-seventies and it was less than half in the early nineties and even less than half at the turn of the millennium. Since then, the amount of applied fertilisers has been slowly increasing, it was 93 kg in 2013 (*Figure 1*).
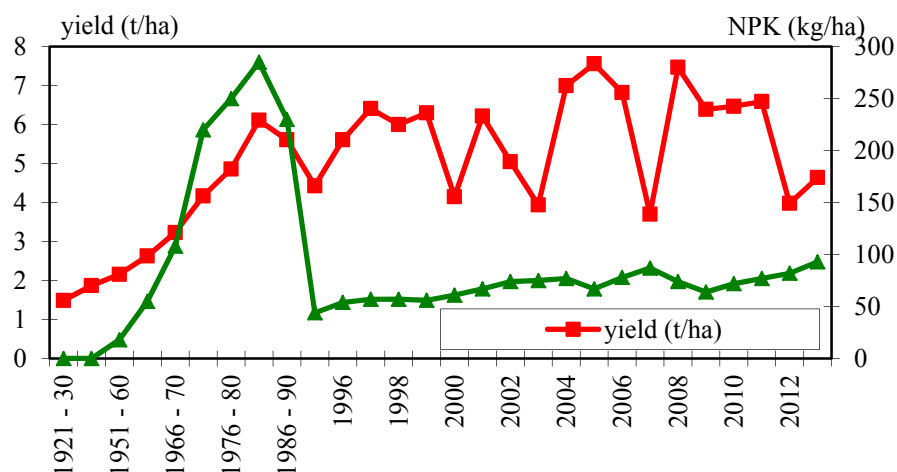

Figure 1. The use of fertilisers and the mean yields of maize in Hungary, 1921–2013

According to the Hungarian technical literature, the most favourable tillage method is 22-25 cm deep autumn ploughing. Any deeper ploughing is harmful, it does not increase yield any

further but it increases costs and the 20-22 cm deep spring ploughing is considered to be unfavourable. As a result of dry weather circumstances, energy- and water-saving soil preparation methods became more preferred (Birkás, 2001).

One of the most significant cost items of maize production technology is fertilisation, while it is also the most signficant yield-affecting factor. Numerous Hungarian and internation publications were made on the basis of these research results (Svecnjak et al., 2004; Bharati et al., 2007; Nagy, 2012; Ványiné et al. 2012). In Hungary, the most important step of determining the nutrient supply of maize hybrids is to determin the optimal N dose. The impact and effectiveness of fertilisation in the growing season is greatly affected by water supply (Pepó et al., 2008).

In addition to the ecological endowments of Hungary, natural precipitation does not cover the water need of maize either in terms of quality or distribution in the majority of growing seasons. However, the rainfall in the period determines the effectiveness of nutrient replenishment and maize yield (Jolánkai, 2005; Nagy 2011, 2012).

Population density has to be set on the basis of the sowing structure, previous crop, the standard of water and nutrient supply and the parameters of plots prepared for sowing. Population density affects the successfulnes sand safety of production (Berzsenyi and Tokatilidis, 2012).

The choice of maize hybrids has long been determined mainly by yield potential and yield stability. However, during the recent years, grain quality parameters became increasingly preferred. The protein content of maize are primarily determined by genetic characteristics (Izsáki, 2009) and they can also be modified by ecological and agrotechnical factors (Győri, 2010). In rainy years, the protein content of maize was 10.8% lower than in dry years (Gyenesné-Hegyi et al., 2001; Ványiné and Nagy, 2012). N fertilisation could contribute to moderate the abiotic stress effects caused by weather and the reduction of protein content. However, great input was needed to achieve this reduction of effect.

Material and Methods

Field experiments have been carried in Eastern Hungary out for more than three decades at the Látókép Experiment Site of the Faculty of Agricultural and Food Sciences and Environmental Management of the University of Debrecen in a moderately warm and dry production area on loess-based mid-heavy calcareous Great Plain chernozem soil with deep humus layer. The results of our multifactoral long-term experiment which are unique and acknowledged in Europe make it possible to evaluate the impact and interaction of crop production factors in different crop years.

The multifactoral long-term experiment had a split-split-plot design with the main plots being the different tillage treatments (autumn ploughing, spring ploughing and spring shallow tillage) and irrigation treatments (non-irrigated and irrigated). The primary subplots represented the maize hybrids with population density values of 60–70–80–90 thousand, while the secondary subplots represented the different fertiliser treatments (control, $120N+90P_2O_5+106K_2O$ kg ha^{-1} and $240N +180P_2O_5+212K_2O$ kg ha^{-1}) with four replications in a randomised way.

General linear model (GLM) was used to evaluate the effect of various treatments on maize yield. Evaluation was performed with SPSS for Windows 14.0.

Results and Discussion

Due to the continental climate, Hungary is prone to drought. In the last 100 years, temperature increased by 1 ^{0}C and forecast predict a further 2.6 ^{0}C increase until 2050. Also, the yearly amount of precipitation greatly decreased from 640 mm to 560 mm and the temporal distribution of precipitation is also uneven. For this reason, the drought resistance of crops produced in Hungary has a great significance. In non-fertilised treatments, the amount of precipitation during the growing season and yield perfectly show the adaptation ability of maize, the natural nutrient supply ability of the soil, as well as the impact of fertilisation which is different each year (*Figure 2*).

We examined the possibility of using minimal tillage, whose aim was to reduce soil compaction and production costs. Autumn ploughing provided the most favourable conditions for maize. Yield per hectare was significantly higher by 1 t (12%) than in the case of spring shallow tillage (*Figure 3*). The impact of primary tillage on yield was different each year and it greatly depended on water supply. The yield surplus of autumn ploughing – in non-fertilised treatments – was 1.4-2.3 t ha^{-1} higher than that of spring shallow tillage, while the difference was higher (2.8-3.3 tha[-1]) in fertilised treatments.

The yield surplus obtained as a results of fertilisation is outstanding in irrigated maize production – 4.4 t ha^{-1} averaged over the examined years. In our experiment – averaged over the examined years – the yield surplus of irrigation was 2.6 t ha^{-1}. This surplus was 4.5–5 t ha^{-1} in drought years.
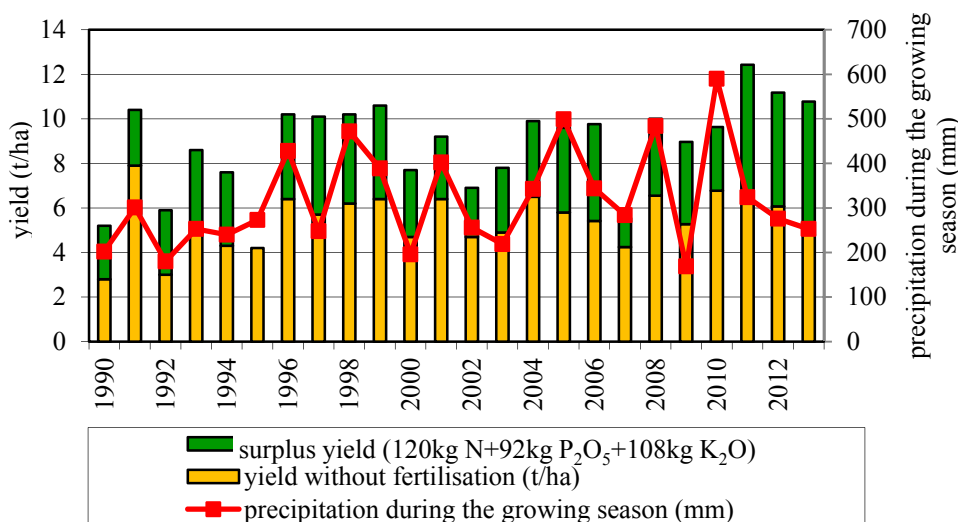
Figure 2. Effect of fertilisation and of the season on the yield of maize, (Debrecen, 1990–2013)
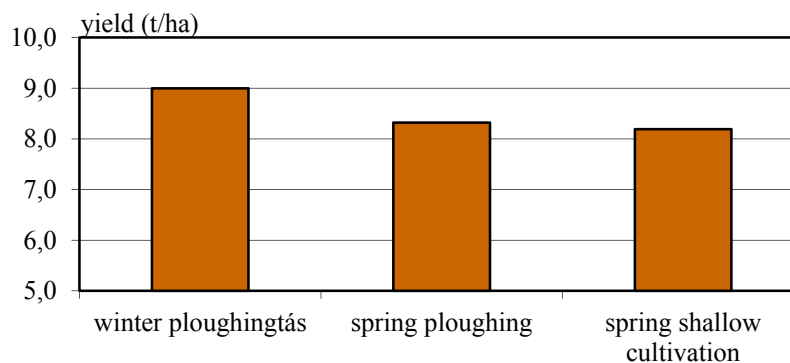
Figure 3. The effect of cultivation on maize hybrid yield, (Debrecen, 1990–2013)

In the case of non-fertilised treatment or using a small portion of fertilisers, the recommended population density is 60 thousand crops per hectare. In the case of higher population density values – in non-fertilised treatment –, yield was 2-12% lower in years with average precipitation supply and 3-14% lower in drought years. In the case of 120 kg N ha^{-1} fertiliser dose, the optimal population density is 70-80 thousand crops per ha. However, applying 240 kg N ha^{-1} fertiliser and 90 thousand crops per hectare is very risky; therefore, it is not recommended (*Figure 4*).

The increasing dose of nitrogen fertilisation increases the raw protein content of the grain maize significantly and linearly. The extent of growth is 5-39%, depending on the given crop year. The starch content relative to one unit of dry matter was significantly decreased by the increasing fertiliser doses (*Figure 5*).
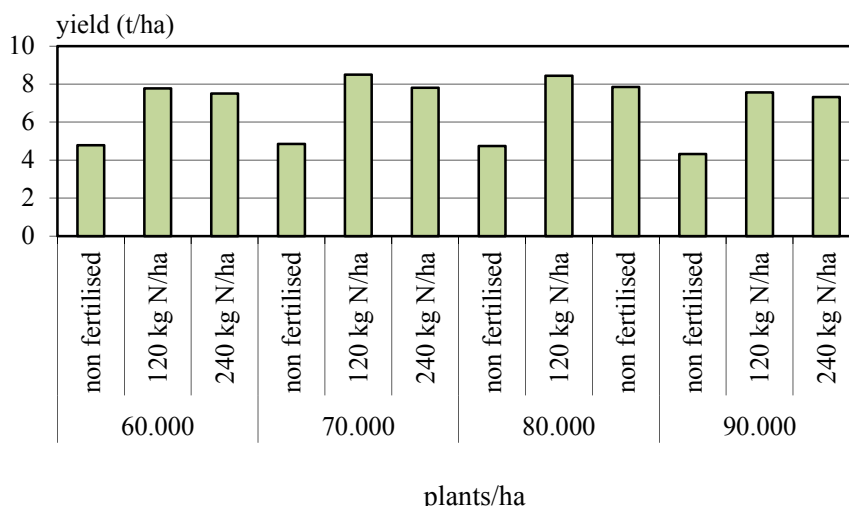
Figure 4. The effect of planting density and fertilisation on yields of maize, (Debrecen, 1990–2013)

Figure 5. The effect of fertilisation on the starch content of maize grain, (Debrecen, 2007–2013)

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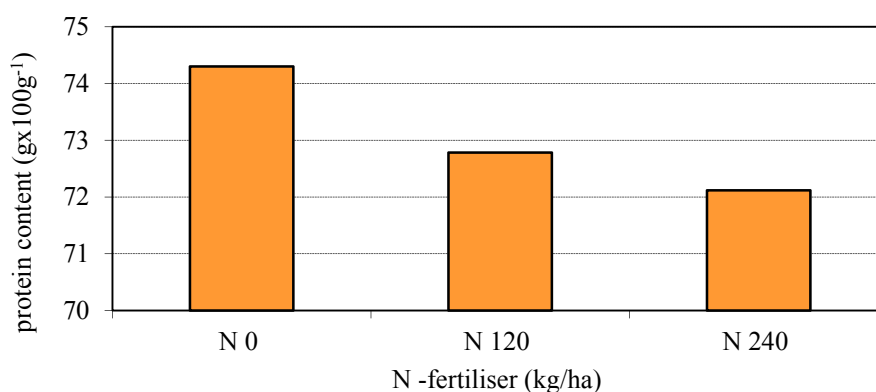
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Effect of GA$_3$ Administration on the Nutrient Content of Japanese Plum Angelino

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Abstract

It is commonly known that various plant growth regulators containing gibberellins play a role in improving fresh fruit quality. Based on tangible information, gibberellins prevent the flesh of dry plums from nigrescence. This study was conducted with the aim of investigating the effect of GA$_3$ on macro-micro nutrient content of 8-year-old Angelino plum varieties that are grafted on wild plum seedlings. GA$_3$ was administered at fixed concentrations of 50 and 75 ppm on branches by spraying at 4 different time periods after the blooming period. Fruits were appropriately harvested upon ripening following the application and were analyzed. Nutrient element analyses of fruits yielded the following results: the highest nitrogen content (%0.78) was determined for the samples treated during the first time period; the highest phosphorus (% 0.20), potassium (% 1.22), calcium (% 0.05), magnesium (% 0.049), zinc (% 3.80), copper (% 4.06) and manganese (% 2.67) contents were determined for the control group. Additionally, the highest iron content (% 83) was determined in the samples that were treated after the fourth time period.

Keywords: Japanese plum, GA3, nutrient content, plant growth regulators

Introduction

The main varieties of plums that are cultivated in Turkey and throughout the world are *Prunus ceracifera L.*, *Prunus domestica L.*, *Prunus institia L.* and *Prunus salicina L.* (Ozcagiran, 1976). Plums can be cultivated on nearly all climates and soil in Turkey, with the exception of the cold high plateaus of the Eastern Anatolian Region and the very hot and dry locations in the Southeastern Anatolian Region. The Aegean, the Mediterranean and the Marmara Regions as well as some transitory regions and several provinces in the Central Anatolian Region are among important centers for plum cultivation (Eris and Barut, 2000). The Japanese plums originating from Asia are commonly known as the Italian plums. The season for plum cultivation varies in different regions in Turkey and it is possible to offer plums to the consumers for a period from June until the end of October. The Angelino variety (*Prunus salicina L.* cv. Angelino), which is a fleshier variety among the Japanese plums, originated from the Americas as a cross-breed between California and Queen Rose. This variety ripens in October and can be appropriately stored for 3-4 months standing out to be more suitable for export than other varieties. This plum variety, which may be considered as an alternative for cherries, has a high market value owing to its late harvesting period and suitability for storage. The world annual plum production in 2012 was 10 772 774 ton as reported by the FAO values for total import and total export. The largest produces were China (600 000 ton), Romania (424 068 ton), Serbia (391 485 ton), Chile (300 000 ton), Turkey (297 000 ton), and Iran (295.000 ton) in descending order. The world annual plum export in 2011 was 654 312 ton as reported by the FAO. The largest exporters were Spain (104 284 ton), Chile (100 784 ton), the USA (65543 ton), and South Africa (53 511 ton), the Netherlands (44 419 ton), and China Hong Kong (29 208 ton) with Turkey exporting 11 276 ton. The world annual plum import in 2011 was 618 643 ton as reported by the FAO. The largest importers were England (63 540 ton), The Federation of Russia (70 702 ton), Germany (43 544 ton), The USA (29 517 ton) and China (25.069 ton) whereas the import in Turkey was only 37 ton (FAO, 2014).Gibberellins are most important plant growth hormones. In particular, GAs are

involved throughout the life cycle of higher plants, during seed germination, stem growth, leaf expansion, flower formation and seed and fruit development. (Kang et al., 1999; Olszewski et. al. 2002; Appleford et al., 2006; Yamaguchi, 2008). Nowadays, gibberellins are used to fruit set, increase the fruit size, increase the fruit yield, fruit ripening and under the control of flower bud production in commercial production. Macronutrients and micronutrients play inportant role in the plant growth. The nutrient elements known to be essetial for plants. For normal growth and optimum production, fruit trees require 13 essential nutrients in varying amounts. Those needed in relatively large amounts are termed macronutrients nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), mag-nesium (Mg), and sulfur (S). Those needed in smaller concentrations are called micronutrients chlorine (Cl), iron (Fe), manganese (Mn), zinc (Zn), boron (B), copper (Cu), and molybdenum (Mo). Growers must learn to manage these nutrients for optimum growth and production and to minimize adverse environmental effects. Most important is balancing the nutrients when one element is deficient, its absence can negatively affect plant processes and thereby inhibit optimum uptake, utilization, or distribution of other elements. On the other hand, anexcess of any element may be toxic to trees, thus affecting the availability of other nutrients in the soil. A good number of researchers have been studied for connection between nutrients and hormones for many years (Krouk, et. al. 20119). The present study aims to investigate the effect of administration of optimal doses of gibberellic acid to Japanese plums as an alternative to hand thinning, to identify the time of administration and to determine its effects on quality during harvesting and storage. Furthermore, it was aimed to determine the effect of such a measure taken on Japanese plum trees on the physical and chemical characteristics as well as the nutritional content of the fruits.

Material and Methods

GA$_3$ was administered at doses of 50 and 75 ppm (+ control set with no administration) 8, 10, 12 and 14 weeks after full blossoming of Japanese plum trees in the present study. Fruit samples were collected from all chemical administered trees as well as from the control trees during the period of harvest. The fruit samples were washed with distilled water, cut into small pieces, dried in an incubator at 65-70°C, and ground in a mill in order to be ready for plant nutritional content analyses. Result of these data were given in Figure 1.
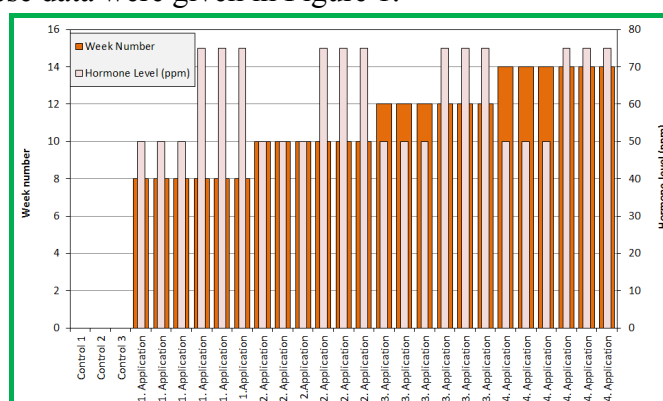
Figure 1. Administration dose and time of gibberellin (GA$_3$)

N content of the fruit samples was determined by the Kjedahl method (Bremmer, 1965), K, P, Ca, Mg, Zn, Fe, Cu and Mn contents were determined from the extract obtained by the method of wet decomposition in HNO3:HClO4 at a ratio of 4:1 (Kacar and Inal, 2008) in which, the P content was determined colorimetrically by the identification of the vanadomolybdate phosphoric yellow color (Lott et al., 1956), the K and Ca contents were determined by flame photometry, and the Mg, Zn, Fe, Mn and Cu contents were determined by Atomic Absorption Spectrophotometry (Kacar, 2009; Dalquist and Knoll, 1978; Munter and Grande, 1981). The statistical analyses were carried out by the SPSS statistical software package (SPSS, Version 16.0, SPSS, and Chicago, IL, USA). The differences between the means of the data were identified based on the Duncan multiple comparison curve at a threshold of $P \leq 0.05$.

Results and Discussion

The effect of hormone administration at varying times (post-blossoming) and doses on the macro-nutrient elemental content of the plum fruit was significantly different (p<0.01). In the study, the total N content was determined to vary in the range of 0.43 - 0.78% in ripe fruits in response to GA3 administration post-blossoming as shown in Figure 1. The highest N content was achieved during 75 ppm hormone administration 8 weeks after blossoming whereas the lowest N content was determined in the control samples. N content was observed to decrease in the remaining administration regimes after the 8th week.

Table 1. Macro-nutrient elemental content of the fruits

Administration regimes	N (%)	P (%)	K (%)	Ca (%)	Mg (%)
Control	0.72 ab	0.21 a	1.22 a	0.050 a	0.049 a
1.50(8 weekends)	0.56 cd	0.18 b	1.19 a	0.043 ab	0.046 ab
1.75(8 weekdays later)	0.78 a	0.18 b	1.13 ac	0.027 ef	0.041 bc
2.50(10 weeks)	0.43 d	0.16 b	0.99 c	0.030 df	0.039 c
2.75(10 weeks)	0.73 ab	0.17 b	1.12 ac	0.023 f	0.037 c
3.50(12 weeks)	0.62 bc	0.17 b	1.04 bc	0.039 bc	0.040 c
3.75(12 weeks)	0.53 cd	0.17 b	1.18 ab	0.033 ce	0.041 bc
4.50(14 weeks)	0.62 bc	0.18 b	1.08 ac	0.036 bd	0.040 c
4.75(14 weeks)	0.60 bc	0.16 b	1.14 ab	0.041 bc	0.040 c
	**	*	*	**	**

The N content of the fruits determined in the present study were in agreement with the values reported by Rato et al. (2010). The phosphorous content was determined to vary in the range of 0.16 - 0.21 %. These values were in agreement with those reported in Rato et al. (2008) and Rato et al. (2010). The P content of the fruit was observed to decrease with respect to its content in the control samples upon hormone treatment of varying doses at different time periods. The K content of the fruits was significantly affected by the hormone application of increasing concentrations at different time periods (p<0.05). The K content was determined to vary in the range of 0.99 - 1.22 % and displayed a similar distribution to that of elemental P. The highest K concentration was determined for the control sample whereas the lowest K concentration was measured in the sample that was treated with hormone at a concentration of 75 ppm 10 weeks after blossoming. The results were in accordance with those reported for the K content of the fruit by Rato et al., (2008 and 2010) and Lopez et al., (2004). Monge et al., (1994) also reported a considerable decrease in the N and K contents of pear fruits upon hormone treatment on the leaves. The Ca content of the fruit was determined to vary in the range of 0.023 - 0.050% and the hormone treatment was shown to create a significant difference in content (p<0.01). The Ca content of the fruit was observed to decrease with respect to its content in the control samples upon hormone treatment of varying doses at different time periods. The results of the present study were in accordance with those of Rato *et al.* (2010) whereas they displayed differences with those of Lopez *et al.*, (2004). The differences were thought to stem from differences in ecology, as well as from differences in the hormone administration scheme and the variety. The highest Ca concentration was determined for the control sample whereas the lowest Ca concentration was measured in the sample that was treated with hormone at a concentration of 75 ppm 10 weeks after blossoming. The Mg content of the fruit was determined to vary in the range of 0.037 - 0.049% and Mg concentration of the control sample was determined to be higher than those of the hormone-treated samples.

The results of the present study were in accordance with those of Rato *et al.* (2008 and 2010). The effect was shown to be significantly different (p<0.01) with respect to varying doses of hormone treatment administered at different time periods. The Mg content of the fruit was observed to be lower than its content in the control samples and the concentration was generally observed to decrease during the treatment that was administered 10 weeks after blossoming. The macro-elemental content of the fruit samples was observed to decline in time in accordance with the dose of hormone that was administered and the time of administration. The Fe content of the fruit samples was not significantly affected by the dose of hormone that was administered and the time of administration. The Fe concentration was determined to vary in the range of 12.69 - 17.53 ppm and higher Fe concentrations were measured in samples, which were administered the hormone 14 weeks after the flowering period, than those of the remaining samples. Similar results were reported in other studies by Rato et al., (2008 and 2010) and Lopez et al., (2004). The Zn concentration was measured to vary in the range of 1.93 - 3.88 ppm. The highest Zn

concentration was determined in the samples, which were administered the hormone at a concentration of 75 ppm 8 weeks after blossoming, and the treatment was observed to be significantly effective (<0.01). The Cu concentration was determined to vary in the range of 2.23 - 4.06 ppm. The highest Cu content was determined for the control sample and the lowest Cu content was determined for the sample, which was treated with 75 ppm hormone 14 weeks after blossoming, and this difference was determined to be statistically significant at a confidence threshold of p<0.01. The administration of hormone was observed to decrease the Cu content of the samples, with the highest Cu content being determined for the control sample.

Table 2. Micro-nutrient elemental content of the fruits

Administration	*Fe* (ppm)	*Zn* (ppm)	*Cu* (ppm)	*Mn* (ppm)
1	13.91 ab	3.81 a	4.06 a	2.67 a
2	14.06 ab	3.88 a	2.88 b	1.67 b
3	12.80 b	2.68 b	2.32 b	1.46 bc
4	12.69 b	2.57 b	2.39 b	0.86 c
5	13.83 ab	2.56 b	2.46 b	1.47 bc
6	13.81 ab	2.68 b	2.88 b	1.27 bc
7	14.41 ab	1.93 b	2.68 b	1.45 bc
8	17.05 a	3.83 a	3.01 b	1.61 b
9	17.53 a	2.56 b	2.23 b	0.88 c

The Mn concentration was determined to vary in the range of 0.86 - 2.67 ppm. The differences were observed to be statistically significant at a confidence level of p<0.01. The highest Mn content was determined for the control sample and the lowest Mn content was determined for the sample, which was treated with 75 ppm hormone 14 weeks after blossoming. The results of the present study displayed partial differences with the micro-elemental content of various other fruits that were under investigation in studies conducted by Carvajal and Alcaraz et al., (2003) and Ertekin et al., (2006), and these differences were thought to be caused by differences in ecology, variety and nutritional element.

Conclusion

The effect of hormone administration by the plum on the plants' nutritional element content was shown to vary with respect to the dose and time of administration although the elemental content of the control plants was identified to be higher. The administration of hormones should be considered along with a supplement of nutritional elements to have more effective results. We believe this study to pave the way for further studies on the administration of gibberellin for improving the fruit flesh tautness and reducing flower budding in Japanese plums (*Prunus salicinia*).

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Field Performances of Large and Small Size Potato Tubers in Minituber Production

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Abstract

The study was conducted in the Tissue Culture Laboratory of the Department of the Field Crops of the Faculty of Agriculture, Ege University from 2012 to 2013. At first *in vitro* plantlets were produced via meristem culture in the laboratory. The meristem plants were micro-propagated to obtain virus free minitubers by growing in the greenhouse in the plastic pots. After harvesting, minitubers were classified into two different groups as large (28-30 g) and small (3-5 g). The large and small size minitubers of 3 potato genotypes (Agria, Granola and Hermes) obtained in the greenhouse were grown in a field trial the fall, 2013 in order to compare their field performances. The trial was arranged in the Randomized Complete Block Design with 3 replications. The plant and yield characteristics were measured during the growing season.

