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CONTENTS

PLANT PRODUCTION

ANIMAL PRODUCTION

FOOD TECHNOLOGY

AGRICULTURAL ECONOMICS

SSR PROFILE SURVEY OF WINTER AND SPRING BARLEY COMPARED TO MALT QUALITY DATA

Ivan ABIČIĆ [1] Alojzije LALIĆ[1] Gordana ŠIMIĆ[1]
Silvio ŠIMON [2] Ivan PEJIĆ[2]

ABSTRACT

In this research we identified certain analogy between SSR polymorphism of referent foreign quality varieties (Vanessa – winter type and Scarlett – spring type) with two varieties of winter (Zlatko and Barun) and two of the spring barley types (Fran and Matej) from the Agricultural Institute Osijek breeding program. Malt quality characteristics such as malt extract, viscosity and friability were run through three consecutive years (2004, 2005 and 2006) at two locations (Osijek and Nova Gradiska). The correlation between SSR polymorphism and malt quality measurement values has been examined in order to attain certain level of marker diagnostic ability. Seven SSR markers previously described in literature as potential detectors of certain chromosomal regions of interest were used: malt extract (EBmac415 and EBmac501), viscosity (Bmag211 and Bmag337) and friability (HVM40, Bmag120 and Bmag7). According to quality data in general, spring barley cultivars when compared with winter cultivars had significantly higher malt extract content (80.57 vs. 79.65), lower malt viscosity (1.588 vs. 1.682) and higher friability (52.61 vs. 65.88) together with specific interactions with growing conditions. This distinction between winter and spring types of barley in a sense of genotype correlates to UPGMA dendrograms for observed traits, related markers and also to variability within observed germplasm (foreign vs. domestic varieties).

Key Words: Barley, breeding, polymorphism, SSR, quality

INTRODUCTION

Barley (*Hordeum vulgare* L.) is one of the most important crop species in the world, and also one of the most representative cereals grown nowadays. It is thought that it originated from *H. vulgare* L. ssp. *spontaneum* which resides even today in the area of the Fertile Crescent (Nevo, 1992). Keeping up with the ever increasing demands of the brewing industry requires intensification in implementing new tools available to plant breeders for a better understanding of the sensitive genomic structure of germplasm used. Nowadays breeders must keep in mind the preservation of genetic variability as well. In order to achieve that knowledge regarding the genetic structure of breeding materials could help to maintain genetic diversity, which would sustain long-term selection responses and reduce vulnerability of breeding programs in that matter (Troyer et al. 1998). Main goal is to combine two data sets (molecular and quality data) to determine the possibility of implementing variability survey to a specific breeding task which is quality improvement. Also, results of this work will provide some better width and understanding of germplasm used within barley breeding program of the Agricultural Institute Osijek.

MATERIAL AND METHODS

Plant material consists of two referent and also foreign barley varieties known for their high quality (Vanessa – winter type and Scarlett – spring type; bred by Saatzucht Josef Breun, GDBR-Herzogenaurach, Germany) as well as two varieties of winter (Zlatko and Barun) and two of the spring barley types (Fran and Matej) descended from the Agricultural Institute Osijek breeding program grown through three consecutive years (2004, 2005 and 2006) on two locations (Osijek (45°31'54 N, 18°45'18 E) and Nova Gradiska (45°14'0 N, 17°20'21 E)), on two soil types, alluvium and eutric cambisol, respectively. Trial setting was arranged as randomized block design with four replications. Laboratory quality data was determined according to Analitica EBC (1998) for extract (method 4.5.1), viscosity (method 4.8) and friability (method 4.15).

DNA was isolated by CTAB method (Doyle and Doyle, 1990) from leaf tissue grown from three seeds (for every sample/cultivar) sown into plastic container filled with substrate. Before DNA isolation, the tissue needed to be lyophilized and grounded with steel beads in order to get powdery texture of the sample. After isolation the concentration of genome DNA was determined by spectrophotometer.

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Amplification process (PCR reaction in Veriti Thermal Cycler, Applied Biosystems, U.S.A.) of microsatellite markers was carried according to Liu et al. (1996) and Li et al. (2003). PCR products were then being analyzed with genetic analyzer (ABI 3130 - size standard used: GeneScan 500LIZ, Applied Biosystems, U.S.A.) and data was retrieved via GeneMapper 4.0 (Applied Biosystems) software. Seven SSR markers previously described in literature as potential detectors of certain chromosomal regions of interest were used: malt extract (EBmac415 and EBmac501 – Mei *et al.*, 2012), viscosity (Bmag211 and Bmag337 – Raman *et al.*, 2003; von Korff *et al.*, 2008) and friability (HVM40, Bmag007, Bmag120 – Li *et al.*, 2005).