Large tubers had significantly higher mean than that of small size minitubers for plot yield (3.4 kg vs 3.2 kg). The yield characteristics such as plant height, tuber number, single tuber weight, plant yield and tuber size had similar means for the large and small size tubers. It could be concluded that small size minitubers could also be used in field multiplication of minitubers in the seed potato programs instead of storing them for the production of next season.

Keywords: Potato, minituber size, greenhouse, field performance

Introduction

In seed potato production the healthy nuclear stocks are established following several virus testing of meristem plants. Then the meristem plantlets are increased through the micro-propagation technics in the greenhouse. These meristem plantlets are grown to obtained micro and minitubers in the pots and seed beds (Yildirim et al.1995; Naik et al. 1998; Yildirim, 2002).

The minitubers obtained in the greenhouse are planted in the field in order to increase minitubers before distributing them the commercial seed growers. In generally following the greenhouse production, seed tubers obtained are classified and large tubers (50 g) are advanced to field growing stage. The smaller tubers are planted in the seed beds next season to obtained normal size tubers to be grown in the field (Ranalli et al.1994).

Tubers of 2-4 gram obtained from meristem plants were grown in field production by Lommen and Struik (1994; 1995). Yildirim and Ozturk, (2009) has classified minitubers obtained in the greenhouse as 2.5-3.0 cm in diameter before planting them in the field. The possibility of using small size tubers in the field production has also been tried by Yildirim et al. (2003).

The purpose of this study was to compare large and small seed tubers under field conditions for yield and tuber characteristics.

Materials and Methods

The study was conducted in the Tissue Culture Laboratory of the Department of Field Crops of the Ege University from 2012 to 2013. First *in vitro* plantlets were produced via meristem culture in the laboratory using the MS medium (Murashige and Skoog, 1962). Meristem plants were sub-cultured in nod segments (Yildirim, 1995). The meristem plants were micro-propagated to obtained virus free minitubers by growing in the greenhouse in the plastic pots (Yildirim and Ozturk, 2009). After harvesting, minitubers were classified into two different groups as large (28-30 g) and small (3-5 g) to plant in the field trial. Randomized Complete Block Design with 3 replications was used. One plot consisted of 1 row 60 cm apart and 30 cm on the row spacing. The field trial was harvested on December 2, 2013. The following traits were measured and recorded: number of stems, plant height (cm), number of leaves, tuber number,

single tuber weight (g), plot yield (kg), single plant yield (g), tuber width (cm), tuber length (cm). The data obtained for the characteristics were analyzed using the ANOVA technique and the means were compared using the LSD test as described Steel et al. (1997).

Results and Discussion

Table 1. The F values of the source of variation for the characteristics studied.

Characteristics	Tuber Size	Genotypes	Tuber Size x Genotypes
Number of stems	1.20^{ns}	1.23^{ns}	1.201^{ns}
Plant height (cm)	5.07^{ns}	9.77^{**}	0.497^{ns}
Number of leaves	13.23^{ns}	0.911^{ns}	0.702^{ns}
Tuber number	0.893^{ns}	0.460^{ns}	0.907^{ns}
Single tuber weight (g)	5.442^{ns}	4.620^{*}	0.972^{ns}
Single plant yield (g)	0.179^{ns}	6.065^{*}	1.870^{ns}
Plot yield (kg)	85.264^{*}	14.962^{**}	1.664^{ns}
Tuber width (cm)	5.25^{ns}	6.871^{*}	1.407^{ns}
Tuber length (cm)	0.638^{ns}	7.221^{*}	0.303^{ns}

*: significant at the $p \leq 0.05$
**: significant at the $p \leq 0.01$
^{ns}: non significant

It could be seen in Table 1 that among the 9 characteristics only plot yield had significant F value. Genotype had significant variation for plant height, single tuber weight, single plant yield, plot yield, tuber width and tuber length. The interaction of genotype x tuber size had non significant F values indicating the comparison of means of genotype and tuber size can be made separately.

The purpose of the study was to compare the field performances of seed tubers with two different sizes. Generally minitubers of large size are increased in field in order to obtain high quality of seed tubers. The size of this type seed tubers are 3.5-4.5 cm diameter. The remaning small size seed tubers smaller in sizes are reproduced in the seed beds under the controlled condition next season.

The similar performance of large and small tubers in the field production for characteristics of potato plants grown from normal size and small size seed tubers indicated the possibility of using smaller seed tubers in the elit quality minituber production. Only the variation of plot yield had significant F value favoring large tubers.

Genotype had significant variation in terms of plant height and yield characteristics. This variation could be expected. Genetic structure of the genotypes might cause yield variation as expected. Although the variations between large and small seed tubers were not significant, the means of characteristics are given in Table 2.

Table 2. Means of the plant and yield characteristics measured in the potato plants obtained from large and small seed tubers grown in the field

Characteristics	Seed tuber size		Genotypes		
	Large	Small	Agria	Granola	Hermes
Numbers of stems	4.4	1.6	5.6	1.8	1.5
Plant height (cm)	47.0	44.8	50.2a	36.7b	50.9a
Number of leaves	25.1	21.6	25.3	21.8	23.0
Tuber number	5.4	4.8	4.9	4.7	4.3
Single tuber weight (g)	102.2	88.7	114.2a	76.5b	95.6a
Single plant yield (g)	455.0	433.2	548.8a	361.6b	406.9b
Plot yield (kg)	3.4a	3.2b	4.1a	2.7b	3.1b
Tuber width (cm)	5.3	5.1	5.5a	4.9b	5.3a
Tuber length (cm)	6.5	6.3	7.1a	5.7b	6.3a

It could be seen in Table 2 that although the characteristics of the plants grown from large size tubers were comparatively higher than those of plants grown from small size tubers. Only plot yield of large size seed tubers were significantly higher than that of the small size tubers (3.4 kg versus 3.2 kg).

The small size tubers could also be grown under the field conditions in order to obtain high quality seed potato tubers under normal conditions. Yield and yield components of the plants grown from the large and small size tubers were not significantly different except plot yield. Lommen and Struik, (1994) reported that minituber yields were lower than conventional (25-35 mm) minitubers. But differences in dry matter contents were found between minitubers classes. There were no significant differences between different classes of minitubers for time of emergence and stem number. They concluded that differences may be related to tuber weight *in vitro* plantlets as well as crop husbandry. Our experiments were arranged to compare two classes of minitubers by obtained *in vitro*. Therefore stem numbers were not significant between large and small tubers. Since the plot yields of the large and small size tubers were not highly significant, small size minitubers (3-5 g) could also be used in practice to obtain minitubers under field conditions. Otherwise small size tubers would be increased in the seed beds causing a one year delay in the programme.

Genotypes had significant differences for the traits as expected. In general Agria and Hermes had high mean as compared to Granola which had lower yield performances.
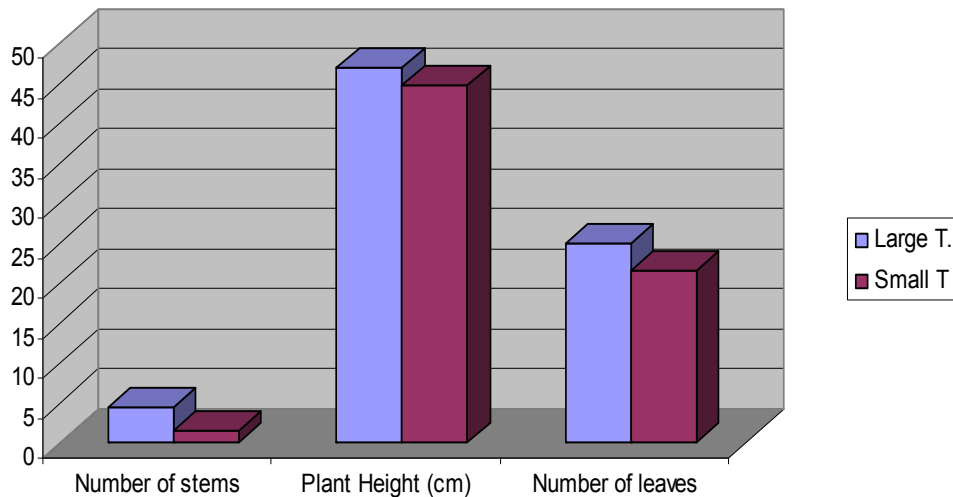

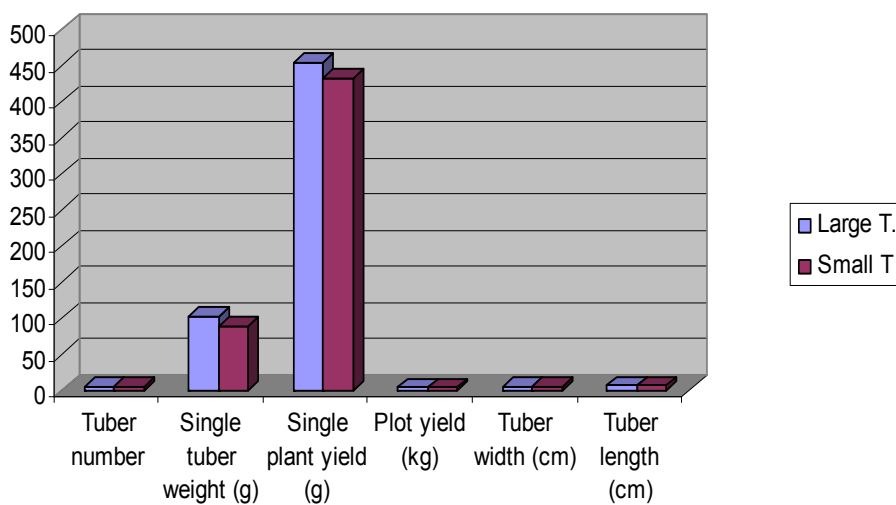Figure 1. Histogram of agronomic characeristics in large and small minitubers

Figure 2. Histogram of yield characeristics in large and small minitubers

Conclusion

Based on the result of this study small size (3-5 g) minitubers could also be used in field propagation in order to obtain high quality of seed tubers.

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Effect of Different Nitrogen Fertilizer Forms on Yield and Quality of Wheat (*Triticum aestivum* L.) Varieties

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Abstract

The use of nitrogen is important not only for yield and quality in agricultural crops, but also in environmental impressions. Therefore, it is particularly important to increase efficiency of nitrogen uptake by the plants because of the fact nitrogen efficiency can provide increasing yield and quality parameters and leading minimal loss to the environment. The aim of this study was to analyze the effect of three different nitrogen (N) sources on yield, yield components and quality parameters of five different wheat varieties. Significant differences could be found among the grain yields of the varieties in terms of nitrogen sources. The highest grain yield (5.2 t ha^{-1}) was achieved in variety Ziyabey, whereas the lowest yield (3.6 t ha^{-1}) was measured in variety Cumhuriyet-75. The new variety Anapo has the highest protein content (14.0%) in the experiment. The diverse nitrogen sources could not ensure significant differences in grain yield and quality parameters. Use of stabilized nitrogen fertilizer form not only provides consuming lesser effort and fewer dosages but also represents nearly equal yields and quality characteristics in comparison to the usual fertilizer forms. In summary, environmental responses should be regarded in the use of stabilized nitrogen compared to usual mineral fertilizer.

Keywords: Wheat, yield, quality, nitrogen forms, varieties

Introduction

Bread wheat (*Triticum aestivum* L.) is actually a main source of human nutrition with its wide adaptation limits and can be grown in different climatic conditions, it has also proper nutritional value in its grain and can be stored and processed easily (Kün, 1988). Turkey realized about 3.6 % of world wheat production with about 18 million tonnes production (Anonymous, 2010). Today in our country there is not sufficient study about bread wheat quality for especially wheat genotypes grown in the Aegean Region. An important part of the present investigations are not sufficient to prove the quality potential of genotypes. In recent years, Turkey has been imported wheat almost every year. Knowing in more detail the quality and properties of wheat genotypes or developing higher quality varieties will help to eliminate the deficiency of quality flour. This study was conducted in the ecological conditions of Büyük Menderes Basin to determinate the most approriate form of nitrogen fertilizer for high efficiency of different bread wheat varieties.

The aim was to reduce the use of nitrogen fertilizer and explore the potential fertilizer applications in less time with determination of accordance form of fertilizer.

Material and Method

This study was established as a randomized complete block split plot design with three repliccations and carried out in trials of Adnan Menderes Universty Faculty of Agriculture. As material five bread wheat varieties (Cumhuriyet-75, Sagittario, Ziyabey, Victoria and Anapo) and three nitrogen fertilizer forms (ammonium nitrate (NH_4NO_3), ammonium sulfate ((NH_4)$_2$SO$_4$) and 26 % nitrogen form (DMPP)) were used. 150 kg/ha nitrogen was applied from each fertilizer form.

Results
Ear length

Differences were found between ear length of varieties and averages changed between 6.82 and 8.87 cm. Considering the average spike length of varieties; the longest ear length was

found to be 8.73 cm by Cumhuriye-75 variety and the lowest spikew length was found to be 7.31 cm in Victoria varierty. There was no statistically significant between other varieties than Cumhuriyet-75 and the varieties were found statistically in the same group. Nitrogen forms had significant effect on ear length. The highest ear length was determined by 26 % DMPP fertilizer (8.14 cm) and also Ammonium nitrate fertilizer was statistically in the same group (Table 1). Obtained values showed same results with Dokuyucu et al. (2002) as far as lower than Kaya et al. (2004).

Number of ears per square meter

The average of varieties changed between 521-550 and nitrogen forms changed between 525-541 number of ears per square meter. The highest number of ears per square meter was found by Anapo variety and also 26 % DMPP nitrogen form had the highest value in varieties except Sagittario variety (Table 1). Obtained values showed differences with studies that reported by Fischer (1993), Singh et al. (1997) and Melaj et al. (2003) but were in consent with Dokuyucu et al. (1997).

Number of kernels per ear

Average of varieties changed between 27.4-35.9 and average values were determined between 29.5-32.0 kernels for nitrogen forms. The highest number of kernels per ear was provided from Sagittario variety and ammoniım sulfate fertilizer compared to the other varieties and fertilizers (Table 1). In the study, the number of kernels per ear was higher than that of Genç et al. (1987).

1000 grain weight

Averages of 1000 grain weight changed between 51.1-55.5 g for varieties and between 46.7-58.6 g for fertilizers. The highest 1000 grain weight was obtained by Cumhuriyet 75 (55.5 g) variety and these results were in agreement with other studies (Yağdı, 2004). Other varieties showed similar results but nitrogen forms had different results. The highest value was taken from Ammonium sulfate fertilizer (58.6) for 1000 grain weight (Table 1). Higher values determined than reported by Genç et al. (1987); Akman et al. (1999); Budak et al. (1997) studies for 1000 grain weight parameter in our experiment.

Grain yield

The grain yield of varieties changed between 3.6-5.2 t ha^{-1} and the average of nitrogen forms changed between 4.0-4.5 t ha^{-1}. The highest grain yield was obtaeined from the variety Ziyabey (5.2 t ha^{-1}) and ammonium sulfate fertilizer (4.5 t ha^{-1}) (Table 1). Grain yield values were close to the results of Genç et al. (1987); Ramussen and Rodhe, (1989); Cossey et al. (2002) studies, but there were differences between the results of Halvorson (2000).

Grain protein content

Protein contents changed between 13.1-14.0 % and the highest value was find from Anapo (14.0 %) variety and 26 % DMPP fertilizer (13.7 %), while the lowest value determined from Ziyabey (13.1 %) variety and ammonium sulfate (13.4 %) fertilizer (Table 1). Similar results reported also by Öztürk et al. (2004) and Mut et al. (2007).

Grain starch content

Highest starch content was obtained from variety Sagittario (62.8 %), lowest determined from the variety Cumhuriyet-75 (62.2 %) in view of the N form the highest starch content was determined from ammonium sulfate (63.0 %) and the lowest from ammonium nitrate (62.3 %) fertilizer (Table 1).

Discussion and Conclusion

When the results are assessed together, ammonium sulfate fertilizer has a positive effect on 1000 grain weight and grain starch content. Generally it could be achieved better results by ammonium sulfate and 26 % DMPP nitrogen fertilizer. The total N was administered as 26 % DMPP nitrogen form only once before sowing. Therefore 26 % N DMPP fertilizer which has got slower release than other fertilizers can bring advantages as using top fertilizer. Especially shortening of the wheat vegetation period caused of rapidly rising temperature at late spring and at the beginning of summer which could be an advantage for a single fertilizer application. However, it should be recalled that the results are based only on one year results and should repeated. In terms of the grain yield the variety Ziyabey brought better results. However, this variety brought the lowest protein contents. In contrast the varieties Anapo and Cumhuriyet-75 achieved the highest protein contents.

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Table 1. The average values of analyzed parameters in the experiment

Variety	Ear Length (cm)				Number of ear per square meter (numbers)				Number of kernels per ear (numbers)				1000 Grain weight (gr)				Grain yield (t/ha)				Grain protein content (%)				Grain starch content (%)			
	AN	%26N	AS	MN	AN	%26N	AS	MN	AN	%26N	AS	MN	AN	%26N	AS	MN	AN	%26N	AS	MN	AN	%26N	AS	MN	AN	%26N	AS	MN
Victoria	7.43	7.70	6.82	7.31 b	513	537	515	521	21.3	31.3	29.8	27.4	40.0	53.4	59.9	51.1	3.9	3.8	4.5	4.1 b	13.4	13.8	13.2	13.4b	62.4	62.2	63.0	62.5 b
Anapo	8.05	7.68	6.88	7.53 b	551	557	544	550	30.4	28.4	29.6	29.4	52.3	45.2	56.8	51.4	4.2	4.0	3.8	4.0 bc	13.9	14.2	13.9	14.0a	62.1	62.3	63.5	62.6 ab
Sagittario	7.64	8.71	7.27	7.87 b	532	523	550	535	35.3	37.2	35.3	35.9	46.1	48.8	58.2	51.0	4.4	4.4	4.6	4.4 b	13.5	13.7	13.6	13.6b	62.9	62.8	62.8	62.8 a
Cum. 75	8.48	8.84	8.87	8.73 a	513	525	512	516	29.8	32.8	32.1	31.5	45.8	60.6	60.2	55.5	3.5	3.6	3.6	3.6 c	13.9	13.7	13.6	13.7ab	61.9	62.2	62.5	62.2 c
Ziyabey	7.78	7.79	7.90	7.82 b	518	563	534	538	30.7	28.5	33.3	30.8	49.3	49.9	57.9	52.4	4.3	5.2	6.1	5.2 a	13.5	13.2	12.7	13.1c	62.4	62.7	63.2	62.7 ab
MN	7.88 ab	8.14 a	7.55 b		525	541	531		29.5	31.6	32.0		46.7 b	51.6 b	58.6 a		4.0	4.2	4.5		13.6	13.7	13.4		62.3 b	62.4 b	63.0 a	

(AN: Ammonium Nitrate, %26 N: DMPP, AS: Ammonium Sulfate, MN: Average , Cum. 75: Cumhuriyet-75. Ear length LSD(fertilizer): 0.43, LSD (variety): 0.57, 1000 Grain weight LSD (fertilizer): 5.10, Grain yield LSD (variety): 48.9, Grain protein content LSD (variety): 0.25, Grain starch content LSD (variety): 0.21, LSD (fertilizer): 0.36)

Effect of Mowing Heights on the Performances of Some Turf Alternatives in Mediterranean Ecology

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Abstract

This study was conducted on the experimental fields of Field Crops Department, Agriculture Faculty of Ege University, in the duration of a vegetation period in between 2011-2013. Pure sowing of *Festuca arundinacea* and mixed with *Lolium perenne* alternatives and traditional mixture including *Lolium perenne*, *Festuca rubra rubra*, *Festuca rubra commutata*, *Festuca ovina* and *Poa pratensis* were investigated. Peculiarities of these turf alternatives under different mowing heights (12-22-32 mm) and performances during various seasons (spring, summer, autumn, winter) were also tested. The traits like leaf texture (1-9 point), leaf color (1-9 point), visual turf quality (1-9 point) and weed invasion (1-9 point) were recorded monthly and given as year average.
Statistical analysis indicated that there were significant variations among the effect of mowing heights and turf alternatives except interactions for all traits.
Overall results of the study highlighted that sole tall fescue (*Festuca arundinacea*) or 60% tall fescue + 40% perennial ryegrass (*Lolium perenne*) mixture are highly adaptable for reduced mowing heights and display acceptable level of quality and texture. It was also concluded that tall fescue should be used more extensively in turfs and its numerous advantages that this turf grass offers under Mediterranean ecological conditions should be fully exploited.

Keywords: Festuca arundinacea, Lolium perenne, mowing height, visual turf quality

Introduction

Genetic information on the environmental adaptability of the most popular varieties of cool season turf grasses may be determined by direct field comparison in targeted environments **(Salman et al., 2011)**. Many researchers tested the adaptability of wide range of cool season turf grasses in Mediterranean environments and quality traits of cultivars in their countries like Greece, Italy, Spain and Turkey in last decades (**Annicchiarico et al., 2000; Yilmaz and Avcioglu, 2000; Russi et al., 2004**). They all suggested that tall fescue (*Festuca arundinacea* Schreb.) was the most adaptable species for dry and hot ecological conditions. **Martiniello (2005)** and **Martiniello and Andrea (2006)** also stated perennial ryegrass and the mixtures with tall fescue as promising turf alternatives in Mediterranean countries. However, its use in sports turf is quite limited due both to reduced tolerance to low mowing height and partial withering of leaves during winter period. Many dwarf-type cultivars proper for sports turf construction have been recently released and management practices related to mowing height and frequency as well as nutrient impacts should be reconsidered (**Volterrani and Magni, 2004**).

The purpose of the recent study was to evaluate the turf quality and related characteristics of a dwarf type tall fescue cultivar sown as a pure stand or in mixture with perennial ryegrass under different mowing heights and to compare its performance with the traditional turf mixture alternative.

Materials and methods

The experiment was established in November 2012 on the experimental farm located in Bornova (38027.236 N, 27013.576 E and 28 m a.s.l.) Ege University, Izmir, Turkey. During the study period the site with a Mediterranean climate had a long year average rain fall of 658 mm, a daily mean temperature 18,2^{o}C, in the remaining months the amount of rainfall might be considered erratic. The native root zone was composed of 80,2% sand, 18,1% silt and 1,7% clay. The soil was sandy-loam with the following characteristics; pH (water) 8,0; total calcium

(CaCO$_3$) 2400 mg/kg^{-1}; total nitrogen (Kjeldahl) 0,2 g/kg^{-1}; organic matter 2,27 g/kg^{-1}; available phosphorus 2,54 mg/kg^{-1}; exchangeable potassium 150 mg/kg^{-1}. The seedbed was made by disrupting a cereal fallow with a mouldboard ploughed 35 cm deep at the beginning of September. Before seedbed preparation, the experimental plots were equipped with a permanent pipeline system based on rotary sprinklers. Supplemental irrigations were applied as needed to prevent visual wilt of the turf by sprinkling during summer season. Prior to seeding, nitrogen and phosphorus and potassium fertilizers were applied at a rate of 75 kg/ha^{-1} P$_2$O$_5$ and 50 kg/ha^{-1} K$_2$O, respectively, before levelling the soil with a cultivator and harrow in the first week of November 2012.

Three turf grass alternatives (TA) (Pure *Festuca arundinacea*, 60% *Festuca arundinacea* + 40% *Lolium perenne* and traditional soccer field mixture: 50% *Lolium perenne*, 20% *Festuca rubra rubra*, 10% *Festuca rubra commutata*, 10% *Festuca ovina*, 10% *Poa pratensis*) were tested in a factorial randomised complete block experimental design arranged with 3 reps. Plot size was 2 m wide by 10 m long and no bare soil corridor was maintained between plots. As an experimental factor, vertical mowing in three different heights (Mlt 1,2-2,2-3,2 mm) was practised on all alternatives. The first mowing was carried out by a vertical mover (Bosch ASM 32F) 6 weeks after sowing. Invading weeds were hand removed during the establishment period, but after the turfs were fully established the weed was allowed to invade due to better evaluation of competition with turf grass cultivars.

The following evaluations were carried out during the trial. **Turf colour**, **texture** (**Beard, 1973**), **weed invasion** and **visual turf quality** traits were assessed by a visual score based on a 1-9 scale, as recommended in the National Turfgrass Evaluation Program in the USA (**Morris and Sherman, 2000**). Observations and scoring were maintained on a monthly basis, and summarized as year average. All data were analysed statistically (**Acikgoz et al., 2004**) and significant variations were detected using LSD tests at 5% probability level.

Results and Discussion

Turf colour (1-9 point): Turf colour, being an indication of healthy development and higher rate of photosynthetic activity in turf crops, is a favourable trait to evaluate the turfs (**Martiniello, 2005**). Variation analysis of the turf colour trait scores indicated the significance of the effects of mowing heights and turf alternatives, although the interaction was not significant. The average colour score of 32 mm mowing height was higher than other treatments, whereas average colour score of 22 mm mowing height ranked second among others. At 12 and 22 mm mowing heights colour were lighter (6.90 and 7.26, respectively) compared with the 32 mm cutting height. The colour scores of 60% tall fescue + 40% perennial ryegrass mixture ranked first and sole tall fescue has also for better colour score than soccer field mixture. Our results related to colour trait were confirmed by **Volterrani and Magni (2004)**'s findings.

Table 1. Turf Colour (1:Very light green, 9: very dark green) and Texture (1:Very coarse, 9: very fine)

Turf Alternatives	Turf Colour				Turf Texture			
	Mowing Height (mm)			Mean	Mowing Height (mm)			Mean
	12	22	32		12	22	32	
Sole Tall Fescue	6.94	7.29	7.37	7.20	7.25	6.38	6.20	6.61
60% Tall Fescue 40% Peren. Ryegrass	7.04	7.47	7.52	7.34	7.29	7.75	7.58	7.54
Soccer Field Mixture	6.72	7.01	7.17	6.96	7.83	7.67	7.41	7.64
Mean	6.90	7.26	7.35	7.17	7.46	7.27	7.06	7.26
LSD (%5)	TA: 0.15 MH: 0.15 TA x MH: na				TA: 0.15 MH: 0.15 TA x MH: na			

Texture (1-9 point): Turf grass texture is a function of the width of individual leaves. A medium fine to medium texture, ranging from 1,5 to 3 mm in width, is generally preferred for most turf grass uses **(Beard, 1973)**. The results related to texture scores of turf alternatives under three different mowing heights and statistical parameters were given **Table 1**. The variation analyses highlighted that main effects (mowing height in turf alternative) and interaction were significant. Texture scores decreased with mowing heights, in another word, leaf width increased. Highest texture score (7.83) was recorded in 12 mm mowing height in soccer field mixture and the lowest in sole tall fescue turf under 32 mm mowing height. Since tall fescue has a very course texture in nature, sole tall fescue and 60% tall fescue + 40% perennial ryegrass mixture turfs displayed relatively reduced scores. However, as indicated by **Grossi et al. (2002)**, texture scores of those turf alternatives increased with the decreasing mowing heights in our experiment.

Table 2. Weed Invasion (1: No invasion, 9: Fully invaded) and Visual Turf Quality (1:Very poor, 9: excellent)

Turf Alternatives	Weed Invasion				Visual Turf Quality			
	Mowing Height (mm)			Mean	Mowing Height (mm)			Mean
	12	22	32		12	22	32	
Sole Tall Fescue	9.00	8.41	7.79	8.40	7.93	8.38	8.50	8.27
60% Tall Fescue 40% Peren. Ryegrass	8.10	7.20	6.61	7.30	7.10	8.00	8.47	7.86
Soccer Field Mixture	5.40	4.81	4.19	4.80	6.35	6.73	6.88	6.65
Mean	7.50	6.80	6.20	6.83	7.13	7.70	7.95	7.59
LSD (%5)	TA: 0.38 MH: 0.38 TA x MH: na				TA: 0.38 MH: 0.38 TA x MH: na			

Weed invasion (1-9 point): The variation analysis of weed invasion scores scores of turf alternatives tested in the experiment revealed the significant main effects of turf types and mowing heights except two factor interaction (**Table 2**). The weed invasion scores of sole tall fescue was higher than other turf alternatives and soccer field mixture had lowest score. Higher average weed invasion score (lower weed infestation) of sole tall fescue and 60% tall fescue + 40% perennial ryegrass mixture were another indication of the superiority of these turf grass to resist weeds under Mediterranean climatic conditions of experimental area **(Avcioglu et al., 2013)**. Lower scores of soccer field mixture under different mowing heights evidenced their extremely limited performances of these mixture crops in terms of competition with weed encroachement. Similar results were also observed among mowing heights and 12 mm mowing height gave the best result (7.50), while 32 mm treatment had very limited grass competitive capacity and weed invasion score. This result was attributed to the weakness of weeds to close mowing practices while they possessed a better growing condition with plenty of leaves under 32 mm treatment.

Visual turf quality (1-9 point): The visual turf quality trait as the composit of color, uniformity and texture traits is a widely used criterion to define the overall performances of turfs in turf management practices. Variation analysis revealed the significant main effects of turf type and mowing height, in addition to two way interaction. The turf quality score of highest mowing height in sole tall grass turf was 8.50 and far beter than soccer field mixtures (6.35) in lowest mowing height which was the minumum score among all others. Although interaction were significant, average quality scores of mowing heights were satisfactory and over 7.00 points. These findings indicated the adaptability of sole tall fescue and 60% tall fescue + 40% perennial ryegrass mixture to close mowing. **Grossi et al. (2002)** and **Magni et al. (2004)** also pointed out similar results.

Conclusion

Our study highlighted that sole tall fescue or 60% tall fescue + 40% perennial ryegrass mixture turfs are highly adaptable for reduced mowing heights under Mediterranean climatic conditions with dramatic heat and drought stresses and display acceptable level of quality and texture. It was also concluded that tall fescue should be used more extensively in turfs and its numerous advantages that this turf grass offers under Mediterranean ecological conditions should be fully exploited.

Acknowledgement

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Effect of Leaf Litter on Morfological Characteristics of Thyme *(Thymus vulgaris)* Seedlings

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Abstrac

Leaf litter is an organic material made of decomposed leaves and other plant parts accumulated on the top of the forest soil. Because of good physical and chemical characteristics, leaf litter can be used as a substratum for the seedlings production. This paper presents two-year research abaut the effect of leaf litter as a substratum component on morphological characteristics of thyme seedlings. The seed of thyme was sown in four different substratum/mixtures: commercial Klassman substratum; leaf litter and livestock manure; leaf litter and vermicompost; garden soil and livestock manure. Using a mixture of leaf litter and vermicopost (70%: 30%) as a potting medium, provided the highest quality the seedlings thyme.

Keywords: Leaf litter, thyme seedlings, substratum

Introduction

Thyme (*Thymus vulgaris*) is a perennial species of the family *Lamiaceae*. It is used in medicinal purposes and as a flavoring dishes. Given the widespread use thyme , cultivated in many countries of the world. In Bosnia and Herzegovina grown less often and smaller areas, mainly in the gardens. Thyme is thermophilic and photophilic plant, and well tolerated drought (Šilješ et al., 1992).

In the production technology thyme is of particular importance production quality and healthy seedlings. Because of the very small seeds (about 0.25 g) thyme is propagated exclusively producing seedlings (Beatović et al., 2007). In our country it is still represented a classic way of producing, and as a substratum usually used garden soil mixed with mature livestock manure. In the production of seedlings of medicinal, aromatic and seasonal plants worldwide are existing technologies improved and new ones introduced that use peat, compost and other materials enhanced by the addition of various organic materials and mineral origin (Jelacic et al., 2005).

Leaf litter is a decomposed plant material (leaves, tree bark, needles and branchlets) in natural conditions. This dead organic material pile up on top of the soil and makes his prime-horizon. The thickness of this layer, its composition and nutrient content varies depending on the climate, crop type, soil fertility, altitude etc.. Leaf litter is loose fill, lightweight and porous to air and water. It belongs to a group of rapidly degradable organic fertilizers and quickly lose reserve nutrients and can not be used as the base substratum for growing plants for many years on. It is used as a substratum for sowing small seeds of plants, to increase the friability of the substratum (Mijanović, 1976). It is used in floriculture for sowing seeds Begonia and growing camellias, primula, anthurium, ferns (Ljuljić-Mijatovic and Mrdović, 1998). Thanks to forest resources, which has Bosnia and Herzegovina, there are huge amounts of organic material, which is little or no use, and may be a cheap and good organic substratum in nursery production. The aim of this study was to determine the effect of leaf litter as a component of the substratum on the morphological characteristics of seedlings thyme and find the best combination of leaf litter and materials for the enrichment of the substratum in the production of seedlings thyme.

Material and Methods

The study was conducted during the 2012 and 2013, in a half controlled conditions of private greenhouses in Bijelo Polje near Mostar. As a material for the tests was used commercial seed thyme and four different substrates, in the following volume ratio:

1. Klassman, commercial substratum for growing seedlings (100%)
2. Leaf litter and livestock manure (70%: 30%)
3. Leaf litter and vermicompost (70%: 30%)
4. Garden soil and livestock manure (50%: 50%).

Leaf litter was taken from mountainous areas (village Ravni north of Mostar) from forests dominated by the tree hornbeam, ash and thorn bush, which means that the formed decomposition of leaves and other plant parts of these species. Table 1. shows the results of chemical analysis leaf litter.

Table 1. Results of chemical analysis leaf litter

Parameters	Unit of measure	Test results	The test method
pH - H_2O	pH	6,15	The electrochemical
pH - KCl	pH	5,45	The electrochemical
Electric conductivity	μs	275	The electrochemical
The nitrogen content	%	0,28	By Kjeldahl
The phosphorus content	mg/100 g	11,50	Al-method by Egner-Riehmu
The content of potassium	mg/100 g	22,80	Al-method by Egner-Riehmu
Organic matter	%	20	The result of the calculation
The humus content	%	7,75	By Kotzman
The ratio of C / N		20,51 : 1	

According to presented results in Table 1. active soil reaction pH was 6.15 which corresponds to the standard classification of weakly acidic reaction, the pH of the KCl-in is 5.35 which corresponds to an acidic reaction. N content was 0.28%, which according Woltmann[1] indicates that the soil is rich in nitrogen. According to the content available P_2O_5 (11.50 mg / 100 g of soil), the substratum is moderately stocked phosphorus (Class II). K_2O content is 22.80 mg / 100 g, which corresponds to a rich supply of substratum (class I). The humus content is 7.75%, which according to the Gračanin[2] means that the substratum is very humic.

The seed was sown on March 24th in plastic containers, with three replications. Containers are the dimensions of 38 cm x 28 cm x 7 cm, with 20 pot each. Volume one pot is 182 cm[3]. In each pot planted 2-3 seeds, and after emergence remained one plant / pot. During the production of seedlings were implemented by the usual measures of care: watering, aeration, weed and pest.

In the ninth week of seedling age measurements were done on 30 plants (10 plants from each of the three containers) for each substratum. Was measured by plant height, fresh and dried herbs and number of leaves per plant. Drying plants was performed a natural way, in the shade and airy space. Results of the research were analyzed by analysis of variance (two factorial ANOVA). Since the F value showed statistically significant, differences in the mean values between groups were tested by LSD test, using MS Excel 2007.

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[1] Priručnik za pedološka istraživanja, Agronomski fakultet, Zagreb, 1982.
[2] Priručnik za pedološka istraživanja, Agronomski fakultet, Zagreb, 1982.

Results and Discussion
Height

Table 2. The average height of seedlings thyme (cm) from various substrates in 2012 and the 2013th

Years	Substratum				Average
	S1	S2	S3	S4	
2012.	15,05	14,12	13,78	12,34	**13,82^b**
2013.	14,77	16,78	17,64	12,85	**15,51^a**
Average	**14,91^b**	**15,45^{ab}**	**15,71^a**	**12,59^c**	

Seedling height thyme depending on the substratum and years ranged from 12.38 cm to 17.64 cm (Table 2). Based on the analysis of variance showed that both factors and their interaction had a statistically significant influence on the seedlings thyme. LSD test results showed that the height of the seedlings substratum 3 (15.71 cm) was significantly higher in comparison to the substratum 1 (14.91 cm), and highly significantly increased relative to the substratum 4 (12.59 cm), while difference in height between the substratum seedlings 2 and substratum 3 was not statistically significant. Analysis of the data by a factor of years can be seen that the height of seedlings thyme was highly significantly higher in 2013 (15.51 cm) compared to 2012 (13.82 cm).

Mass of the fresh herb

Table 3. The average weight of fresh seedlings thyme (g) of various substrates in 2012 and the 2013th

Years	Substratum				Average
	S1	S2	S3	S4	
2012.	1,98	1,27	2,15	1,22	**1,65^a**
2013.	1,04	1,69	1,95	1,07	**1,44^b**
Average	**1,51^b**	**1,48^b**	**2,05^a**	**1,14^c**	

In relation to the substratum and year of research weight of the fresh plant seedlings thyme ranged from 1.04 g to 2.15 g (Table 3). Data from the analysis of variance showed that the substratum and age as factors research, and their interaction had a statistically significant effect on the weight of the fresh plant. LSD test for factor substratum showed that the mass of fresh herbs from the substratum 3 (2.05 g) was statistically a significantly higher compared to the value of this parameter from the other three substrates. According to the results of LSD test by a factor of years shows that the weight of the fresh plant, were significantly higher in 2012 (1.65 g) compared to the average value of the measured parameter in 2013 (1.44 g).

Mass of dry herb

Table 4. The average weight of the dried herb seedlings thyme (g) of various substrates in 2012 and the 2013th

Years	Substratum				Average
	S1	S2	S3	S4	
2012.	0,29	0,23	0,33	0,25	**0,27^a**
2013.	0,15	0,29	0,31	0,21	**0,24^b**
Average	**0,22^c**	**0,26^b**	**0,32^a**	**0,23^c**	

Depending on the substratum and year dry weight of plants ranged from 0.15 g to 0.33 g. According to the analysis of variance were found to be at this property significantly acted the individual factors of research and their interaction. The dry weight plants from substratu 3 (0.32

g) was statistically significantly higher compared to the dry weight of seedlings from the other three substrates, while the seedlings from 2012 (0.27 g) had significantly higher mass of the dried herb in relation the seedlings were grown in 2013 (0.24 g).

Number of branches

Table 5. Average number of branches thyme seedlings from various substrates in 2012 and the 2013th

Years	Substratum				Average
	S1	S2	S3	S4	
2012.	26,47	16,77	17,57	19,03	**19,96[ns]**
2013.	16,13	17,93	26,83	17,37	**19,56[ns]**
Average	**21,3[a]**	**17,35[b]**	**22,2[a]**	**18,2[b]**	

The number of branches in seedlings thyme relative to the substratum and year ranged from 16.13 to 26.83. Analysis of variance for this proprety showed that the number of branches influence factor substratum and interaction of two factors, while the years had no significant effect. According to the data by a factor LSD test substratum may be observed that the seedlings from the substratum 3 (22.2) had a significantly higher number of branches relative to the seedlings from the substratum 2 (17,35) and substratum 4 (18,2), while the difference in the number of branches between the substratum 1 and substratum 3 statistically not significant.

Conclusion

Based on the study it can be concluded the following:
- Using a mixture of leaf litter and vermicopost (70%: 30%) as a potting medium, provided the highest quality the seedlings thyme;
- As the worst substratum proved to be a mixture of garden soil and manure (50%: 50%), because they generated at least values tested parameters of quality seedlings thyme;
- Leaf litter, due to favorable physical and chemical properties, as well as unlimited amounts of cheap and easily available organic material, with additional enrichment of organic and mineral material can be successfully used in the production of quality seedlings thyme, and other aromatic and medicinal and floral culture;
- Since the leaf litter slightly and insufficientlyresearched, and may be a good potential organic material in nursery production, research should expand and focus on a more detailed analysis of physico-chemical properties of leaf litter originating from different forest terrain which have different types of trees, different climatic conditions and the substrate on which the organic material is accumulated. After that, its application in the nursery production of aromatic, medicinal and floral culture probably could become common.

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Phenological Sensitivity of Wine Grape Varieties Grown in the Region of Sremski Karlovci, Serbia

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Abstract

The study aimed to assess phenological sensitivity of 20 wine grape varieties, grown in the region of Sremski Karlovci. An identification of varieties differences in phenological sensitivity is important for selection of varieties that are adapted for growing under changing climate. Phenological sensitivity was calculated as the shift in phenological event date per degree of temperature change using long-term observations (1986–2007). Four phenological stages of grapevine were examined: beginning of budburst, beginning of flowering, beginning of veraison and harvest. There were no considerable differences in the phenological sensitivity among varieties for the beginning of budburst (from –2.0 to –3.9 days per 1°C of increase in average January–March temperature) and for the beginning of flowering (from –4.1 to –5.5 days per 1°C of increase in average April–May temperature). The veraison date showed –6.0 to –8.9 day response per 1°C of increase in average April–July temperature, depending on the variety. The harvest date displayed the greatest advancement, ranging from –6.2 to –14.6 days per 1°C of growing season (April–September) warming. Overall, the autochthonous variety Beli Medenac exhibited the smallest phenological sensitivity and Pinot Noir the greatest.

Keywords: Grapevine, phenological sensitivity, climate change, Serbia

Introduction

Phenological events are very sensitive and easily observable indicators of the biological response to climate change. There is a great difference among species in their phenological sensitivity to climate. Cleland et al. (2012) suggested that species that can phenologically "track" inter-annual variation in temperature might be at lesser risk under future climate conditions. Springate and Kover (2013) supported the concept that phenological sensitivity, defined as the shift in phenological event date per degree of temperature change, may serve as an indicator of success under increased temperature at both genotypic and species level.

Grapevine (*Vitis vinifera* L.) is a phenologically distinct plant with the main phenological stages being budburst, flowering, veraison and harvest (Jones and Davis, 2000). The grapevine development rate depends on variety, meteorological conditions, soil, topography and viticultural practices. Each variety has to satisfy its own climatic requirement in order to complete developmental cycle successfully and produce grapes with favorable quality. As a climatically sensitive plant, grapevine can adjust the genetically predetermined characteristics, including phenological timing. Many studies have reported the significant advances of grapevine phenology in response to climate change in different wine producing regions (Ramos et al., 2008; Dalla Marta et al., 2010; Bock et al. 2011; Daux et al., 2011; Tomasi et al., 2011; Sadras and Petrie, 2011; Webb et al., 2011; Vrsic and Vodovnik, 2012). Similar trends were observed in Serbia, in the region of Sremski Karlovci (Ruml et al., 2013).

The aim of this study was to examine phenological sensitivity for a number of varieties in the wine-producing area of Sremski Karlovci in order to assess how individual wine grape varieties may respond to future climate change.

Material and Methods

Phenological observations were undertaken at the experimental station of the Novi Sad Faculty of Agriculture (45°10' N, 20°10' E, 110 m a.s.l.). The station is located in Sremski

Karlovci, the wine capital of the Srem viticultural region, one of the oldest vine growing areas in Europe. The climate is mid-latitude moderate continental (Koeppen's Cfw) with mean annual air temperature of 12.3°C and mean annual precipitation of 650 mm. Experimental vineyard was established in 1979 and each variety was represented by 20 vines, planted with a spacing of 3 x 1 m and trained using the single Guyot system.

Investigations comprised 20 wine grape varieties (7 red and 13 white varieties). Four phenological stages of grapevine were analyzed for the period 1986–2007: beginning of budburst (the date when green shoot tips became just visible), beginning of flowering (the date when first flower hoods were detached from the receptacle), beginning of veraison (the date when berries begin to develop variety-specific color) and harvest. Temperature was measured with standard National Weather Service thermometers at 2 m above the soil surface at climatological station located in the experimental vineyard.

The slope of linear regression between onset date of phenological event and average temperature preceding the event was considered a measure of phenological sensitivity.

Results

Phenological sensitivity of selected wine grape varieties is displayed in Table 1. The mean date for each phenological event of average variety was obtained by averaging mean values of all examined varieties and slopes were then determined for that average variety, not by averaging slope values across all varieties. Linearly fitted phenological events dates to the relevant temperature variables for average variety are shown in Fig. 1.

Table 1. Phenology sensitivity of wine varieties expressed as the slope coefficient of a linear regression between the beginning of budburst date and average January–March temperature, the beginning of flowering date and average April–May temperature, the beginning of veraison date and average April–July temperature, harvest date and average April–September temperature

Variety	Phenological sensitivity (days/°C)			
	Beginning of budburst	Beginning of flowering	Beginning of veraison	Harvest
Pinot Noir	-3.6	-4.7	-7.8	-14.6
Cabernet Sauvignon	-2.1	-4.9	-7.0	-10.8
Gamay	-3.7	-5.0	-7.5	-12.3
Merlot	-2.3	-4.9	-7.8	-11.5
Probus	-2.5	-4.6	-7.0	-12.0
Lemberger	-2.9	-5.1	-8.9	-13.3
Prokupac	-3.9	-4.4	-7.3	-10.5
Chardonnay	-3.7	-5.0	-7.6	-11.7
Bouvier	-3.4	-4.9	-6.0	-7.7
Ezerjo	-3.1	-4.8	-7.0	-7.6
Petra	-3.8	-4.8	-8.5	-10.7
Pinot Blanc	-3.4	-5.5	-7.3	-10.0
Neoplanta	-3.9	-4.8	-7.2	-8.1
Kreaca	-3.2	-4.9	-7.6	-9.5
Muscat Ottonel	-2.8	-5.1	-6.7	-10.2
Riesling 239-20 Gm	-3.4	-4.4	-8.5	-10.4
Pinot Gris	-3.1	-4.4	-6.9	-10.8
Beli Medenac	-2.7	-4.9	-6.4	-6.7
Bagrina	-2.6	-5.4	-8.2	-10.7
Riesling Italian	-2.0	-4.1	-6.4	-8.5
Average	-3.1	-4.8	-7.4	-10.4

There were no considerable differences among varieties in phenological sensitivity for the beginning of budburst and the beginning of flowering. The variety with the smallest advancement in budburst date per 1°C of increase in average January–March temperature was

Riesling Italian (–2.0 days), while varieties with the greatest advancement were Prokupac and Neoplanta (–3.9 days). Riesling Italian exhibited the smallest (–4.1 days) and Pinot Blanc the greatest (–5.5 days) response in the beginning of flowering date per 1°C of increase in average April–May temperature. An increase of 1°C in average April–July temperature led to an earlier occurrence of veraison from –6.0 days in Bouvier to –8.9 days in Lemberger. The harvest date exhibited the greatest advancement among examined events and greatest difference among varieties. Variety with the largest shift of harvest date per 1°C of growing season (April–September) temperature increase were Pinot Noir (–14.6 days) and variety with the smallest shift was Beli Medenac (–6.7 days).
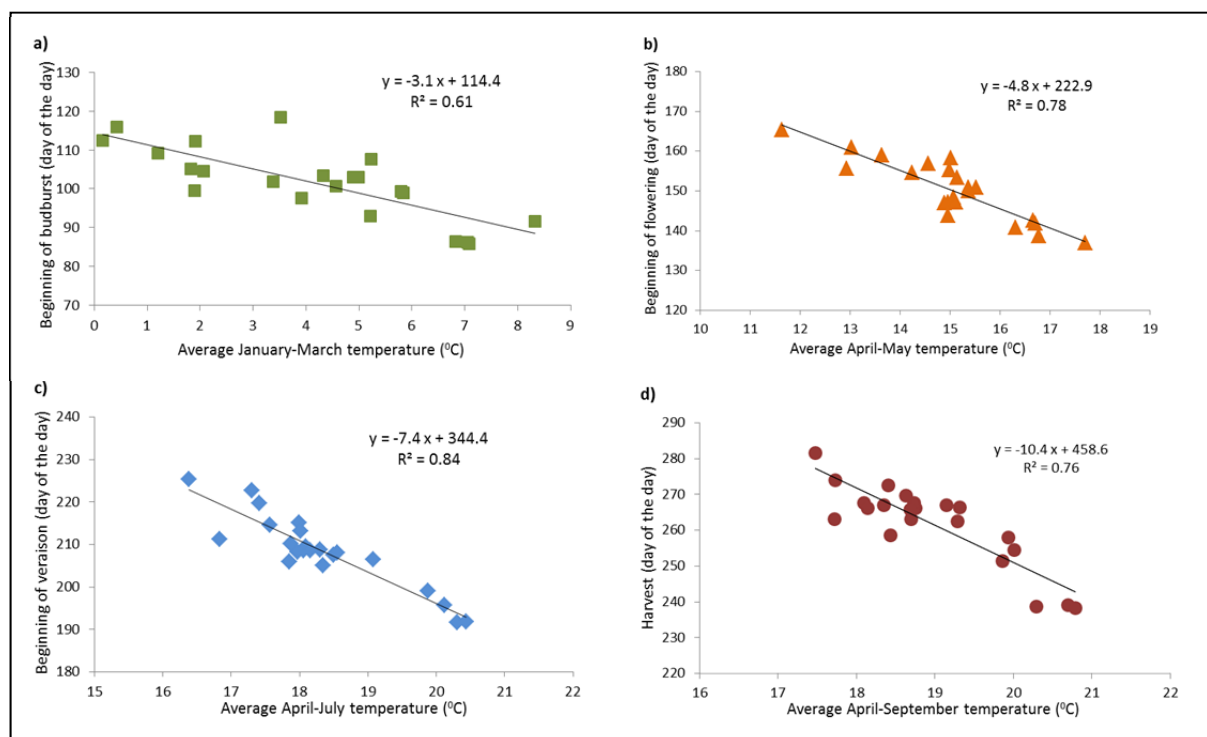

Figure 1. Relationship between phenology and temperature for average variety: a) beginning of budburst, b) beginning of flowering, c) beginning of veraison, d) harvest.

Discussion and Conclusion

The study presents an analysis of temperature-dependent shifts in phenology, determined for a number of varieties grown in the region of Sremski Karlovci using long term phenological and temperature data. Obtained phenolgical sensitivity is in agreement with results of similar studies. Tomasi et al. (2011) reported for the Veneto Region in Italy that the advancement of phenological event dates per 1°C change of relevant temperature variable were 2.9, 4.1, 3.2 and 8.0 days for budburst, flowering, veraison and harvest, respectively, on average for 18 varieties. In the study of changes in European wine grape phenology and its relationships with climate, phenology showed 3–6 day response per 1°C of warming averaged across all sites and varieties over last 30–50 years (Jones et al., 2005). On average for all examined phenological events, the autochthonous variety Beli Medenac, followed by Riesling Italian, exhibited the smallest phenological response to increased temperature, while Pinot Noir, followed by Lemberger, displayed the greatest phenological sensitivity. As already mentioned, greater phenological sensitivity of variety might contribute to its success with climate change.

According to climate projection for Serbia, warming trend will likely continue and become even stronger (Ruml et al., 2012). Therefore, knowledge of variety differences in phenological timing and sensitivity is important for assessment of their response to future climate change and

capacity to adapt to changing conditions. Further studies are needed to explore the mechanisms and effects of the phenological sensitivity on the yield and composition of grapes.

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The Effect of Different Colours of Light on the Germination Properties of Some Crops

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Abstract

This study was conducted in order to determine the effect of different colours of light on the germination properties of some crops under laboratory conditions in 2013. Six treatments were applied in the experiment; the first treatment was in dark as a control and the other were received white, red, green, blue and yellow lights. Five various seeds of crop were used as material that had some problematic like embryo dormancy or coat-imposed dormancy, such as *Lathyrus sativus*, *Petroselinum crispum*, *Phacelia tanacetifolia*, *Stevia rebaudiana* and *Vicia villosa*. The results showed that different colours of the applied light for three week have variety impacts on seedlings features. Data indicated that germination rate of *V.villosa* and *P.crispum* crops were 94.4% and 93.2% under dark and white colours respectively among other treated light colours instance blue, green, yellow and red colours. Data illustrated various hypocotyl lengths among examined plants which was highest in *V.villosa* in dark and lowest hypocotyl length in *P.tanacetifolia* and *S.rebaudiana* plants under blue colour treatment. Radicle lengths were significant different between the light colour and radicle length distinguished among plants.