Two-way approach for data analysis considered the use of different software. Firstly, the laboratory data for quality were processed via cluster analysis (Everitt, 1980). Also the differences between varieties and environments were tested with LSD-test and Duncan`s Multiple Range test. Dendrograms were formed to estimate and display the leveling of groups between varieties for extract and viscosity. Method of "Hierarchic Tree Clustering" was used to graphically point out different groups (clusters) via dendrograms. Ward`s minimum variance method was used to estimate the distance between clusters. Software used: IRRISTAT 5.0, IRRI of Manila (Irristat for Windows ©, 2005), for cluster analysis and dendrogram visualization. Secondly, SSR profile data also underwent variability analysis together with calculation of the phylogenic tree. Software used: POWERMARKER 3.25 (Liu and Muse, 2005) software and tree visuals formed by TREEVIEW 1.6.6. (Page, 2001). Main idea is to compare dendrogram data from two distinct sources to determine if those will show certain congruencies and to what extent.

RESULTS

The results of extract content and cytolytic degradation showed significant differences among cultivars of winter and spring type together with the year of cultivation. But as far as the results from locations are concerned there was no evidence which would point out the statistically significant difference towards extract content together with malt cytolytic degradation parameters. The significant (P≥0.05) results of the largest extract content and with best malt cytolytic degradation points to variety Scarlett. This variety is being followed by Fran (also spring type) and Vanessa (winter type). In general (tab. 1) spring barley varieties had higher amount of extract (80.57 vs. 79.64), lower malt viscosity (1.588 vs. 1.682) and higher friability (52.61 vs. 65.88) in GxE correlation in comparison to winter types.

Table 1. Means for extract fine grind, friability and malt viscosity for 6 barley varieties at two localities in three years

Variety/ Year / Location/ Seasonal type	Extract, %		Friability		Malt viscosity	
Zlatko	79.13	b	47.53	c	1.788	a
Barun	79.73	b	50.03	c	1.700	a
Vanessa	80.07	ab	60.27	b	1.559	b
Fran	80.62	ab	71.62	a	1.552	b
Matej	80.42	ab	55.62	bc	1.700	a
Scarlett	81.32	a	70.42	a	1.512	b
$LSD_{0.05}$	1.57		9.80		0.129	
2004.	79.04	c	51.58	b	1.709	a
2005.	79.89	b	59.16	ab	1.560	c
2006.	81.38	a	67.00	a	1.636	b
$LSD_{0.05}$	0.75		8.83		0.072	
Osijek	80.38		61.43		1.668	
Nova Gradiska	79.83		57.07		1.602	
$LSD_{0.05}$	ns		ns		ns	
Winter barley	79.64	b	52.61	b	1.682	a
Spring barley	80.57	a	65.88	a	1.588	b
$LSD_{0.05}$	0.91		16.36		0.074	
Average	80.11		59.25		1.635	

"a...c" - Duncan's Multiple Range Test at P≤0,05

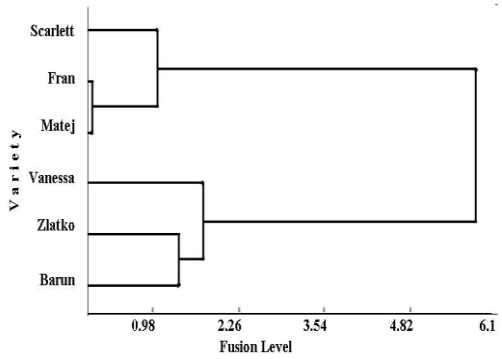

Figure 1. Extract content (Ward)

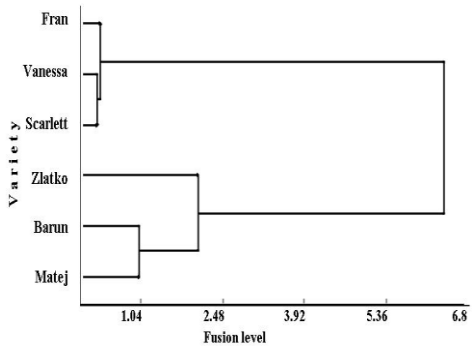

Figure 2. Malt viscosity (Ward)

Two distinct groups reveal themselves when we form a dendrogram for extract content, the spring types in one group and winter types in the other. Malt viscosity shows different display of dominant varieties, where all of the varieties tested did not show a specific grouping profile dependant solely on the fact what seasonal type varieties belong to. Nevertheless, combination of the data (fig. 1 and 2) reveals a group of higher malt quality varieties formed by Scarlett, Fran and Matej (spring) and Vanessa (winter).