Keywords: Colour of light, germination, hypocotyl and radicle length.

Introduction

Light as an energy source for plant life is known to affect plants dually. It affects photosynthetic rate and assimilate accumulation, thereby playing a substrate role; it also controls growth and development, in that way, it plays a regulatory role (Sysoeva et al., 2010). The different photochemical systems found in plants are able to sense changes in duration, direction and spectral quality of light. The activating process in plants results in qualitative modification of growth and developmental pattern in response to changes in the environment. For example phytochrome action, photoperiodism, breaking of dormancy, flowering and many more are affected by light (Akinbode et al., 2013).

Germination of seeds may be affected by several environmental factors. It is complex process that is controlled by several biological (species, seed viability, see dormancy, seed size) and environmental (moisture availability, temperature, relative humidity, light intensity and duration) factors. Since plant species vary in their response to these factors, it is important to determine the optimum conditions and seed treatments for germination and seedling establishment under the prevailing climatic conditions (Sakpere, 2011). For example Seed can be roughly divided into two categories, those that require light to germinate and those that germinate in the dark. Each category provides the germinating seedlings with a definitive survival strategy (Barnes, 2007).

According to Sokol and Stross (1992) the germination of most seeds, spores of ferns, lichens, mosses, and related plants is activated by brief exposures to red light. The exact mechanism is known as the phytochrome response and it is based upon the role of the various photoreceptor proteins, Phytochrome A, Phytochrome B, and Phytochrome C and how they are affected by the influx of red and far red light. The ratio of which regulates the activity of germinating seeds. In addition to the phytochromes there are other light initiating germination pigment systems, one or more for blue light and one for ultraviolet A and one for Ultraviolet B, called crytochromes (Chory et al, 1996). Cross (2006) also lists some twenty four different functions that Phytochrome activity affects in germinating and developing plants. The phytochrome and cytochrome responses to light can be modulated and influenced by a series of screening pigments in seed batches (Cone and Kendrick, 1985). A survey of the literature shows that most phytochrome studies have been with darkness, red light, or white light (Chory et al., 1996). Kavalen and Appelgren's work (Kvaalen and Appelgren, 1999) is a notable exception with a study on the germination of somatic embryos and seeds in *Picea abies* with coloured lights. A study on the germination of *Phalaris arundinacea*, reported that there was a high germination percentage under dark conditions (38%) and it was stated that "germination is not accelerated by

light as in many other grass seeds, and may be even light inhibited in some cases" (Cisneros and Zedler, 2001). This is in agreement with the theory that phytochrome is the main sensor for light regulated seed germination. This principle allows the embryo to germinate in the absence of light (Raven and Santana, 1999). Lopez and Sanchez (1989) and Dan and Brix (2007) reported that seeds of *Sesbania sesban* can germinate without light. The main objective of this study is to determine whether different colors of light hinder or aid in the germination of some crops.

Materials and Methods

This study was conducted at the laboratory of Field Crop Department, Faculty of Agriculture Ege University during autumn season in 2013. The following colours of light (Table 1) and crop species were tested (Table 2).

Table 1: Wavelength and lux values of color of light tested.

Color of light	Wavelength (nm)	Intensity (lux)
Blue	470	1100
Green	530	7660
Yellow	590	4180
Red	627	3950
White	-	12260
Dark	-	-

Table 2: Tested crops species and seed ages.

Species	Scientific name	Symbol	Seed age (year)
Grasspea	*Lathyrus sativus*	Ls	4
Parsley	*Petroselinum crispum*	Pc	2
Phacelia	*Phacelia tanacetifolia*	Pt	4
Stevia	*Stevia rebaudiana*	Sr	1
Hairy vetch	*Vicia villosa*	Vv	2

Treatments were designed in factorial of two factors: first factor was crops species and another factor was the light qualities, namely blue, green, yellow, red, white and dark. Seeds (no scarification) were surface sterilized with 2500 mg L^{-1} sodium hypochlorite solution for 5 min, rinsed with sterile distilled water twice and briefly blotted onto sterile paper towels. Seeds were germinated in covered, sterilized disposable petri dishes (12 cm diameter) containing germination paper moistened once with 20 ml of distilled water. The petri dishes were tightly sealed with O_2 permeable parafilm to prevent evaporation of water, thus minimizing changes in concentration of solutions. There were 50 or 25 small and large sized species in a petri dish and four replications of each treatment, respectively. The samples put into opaque plastic rectangular box (45×30×25 cm). Upper side of the boxes a led group was fixed on an aluminium plate which the same size with the cover. The led groups were connected to network electricity by a step down power supply unit (230V 50Hz to 12V DC). The mean temperature was 25±0.5ºC and relative humidity was 80%. The light treatment was uninterruptible and continuously. Seeds were considered as germination when the emergent radical reached 2 mm in length. Germination rates were recorded 10th or 20th day. On the final day, lengths of radicles and hypocotyls were measured. All data were statistically analyzed using analysis of variance (ANOVA) with the Statistical Analysis system (SAS, 1990). Probabilities equal to or less than 0.05 were considered significant. If ANOVA indicated differences between treatment means a LSD test was performed to separate them.

Results and Discussion

Although many crops might be used in this experiment, we preferred to use the seeds in Table 2 because they had some problematic like embryo dormancy or coat-imposed dormancy. The study focused mainly on the germination rate, hypocotyls and radical length the crops at the end of a three week observation period.

We noted different colours of the applied light have variety impacts on seedlings features at the end of this study. Therefore data indicated in Vv and Pc plants germination rate 94.4% and 93.2% in dark and white colours respectively among other treated light colours instance blue, green, yellow and red colours (Table 3). Germination rate was significantly different in Pt plants by treating with blue, red and white colours and for Pt plant in which treated by blue colour as lowest germination rate (0.0%) in compared with other plants.). Kavalen and Appelgren's work (Kvaalen and Appelgren, 1999) is a notable exception with a study on the germination of somatic embryos and seeds in *Picea abies* with coloured lights. A study on the germination of *Phalaris arundinacea*, reported that there was a high germination percentage under dark

conditions (38%). The speed of germination is a direct measure of seed vigour. Vigorous seed lots have more germination speed compared to non-vigorous seeds (Khan et al., 2003). Thus, the observed increase in germination speed indicates that light has positive effect on speeding up the germination process as it brought about increase in germination. These results are supported by the earlier findings of Sivritepe and Dourado (1995) in pea seeds.

Table 3: Effect of different colours of light on the germination rate, hypocotyls and radical length of some crops

Colour of light	….Germination rate (%)….					….Hypocotyl length (mm)….					….Radicle length (mm)….				
	Ls	**Pc**	**Pt**	**Sr**	**Vv**	**Ls**	**Pc**	**Pt**	**Sr**	**Vv**	**Ls**	**Pc**	**Pt**	**Sr**	**Vv**
Blue	72.3	57.5	0.0	0.0	80.3	25.4	6.4	0.0	0.0	39.0	39.6	32.7	0.0	0.0	36.5
Green	71.3	66.3	35.8	11.3	70.0	40.7	17.7	42.0	24.8	58.7	46.2	51.7	61.2	13.1	59.9
Yellow	75.1	67.5	34.5	7.3	86.3	35.6	33.4	67.6	2.3	108.9	53.0	39.3	94.1	31.1	93.8
Red	79.6	89.6	31.6	0.0	92.6	42.4	25.8	59.8	0.0	87.0	62.4	37.3	56.6	0.0	66.9
White	82.9	93.2	8.7	0.0	52.5	23.1	4.8	2.2	0.0	56.2	49.8	47.7	15.3	0.0	55.2
Dark	82.9	89.3	64.6	4.5	94.4	86.7	57.1	65.0	4.5	125.9	59.7	36.6	36.8	2.6	66.1
Mean	77.3	77.2	29.2	3.8	79.3	42.3	24.2	39.4	5.3	79.3	51.8	40.9	45.5	7.8	63.1
LSD	L:5.3 C:4.8 LxC:11.7 CV(%):15.5					L:4.5 C:4.1 LxC:9.9 CV(%):18.5					L:3.3 C:2.9 LxC:7.3 CV(%):12.3				

Our observation showed a steady pattern of germination rate which was increased through the light colours application from blue to dark in Ls and Pc plants. This shape of increasing was not detected in other plants during of experiment. However Vv showed highest germination rate (94.4%) and Sr (4.5%) as lowest rate in dark colour. This suggests that seeds of Vv may germinate better in an environment with longer period of darkness than light. The decrease in germination of Vv seeds in the light regime may due to the fact that light may induce the production ABA (Abscisic acid) at certain temperatures thereby slowing down germination (Karsen, 1976). Serrano-Bernado and Rosua (2007) found that some species such as Genista versicolor germinated easier under darkness at low temperature while Thymus serpylloides presented maximum germination under constant light to a higher temperature. A study on the germination of Phalaris arundinacea, reported that there was a high germination percentage under dark conditions (38%) and it was stated that "germination is not accelerated by light as in many other grass seeds, and may be even light inhibited in some cases" (Cisneros and Zedler, 2001). This is in agreement with the theory that phytochrome is the main sensor for light regulated seed germination. This principle allows the embryo to germinate in the absence of light (Raven and Santana, 1999). Lopez and Sanchez (1989) and Dan and Brix (2007) reported that seeds of Sesbania sesban can germinate without light. Finally the mean date of germination rate was achieved by Vv (79.3%).

Further seedlings evaluation gathered reasonable data with measuring hypocotyl length through light colours application. Data illustrated various hypocotyl length among examined plants which was highest in Vv in dark colour and lowest hypocotyl length in Pt and Sr plants under blue colour treatment. Despite significant hypocotyl length in green colour Pt and Sr showed no hypocotyl grown in red, white and blue colours. Nevertheless Pt has shown no hypocotyl grown in blue colour this plant was significantly hypocotyl grown in green, yellow, red and dark except white colour. Hypocotyl length data indicate the highest in Vv by dark colour treatment (125.9 mm) and lowest belong to Pt at the white colour treatment (2.2 mm). Eventually mean data of hypocotyl length growth was belonging to Vv (79.3 mm).

According to Weiner and Thomas (1990), stem extension plays an important role in determining exposure of leaves to light, shading of competitors, and elevation of reproductive structures. Variation in temperature greatly affects plant growth and flowering. These results are in agreement with the results of Mortensen and Larsen (1989), who observed a decreased in shoot length at high light intensity. Shaded plants showed increased stem elongation which is considered to be due to photosynthetic limitation under low light condition. Kephart and Taylor (1992) found that increased stem elongation was associated with moderate reductions in irradiance, which is influenced by photosynthate availability and photosynthate partitioning into stem growth.

Radicle length was measured at the end of study, so that significant different between the light colour and radicle length distinguished among plants. Where the longest radicle length was observed in Vv at yellow colour, Sr and Pt did not appear radicle in blue, red and white colour respectively. Ls were able to grown radicle throughout all treated light colour with significant high length whereas Sr was not able to produce radicle during lighting experiment except green and yellow colour. Sr showed slight radicle length in dark colour treatment. Vv plant was most successful crop in product radicle through all light colour treatment. Ultimately the mean data of radicle length growth was belonging to Vv plant (63.1 mm).

Conclusion

It was revealed from the study that different light treatments can have various effects on germination rate of crops species. The results showed that different colours of the applied light for three week have variety impacts on seedlings features. Data indicated that germination rate of V.villosa and P.crispum crops were 94.4% and 93.2% under dark and white colours respectively among other treated light colours instance blue, green, yellow and red colours. Data illustrated various hypocotyl lengths among examined plants which was highest in V.villosa in dark and lowest hypocotyl length in P.tanacetifolia and S.rebaudiana plants under blue colour treatment. Radicle lengths were significant different between the light colour and radicle length distinguished among plants.

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Isoprenoids: Terpenoids in Plants

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Abstract

Isoprenoid derivatives are one of the largest groups of natural products; naturally occurring terpenes and terpenoids which are derived from isoprene units with five-carbon assembled and modified in thousands of ways. They are located in the cytoplasm of the plant cell. Mono and sesquiterpenes have distinctive smells and odours that they have been found in most common fruits and vegetables. They are idendified as volatile constituents and also volatile terpenes are the essential oils. Terpenoid essential oils have been used in natural parfumes and also in food industry as spices and flavourings because of having characteristic scent and odour. Diterpenoids, divided into three groups; resin diterpenes, toxic diterpenes and the gibberellins. Triterpenoids have cyclic structures, squalene and can be divided into four classes such as, true triterpenes, steroids, saponins, and cardiac glycosides. Saponins, are glycosides of triterpenes and sterols. Carotenoids are tetraterpenoids which occur in many different kinds of tissue. Two main functions of pigments in plants has been recorded; take part as accesory pigments in photosynthesis and form colors of plants. Lastly, plant terpenoids are usually used for their aromatic qualities. Terpenoids have therapeutic effects against inflamatory diseases and cancer. In additionally, they play a role in traditional herbal remedies and have been investigated for antibacterial, antineoplastic, and other pharmaceutical functions. Morever, some of the terpenoids are used as agricultural pesticides. The purpose of this review study is to exhibit the importance of various aspects of isoprenoid derivatives.

Keywords: Isoprenoids, terpenoids, medicinal plants.

Introduction

Isoprenoid derivatives are one of the largest groups of natural products; naturally occurring terpenes and terpenoids (Harborne, 1984; Herbert, 1989; Dudareva et al., 2004; Salisbury et al., 1992). Terpenes are a large and varied class of hydrocarbons which are produced by a wide variety of generally plants. They are abundantly found in fruits, vegetables, and flowers. Terpenes have function as attractants or repellents in plants. They are responsible for the characteristic fragrance of many plants. Also, terpenes can be toxic against to herbivores and pathogens (Paduch, 2007). Terpenoids; are derived from the "**isoprene molecule**". They are located in the cytoplasm of the plant cell Terpenoids have been used as spices in foods and as fragrance in parfumes (Harborne, 1984; Herbert, 1989; Dudareva et al., 2004; Salisbury et al., 1992).

In plants, carotenoids, phenolic compounds, terpenoids, steroids have been reduced the risk of various chronic diseases such as cancer, cardiovascular disease etc. Some of them may also be applicable for bio-chemoprevention project (Nishino ett all., 2002). On the other hand; It has been developed, secondary metabolites which are belonging isoprenoids, for using as therapeutic agents or diagnostic tools in medical healtcare (Karuppusamy, 2009). The purpose of this review study is to exhibit the importance of various aspects of isoprenoid derivatives.

Isoprenoids – Terpenoids

A compound is called as "**isoprenoid**", if it is derived biologically from an "**isoprenoid**" precursor. Isoprenoids derivatives are one of the largest groups, they occuring terpenes and terpenoids (Harborne, 1984; Herbert, 1989; Dudareva et al., 2004; Salisbury et al., 1992). Terpenes are biosynthetically derived from isoprene units. Isoprene units may be linked "head to tail" to form linear chains or they may be arranged to form rings Terpenes can exist as hydrocarbons or have oxygen-containing compounds. Terpenoids occur by chemical modification of terpenes (Paduch, 2007).

Two different biyosynthetic pathways produce the main terpene building block; **isopentenyl diphosphate** (IPP). The first is referred to as either the MEP (methylerythritolphosphate) or DOX (**l-deoxy-D-xylulose**) pathway. IPP is formed in the cloroplast, mainly for the more volatile mono- and diterpenes. The second biosynthetic route is known as the MVA (**mevalonic asid**) pathway. This takes place in the cytosol, producing sesquiterpenes (Cseke et al., 2006). For a long time the mevalonate pathway was considered the universal source of the terpenoid C_5 precursors **isopentenyl pyrophosphate** (IPP) and dimethylallyl pyrophosphate (DMAPP). In this pathway, three molecules of acetyl-CoA are condensed to 3-hydroxy-3-methylglutaryl-CoA with subsequent reduction to mevalonate, which is converted to IPP and DMAPP Terpenes are defined as a unique group of hydrocarbone that derived from isoprene (Figure 1) (Paduch, 2007).
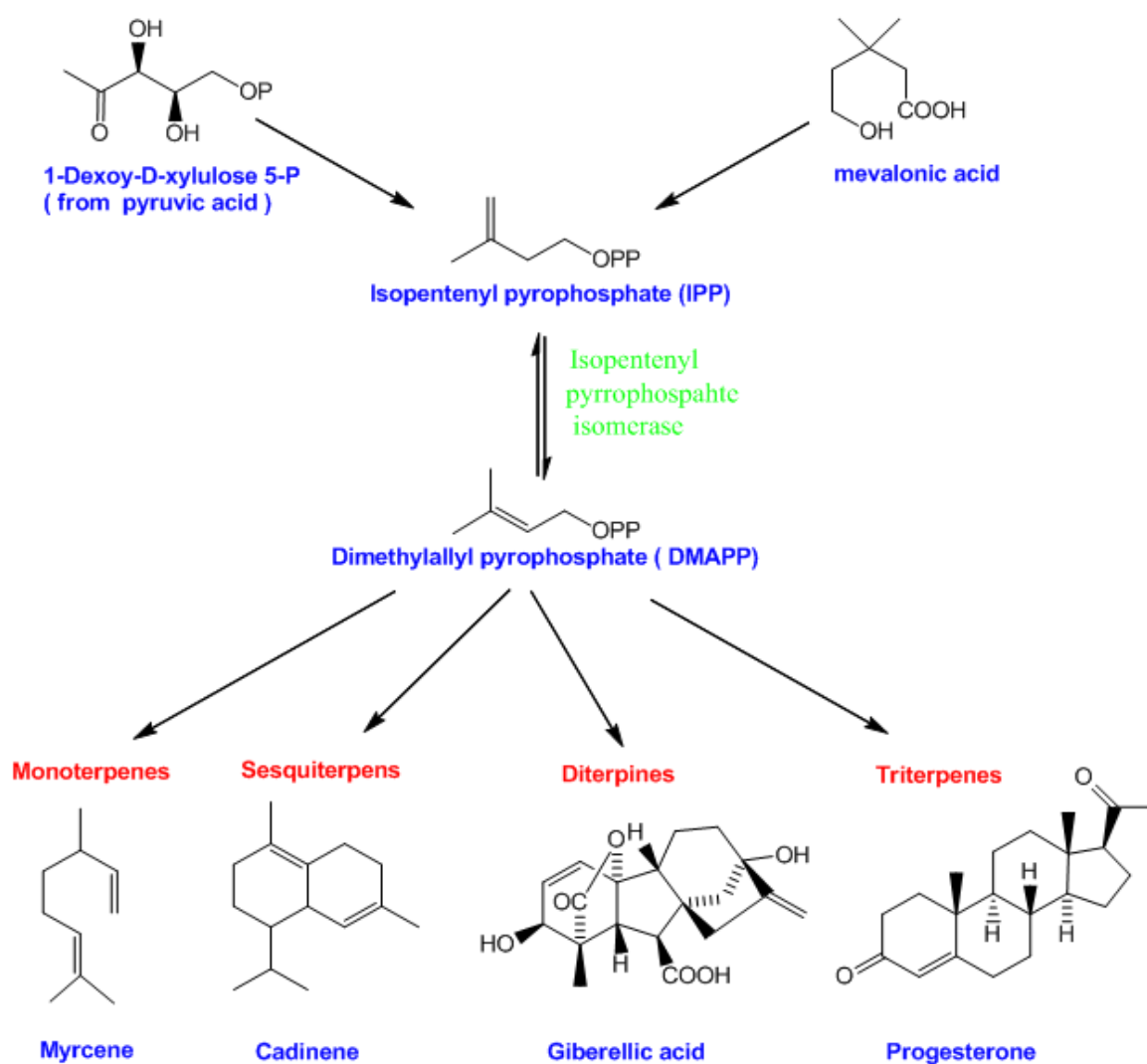

Figure 1: General Formation for the Biosynthesis of Terpenes (http://ictwiki.iitk.ernet.in, 2012).

Terpenoids; are derived from the isoprene molecule. They are located in the cytoplasm of the plant cell. Chemically the terpene essential oils can be divided into two classes, the mono and sesquiterpenes, C_{10} (e.g. geraniol and limonene) and C_{15} (e.g. farnesol) isoprenoids. Both of the mono and sesquiterpenes are in most common fruits and vegetables, they are idendified as volatile constituents and also volatile terpenes are the essential oils. Essential oils have been used in natural parfumes and also in food industry as spices and flavourings characteristic scent and odour. (Harborne, 1984; Herbert, 1989; Dudareva et al., 2004; Salisbury et al., 1992).

Sesquiterpenoid, abscisins and the gibberellins with diterpenoid based are major classes of growth regulators. Two derived sesquiterpenoids have growth-regulating properties; abscisic acids of harbecous plants and buds of woody plants takes role as the hormone controlling dormancy. Xanthinin has a role as an auxin-antogonist in plant physiology. Auxin in some plants has been taken role with flowering and sex expression. The auxin has role in so on many diverse growth system. It is as a master hormone in growth and devolepment in plants. The giberrelins have many developmental processes and these processes controlled by light, temperature, germination, seed and plant dormancy and fruit development. The gibberelins are responsible for cell enlargement and division in subapical meristem. They performed stimulation of growth in many plants. Quinine also have been found in fruits and in seeds. The quinine have an important influence in the stimulation of cell divisions. Quinine is likely to encourage the growth of the embryo. There are interaction between quinine and auxin. High auxin and low kinin causes root development but low auxin and high kinin causes bud development. Kinins affect various physiological mechanisms such as light responce, leaf growth and even aging. In addition to these all plant hormones have been active in regulating protein synthesis probably (Harborne, 1984; Herbert, 1989; Dudareva et al., 2004; Salisbury et al., 1992).

Diterpenoids, (C_{20}) with four isoprene units, they divided into three; resin diterpenes, toxic diterpenes and the gibberellins. Resin diterpenes have protective function in nature they are located in wood of trees. Toxic diterpenes are poisonous nature of the foliage of the some plants; *Rhododendron* and *Kalmia* species. Last group, gibberellins (e.g. gibberellic acid.) are hormones which generally situmulate growth (Harborne, 1984; Herbert, 1989; Mazid, 2011 et al. Dudareva et al., 2004; Salisbury et al., 1992).

Triterpenoids (C_{30}) with six isoprene units have cyclic structures, squalene. Triterpenoids can be divided into four classes, they are true triterpenes, steroids, saponins, and cardiac glycosides. The latter two groups are essentially triterpenes or steroids which foud as mainly glycosides. Some triterpenes have taste properties like bitterness of *Citrus* fruits because of limonin. Many triterpenes ocur in the waxy coatings of leaves and on fruits. They have protective roles in repelling insect and microbial effect. Saponins, are glycosides of triterpenes and sterols. They have ability to haemolyse blood cells. Saponins have also used to make soap because of their foaming characteristics. In higher plants, phytosterols (with six isoprene unit) are known three sterols; sitosterol, stigmasterol and campesterol. The last group of triterpenoids to be considered are the cardiac glycosides for example oleandrin the toxin from the leaves of the oleander, *Nerium oleander.* Most cardiac glycosides are toxic and they have pharmacological activity on the heart (Harborne, 1984; Herbert, 1989; Mazid, 2011 et al. Dudareva et al., 2004; Salisbury et al., 1992).

Carotenoids (C_{40}) are tetraterpenoids with eight isoprene units. The carotenoids occur in many different kinds of tissue. Pigments have two main functions; one of them are to take role as accessory pigments in photosynthesis, the other one is to task as colouring matters in flowers (mostly yellow colours) and fruits (especially orange or red colours). Well known carotenoids are lycopene and xanthophyll. Carotenoids participate in photosynthesis prevent photooxidation of chlorophylls. Xanthophyll, violoxanthin have role as the metabolic precursors of abscisic acid. It is said that, xanthophyll take role as attracting pollinating insects. Our livers convert to carotene carrots vitamin A. Probably because of being an antioxidant, it also has protected against some cancers (Harborne, 1984; Herbert, 1989; Dudareva et al., 2004; Salisbury et al., 1992).

Rubber is terpenoid containing 3000 to 6000 isoprene units. The rubber is extracted from latex, a milky for example the rubber tree (*Hevea brasiliensis*) produce for commercial purposes (Harborne, 1984; Herbert, 1989; Mazid, 2011 et al. Dudareva et al., 2004; Salisbury et al., 1992).

Conclusion

Scientist have conducted many researches about terpenes for years. Potentials of terpenes are very important in agrobiotechnology age. The role of these substances in plant are very important both plant and human. Altough people has benefited from terpenes tremendously, they are not to be discovered accurately. Because of its importance in plants, understanding the function of genes in terpene production is significant. Research results will reveal the discovering of pathways and compounds used for human applications (Zwenger and Basu, 2008). Terpenes are also presented agents involved in the prevention and therapy of several inflammatory diseases (Paduch ett. all., 2007). They have been used in parfumery because of their nice odour. Because of their industrial properties and agricultural applications; these substances are significant for industrial usage and insecticide, predator or pollinator in agriculture. Due to their antibacterial and pharmaceutical properties, they have tremendous usage in medicine. Isoprenoids; terpenes and terpenoids are important compounds chemically, as medical, as agricultural and also as industrial. The role of isoprenoids in plants guide and direct researchers to the other application fields. More studies should be done especially in these fields. For example; isoprenoids quantities in plants and the interconversion of these components can be examine in cultivation conditions. Morever the production behaviour of these compounds in the tissue culture conditions should be tested and compared with cultivation conditions.

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Endemic Plants Belonging to the *Asteraceae* Family in Rize Province and Their Possible Use in the Folk Medicine

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Abstract

Turkey is one of the world's richest countries in terms of endemic plants focussing on its geographical zone. Endemic plants showing narrow distribution in our country have been maintaining their life with a certain mountain and mountain chains in certain habitats. Black Sea Region with 220 endemic plant species is in the fourth place in geographic areas and its surrounded with high mountains. Rize is considered as a place with high rates of endemism. The *Asteraceae* (*Compositae*) family is the richest family in terms of 115 endemic taxa from total of 26 families in Rize. 24.3 % (28 taxa) of these endemic taxa belongs to the *Asteracaea* family, while the part of the 10.4 % (12 taxa) belongs to the *Poaceae* family and a part of 7.0 % (8 taxa) to the *Scrophulariaceae* family.