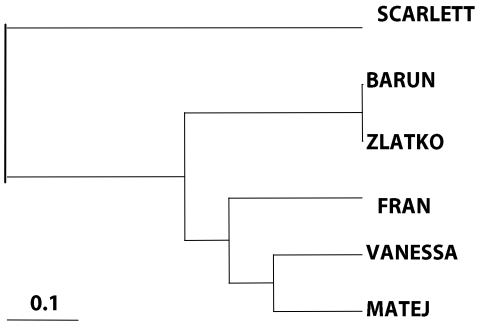

Figure 3. Extract content via UPGMA (SharedAllele)

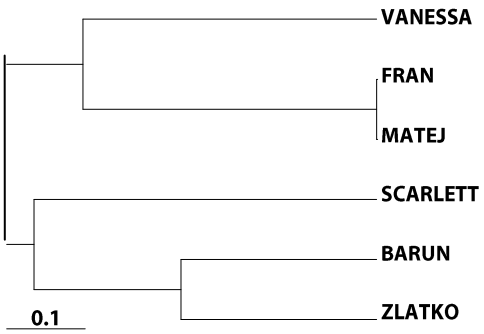

Figure 4. Malt viscosity via UPGMA (SharedAllele)

Slightly different results occur in dendrograms formed solely on SSR polymorphic data. Certain crucial points could be made considering a number of the distinctly formed groups. Profiles connected to specified parameters observed, show us a constant in formation of the groups with clear distinction between winter and spring types of barley (fig. 3, 4, 5). The UPGMA dendrogram for extract accurately depicts the results obtained in tab. 1 by forming a single group of Fran, Vanessa and Matej which also show the similar reaction/result for this trait. Varieties Scarlett and Vanessa each belong to different seasonal types of barley (spring vs. winter) and this could be seen through all dendrograms. These varieties (Scarlett and Vanessa) also distinct themselves according to general variability, which is an expected result and something that represents a control mechanism of varieties, as well as, a starting point for further analysis (foreign vs. domestic) (fig. 6). These two referent varieties are of the foreign descent (country of origin is Germany). There is logic in the grouping process where Barun and Zlatko group together while Fran and Matej form a distinct group, all together (fig. 6). The same reaction/result could also be seen according to friability parameter where (on the higher level of joining) we can attach Scarlett and Vanessa as a subgroup to the group formed by Fran and Matej which also matches the laboratory data (fig. 5, tab. 1). The demands of brewing industry considering friability levels, state the need for no less than 70% in friability value and only Fran and Scarlett possess such values (tab. 1).

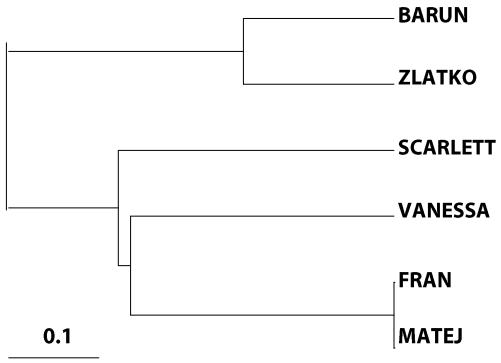

Figure 5. Friability via UPGMA (SharedAllele)

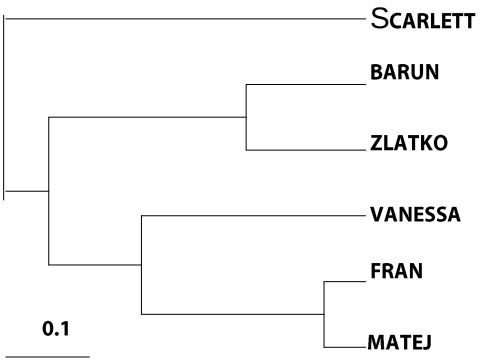

Figure 6. General variability – all markers included via UPGMA (SharedAllele)

DISCUSSION

Laboratory data suggest a range of value variation in extract difference, as well as the average values of year and location for this parameter. This trait is influenced to a significant extent by agronomic conditions during vegetation, meaning climate and soil. Parallel analysis based on homogenous groups points out similarities that may be useful while recommending for new varieties, because it is possible to determine similarities and differences from standardized and confirmed varieties, and in addition it is possible to assume reactions of these new varieties under production and specific cultivation conditions. Spring barley in general sense shows better results as far as the malt quality is concerned. This has been corroborated by Lalić and Kovačević, (1997) who point out that spring barley grown in the Republic of Croatia has the overall better and more stable results concerning quality of malt over winter types.