This review broughts research conducted previously on the endemic plants from *Asteraceae* family in Rize province together, the use of these plants (such as *Centaurea armena* Boiss, *Centaurea helenioides* Boiss., *Centaurea appendicigera* C. Koch. and *Helichrysum chionophilum* Boiss. Et Bal.) and their major components will be discussed in detail.

Keywords: *Asteracea,* endemic plants, treatment

Introduction

Because of its distinctive climatic, geographic and topographic characteristics, Eastern Black Sea region and Rize display a huge plant genetic diversity. From the sea level up high mountains, Rize province contains also a wide rage of plant species. A part of this valuable plants are endemic. Medicinal and aromatic plants of these endemic taxa stated a significant role in local people for centuries. Besides their use as food, herbal tea and spice, these plants include important bioactive components and therefore they have been used especially for traditional medicine.

Turkey's richest family is *Asteraceae* (*Compositae*) in terms of plant species. Morever this family is also rich in endemic species. In the flora of Turkey, 447 from total 1.209 species belonging to this family are endemic (Acikbas, 2009).

The *Asteraceae* (*Compositae*) family, one of the plant 26 families in Rize, has 28 (24.3 %) of 115 endemic taxa while the part of the 10.4 % (12 taxa) belongs to the *Poaceae* family and a part of 7.0 % (8 taxa) to the *Scrophulariaceae* family.

Endemic plants of *Asteraceae* family in Rize

28 endemic taxa belonging to the family *Asteracea* are given below:

1   *Anthemis melanoloma* Trautv. subsp. *trapezuntica* Grierson
2   *Cicerbita boissieri* (Rouy) C. Jeffrey (Synonym: *Lactuca sonchoides*)
3   *Cirsium pseudopersonata* Boiss. Et Bal. subsp. *pseudopersonata* Boiss. Et Bal.
4   *Cirsium sommieri* Petrak
5   *Cirsium trachylepis* Boiss.
6   *Doronicum balansae* Cavill.
7   *Helichrysum chionophilum* Boiss. Et Bal
8   *Hieracium hypopityforme* Juxip
9   *Hieracium insolitum* (Zahn) Juxip
10   *Hieracium ovalifrons* (Woronow Et Zahn) Juxip

11   *Hieracium djimilense* Boiss. Et Bal.
12   *Hieracium lazicum* Boiss. Et Bal.
13   *Hieracium microtum* Boiss.
14   *Senecio inops* Boiss. Et Bal.
15   *Senecio integrifolius* (L.) Clairv. subsp. *karsianus* Matthews
16   *Senecio lazicus* Boiss. Et Bal.
17   *Senecio ovatifolius* Boiss.
18   *Tragopogon aureus* Boiss
19   *Carduus lanuginosus*
20   *Doronicum* alf. Macrolepis
21   *Tanacetum repens* (Freyn. Et Sint.)
22   *Tanacetum monticolum* (Boiss. Et Huet)
23   *Centaurea armena*
24   *Centaurea helenioides* Boiss.
25   *Centaurea appendicigera* C. Koch.
26   *Taraxacum revertens* G. Hagl.
27   *Jurinea alpigena* C. Koch
28   *Pilosella hoppeana* (Schultes) C. H. Et F. W. Schultz subsp. *isaurica*

In Rize and *Asteraceae* family, there are a few endemic taxa conducted researches on. These taxa consist species of *Centaurea armena* Boiss, *Centaurea helenioides* Boiss., *Centaurea appendicigera* C. Koch. and *Helichrysum chionophilum* Boiss. Et Bal.

Centaurea armena Boiss. from *Asteraceae* family grows in the range of 2.300-2.800 m above sea level on the mountain slopes in Rize. The other taxa in *Asteraceae* family, *Centaurea helenioides* Boiss., grows in 1.400 m above sea level and shows the spread at an altitude 2.600 m in subalpine meadows in the Ikizdere district. *Centaurea appendicigera* C. Koch, in Camlihemsin district, finds the chance to grow at an altitude 2.800 m while it can grow Ballikoy-Bayburt strait (altitude: 3.040 m) in Ikizdere district. As similar to that of *Centaurea appendicigera* C. Koch, *Helichrysum chionophilum* Boiss. Et Bal. has adapted at an altitude 2.950-3.000 m in Ballikoy (Guner et al., 1987).

Endemic plants of *Asteraceae* family that known benefits in Rize
Centaurea sp.

179 species of the genus *Centaurea* are found in Turkey, which 109 species are endemic. Many *Centaurea* species have long been used in traditional medicine to cure various ailments, such as hemorrhoids, abscess and the common cold (Baytop, 1999; Tekeli et al., 2011).

Some authors focused on the chemical components and antimicrobial activity of the essential oil of *Centaurea* species. In a study, Yayli et al. (2005) obtained the essential oils of air-dried *Centaurea armena* Boiss. by hydrodistillation and analyzed by gas chromatography-mass spectrometry (GC–MS). Twenty components were identified in the essential oils and the main component of these taxa was b-eudesmol in the ratios of 19.3% from *C. armena* Boiss. Essential oil of the plants showed moderate antibacterial activity against Gram-positive and Gram-negative bacteria. In addition, Yayli et al. (2009) investigated the antimicrobial effect of the essential oils from two *Centaurea* species (*C. helenioides* Boiss. and *C. appendicigera* C. Koch) and demonstrated a moderate antibacterial activity on Gram-positive and Gram-negative too.

Grosheimin and cynaropicrin sesquiterpenes were isolated from the flowers of *C. helenioides* Boiss. by (Yayli et al., 2006). In another researche, *C. helenioides* Boiss. was one of the prominent species with their MIC values (Buruk et al., 2006).

The essential oils of air-dried *C. appendicigera* C. Koch and *C. helenioides* Boiss. were obtained by hydrodistillation in a Clevenger-type apparatus and analyzed by GC-MS. Forty-five

and fifty-one components were identified in the essential oils of *C. appendicigera* C. Koch. and *C. helenioides* Boiss., respectively, and the main components of these taxa were found to be *β*-caryophyllene (17.5%) from *C. appendicigera* C. Koch. and caryophyllene oxide (18.2%) from *C. helenioides Boiss*. The antimicrobial activity of the isolated essential oil of the plants was demonstrated moderate antibacterial activity against Gram-positive, Gram-negative bacteria, and yeast-like fungi (Yayli et al., 2009).

Helichrysum sp.

Among the other endemic species, in Rize, is *Helichrysum chionophilum* Boiss. Et Bal.. *Helichrysum* Mill., (*Asteraceae*) species (popularly known as immortal flower), grow wild in Anatolia. They are plants widely used as tea. They are used for the treatment of kidney stone, uro-genital and stomach pain, jaundice, diarrhea and asthma. In a study, it was found that mitotic and replication indexes rates of *H. chionophilum* Boiss. Et Bal. did not show a cytotoxic effect (Eroglu et al., 2010).

It was reported that *Helichrysum* species would be useful to take into consideration as an alternative in terms of antioxidant activities for food processing industries (Tepe et al., 2005). Albayrak et al. (2010) investigated the methanolic extracts of 16 *Helichrysum* species for their in vitro antioxidant, radical scavenging and antimicrobial activities. All the extracts showed strong antioxidant and radical scavenging activity. Among the tested *Helichrysum* species; *H. kitianum* had highest extract yields while *H. chionophilum* Boiss. Et Bal. had lowest extract yield. In this study total phenolic content, antioxidant and antimicrobial activities (IC50 value) of methanolic extracts of *H. chionophilum* Boiss. Et Bal. collected from Turkey were 106.97 mg GAE/g extract, 140.43 mg AAE/g extract and 53.10 lg/ml respectively.

Hieracium sp.

Hieracium L. is a large genus of perennial herbs well known for its taxanomic complexity. *Hieracium* species are important components of natural ecosystem. They never pose a problem as weeds, but often are considered desirable and beneficial, not only for the environment, but also for some of their medical properties. Several species of *Hieracium* at the blooming stage, including the root, are used for infusions and tinctures. Also the plants have antibiotic properties and are used against dropsy, nephritis, gout, dyspna, hemoptysis, cardiac oedema, diarrhoea and intermittent fevers. In addition, *Hieracium* species are an important source of nectar for honeybees and can be eaten by livestock providing a complementary source of foods. Several reports on the chemical composition of *Hieracium* species have appeared in the literature but, there are a few records about the endemic species of *the genus Hieracium*. One of these records is present in a study which conducted by Durmu et al. (2002) to compare the contents of phenolic substances and soluble sugar in the leaves of four *Hieracium* species (*H. hypopityforme* Juxip, *H. karogoellense*, *H. microtum* and *H. gentiliforme*). The results showed that leaves of the *Hieracium* species were very rich in phenolic substances and sugars.

In additon to these species, Kirbag and Zengin, (2006) reported that the plant infusion (5%) of *Taraxacum revertens* has been used as laxative, diuretic and kolagog in Elazığ in Turkey. There are very limited studies related endemic plants of *Asteraceae* family in Rize. It is need to expand the researches on the endemic plants for more data.

Conclusions

This review focused on the endemic plants belonging to the *Asteraceae* family in rize province and their possible use in the folk medicine by considering the studies conducted before.

From the sea level to high mountains, Rize province has also wide rage of plant species. A part of this valuable plants is endemic. Medicinal and aromatic plants of endemic taxa have been significant role in local people for centuries. These plants include important bioactive

components and therefore have been used especially for traditional medicine. Among these valuble taxa from *Asteraceae* family, there are species such as *Centaurea armena* Boiss, *Centaurea helenioides* Boiss., *Centaurea appendicigera* C. Koch. and *Helichrysum chionophilum* Boiss. Et Bal. The studies on endemic plants remained limited in our country. In addition to make efforts to protect these valuable genetic resources, it should be also focused on opportunities to benefit from these plants.

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Variation of Polyphenol Profiles of *Vaccinium corymbosum* L. by Different Solvent Extraction

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Abstract

Vaccinium corymbosum L. (Blueberry) from *Ericaceae* family is considered to be potent source of antioxidant compounds such as polyphenols. The aim of this study was not only to illuminate polyphenol composition of Blueberry fruits but also to determine the changes of polyphenolic profiles of their different solvent extracts.

The fruits of a blueberry cultivar, which are grown in Blueberry Application and Research Center Located in the village Sutluce of Rize Province in Turkey, harvested in 2012. Soxhlet extraction method was performed using methanol, ethanol and acetone solvents separately. Obtained extracts were fractionated with liquid-liquid extraction using equal amounts of dichloromethane, diethyl ether, ethyl acetate and butanol respectively. Each organic fraction were evaporated until dryness and solved with methanol for HPLC-UV analyses. The standarts of gallic acid, protocatechuic acid, *p*-hydroxybenzoic acid, catechin, chlorogenic acid, vanillic acid, caffeic acid, syringic acid, epicatechin, *p*-coumaric acid, ferulic acid, rutin, *o*-coumaric acid, quercetin and kaempferol were used to identify and quantify phenolic compounds of each extract by HPLC-UV. Total phenolic content of fractions of methanol and ethanol extracts were determined using Folin-Ciocalteu's reagent and expressed as mg quercetin/gallic acid equivalent per mL extracts.

Chlorogenic acid, being most abundant phenolic compound, was found highest amount in butanol fractions according to HPLC-UV analyses. Other phenolic acids were also found most abundant in butanol fractions of the extracts except from catechin, epicatechin, o-coumaric acid, rutin and kaempferol, which were not detected in the extracts. The highest total phenolic contents were found in their butanol fractions as well. The total phenolic content and amounts of phenolic compounds of fractions have followed the same sort descending as butanol, ethyl acetate, diethyl ether and dichloromethane.

Keywords*:* Blueberry, extraction, phenolic compounds, treatment

Introduction

Highbush blueberries (*Vaccinium corymbosum* L.) of the family *Ericaceae* are extensively cultivated in the United States and more recently have become a popular commercial crop in Europe (Kader et al. 1996). In Poland, first attempts of introducing this species in the 1930s were unsuccessful. The progress was attained only in the 1970s. The cultivation area constantly enlarges because of fruit sensory attributes and high marketable price (Mitek et al. 2001).

Blueberries are often converted to extracts such as juice or juice concentrate for subsequent use in beverages, syrups and other food products. Highbush blueberries are large fruit with intensive colour (dark-blue), firmness and pleasant sweet taste. Blueberries have low calorie content. According to (Anon.,2005) 100 g of fresh fruit contains 84.2 g of water, 0.74 g of protein, 0.33 g of fat, 14.5 g of carbohydrate, 2.4 g of fiber, 0.24 g of ash. Fruits are rich in mineral matters and contains more potassium (77.0 mg). Phosphorus (12.0 mg), calcium (6.0 mg), magnesium (6.0 mg) and other minerals follow it. Compared with regards to vitamins, more vitamin C (9.7 mg) is available in fruit.

The berries are known to be one of the valuable fruits due to their high antioxidative activity (Kraujalytė et al., 2013). Highbush blueberries are an excellent source of phytochemicals that are believed to have significant biological activity (Schmidt et al. 2005; Skupień, 2006). Cultivars of *V. corymbosum* are rich sources of chlorogenic acid and contain complex phenolic acids have natural variation in fruit composition (Milivojevic et al., 2012).

People are faced with many health problems recently. Coronary heart disease and cancer are among the most important and common ones. Cardiovascular disease (including stroke), cancer, and diabetes account for approximately two thirds of all deaths in the United States (Eyre et al.,2014). Besides of leading causes of death, these diseases share another common trait: they can effects to lifestyle choices (Kraus et al., 2012). Studies suggest that the consumption of both an antioxidant and phytochemical-rich diet contribute towards the reduction of heart disease and several cancer types. At this point, there has been a substantial amount of interest in *Vaccinium corymbosum*, due to their high antioxidant levels which have been showed to help prevent cancer of the colon (Yi et al., 2005), breast, and prostate (Roy et al., 2009). Moreover, blueberry extracts ameliorate age-related declines in neuronal and cognitive function, common in disorders such as Alzheimer disease (Youdim et al. 2000; Skupień, 2006).

The aim of this study was not only to illuminate polyphenol composition of Blueberry fruits, have great benefits in terms of health, but also to determine the changes of polyphenolic profiles of their different solvent extracts.

Material

In this research, there were used the fruits belong to a blueberry cultivar (Spartan). Bluberry (*Vaccinium corymbosum)* grown in Blueberry Application and Research Center in Sütlüce Village of Rize Province, which is located at 40° 58,517′ N latitude, 040° 33,421′ E longitude with an average altitude of 350 m above mean sea level. After the ripe fruits harvested in July of 2012, the fruits were kept as a whole in the oven at 60 °C to dryness. The dried material was divided into small pieces in a mill and exposed to vapour about 10 minutes, dried again and then pounded in a mortar to pulverize. Dried material was maintained at +4 °C until analysis.

The standarts of gallic acid, protocatechuic acid, *p*-hydroxybenzoic acid, catechin, chlorogenic acid, vanillic acid, caffeic acid, syringic acid, epicatechin, *p*-coumaric acid, ferulic acid, rutin, *o*-coumaric acid, quercetin and kaempferol were used to identify and quantify phenolic compounds of each extract by HPLC-UV.

Method

Extraction process was performed with Soxhelet method for 12 hours. Materials was extracted by three solvents, methanol (% 99,9 Merck) and ethanol (% 99,9 Merck). It was used 180 ml solvent for each 5 g dry sample. At the end of the extraction, solvent-extract mixture filtrated by using filter paper (Whatman No. 1) and the solvent was evaporated in a rotary evaporator under vacuum at 60 °C. Extract in glass flask was dissolved adding 50 ml of heated purified water (60 °C). Ultrasonic water bath was used to pass completely the extract pieces adherent to the glass into the flask.

The extracts were partitioned using 2x5 mL dichloromethane (DCM), ether, ethyl acetate and butanol consecutively (Termentzi et al. 2008). Afterward the solvent was evaporated under vacuum using a rotary evaporator. The dried extracts were dissolved in 2 mL of methanol and stored at 4°C until HPLC-UV analysis.

Result and Discussion

In this study, considering the extracts from fruits using three main solvents, the most rich phenolic compounds were obtained by methanolic extracts in terms of either phenolic acids or total phenolic content (Table-1, 2, 3 and 4). Ethanolic and acetonic extracts followed it respectively.

Table 1. Different fractions of the methanolic extracts from blueberry fruits (mg standard/L extract)

Compounds	Fractions			
	Dichloromethane	Diethyl ether	Ethyl acetate	Butanol
gallic acid	-	4,48	16,32	41,96
protocatechuic acid	-	-	34,24	31,16
p-OH benzoic acid	-	-	-	-
chlorogenic acid	9,44	21,36	245,08	1684,6
vanillic acid	2,83	5,04	-	-
caffeic acid	-	4,56	8,04	6,52
syringic acid	6,21	17,04	33,80	37,24
p-coumaric acid	-	8,00	8,57	4,20
ferulic acid	0,88	2,64	2,92	2,00
quercetin	-	-	-	-

Note: Five standarts (catechin, epicatechin, rutin, o-coumaric acid and kaempferol) were not detected in the extracts

Table 2. Different fractions of the ethanolic extracts from blueberry fruits (mg standard/L extract)

Compounds	Fractions			
	Dichloromethane	Diethyl ether	Ethyl acetate	Butanol
gallic acid	-	6,06	13,52	43,84
protocatechuic acid	-	20,84	21,08	15,2
p-OH benzoic acid	-	1,62	-	-
chlorogenic acid	36,08	23,70	180,93	1284,76
vanillic acid	13,92	3,42	-	-
caffeic acid	-	6,54	5,18	6,08
syringic acid	9,28	33,22	25,78	34,68
p-coumaric acid	1,68	9,62	4,98	3,24
ferulic acid	1,76	0,30	1,58	1,84
quercetin	-	-	-	-

Note: Five standarts (catechin, epicatechin, rutin, o-coumaric acid and kaempferol) were not detected in the extracts

Table 3. Different fractions of the acetonic extracts from blueberry fruits (mg standard/L extract)

Compounds	Fractions			
	Dichloromethane	Diethyl ether	Ethyl acetate	Butanol
gallic acid	-	-	1,75	5,03
protocatechuic acid	-	-	6,80	5,48
p-OH benzoic acid	-	-	-	-
chlorogenic acid	3,76	5,30	17,38	164,80
vanillic acid	-	0	-	-
caffeic acid	-	0,45	0,61	0,85
syringic acid	1,192	2,95	5,77	4,19
p-coumaric acid	-	0,86	0,84	0,28
ferulic acid	-	-	-	-
quercetin	-	1,70	1,50	1,30

Note: Five standarts (catechin, epicatechin, rutin, o-coumaric acid and kaempferol) were not detected in the extracts

It was determined that the compounds in dichloromethane fractions of each extract were too limited and low. However, diethyl ether fractions of ethanolic extracts contained much more phenolic acids compared to other extracts. In the other hand, ethyl acetate fractions were affected widely depending on extracts while compounds in Butanol fractions were affected less. Moreover, fractions of extracts obtained by three solvent showed that butanol fractions were rather rich in terms of especially chlorogenic acid and gallic acid, and the ethyl acetate fractions was ranked second after butanol fractions. Milivojevic et al. (2012) reported that cultivars of *V.*

corymbosum were rich sources of chlorogenic acid. In addition, in another study, chlorogenic acid (as 3-caffeoylquinic acid) was the most abundant among the phenolic acids in bilberries and blueberries (Moze et al., 2011).

Tablo 4. Total phenolic contents

Solvents used for fractions	Ethanolic extraction		Methanolic extraction	
	mg gallic acid/mL	mg quercetin/mL	mg gallic acid/mL	mg quercetin/mL
Dichloromethane	1,60	0,92	1,16	0,74
Diethyl ether	1,55	0,94	1,56	0,99
Ethyl acetate	2,55	1,54	2,90	1,77
Butanol	11,32	4,48	16,37	5,62

Quercetin was not found in both methanolic and ethanolic extracts but maximum quercetin is determined in diethyl ether fractions of acetonic extracts and followed it ethyl acetate and butanol fractions respectively.

The highest total phenolic contents were found in butanol fractions of extracts as well. The total phenolic content and amounts of phenolic compounds in fractions have followed the same sort descending as butanol, ethyl acetate, diethyl ether and dichloromethane (Table-4).

Conclusion

In this study, considering the extracts from fruits using three main solvents, the most rich phenolic compounds were obtained by methanolic extracts in terms of either phenolic acids or total phenolic content.

Chlorogenic acid, being most abundant phenolic compound, was found highest amount in butanol fractions. Other phenolic acids were also generally found most abundant in butanol fractions of the extracts except from catechin, epicatechin, o-coumaric acid, rutin and kaempferol, which were not detected in the extracts. The highest total phenolic contents were found in their butanol fractions as well. The total phenolic content and amounts of phenolic compounds of fractions have followed the same sort descending as butanol, ethyl acetate, diethyl ether and dichloromethane.

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Apple Cultivars Sensitivity on the Fire Blight (*Erwinia amylovora* (Burrill) Winslow et al.) in Central Bosnia

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Abstract

Erwinia amylovora (Burrill) Winslow et al., is the causal agent of fire blight, which is considered as the most serious disease affecting pear and apple cultivars in many countries around the world. This bacterial disease is included in the EPPO A2 and the EU Annex II/A2 list, but also many other (non-EU) countries quarantine lists implicate it in order to prevent further spread. This bacteria cause typical tissue necrosis and in optimal conditions this can lead to complete destruction of the plant. Destruction degree depends of plant sensitivity on *E. amylovora.* In Bosnia and Herzegovina the occurrence of fire blight is confirmed on some commercial apple cultivars, whereas local cultivars are considered to be tolerant or less sensitive to this bacterial disease. It should be noted that there are no official data for the presence of fire blight in Bosnia and Herzegovina, yet. Although, typical symptoms simplify the identification of the disease by visual inspection, for a concrete diagnose and presence confirmation of this quarantine pathogen laboratory tests are necessary. The aim of research was to contribute the first official confirmation of regional distribution of the fire blight. During the growing season in 2012. apple samples with symptoms were collected in several orchards located in the central Bosnia region. After seeding on culture media, three samples which had shown typical colonies were further tested for the presence of the bacteria by some methods prescribed by EPPO diagnostic standards. The applied nutritional and enzymatic identification tests showed positive reaction in two samples of commercial apple cultivars (Idared and Golden delicious), while sample of the local cultivars Senabija was found to be free of any infection. The results of this research confirmed the presence of fire blight in Bosnia and Hercegovina, but also indicate a potential tolerance of local apple cultivar Senabija on this hazardous bacterial disease.

Keywords*: Bacterial disease, Erwinia amylovora,* fire blight, apple, quarantine lists

Introduction

Fire blight presents the most important apple disease in the world. Its catalyst, bacteria Erwinia amylovora belongs to most widespread and economically most significant phytopathogens of a bacteria. Immense damages are recorded all around the world caused by this disease, which resulted in losing thousands of acres of apple and pear plantations, and in some parts due to enormous loss, production of these cultures was entirely withdrawn.

Fire blight symptoms are characteristic and manifest in a form of inflorescence's necrosis and misplaced fruits, shoot blight, necrosis and drying of branches and entire trees (Van der Zwet i Keil, 1979). As opposed to other phytopathogenic bacteria which induce creation of necrosis on herbal tissue, *E. Amylovora* spreads exceptionally fast from the place of a primary infection. On sensitive cultivars under desirable conditions (including climate and tree physiology), disease migrates from the infected flower to the root, causing death of a tree in one vegetation season (Vaneste et al, 2000).

It is first described in USA at the end of VIII century and back then its appearance was ascribed to various phytopathogenic fungi, insects and even weather conditions, up until 1883 when the bacterial nature was confirmed by Burill. (Van der Zwet and Keil, 1979)

20th century period represents the time of intensive disease expansion. In Europe, it first appeared in Great Britain in 1957, and it quickly spread over other countries, such as Poland,

Netherlands, Germany, Denmark, Greece, Sweden, Ireland, Norway, Cyprus etc. This disease was not recorded in South America and majority of African and Asian countries. (Bonn and Van der Zwet, 2000).

Fire blight was confirmed on the territory of Bosnia and Herzegovina at the end of 1980's on the area of Bosanska Gradiška as a pathogen of pear, apple quince and medlar (Arsenijević i sar., 1991). Even though there are no official records about its prevalence, today it is considered to be spread over the majority of this country.

Considering the major role that apple has in overall fruit production in Bosnia and Herzegovina, and that it is the most important host to fire blight, over the last few years huge attention was shifted to monitoring the appearance of this infection on Bosnian-Herzegovinian territory. It is necessary to mention that there are certain diversities in resistance that all sorts of apples are giving, so one of the key measures to fighting this disease should be choosing more resistant sorts and grounds (Van der Zweit and Keil, 1979). On the territory of Bosnia and Herzegovina a significant number of indigenous cultivars is preserved, which are potentially tolerant to the appearance of fire blight.

Materials and Methods

Area predicted for the research about possible presence and infection with fire blight is Sarajevo County. In June 2012, samples were gathered from three locations in Sarajevo. First location was apple orchard in Semizovac, Vogošća municipality where asymptomatic samples from indigenous sort 'Senabija' were took. For second location (B), an orchard in Sovrle, municipality of Ilijaš was chosen, where symptomatic samples of commercial sorts 'Idared' and 'Golden delicious' were took. Third location (C) included an orchard on Butmir, Ilidža municipality. From there 'Golden delicious' sort's symptomatic samples were took. Herbal material consisted of branches, leaves, flowers and fruits. From every sort, 10 samples were took which consisted the mentioned herbal material.

Samples were delivered and analysed in Federal Agricultural Bureau's laboratory in Sarajevo. It is necessary to mention that for the assignment purposes considerably larger amount of samples was covered, but due to the absence of any disease and presence of bacteria indicators or establishing the fact that similar symptoms caused by some other diseases or insects are causing the problem, those samples were rejected at start and were not analyzed.

Within this assignment, three samples were analyzed which showed symptoms of infection by *E. Amylovora*. Analysis was conducted in accordance with EPPO standards for fire blight, which implied the method of planting on nutrient grounds, review with the help of biochemical tests. Samples weighing 0,5 g were submitted to extraction with PBS buffer and put on MULTI-Vortex V-32. After extraction, the isolation of bacteria on nutritive grounds was made. For isolating *E. Amylovora*, King B (King et al. 1954) and Levan nutritive grounds were used.

After formation of colonies, identification started by using various nutritive and enzyme tests. In this assignment, in accordance with EPPO standards, identification is made by citrate utilization test, gram staining, indole test, Kovacs oxidase test, fluorescent pigment on King B's surface test, pathogenicity test, and a final identification was made with the help of ELISA-test. Citrate utilization test (citric acid) was made using Simmons Citrate Agar to which colonies that formed on Levan ground were transferred. Incubation was made on a temperature of 370C in a period of three days. Gram staining test is a quick method for diversifying gram negative and gram positive bacteria, and it involves bacteria solubility test in 3% KOH. For final identification DAS-ELISA was used. Commercial anti-serums specific for *E. Amylovora* were used, and the procedure was made by manufacturer's protocol.

Results and Discussion

24 hours from isolation to nutritive King B ground colonies appeared which were creamy white, round-shaped, and had a tendency of expansion that do not fluorescence on 366 nm under UV light after 48 hours. Listed colonies were morphologically typical for *E. Amylovora* on King B ground and all of the samples were assessed positive. On Levan ground, colonies of bacteria typical for this ground by appearance and color were obtained on all analyzed samples. After positive isolation the approach was made to identification by various tests. Citrate usage test showed positive on all three analyzed samples, which could be noticed by the appearance of characteristically yellow color. Gram test confirmed the Gram bacteria negative, which is characteristic of *E. Amylovora.*

E. Amylovora has a negative reaction on Indole test, oxidase test as well as fluorescent pigment on King B ground. Considering the fact that all analyzed samples were negative, after the tests were done it is concluded that in the case of bacteria isolated from herbal tissue, it is *E. Amylovora.*

Examination on pathogen was conducted on young pear fruits ('Viljamovka' cultivar), where necrotic and ringed spots were visible around sting place, 3-4 days after incubation, and also bacterial exudates appeared. The specified phenomenon was recorded on two samples (Idared and Golden delicious), while the third sample with indigenous cultivar showed necrosis symptoms but with no exudates appearance. Since *Pseudomonas syringae* lacks formation of exudates drops (Arsenijević. 1988) it is considered that in this sample's case there is no infection by the wanted pathogen *E. Amylovora.* Final identification was made by DAS-ELISA test. With this test, samples 2 and 3 (Idared and G. delicious) showed a positive reaction while indigenous cultivar had a negative one. With this, the non-existence of *E. Amylovora* infection was proved on indigenous cultivar of 'Senabija' apple.

Presence of phytopathogenic bacteria, *E. Amylovara* was confirmed on two samples by laboratory research. 'Idared' and 'Golden delicious' cultivar samples showed positive, while indigenous sort 'Senabija' showed negative results on wanted pathogen after the first test of isolating the bacteria which shows potential tolerance of this cultivar. Ognjanov (2005) points out that some indigenous species have a high level of horizontal, racially unspecific resistance towards catalysts of economically most significant diseases - apple scab, powdery mildew and downy mildew. For objective and official data a considerably higher number of samples from indigenous apple assortment should be tested, but these first results impose a high potential which it has. On 'Golden delicious' and 'Idared' cultivars, presence of a wanted pathogen is visible. Above mentioned commercial sorts are treated as sensitive and medium sensitive to fire blight.

Conclusion

Fire blight causer, *E. Amylovora* is present and confirmed in Bosnia and Herzegovina, in Sarajevo County. Based on the analysis it is possible to conclude that commercial apple sorts have a higher level of infection with fire blight than autochthounus species. In this case it is confirmed on 'Idared' and 'Golden delicious' cultivars, although it should be took into consideration that even with commercial cultivars there are notable differences in sensitivity. Indigenous sorts are mainly resistant to fire blight.

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Determination of Grafted Success for Some New Registered Grape Varieties

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Abstract

This study was conducted in order to determine the success ratio of omega bench grafting for 5 new grape varieties which were grafted onto 2 different rootstocks (1103P and 1613C). Research has conducted in the nursery of Manisa Viticulture Research Station and 5 new cultivars (Sultan 1, Sultan 7, Manisa Sultanı, Altın Sultani, Saruhanbey) were used as plant materials which were registered by the Directorate of Manisa Viticulture Research Station. At the end of the study, rootstocks had different effects in terms of callusing ratio (%), rooting and sprouting ratios (%), callusing levels (0-4), number of roots, the ratio of grafted cuttings having planting quality (%), root development level (0-4), root thickness (mm), root length (cm), shoot development level (0-4), shoot thickness (mm), shoot length and productivity of grafted vine (%).

As a result all parameters were considered together for both grape varieties in callus room and 1103P was found to be optimal rootstock. In addition the highest value on productivity of grafted vine were obtained from Sultan 7 grafted on 1103P although the lowest value was determined from Saruhan Bey grafted on 1613C rootstock.

Keywords: Grafted vine, omega grafting, new cultivars, 1103 P, 1613 C

Introduction

The year 2012 data showed that Turkey produced 3 393 588 total number of grapevine cuttings (Anonim, 2013). This is however not enough because sapling producers have low performance (Bahar et al., 2006; Korkutal et al., 2011). Grafting combines two different plant pieces, a scion and rootstock. Viticulture is based on grafting; scion is a cultivar of Vitis vinifera L. and the rootstock is Vitis sp. or interspecific hybrids (Winkler et al., 1974). Therefore scion/rootstock combination is one of the most important factor which effects grafted vine production (Çelik and Ağaoğlu, 1979).

Especially choice of ideal rootstock/scion combination at the establishment has determinative role in the life of a plantation. An ideal rootstock/scion combination according to the aim of the production (table grape, raisin or wine) has beneficial effects on the quality parameters of the grape, must and wine, and it can even result higher yields together with better quality (Bánszki, 2009; Lőrincz and Barócsi, 2010). Rootstock varieties differently affect fruiting, rate of growth, yield and fruit quality. In the process of these effects a highly crucial role has both the rootstock and the scion (Bényei and Lőrincz, 1999; Fekete et al., 2012).

The main goal of this study was to determine the success ratio of omega bench grafting for 5 new grape varieties which were grafted onto 2 different rootstocks (1103P and 1613C). Also compatibility or incompatibility of these rootstocks and new grape varieties which were untested so far will be assessed under this experiment.

Material and Methods

The experiment was carried out in the nursery of Manisa Viticulture Research Station. In this study 5 new cultivars (Sultan 1, Sultan 7, Manisa Sultanı, Altın Sultani, Saruhanbey) were used as plant materials which were registered by the Directorate of Manisa Viticulture Research Station have been grafted onto the 1103P and 1613C rootstocks.

Cuttings of the following rootstocks known to be resistant to phylloxera namely; 1103 Paulsen and 1613 Couderc were obtained from the rootstocks production parcels in the dormant season. Furthermore 1 year old canes of 5 new varieties were used as scion material. One bud scions of varieties were bench-grafted onto the 1103P and 1613C rootstocks with using omega shaped knives. Then grafted cuttings were placed in the callusing room under controlled

conditions (25-27°C and %85-90 relative humidity) for 3 weeks to obtain callus formation between rootstock and scion. Grafted cuttings which completed callus formation were planted in black plastic bags containing a mixture; pine sawdust, sifted soil, farm manure, perlite, peat, woodchip (2:1:1:1:1:1) (Ilgın et al., 1990). Then planting they were settled for uprooting over 6-7 weeks at 25-27°C, 70-75% humidity in greenhouse. After callus formation was completed in the callusing room, following parameters were measured; callusing level at the grafting union (0-4), number of roots, callusing ratio (%), rooting and sprouting ratio (%) and the ratio of grafted cuttings having planting quality (%). Furthermore, the growth of the cuttings was assessed by the measurement of the rooting and shooting level (0-4), root and shoot thickness (mm), root and shoot length (cm), root and shoot dry matter ratio (%), productivity of grafted vine (%) and chlorophyll contents (SPAD) at the end of the 6-7 weeks in the greenhouse when the potted seedlings were rooted. All parameters were examined to determine the effects of rootstocks on the new varieties.

The experimental design was completely randomized simple factorial design with three replications and there were 30 cuttings in each replication. Analysis of variance is implemented to research data by using TARIST statistical analysis software package on computer, and in order to determine the differences among averages, LSD test is implemented on importance level of 5% and 1%.

Results

According to the measurements of after callus formation in the callusing room, effetcs of 1103P/Variety and 1613C/Variety combinations on Callusing level, Callusing ratio, Rooting ratio, Sprouting ratio, Ratio of grafted cuttings having planting quality were not statistically significiant while Number of roots were significant with $p<0.05$ and $p<0.01$ level for 1103P/Variety and 1613C/Variety combinations, respectively.

Effects of new registered varieties which grafted onto 1103P rootstocks were statistically significiant ($p<0.01$) on some parameteres as Productivity of grafted vine, Chlorophyll content, Number of roots, Fresh root weight, Shooting level, Dry shoot weight, Fresh shoot weight (Table 1). Furthermore, effects of combinations with 1103P rootstock on Root thickness, Dry root weight, Shoot thickness, Shoot length were statistically significiant ($p<0.05$). On the other hand effects of 1103P/varieties combination were not statistically significiant in terms of Rooting level and Root length. Additionally, effects of 1613C/Varieties combination on Productivity of grafted vine, Chlorophyll content, Dry root weight, Fresh root weight, Shooting level, Dry shoot weight, Fresh shoot weight were found significiant ($p<0.01$). Moreover effects of these combinations with 1613C on a few parameteres as Root thickness and Number of roots were found to be significiant ($p<0.05$). On the other hand effects of these combinations on some parameters as Rooting level, Root length, Shoot length, Shoot thickness were found to be unimportant (Table 2).

Discussion and Conclusion

Overall the findings reveal that the highest value of final take (Productivity of grafted vine) was obtained from Sultan 7 for both 1103P and 1613C rootstocks, (%81.1) and (%44.4) respectively while the lowest was obtained from Altın Sultani (%51.1 and %15.5). Additionally Sultan 7 had the highest value in terms of shooting level (2.58), shoot length (20.34) and fresh shoot weight (60.48) with 1103P rootstock. These results highlight that Sultan 7 gave the better result with 1103P than 1613C rootstock. On the other hand Manisa Sultanı had the highest value in terms of chlorophyll content (21.33), dry root weight (13.14), number of roots (51.50) and fresh root weight (67.05) for 1613C rootstocks. Moreover this variety had the second high final take value after Sultan 7 which grafted on 1613C. As can be seen from the results, Sultan 7, which is a raisin variety, has stood out with its high values for both rootstocks. Therefore this variety should be promote to common use for raisin production. Furthermore Manisa Sultanı can be use for table grabe production owing to its high results with 1103P and 1613C rootstocks.

Table 1. Effects of 1103P/Variety combinations on some parameters.

Varieties	Productivity of grafted vine (%)	Chlorophyll content (SPAD)	Root thickness (mm)	Dry root weight (g)	Number of roots	Fresh root weight (g)	Shooting level (0-4)	Shoot thickness (mm)	Shoot length (cm)	Dry shoot weight (g)	Fresh shoot weight (g)
Sultan 1	56.67 b	17.13 d	0.53 abc	4.33 c	26.64 b	35.21 c	2.18 ab	2.14 a	14.19 b	12.10 b	53.89 b
Sultan 7	81.11 a	19.33 c	0.39 c	6.69 ab	60.50 a	45.72 b	2.58 a	2.09 a	20.34 a	12.68 b	60.48 a
Manisa S.	57.78 b	17.75 d	0.61 ab	5.05 bc	24.81 b	36.37 c	2.33 ab	2.06 a	17.00 ab	11.35 b	46.68 d
Altın S.	51.11 b	20.72 b	0.66 a	7.16 a	33.75 b	50.52 a	1.66 c	2.03 a	15.84 b	14.59 a	59.23 a
Saruhanbey	65.56 ab	22.06 a	0.45 bc	7.08 a	63.11 a	46.83 b	2.03 bc	1.72 b	15.28 b	12.21 b	50.71 c
P	**	**	*	*	**	**	**	*	*	**	**
LSD	20.530	0.887	0.185	1.818	21.548	2.262	0.449	0.228	3.741	1.562	2.724

n.s. Non significiant; **, *, are significiant at P≤0.01 and P≤0.05, respectively.

Tablo 2. Effects of 1613C/Variety combinations on some parameters.

Varieties	Productivity of grafted vine (%)	Chlorophyll content (SPAD)	Root thickness (mm)	Dry root weight (g)	Number of roots	Fresh root weight (g)	Shooting level (0-4)	Dry shoot weight (g)	Fresh shoot weight (g)
Sultan 1	16.67 cd	15.30 c	0.84 a	7.45 b	23.08 c	57.34 d	1.97 a	14.46 a	61.52 a
Sultan 7	44.44 a	18.01 b	0.69 ab	6.35 b	31.19 bc	52.03 e	1.94 a	11.63 b	51.88 c
Manisa S.	28.89 b	21.33 a	0.49 c	13.14 a	51.50 a	67.05 a	1.32 bc	14.22 a	54.64 b
Altın S.	15.55 d	17.15 bc	0.54 bc	8.17 b	45.92 ab	64.41 b	1.80 ab	10.78 b	46.58 d
Saruhanbey	25.55 bc	18.26 b	0.68 ab	8.20 b	33.58 abc	60.89 c	1.26 c	14.79 a	54.40 b
P	**	**	*	**	*	**	**	**	**
LSD	9.710	2.370	0.184	3.057	18.256	2.279	0.479	1.567	1.733

n.s. Non significiant; **, *, are significiant at P≤0.01 and P≤0.05, respectively.

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The Influence of Foliar Fertilizing with Liquid Organic Fertilizers on Potato Yield Grown in Strumica Region

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Abstract

It was studied the effect of foliar fertilization with liquid organic fertilizers on potatoes yield grown in Strumica region, in the vicinity of the village Kuklis in the period of year 2011-2012. The experiment was set in four variants and three repetitions. The variants in the experiment were:

1. Control (no-fertilizing variant);
2. Humusil (organic matter 1.86%; organic carbon 1.08%; humins acids 0.14%; N 224 mg/L; P_2O_5 71 mg/L; K_2O 1024 mg/L; CaO 180 mg/L);
3. Humustim (organic matter 58.63 %; dry matter 12.38 %; humins acids 20.40 %; fulvo acids 2.15%; N 3%; P_2O_5 1.02%; K_2O 7.92%; Ca 3.70 %; Mg 1.03%);
4. Ingrasamant foliar (N 0 %; P_2O_5 130 g/L; K_2O 130 g/L; ME in helate form and plant extracts 0.005 g/L).

The experiment was arranged in 12 rows and in each variant and replication was involved 100 plants, total in all experiment were involved 1200 plants. The planting was made in rows at a distance of 60 cm row by row and 20 cm in the rows. The row's length was 20 m. Three foliar treatments were applied with given above fertilizers at a concentration of 0.4%.

Before setting up the experiment was carried agrochemical analysis of soil in which were concluded good fertility with three basic macrobiogen elements. After the harvesting and yield measuring was concluded that the foliar fertilization have a positive influence on potatoes yield. In named three variants treated with different organic fertilizers was found a higher yield of potatoes compared with control variant. The highest potatoes yield of 54.62 t ha^{-1} was established in variant 4th treated with organic fertilizer Ingrasamant foliar (N 0 %; P_2O_5 130 g/L; K_2O 130 g/L; ME in helate form and plant extracts 0,005 g/L). The results obtained in all variants with different fertilizers are statistically significant at the LSD (0.01) level, and in variants 3 and 4 the statistical significance at the LSD (0.05) level.

Keywords: Potatoes, foliar fertilization, yield.

Introduction

In the modern agriculture, the main aim is to obtained higher yields that are characterized with good quality.

One of the most important agricultural measures, which together with the others should allow continuous, high and cost effective production, is plant nutrition (Vukadinović and Lončarić, 1997).

For normal growing, yield and getting quality fruits it is necessary normal regime of plant nutrition. Regular nutrition means availability of all macro and mircobiogen elements in the correct phenophases of the plant development (Jekić, 1983). Each biogenic element has its specific influence in the different plant parts. Plant nutrition has an influence of numerous physiological – biochemical processes, of which depends growing, developing and potato yield. Plants that are timely and regular nourished, gets fruits with characteristic form, color and size, with typically organoleptic properties (Sarić et al., 1989; Šaćiragić and Jekić, 1988). Because of different reasons, limiting of biogenic elements in the root area is often. Intensive agriculture and use of high productivity cultivars led to a continuous decrease in soil micronutrient content (Kalinova et al., 2014). Using of foliar fertilizers in the crop cultures nutrition, has a big influence for getting higher yields, but productions that are characterized with better quality, too. With using of foliar fertilizers allows directly supply of leafs, flowers and fruits with biogenic elements in the period of most needed. Foliar fertilization is a widely used practice to correct nutritional deficiencies in plants caused by improper supply of nutrients to roots (Shaaban, 2001). Foliar spray with fertilizers is necessary to further activity in the whole system of optimal

mineral nutrition of plants. Foliar spray provides a more economical water regime of plants and allows overcoming the physiological disturbances caused by adverse soil conditions that hamper mobility and absorption nutrients (Kostadinov and Kostadinova, 2014). Potato, as one-year culture, has a big economic importance. The most importance has in the human nutrition, as raw material in the industry and in the livestock nutrition. In the human nutrition has a principle place because of its using for preparing lot of foods.

Potato is irreplaceable for preparing diet food. By industrial processing, potato can dehydrates and in this form it is easier for keeping and transporting. In the food industry it is using for preparing flour, mashed, fries etc. It is also used by many other industries for getting alcohol, starch, glucose, doctrines, and maltose. Potato is widely used in the conservatory and pharmacy industry (Lazić, 1990).

In the livestock nutrition it has great importance for dairy and fattening livestock.

Potato is an excellent pre-culture for all the cultures, especially for the cereals. After potato harvesting, soil stay clean and loose (Maksimoviħ and Jain, 1996). This makes it suitable for preparation and sowing of autumn crops. Potato is root vegetable that is characterized with big nutrition value. Potato is one of the richest sources of starch, minerals and fiber. Its contain vitamins A, C and B6, minerals as well as: iron, manganese, copper and potassium (Đinović, 1989).

The aim of our explorations is to determine the influence of foliar fertilizing with liquid organic fertilizers on potato yield grown in Strumica region.

Material and Methods

In the Strumica region, in the vicinity of the village Kuklis during the years of 2011 and 2012 was appointed field experiment in the protected space of 96 m^2.

Material of work was potato cultivar *carrera*. This is early cultivar and its vegetation period is 95-100 days. The tubers have right globular oval form. The experiment was set in 12 rows. The tests included 4 variants and 3 repetitions. Seeding was obtained in raw spacing of other 60 cm and between plants 20 cm. The rows had 20 m length. In each variant and repetition were included in 100 plants and total for the whole experiment had 1200 plants. The experiment was set in terms of watering. During the potato vegetation period were applied all basic agricultural measures.

Variants in the experiment were:
1. Control (no-fertilizing);
2. Humusil;
3. Humustim;
4. Ingrasa mant.

Each variant was treated foliar with 0.4% solution of the tasted fertilizers. The application of fertilizers was done with hand spray, by spraying the played leaves. The treatments were made in the evening hours. During the vegetation were conducted seven foliar treatments.

Three types of fertilizers were used:
- Humusil: (organic matter 1.86%, organic carbon 1.08%, humic acid 0.14%, N 224 mg /L, P_2O_5 71 mg /L, K_2O 1024 mg /L, CaO 180 mg /L);
- Humustim: (organic matter 58.63%, dry matter 12.38%, humic acids 20.40%, fulvi acids 2.15%, N 3%, P_2O_5 1.02%, K_2O 7.92%, Ca 3.70%, Mg 1.03 %);
- Ingrasa mant: (N 0%, P_2O_5 130 g/L, K_2O 130 g/L, ME in helate form, plant extracts 0.005 g/L).

The harvesting was carried out in the full maturity of the potatoes separately by variations and repetitions.

Before setting up the experiment soil samples were taken for agrochemical and analyses were performed on the following parameters:

- pH value determined potentiometric with pH meter (Bogdanović, et al., 1966);
- Content of easy available nitrogen – chosen by method of Tjurin and Kononova;
- Content of easy available phosphorus – chosen by AL method and reading of spectrophotometer (Bogdanović et al., 1966);
- Content easy available potassium – chosen by AL method and reading of spectrophotometer (Bogdanović et al., 1966);
- Content of carbonates–chosen with Schaiblerov Calcimeter (Bogdanović et al., 1966).

Results

For getting high and quality potato yields it is necessary favorable soil and climatic conditions.

The best potato yields are getting in deep sand and loose soil rich in readily available nutrients. The optimal soil pH value for potato is weakly acidic from 6.0 till 6.5.

Potato requires high soil permeability because tubers are deformed by compact soils. Potato requires good soil drainage. Waterlogged soil leads to numerous physiological changes in tuber that become watery and difficult to store. For successful cultivation of potatoes of great importance is the presence of organic matter improves soil structure and water capacity (Lazić et al., 2001).

In Table 1 are given the results of the soil agrochemical analysis before setting up the experiment.

Table 1. Agrochemical soil analysis

No.	Tag	Deep (cm)	pH		Available forms (mg/100 g soil)			CaCO₃ (%)
			H_2O	KCl	N	P_2O_5	K_2O	
1	Potato I	0-20	7.35	6.75	8.30	20.70	25.20	/
2	part	20-40	7.40	6.70	8.10	21.30	24.80	/
Average		0-40	7.37	6.72	8.20	21.00	25.00	/
3	Potato II	0-20	7.43	6.80	8.15	22.00	22.80	/
4	part	20-40	7.40	6.85	8,10	20.30	25.70	/
Average		0-40	7.41	6.82	8.12	21.15	24.25	/

From the data in the table it can be concluded that soil which is set experiment has a neutral pH, and good fertility with the available nitrogen, phosphorus and potassium. There is no presence of carbonates.

In Table 2 are given the results for obtained yield in different varieties.

Table 2. Average potato yield 2011/2012

Variant	Total yield per variant (kg)	Average per plant (kg)	Yield (t ha⁻¹)
1	114.90	0.383	47.87
2	121.50	0.405	50.62
3	126.90	0.423	52.87
4	131.10	0.437	54.62

LSD (0.05) = 2.403
LSD (0.01) = 3.497

Discussion

From the data obtained can be concluded that foliar fertilizing with liquid organic fertilizers had a positive influence on potato yield achieved. In all of the variants with different organic fertilizers was obtained higher yield compared with control (no-fertilizing) variant. The higher yield (54.62 t ha⁻¹) was obtained in variant 4 where the treatments were made with organic fertilizer Ingrasa mant: N 0%, P_2O_5 130 g/L, K_2O 130 g/L, ME in helate form, plant extracts 0.005 g/L.

The lowest yield (47.87 t ha^{-1}) was determined in control (no-fertilizing) variant. The differences in achieved potato yield between separated variants were small. The positive foliar influence of used organic fertilizers on potato yield is due to their chemical composition. The presence of micro elements in the analyzed fertilizers has a great influence on the regular growing, development and potato yield (Gramatikov, 2005). This elements has an influence on numerous physiological – biochemical processes that has a vital meaning on culture vegetation cycle. Balanced nutrition plays a significant role in increasing crop production and its quality and presents an essential component of nutrient management (Panayotova et al., 2014).

Obtained results in all of the variants with different organic fertilizers are statistically significant at LSD (0.05) level, but in the variants 3 and 4 the statistically significance is at LSD (0.01) level.

Conclusion

After the following of foliar fertilization with different liquid, organic fertilizers on potato yield the following conclusions can be made:

▪ the soil where the experiment were setting had a good fertility with nitrogen, phosphorus and potassium;

▪ foliar fertilization had achieved positive effects at all variants with different organic fertilizers compared with control variant;

▪ the highest yield of 54.62 t ha^{-1} of potato was determined in variant treated with organic fertilizer Ingrasa mant: (N 0%, P_2O_5 130 g/L, K_2O 130 g/L, ME in helate form, plant extracts 0.005 g/L);

▪ The results in all variant are statistically significant at the level LSD (0.05), and the results in variants 3 and 4 are statistical significance on the level LSD (0.01).

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Characterization of Stomatal Sensitivity to Water Deficits of Several Apple Genotypes

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Abstract

Climate changes and increases in air temperature pose a considerable threat to fruit growing. In view of such forecasts, selection and breeding for resistance of to high temperature and drought has received particular impetus. Among the various approaches used, selection of drought tolerant genotypes is a major area of efforts. Because of the central role that stomata have in the control of water loss, many efforts have concentrated on the use of stomatal characters in breeding for drought tolerance. Among these stomatal characters is stomatal response, selecting a genotype that is effective in closing its stomata in response to drought. Using a model based on a parameterized Penman – Monteith equation for stomatal conductance we have characterized the stomatal response of several apple cultivars. The experimental set up consisted of several saplings of three apple cultivars on the same rootstock on which a series of sap flow sensors were installed combined with a meteorological station. The results show a change in stomatal behaviour, in particular stomatal closure, due to increases of vapour pressure deficit. Another advantage is that the model can be used to screen germplasm collections or for trait breeding for many fruit tree species.

Keywords: Stomatal conductance, transpiration, apple, selection, drought tolerance

Introduction

Apple growing has been of great relevance compared to other species and is, perhaps except for olive and grape production (Spornberger et al., 2013), the most important fruit in Albania (Kullaj and Thomaj, 2013). To benefit from the advantages of earliness and vicinity to the markets of main cities, there is a growing trend of cultivating it in the Western Plain, outside of its typical and optimal areal of cultivation, the Central- and North-Eastern (Domi et al., 2014).

Temperature and therefore transpiration increases associated with climate changes have already affected the agricultural production in Mediterranean countries, including Albania. Furthermore, temperature increases by 1.5°C in the next decades in Albania as forecasted, constitute a challenge to sustainable fruit production, which considers also water usage. Under such scenario, selections of drought resistance traits are imperative (Thoma and Kullaj, 2014). Among the rich apple germplasm of Albania (Kullaj, 2006) it is possible to find genotypes less sensible to drought but their screening requires a fast method. The research presented here describes a model of transpiration based on sap flow.

In this new areal and under such climatic scenario, apple trees are subjected to high levels of radiation and temperatures, therefore multiple climatic stresses, affecting their carbon balance and therefore productivity (Kullaj and Thomaj, 2013). According to Jones 2014, the effects of individual factors such as radiation, temperature, humidity or leaf water status on stomatal conductance can be studied best in controlled environments or leaf chambers where each factor may be varied independently. However, the use of this information to predict the stomatal conductance in a natural environment is complicated by various factors.

Stomata are sensitive to plant water status, tending to respond in such a way as to minimize imposed changes in the balance between water supply and evaporative demand. The hypothesis that leaf conductance could respond directly to soil water status was tested further by pressurizing the root system to maintain pressure in the xylem at zero (thus maintaining the leaf cells fully turgid), as soil was allowed to dry (Gollan et al., 1986).

A number of empirical models have been proposed to describe stomatal behavior in the field. It is difficult to determine stomatal responses from measurements in the field. Although the basic mechanisms involved in the control of stomatal aperture are increasingly difficult to stimulate stomatal behavior in the field (Jones, 2014).

Materials and Methods

Four local apple genotypes, namely 'Zheji' (Sl#01), 'Gjeçe'(Sl#02), 'Bardhe' (Sl#03), 'Kumardha' (Sl#04) and were collected from the Fruit Germplasm Collection at the Didactical and Experimental Enterprise of the Agricultural University of Tirana. These local varieties have been phenotypically described and are known to have a different degree or drought sensitivity (Kullaj, unpublished). For the drought experiment, young trees (~1 m tall) propagated by shoot proliferation were grown for several weeks. A simulated moderate-severe drought was imposed by withholding water until the pots reached 40% of full saturation and maintained for 2 weeks at this level. Using a fast modeling approach based on parameterized Penman – Monteith (PM) equation we calculated the daily transpiration dynamics in real–time. Details of the modelling procedure and equations have been described elsewhere (Kullaj et al. 2014b). The method is based on diurnal courses of variables instead of commonly used daily means (Kullaj, et al. 2014a) and a different evapotranspiration formula describing the influence of vapour pressure deficit (VPD) to stomata closure and the parameterization process (Lohammar, 1980) is performed as a direct non–linear multi–regression analysis of P–M equation (Kullaj 2013a, b) to radiation (R) and VPD.

$$E = \frac{\left(\Delta.(R_n - G) + \rho c_p D g_a\right)/\lambda}{\Delta + \gamma.(1 + \frac{g_a}{\frac{R_g}{R_g + R_o} \cdot g_{\lim}(0.5 - \frac{1}{\pi} arctg(\frac{D}{a} - b) + g_{\min}})}$$

The use of diurnal courses was enabled by sap flow (SF) data measured using sap flow sensors EMS 62 (EMS Brno), based on SHB (stem heat balance) method (Lindroth et al. 1995; Čermak et al. 2004). Sensors were installed on shoots (12 mm thick) on the stem of 9 saplings, 3 for each genotype. The measuring interval was every minute with 1 s warm-up and storing interval every 15 minutes during the hottest period. A portable meteorological station Minikin RTHi (EMS Brno, CZ) measured the radiation (R), air temperature (Ta) and humidity of air (RH). Atmospheric vapour pressure deficit (VPD) was calculated from vapour pressure and relative humidity. Plants were subject to water stress (high radiation and temperature). Plants were subjected to a dry period followed by full irrigation to evaluate their ability to recover. Soil water potential values were reduced to 1,5 MPa.

Results

The weather during the study period has been relatively stable (Figure 1) with few rain events but partly cloudy weather which enabled us to apply a water deficit for part of the study period, sufficient to create a stress condition.
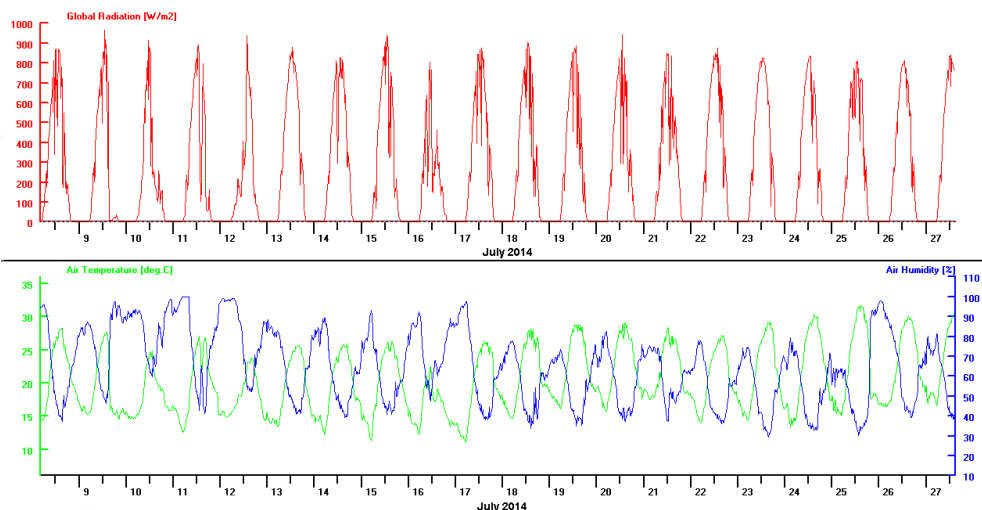

Figure 1. Meteorological variables during the period of study

Global radiation reached maximum values of 964 W m^{-2}. The temperature regime has been relatively stable with a minimum of 10.9°C and maximum 31.7°C (std. dev. 4.8°C). Air humidity has been also relatively stable but rather low, with a minimum of 29.5°C and average 65%, only occasionally reaching 100%, therefore the refilling of xylem vessels could have been partial.
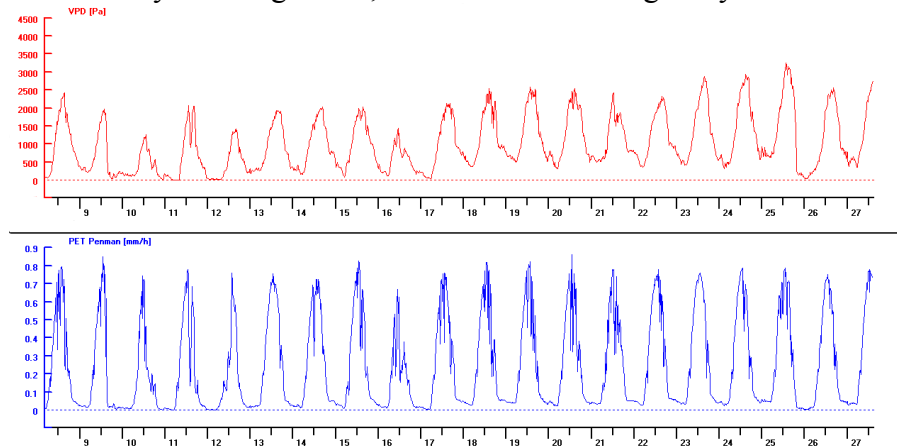

Figure 2. Vapour pressure deficit (VPD) and potential evapotranspiration (PET) during the study period. VPD drives the transpiration and canopy conductance.

The levels of leaf–to–air vapour pressure deficits shows a gradual increase with the progressing of the season with an average of 1 kPa and maximum values above 3 kPa (3245 Pa).
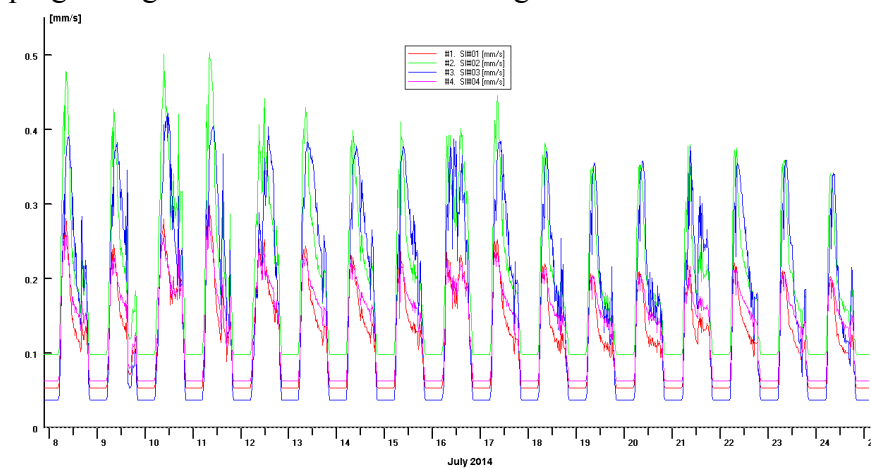
Figure 3. Canopy stomatal conductance of different selections during a period of measurement
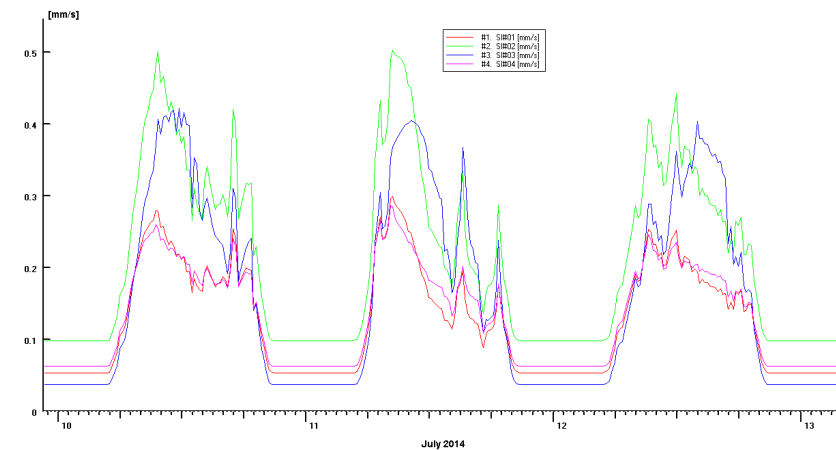

Figure 4. Changes in diurnal patterns of canopy stomata conductance of selected days

If we examine Figure 4, we see that according to the model, with increase of VPD there is a gradual reduction in g$_c$ until stomata close.

Discussions and Conclusions

Stomata respond directly to light and for apple there is a light saturation at about one tenth of full sunlight and consequently, the light requirement for stomatal opening is lower than the light effect on photosynthesis even in shaded positions within the canopy (Lakso, 1994). Therefore, considering the radiation levels in Figure 1 there should be no limitation of stomata opening from the light. However, it is interesting to notice the there is a change in stomata opening between the three genotypes under study. This change can be explained with long – term adaptations of these genotypes. Contrary to the belief that leaf water potential (Ψ_l) was the primary regulator of stomata, the active osmotic adjustment in apple leads to the interpretation that turgor potential (Ψp) instead regulates stomatal closure (Lakso et al., 1984; Goode et al., 1973; Fanjul and Rosher, 1984) at variable Ψ_l. The mirror diurnal pattern between air VPD to that of g_s (Figure 4), thus a high correlation is found between them is found by other authors (Watson et al., 1978; Thorpe et al., 1980; Warrit et al., 1980; Fanjul and Jones, 1982; Lakso, 1994) although there are times which contradicts this conclusion (Lakso, 1983; 1994).

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Stomatal Response Kinetics in Various Apple Cultivars Under a High Radiation Environment

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Abstract

Perhaps the most consistent and well-documented stomatal response is the opening that occurs in most species as irradiance increases. Maximum aperture is usually achieved with irradiances greater than about a quarter of full summer sun. The rate of stomatal response to changing light is a variable, though closing responses tend to be more rapid than opening. The present research sought to investigate the stomatal response kinetics of various apple cultivars. We selected three apple cultivars, namely Golden Delicious, Gala and Pink Lady with different ecophysiological characteristics planted as young saplings under a high radiation location in Western Plain of Albania. Using a model based on a parameterized Penman – Monteith equation for stomatal conductance we have assessed the stomatal kinetics, especially stomatal opening. We have used diurnal courses of variables instead of commonly used daily means bringing more details to the analysis of stomatal response. The results showed that the cultivars changed in their behaviour to stomatal opening in terms of photon flux density and especially closure to increasing vapour pressure deficit. The model could be used for assessing the genotype–to–environment interactions especially in relation to the stomatal response to abiotic factors as well as a proxy physiological marker in selection for resistance.

Keywords: Stomatal kinetics, genotype–to–environment interactions, apple

Introduction

Apple (*Malus domestica* Borkh.) is one of the most important fruit species cultivated Eastern Albania (Kullaj et al., 2014a), particularily in Southern Highlands and Northern and Central Mountains agro–ecological zones. In the last decade apple orchards are also disseminated in the Western Lowland agro–ecological zone, under a high radiation and temperature regime (Domi et al., 2014), where the actual Heliothermal Index (Hughlin, 1978) is between 2400 – 3000 and in some sites even more than 3000 (Kullaj et al., 2013a). Temperature increases by 1.5°C in the next decades forecasted for Albania (Sutton et al., 2013) will raise the transpiration demand affecting both plant and soil water usage.

In this new areal and under such climatic scenario, apple trees are subjected to high levels of radiation and temperatures, therefore multiple climatic stresses, affecting their carbon balance and therefore productivity (Kullaj and Thomaj, 2014). In particular, we are interested in stomatal response because almost all the water transpired by plants, as well as the CO_2 absorbed in photosynthesis, passes through these pores (Jones 2014). Perhaps the most consistent and well – documented stomatal response is the opening that occurs in most species as irradiance increases (Shimazaki et al., 2007). Differently from what was believed until the early 1970s (Meidner and Mansfield, 1968), it is now clear that the stomata in many species close in response to increased leaf–to–air vapour pressure difference (VPD) (Jones, 2014) and tends to be greatest for temperate deciduous species (Franks and Farquhar, 1999).

Materials and Methods

Four local apple cultivars were used in this study are 'Golden Reinders' (Gold), 'Royal Gala' (Gala) and 'Pink Lady' (Pink), which are also the main cultivars in Western lowlands (Kullaj and Thomaj, 2014). Young trees (~1 m tall) propagated by shoot proliferation were grown for several weeks in 2012. A simulated moderate-severe drought was imposed by withholding water until the pots reached 40% of full saturation and maintained for 2 weeks at this level.

Using a fast modeling approach based on parameterized Penman – Monteith (PM) equation we calculated the daily transpiration dynamics in real–time. The details of the modelling

procedure and equations have been described elsewhere (Kullaj et al. 2014b). The method is based on diurnal courses of variables instead of commonly used daily means (Kullaj, et al. 2014a) and a different evapotranspiration formula describing the influence of vapour pressure deficit (VPD) to stomata closure and the parameterization process (Lohammar, 1980) is performed as a direct non–linear multi–regression analysis of P–M equation (Kullaj 2013b,c) to radiation (R) and VPD.

$$E = \frac{(\Delta.(R_n - G) + \rho c_p D g_a)/\lambda}{\Delta + \gamma.(1 + \cfrac{g_a}{\cfrac{R_g}{R_g + R_o} \cdot g_{\lim}(0.5 - \cfrac{1}{\pi} arctg(\cfrac{D}{a} - b) + g_{\min}})}$$

The use of diurnal courses was enabled by sap flow (SF) data measured using sap flow sensors EMS 62 (EMS Brno), based on SHB (stem heat balance) method (Lindroth et al. 1995; Čermak et al. 2004). Sensors were installed on shoots (12 mm thick) on the stem of 9 saplings, 3 for each genotype. The measuring interval was every minute with 1 s warm-up and storing interval every 15 minutes during the hottest period. A portable meteorological station Minikin RTHi (EMS Brno, CZ) measured the radiation (R), air temperature (Ta) and humidity of air (RH). Atmospheric vapour pressure deficit (VPD) was calculated from vapour pressure and relative humidity. Plants were subject to water stress, beside others (high radiation and temperature). Plants were subjected to a dry period followed by full irrigation to evaluate their ability to recover. Soil water potential values were reduced to 1,5 MPa.

Results and Discussions

The weather during the study period has been relatively stable (Figure 1) with no rain events which enabled us to properly maintain a uniform daily transpiration and photosynthesis, therefore, stomatal movements.
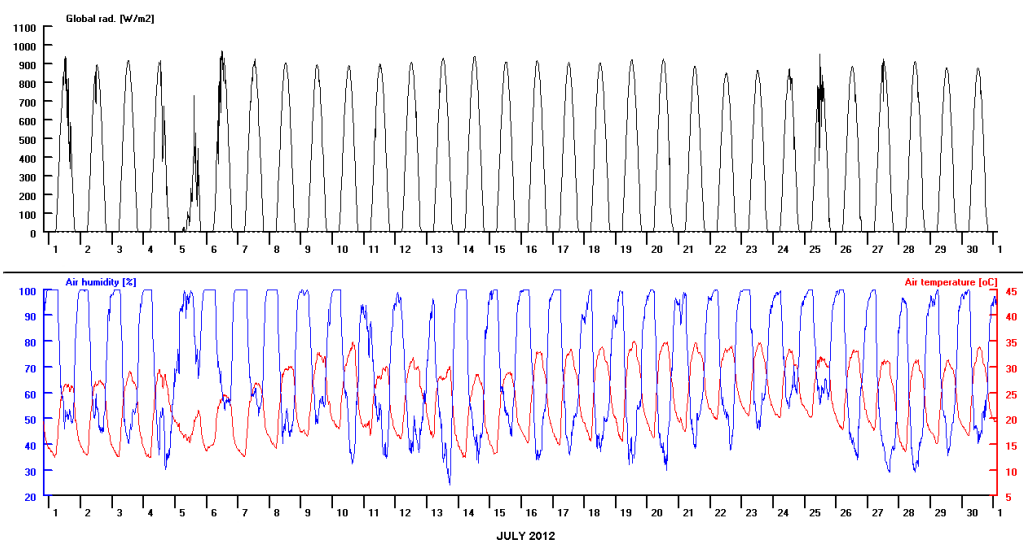

Figure 1. Meteorological variables during the period of study (July 2012)

Global radiation reached maximum values of 950 W m^{-2}. The temperature regime has been relatively stable with a minimum of 13.9°C and maximum 34.7°C (std. dev. 6.5°C). Air humidity has been also relatively stable but rather low, with a minimum of 14.5°C and average 73%, frequently reaching 100%, therefore enabling refilling of xylem vessels.

The levels of leaf–to–air vapour pressure deficits shows a steady high level during the measuring period with an average of 2.8 kPa and maximum values just above 4 kPa.

Figure 3 shows a change in the value of maximum aperture depending on the cultivar but also on the natural radiation environment. Although the model shows an average response for the

entire canopy, stomata on shade–grown leaves open at lower light levels than do those on sun – adapted leaves. Furthermore, the kinetics of response are not particularly important since he light is not changing rapidly as it happens with the lower part of the canopy which receives sunflecks rather than full sun. The conductance – irradiance relationship doesn't show hysteresis because the light is not altered and there is sufficient time for complete equilibrium.
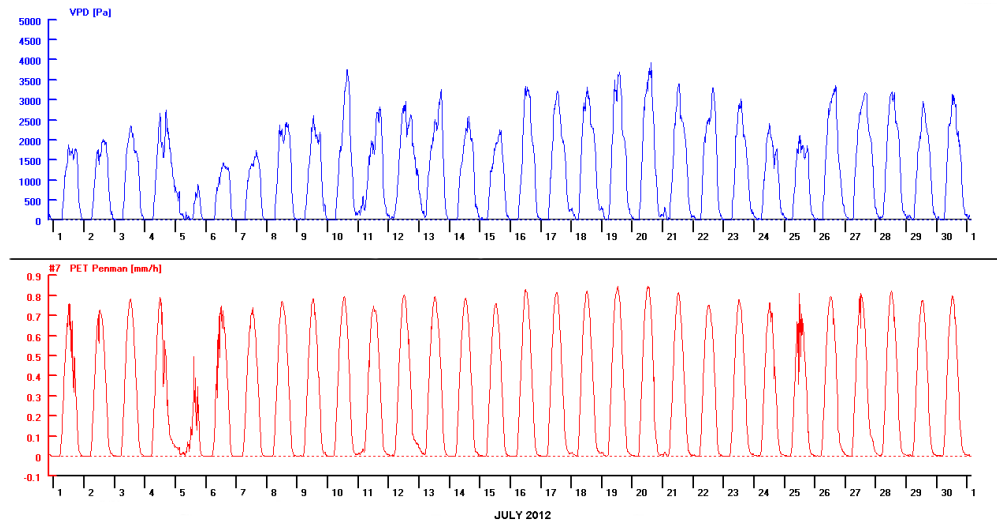

Figure 2. Vapour pressure deficit (VPD) and potential evapotranspiration (PET) during the study period. VPD drives the transpiration and canopy conductance and, in particular, is responsible for stomata closure.
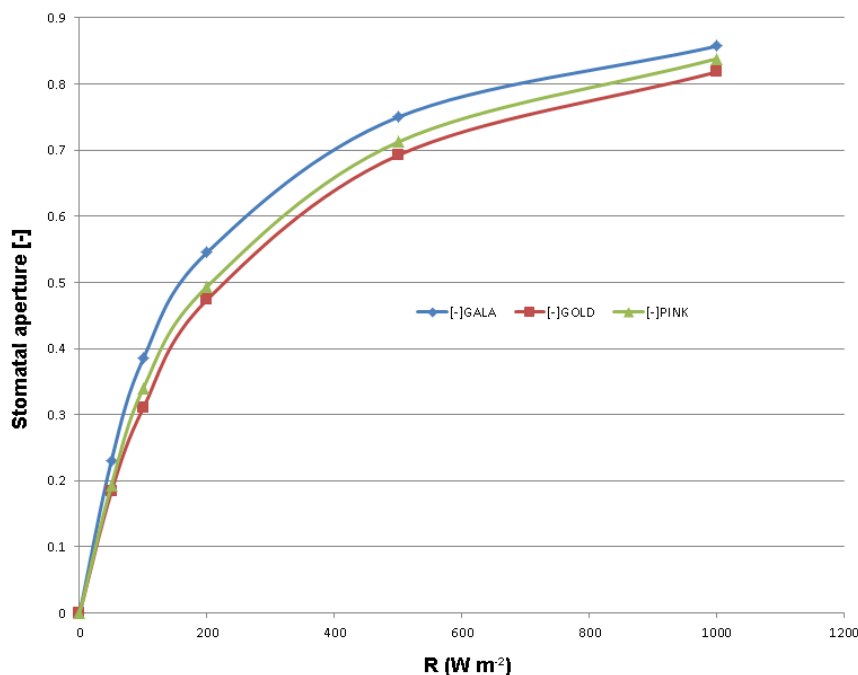

Figure 3. Stomata opening in relation to radiation showing differences in cultivars in relation to minimum radiation level for stomata opening and saturation levels.

Figure 4 shows that there is a bigger difference between cultivars in terms of stomatal closure. Changes are both in terms of absolute values but also in terms of behavior, especially 'Pink Lady'. Although the humidity response frequently takes minutes to reach full expression, it has been reported for apple leaves that as much as 90% of the total stomatal response to an increased VPD can occur within 20 s of the humidity change (Fanjul and Jones, 1982).

Conclusions
Using this fast modeling approach based on parameterized PM equation we showed that the

cultivars changed in their behaviour to stomatal opening in terms of photon flux density and especially their closure to increasing vapour pressure deficit. The model could be used for assessing the genotype–to–environment interactions especially in relation to the stomatal response to abiotic factors as well as a proxy physiological marker in selection for resistance.
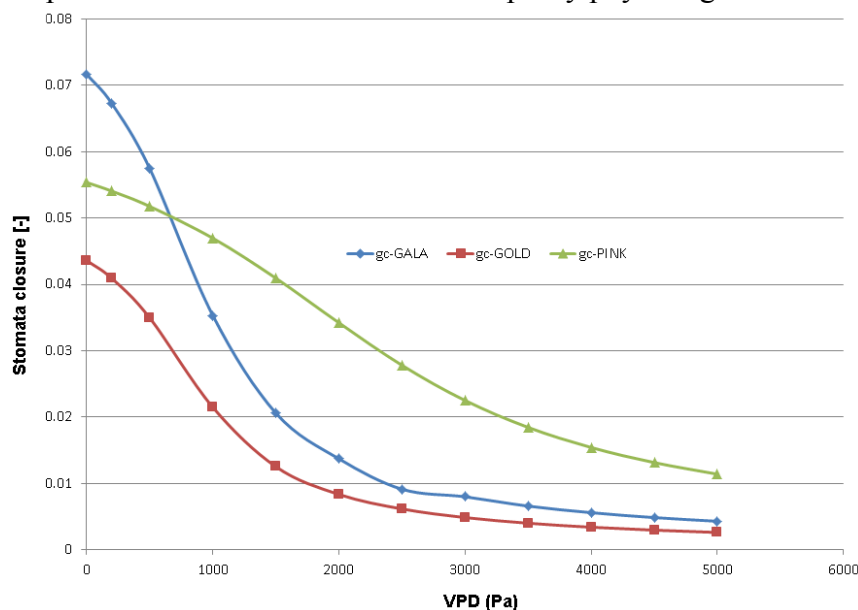

Figure 4. Stomatal closure in relation to increase of vapour pressure deficit showing differences in cultivars both in terms of values and behaviour

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An Investigation of Determination for Correlation of Yield and Yield Component in Peanut

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Abstract

This study was conducted during 2005-06 growing season to assess performance of peanut in Cukurova Region. The objective of this study was to explore the extent of the yield and yield components correlations at *NC-7 Peanut variety*. The yield of peanut crop depends on not only breeding of adapted varieties from different ecological conditions and cultivation applications, but also yield and yield components.

In this research, of which field experiments were layout as to *NC-7 Peanut Variety* in Cukurova region, positive correlation between pod yield and 100 seed weight (0.871), 100 pod weight (0.789), pod yield per plant (0.696), internal ratio (0.858); weight of second quality pod (0.700) and ratio of oil (0.842) was concluded, while there exists negative correlation between pod yield and number of pod per plant. Our results provide an initial step toward the identification of peanut varieties that may be useful for the development of high-quality peanut cultivars.

Keywords: NC-7, peanut, variety, correlation

Introduction

Peanut is one of the most important and economical oilseeds in tropical and subtropical regions which is mostly grown due to its oil, protein and carbohydrates (Panhwar, 2005). It is an annual shrub of *Leguminosae* family and *Arachis genus* which has a main straight root (Panjtandoust, 2008). The peanut seed is rich in edible oil and contains 43-55% oil and 25-28% protein (Maiti and Ebeling, 2002).

Cultivated peanut (*Arachis hypogaea L.*) is highly self pollinated, allotetraploid annual legume with 2n = 40. There are 4 different market types of peanut, namely spanish, virginia, runner, and valencia, and the majority of varieties grown in Turkey are Virginia type. Peanut is widely grown in more than 80 countries of America, Africa, and Asia (Pearman, 2005). Peanut is native to South America, probably from a region including central Brazil and Paraguay. Spanis explorers took peanuts to Europe (Pearman, 2005); however, our knowledge is limited as to how and when the peanut was introduced in Turkey, although it was first cultivated in the Thracian region (Arıoğlu et al., 2003; Arıoğlu, 2007).

Peanut breeding was initially started by Akdeniz Agricultural Research Station in Antalya by collecting local land races from different areas and cultivars such as Com and Gazipaşa were developed through the single plant selection method (Arıoğlu, 2007). Later peanut germplasm introduced from abroad was used for breeding some peanut varieties such as NC-7 and Florspan through the same institute (Ceşit Kataloğu, 2008).

Peanuts have many uses. They can be eaten raw, used in recipes, made into solvents and oils, medicines, textile materials, and peanut butter, as well as many other uses. Peanut butter has been a tradition on camping trips and the like because of its high protein content and because it resists spoiling for long periods of time, the primary use of peanut butter is in the home. Large quantities are also used in the commercial manufacture of sandwiches, candy, and bakery products. Peanut seeds have a protein content of 24 to 36% on a dry weight basis. Peanut protein does not contain significant amounts of any intrinsic anti-nutritional factor among the vegetable proteins, which makes it a relatively inexpensive source of protein for human consumption (Prakash et al., 1986). Peanuts are a good source of niacin, and thus contribute to brain health and blood flow. There are carbonhidrat about % 18 in peanut. While peanuts are used in a wide

variety of other areas, such as cosmetics, plastics, dyes and paints, peanuts meal is used in forage and food industry (Arıoğlu, 1999).

Thousands of peanut cultivars are grown, with four major cultivar groups being the most popular: Spanish, Runner, Virginia, and Valencia. Certain cultivar groups are preferred for particular uses because of differences in flavor, oil content, size, shape, and disease resistance. Virginia type peanuts are the best all-around choice for both boiling and roasting. There are numerous varieties of each type of peanut. There are two main growth forms, bunch and runner. Bunch types grow upright, while runner types grow near the ground. Virginia type peanuts have high yield and excellent flavor. Large-seeded Virginia type. *NC 7* delivered higher yields across Queensland (approx. 20% better than 'Virginia Bunch'). As well as being more broadly adapted than Shulamit, *NC 7* had outstanding kernel quality. The yield of peanut crop depends on not only breeding of adapted varieties from different ecological conditions and cultivation applications, but also yield and yield components.

The objective of this study was to explore the extent of the yield and yield components correlations at *NC-7 Peanut variety*.

Material and Methods

This study was conducted during 2005-06 growing season to assess performance of peanut in Cukurova Region at *NC-7 Peanut variety*. *NC-7 variety* has medium maturity. The seed of *NC 7* is larger than the other types. The yield potential with good grades. Variety was grown in a randomised complete block design with three replications. The experimental plots consisted of one row of 4 m length with inter- and intra-row spacing of 70 and 12 cm, respectively. Seeds were sown in a row by hand. Before being planted, 30 kg da^{-1} nitrogen (N), 30 kg da^{-1} phosphate (P_2O_5), and 30 kg da^{-1} potassium (K_2O) fertilization were provided by applying of 15-15-15 fertilizer in the field. Second nitrogen (N) 10 kg da^{-1} was provided by ammonium nitrate (33%) at blooming. Irrigations were applied to plots during the growing period with furrow irrigation five times. Weed control was controlled and done generally by hand when necessary. Harvest was done in October 2005. During growth, measurements of pod yield (kg/da), 100 seed weight (g), 100 pod weight (g), pod yield per plant (g/plant), number of pod per plant (number/plant), internal ratio (%), weight of first quality pod (%), weight of second quality pod (%) and ratio of oil (%) were made.

The characteristics of the experiment soil are given in Table 1. The soil of the experiment area is an alkaline and loamy soil type with pH 7.68. The soil has a low salt ratio and low organic matter.

Table 1. Physicochemical characteristics of experimental soils

pH	7.68	P_2O_5 (kg/da)	4.43
Salinity (%)	0.043	K (ppm/da)	272
Cu (ppm)	1.229	Org. Mat. (%)	1.66
Fe (ppm)	11.238	NH_4 (kg/da)	1.73
Zn (ppm)	0.647	NO_3 (kg/da)	1.70
Mn (ppm)	7.848	N (kg/da)	3.18

The data were statistically analyzed using a standard analysis of variance technique for a randomized block design using TARIST software (Açıkgöz et al.. 1994) and MSTATC (Version 1.4. Michigan State University. Ann Arbor. MI. USA) statistical program.

Results and Discussion

This study was conducted to investigate relationships among some characters affecting yield and yield components in *NC 7* variety and determine direct effects of these characters on yield and yield components. It was shown that there was no significant relationship (0.05) between 100 seed weight and weight of first quality pod while there was statistically significant relationships (0.05) positive correlation between 100 seed weight and 100 pod weight; 100 pod weight and pod yield per plant; 100 pod weight and weight of second quality pod were found.

Moreover significant relationship (0.01) between 100 seed weight and ratio of oil; 100 pod weight and ratio of oil were found.

Table.2. Yield and Yield Components Correlations at *NC-7 Peanut Variety*

The characters of evaluated	100 seed Weight	100 pod Weight	Pod yield per plant	Number of Pod per plant	Int. ratio	Weight of first quality Pod	Weight of sec. quality Pod	Ratio of oil
Pod yield	0.871	0.789	0.696	-0.630	0.858	-0.755	0.700	0.842
100 seed Weight		0.989*	0.959	-0.167	0.494	-0.980*	0.961	0.998**
100 pod Weight			0.990*	-0.021	0.361	-0.999**	0.991*	0.996**
Pod yield per Plant				0.119	0.228	-0.996**	1.000**	0.973
Number of Pod per plant					0.940	-0.033	0.113	-0.112
Internal ratio						-0.311	0.234	0.446
Weight of first quality Pod							-0.997**	-0.989*
Ratio of oil								0.975*

(*: 0.05 ; ** 0.01)

Conclusion

In this research, of which field experiments were layout as to *NC-7 Peanut Variety* in Cukurova region, positive correlation between pod yield and 100 seed weight (0.871), 100 pod weight (0.789), pod yield per plant (0.696), internal ratio (0.858); weight of second quality pod (0.700) and ratio of oil (0.842) was concluded, while there exists negative correlation between pod yield and number of pod per plant. Our results provide an initial step toward the identification of peanut varieties that may be useful for the development of high-quality peanut cultivars.

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Efficient Use of Soil and Water Resources in Isparta-Turkey

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Abstract

The efficient use of soil and water resources, which are among the limited natural resources, is of extreme importance for sustainable agriculture and sustainable irrigation. The resources concerned must be efficiently used particularly in the areas with high potential for agricultural production. Isparta is a province with high potential for agriculture that allows growing many products thanks to its climate and ecological features. The total agricultural land in the province is 251,286 ha. The quantity of land opened for irrigation is 108,870 ha.

In this study, the studies for the development of agricultural infrastructure in the province were examined; the large irrigation schemes were evaluated by means of such indicators as irrigation ratio, irrigation efficiency, and water supply ratio; and solutions were proposed.

Keywords: Water resources, irrigation ratio, irrigation efficiency, Isparta.

Introduction

In terms of the level of development, Isparta ranks forty-first among the 81 provinces in Turkey. A significant share of the population lives in the rural area (43%) and works in the agricultural sector (55%) in Isparta province. Horticulture, animal production, field crops, and vegetable growing are the major agricultural activities in Isparta (Bozkurt et al., 2013). With its geographical and ecological features, Isparta is in the top ranks in Turkey especially in apple and rose flower production. The maximization of yield in agriculture in the province depends on carrying out land consolidation – an activity to organize the rural infrastructure – besides the intensive use of technological production factors such as irrigation, fertilization, the use of seeds of good quality, and mechanization in agriculture. The on-time and efficient use of technological production factors and their collective performance will also allow the enhancement of workforce and energy efficiency in the rural area. To determine whether the investments in rural areas have reached their targets, these investments should be monitored and evaluated in specific periods.

The investments regarding the soil and water resources in Isparta were evaluated and the water supply ratios of large irrigation schemes for 2013 were examined in this study.

Material and Method

The agricultural lands of Isparta were considered the study area, and the irrigation schemes of Isparta were considered the material. Isparta is located between 37°18'-38°30' northern latitudes and 30°20'-31°33'eastern longitudes. The water resources of the study area are Lake Egirdir, Lake Beysehir and the Uluborlu Dam. Data about the agricultural infrastructure were collected from the State Hydraulic Works (SHW), the Provincial Directorate for Agriculture, the Special Provincial Administration, and the obsolete Directorate General for Rural Services (DGRS). The following equations were utilized to calculate the irrigation ratios, irrigation efficiency, and water supply ratios of the irrigation schemes in the study. (IR: Irrigation ratio; IA: Irrigation area; TA: Total irrigable area; IE: Irrigation efficiency, RW: Required irrigation water; DW: Diverted irrigation water; WSR: Water supply ratio)

$$IR = \frac{IA}{TA} \times 100; \qquad IE = \frac{RW}{DW} \times 100; \qquad WSR = \frac{DW}{RW} \times 100$$

Results and Discussion

Soil and water resources of Isparta

The total area of Isparta is 897,313 hectares. Of this area, 251,286 ha (28.12%) were classified as agricultural lands, 372,597 ha (41.70%) as forestland, 17,010 ha (1.90%) as pasture land, 67,394 ha (7.54%) as the water surface, and 189,026 ha (20.71%) as other lands according to the investigation reports by the obsolete DGRS and SHW. Of 251,286 ha of agricultural lands, 195,700 ha were determined as irrigable lands according to the investigation reports by the obsolete DGRS and SHW. Some 108,870 ha of the irrigable lands had been opened for irrigation by 2014. Of this area, 21,184 ha were opened for irrigation by the obsolete DGRS and the Special Provincial Administration (Underground irrigation Surface irrigation, and Pond irrigation) and 69,468 ha were opened for irrigation by the DSI. The remaining 18,218 ha of it are the areas that the people opened for irrigation with their own possibilities, which is expressed as public irrigation applications. The mean actual irrigated area between 2009 and 2013 by the DSI was 21,271 ha and the mean irrigation ratio in the same years was 36%. The mean irrigation efficiency of the large irrigation schemes opened for irrigation by the SHW between 2002 and 2013 was 44%.

Table 1. The areas opened for irrigation in Isparta and their characteristics (Anonymous, 2013a)

Institution/Organization which opened for irrigation	Gross Irrigation Area, (ha)	Net Irrigation Area, (ha)	Actual irrigated area (ha)	Irrigation Ratio, %	Irrigation Efficiency, %
The State Hydraulic Works	69,468	60,466	21,271***	36***	44****
The Obsolete DGRS/Special Provincial Administration	21,184	21,184*	21,184**	--**	-
Public Irrigation Applications	18,218	18,218*	18,218**	--**	-
TOTAL	108,870	99,868	60,673**	--**	-

*Since the net irrigation area was not detected in the cases of the obsolete KHGM/Special Provincial Administration and Public Irrigation Applications, the entire area opened for irrigation was evaluated as the net area. **As there is no indicator system concerning the monitorization of these irrigation applications and their ultimate evaluation in the cases of the obsolete KHGM/Special Provincial Administration and Public Irrigation Applications, the actual irrigated area cannot be known, as in the case of irrigation applications by the DSI. Therefore, the figure of gross area was used in these irrigation applications instead of the actual irrigated area. These figures are not measurement values. ***The mean value for 2009-2013. **** The mean value of the large irrigation schemes for 2002-2013.

The SHW transferred 9 of the large irrigation schemes which it had opened for operation to the Irrigation Unions [(Atabey, Yılanlı-Aksu, Boğazova, Gelendost, Hoyran, Senirkent, Şarkikaraağaç, Yalvaç, and Yenişarbademli), Total number of members: 17,097], 2 of them to the irrigation cooperative (Barla and Yukarıgökdere), and one of them to the Municipality (Uluborlu). The obsolete DGRS and Special Provincial Administration transferred almost all areas which they had opened for irrigation to the irrigation cooperatives. There are 67 irrigation cooperatives in the province in total. These cooperatives have a total of 13,014 members. To make the pressurized irrigation systems, whereby water could be used more efficiently, widespread in the province, totally 25 projects were provided with 75% grant support for infrastructure in an area of 3,339.3 ha by the MFAL (the Ministry of Food, Agriculture and Livestock). These projects were realized in the areas previously opened for irrigation by the obsolete DGRS/Special Provincial Administration and SHW. Some 623 ha of the same area were provided with 50% grant support for superstructure. Moreover, the parcel-based individual irrigation projects were provided with 50% grant support in an area of 58.7 ha. Within the scope of making pressurized irrigation systems widespread in the province, the pressured irrigation system was implemented in an area of 3,057 ha by the obsolete DGRS/Special Provincial Administration and in an area of 8,189 ha by the SHW. Therefore, the pressured irrigation system was implemented in a total area of 14,585 ha.

Within the framework of developing the soil resources, land leveling was performed in an area of 5,332 ha by the obsolete Rural Services and some 20 ponds were constructed again by the same institution. Erosion control dams were built for erosion control in the ponds of Çatak-Gönen and Kızıldere-Gönen out of these ponds. Terracing was carried out in 34 different places

by obsolete Topraksu within the framework of the soil protection study. Some 129 flood protection and sediment prevention facilities serving an area of 16,467 ha were constructed by the SHW. Furthermore, 9 Animal Drinking Water (ADW) ponds were built again by the obsolete Rural Services in those places where natural pasture animal husbandry was particularly performed intensively (Anonymous, 2013b).

Intra-field development services

In Turkey, land consolidation has been carried out in an area of 2,645,573 ha since 1961 (Anonymous, 2013d). According to the results of Agricultural Survey 2001, the mean enterprise size was 6.1 ha and the mean parcel size was 1.5 ha (TUIK, 2001). Isparta is one of the provinces in which one of the prototypical examples of land consolidation activities was performed in Turkey (1975, the Harmanören Project). The land consolidation project has been completed in a total area of 7,903 ha in the province since 1975, when the first land consolidation was carried out, and it is ongoing in an area of 2,128 ha. It was proposed to include a total area of 9,450 ha in 5 settlement units in the investment program in order to perform consolidation. The Provincial Directorate of the MFAL reported that land consolidation could be carried out in an area of 67,000 ha. According to the values by the Farmer Registration System, the mean enterprise size is 3.41 ha and the mean parcel size is 0.32 ha in Isparta (Anonymous, 2012). When these values are compared with the averages of Turkey, it is seen that the enterprise size is 44% smaller and that the parcel size is approximately 79% smaller. Raising the mean enterprise size and the mean parcel area at least up to the averages of Turkey can only be achieved thanks to land consolidation projects.

Water supply ratio

A water supply ratio between 1 and 1.5 indicates that the scheme is provided with adequate water (Nihal, 1992). In 2013, the water supply ratios ranged from 0.41 to 3.26 by scheme. Accordingly, less water than needed was provided in Aksu, Barla, Boğazova, and Uluborlu but more water than needed in Atabey, Şarkikaraağaç, Yenişarbademli, and Yalvaç in 2013. In addition, irrigation water as much as the schemes required was provided in Gelendost, Hoyran, and Senirkent. Given the mean water supply ratio of 1.39 on a scheme basis, it might be stated that about 40% more water was applied to all schemes. When all irrigation schemes were taken into consideration, it was found that the highest water supply ratio was in May (4.01) but the lowest water supply ratio was in October (0.82) on a monthly basis.

Table 2. The water supply ratios of the schemes in 2013 by month

Irrigation Schemes	Months						
	May	June	July	August	September	October	**Average**
Aksu	1.71	0.66	0.58	1.16	-	0.86	**0.99**
Atabey	9.78	2.54	1.53	1.46	1.01	-	**3.26**
Barla		1.14	0.91	0.79	0.42	-	**0.81**
Boğazova	0.53	1.02	0.93	0.38	-	0.78	**0.73**
Gelendost	-	0.59	1.25	1.38	1.25	-	**1.11**
Hoyran	-	1.78	0.78	1.24	1.76	-	**1.39**
Senirkent	-	1.19	1.52	1.39	0.96	-	**1.26**
Şarkikaraağaç	-	-	1.70	2.11	-	-	**1.91**
Uluborlu	-	0.23	0.37	0.69	0.35	-	**0.41**
Yenişarbademli	-	-	1.57	1.77	-	-	**1.67**
Yalvaç	-	1.66	1.58	1.87	1.69	-	**1.70**
Average	**4.01**	**1.20**	**1.16**	**1.30**	**1.06**	**0.82**	**1.39**

RWS was reported to range from 0.91 to 7.15 in 158 transferred irrigation schemes in Turkey by Degirmenci (2001). In addition, Kukul et al. (2008) reported it to range from 0.45 to 2.30 in the pre-transfer period, from 0.53 to 1.41 in the irrigation of the right bank, and from 0.49 to 1.36

in the irrigation of the left bank during the post-transfer period in the irrigation of Menemen. In the studies by the IWMI, the value concerned was in the range 0.41-4.81 (Molden et al., 1998). In the research by Uçar (2011) in the same region according to the data of 2004-2008, the highest water supply ratio was in the irrigation of Sarkikaraagaç (7.32) in 2007, followed by the irrigation of Yenisarbademli (5.62) in the year concerned. On the other hand, the lowest RWS was recorded in Uluborlu (0.60) in 2008.

Irrigation ratio and irrigation efficiency

The irrigation ratio defines the efficient use of the areas opened for irrigation, whereas irrigation efficiency defines the efficient use of water resources. The irrigation ratio values varied between 10% and 100%. The variability of the irrigation ratio values in a wide range is thought to result from the variability of plant patterns, agricultural techniques, and the culture of irrigated agriculture. The highest irrigation efficiency was in Uluborlu (94%), followed by Boğazova (65%), whereas the lowest irrigation efficiency was in Atabey (32%). This lowness in irrigation efficiency is thought to be due to the physical inadequacy of the schemes and the unavailability of measurement facilities and because the culture of irrigated agriculture was not fully established among the farmers.

Table 3. Irrigation ratios and irrigation efficiency in 2013

Irrigation Scheme	Irrigation Ratio, %	Irrigation Efficiency, %	Irrigation Scheme	Irrigation Ratio, %	Irrigation Efficiency, %
Aksu	35	32	Senirkent	47	47
Atabey	34	36	Şarkikaraağaç*	-	-
Barla	61	50	Uluborlu	78	94
Boğazova	100	65	Yenişarbademli	10	60
Gelendost	65	47	Yalvaç	16	39
Hoyran	58	45			

*Not evaluated as no sound data could be obtained.

Conclusion

At the stages of planning, projecting, and implementation of the investments made for the efficient use of soil and water resources, these investments should be monitored and the obtained results should be compared with the objectives, along with taking necessary pains. In the present study, it was seen that even though the considerable majority of the irrigable areas in Isparta were opened for irrigation, especially the large irrigation schemes were not in good condition in terms of water use efficiency. Additionally, the fact that land consolidation, the greatest infrastructural design work in the rural area, had just been carried out in a limited area was determined as another shortcoming. In the event that these shortcomings are eliminated, soil and water, each of which is a limited natural resource, can be utilized more efficiently.

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A Radiosensitivity Study on Sultana Grape Variety in *In Vitro*

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Abstract

To induce mutation in a plant material is being done by using physical and chemical mutagens. Before mutation breeding, the determination of the material sensitivity to the mutagen is the necessity for the success of the breeding program. By the development of *in vitro* methods, mutation breeding studies have being done in *in vitro* and it has been possible to get results in a shorter time than in *in vivo*. In this study it was aimed to determine the radiosensitivity of Sultana grape variety in *in vitro* by applying different gamma ray doses. Two different MS medium that contains 2 μM (MS1) and 5 μM (MS2) BAP were used. Radiation treatments were done by two months intervals, and three different doses (2+2 kRad, 4+4 kRad, 8 kRad) were applied. Observations and measurements were made before each subculture and plant height, plant number and multiplication ratios were recorded. Plant reactions to radiation were generally appeared as reduction of growth and multiplication, drying of the shoot tip or whole plant. Height reduction of plants that were totally 4 kRad radiation applied was 20% while in 8 kRad applied group the reduction was %50 or more, in respect to control. The similar reductions were also recorded in plant number and multiplication ratios. Generally, the plants in MS1 medium showed slightly more dramatic reductions than the plants in MS2 medium. It was determined that the application of a high dose at once is more effective than the intermittent application of the same dose. Despite the higher doses were increased the mutation frequency, the regeneration capacity of the plant dramatically reduced.

Keywords:Vitis, Sultana grape, radiosensitivity*, in vitro.*

Introduction

Modern fruit industry needs new fruit varieties which are economically profitable. New varieties must have some common features like, stable and high yield, short juvenility, resistance to pests and diseases, uniform maturation, compact development and suitability to post harvest processing (Donini, 1982).

Traditional breeding methods such as crossing and selection take long time to achieve these goals. Mutation breeding is an alternative method which takes relatively short time and aiming to chance one feature of the variety without disrupting the other desirable ones. Mutation breeding has being done by many researchers since 1950's and many new fruit varieties have introduced to the markets by this method.

Gamma radiation is widely used to make mutations. Optimum dose is determined depending on variety, plant part, growth stage and production method. It is a necessity to determine the radio sensitivity of the plant material to choose the optimum dose (Einsett and Pratt, 1975). Radio sensitivity is also depends on many factors like nuclear volume, chromosome number, ploidi level, etc.

Mutation breeding in grapevines aims high yield, seedlessness, berry color and shape, and stress resistance (Spiegel-Roy, 1990).

Material and Method

Plant material of this study was six years old Sultana grapevines obtained from ManisaViticultural Research Station. Gamma rays from ^{60}Co source were used toinduce mutation. In vitro culture initiated by using 1cm shoot tips taken from the vineyard during summer.

MS medium (Murashige and Skoog, 1962) consisting 2 μM(MS1) and 5 μM(MS2)BAP (benzyl amino purine) were used. Subcultures were made every 7 weeks.

Radiation treatment was made twice with an interval of 2 months. Two different doses were applied after 3 weeks from the initiation of the culture. 2 kRad and 4 kRad gamma ray doses

were used at the first application. Second application was made at second subculture and 2 and 4 kRad gamma ray doses applied to same plants and additionally 8 kRad acute dose also applied to another group of plants.After radiation treatment plant materials were subcultured twice.Observations were made before eachsubculture. Plant numbers, plant heights and multiplication rates were determined.

Results

Average reductions of plants in MS1 and MS2 mediawere recorded. In MS1 medium, total 4 kRad(2+2 kRad) radiation applied group showed 28% average plant height reduction while in total 8 kRad (4+4kRad) radiation applied group the reduction was 44% and 8 kRad acute radiation caused 57% plant height reduction in in respect to control. Similarly, in MS2 medium,plant height reductions were 16%, 38% and 49% in respect to control (Figure 1).

After radiation treatments plant numbers of each subculture recorded and average numbers were calculated. 49%, 67% and 85% reduction were recorded in MS1 medium in respect to control by 4, 8 and acute 8 kRad radiation treatments respectively. In MS2 medium these reductions were 51%, 60% and 88% respectively (Figure 2).

Plant multiplication rate in MS1 medium were also dramatically reduced by induced radioactivity doses. Average multiplication rate reduced 49% at 4 kRad dose in respect to control. At 8 kRad dose it was 56% and acute 8 kRad dose caused 87% reduction.In MS2 medium these reductions were 52%, 56% and 99% respectively (Figure 3) .
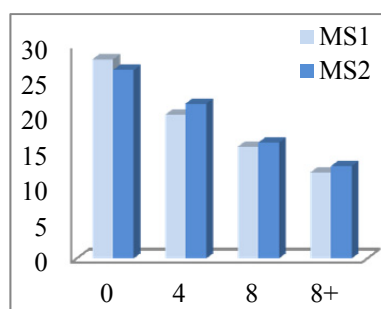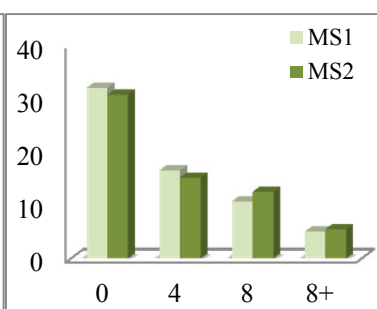

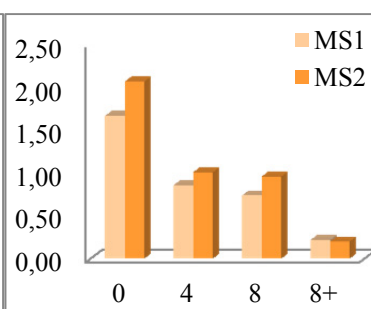Figure 1. Average plant height   Figure 2. Average plant number   Figure 3. Multiplication rate

Discussion and Conclusion

Radiation treatments dramatically affect the growth of *in vitro* cultures. The symptoms were growth retention and shoot tip or whole plant drying. At 2 kRad and 4 kRaddoses plant growth retention occurred but at 8 kRad application plant regeneration has severlyeffected. At high doses it is clear that the mutation frequency will be high but the survival will be low. Acute 8 kRad radiation dose were more lethal than intermittent application of total 8 kRad dose. It is important the choose application method at this point. In literature, it was reported that the suitable dose for grapevines depends on cultivar and ranging between 2.5-4 kRad (Botta et al., 1989; Rosati et al., 1990; Çoban et al., 2002, Marasalı et al., 2003). Plants in MS1 medium showed slightly more reductions than plants in MS2 medium where more compact growth was observed.

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