SSR markers used for screening of the barley cultivars are able to determine the potential carriers of desirable traits, and the data shown in this paper confirm this on the level of variability study. This is due to various literature statements and scientific papers published and noted here. Area for examination of QTL's for quality concentrates mainly around chromosome 1H. Regions on chromosome 1H are well known for their associations with malt extract and other malting attributes (Marquez-Cedillo *et al.* 2000; Collins *et al.* 2003). Also, the effect for other traits, meaning viscosity and friability are highly correlated to other ways of cytolitic and proteolitic disintegration of malt. Another way of trait improvement was set out by Von Korff *et al.* (2008) who state that as viscosity and friability are mainly affected by the breakdown of β-glucan and other cell wall polysaccharides, genes affecting β-glucan or β-glucanase activity may also underlie QTL's detected for mentioned traits. This fact opens another approach in detecting genes, QTL's and/or alleles which post as carriers of traits for better enzymatic activity. In a sense it is possible to make selection by a two way approach improving both viscosity and friability on one hand and enzymatic activity on the other (cumulative effect) by selection process. Method described in this paper (genetic screening and comparison of data) could provide the basis for this type of problem solving.

CONCLUSION

Integration of molecular and quality data is possible to some extent and genetic data is satisfactory in terms that it explains the genetic background and variability of examined varieties well. On this level of data analysis this method is limited because of relatively small number of varieties examined but more importantly it is the small number of SSR markers that represents a restrictive factor for better and more precise genetic data resolution. The point is to improve the method by inclusion of more SSR markers (linked to QTL's of interest) into genetic profile exploration of the germplasm concerned. In that way it will be possible to determine and display groups of elite barley lines which carry QTL's for traits of interest (in this case quality traits) in a more precise manner. That way a set of "quality SSR markers" can be determined which will be useful for DNA screening of future progeny after the cross of previously screened parental lines.

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DISTRIBUTION AND SEASONAL DYNAMICS OF FUNGI OF SECONDARY AND TERTIARY ECOSYSTEMS OF BUŠĆE NEAR SARAJEVO

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ABSTRACT

Biodiversity of mushrooms in Bosnia and Herzegovina is poorly explored. Therwith, the Sarajevo surrounding area is insufficiently explored as well. This paper aims to present the seasonal distribution and dynamics as well as to give the new biodiversity data of this area.

The research is conducted during 2010. The field trips started by the end of March and they lasted until the middle of November. Spring, summer and autumn aspects were examined. Secondary and tertiary antropogenous meadow ecosystems were explored. The research used the different lengths transect method.

In total, the research found: 2 order, 6 families, 14 genus and 23 species. Major families are: *Agaricaceae* and *Lycoperdiaceae*. The prevalent mushroom is of the explored area is *Marasmius oreades*. Most mushrooms were found in autumn.

Key Words: Diversity, distribution, mushrooms, ecosystems, dynamics.

INTRODUCTION

Biodiversity of fungi in Sarajevo area is very poorly researched. These are the first data on fungi of investigated area.This paper aims to present the seasonal distribution and dynamics as well as to give the new biodiversity data of this area.

The research is conducted during 2010. The field research began in late March and lasted until the middle of November. Spring, summer and autumn aspects were examined. Secondary and tertiary anthropogenic meadow ecosystems were explored.

The following literature was used for determination of fungi: Breitenbach & Kränzlin (1995), Božac (1995, 2005), Candusso (1997), Foht (1979, 1990), Gerhardt (1997), Hansen & Knudsen (1992, 1997), Pace (1977), Pilat (1951) and Poler (1991).

MATERIAL AND METHODS

We used transect with different lengths for method of investigation. The researchwas conducted during 2010. on the different ecosystems. Secondary and tertiary anthropogenic meadow ecosystems were explored. From secondary ecosystems we explored folowing orders: Arrhenatheretalia and Brometalia erecti and from tertiary anthropogenic order Secalinetalia. The field research began in late March and lasted until the middle of November. Spring, summer and autumn aspects were examined.

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Figure 1. Marasmius oreades (Bvolton ex Fr.) Fr., the dominant fungi of this area.

RESULTS AND DISCUSSION

Order: *Agaricales* Clements

Family: *Hygrophoraceae* Roze ex Maire

Genus: *Hygrocybe* (Fr.) P. Kumm.
Hygrocybe pratensis* (Pers. ex Fr.) Murrill. Var. *pratensis
Period: autumn, one of the last autumn fungi and very rare species-only one colony with small number representatives, *Brometalia erecti.*

***Hygrocybe punicea* (Fr.) P. Kumm.**
Period: autumn, *Arrhenatheretalia.*

***Hygrocybe virginea* (Wulfen ex Fr.) P. D. Orton & Watling**
Period: autumn, one of the last autumn fungi, *Arrhenatheretalia.*

Family:*Tricholomataceae* Heim ex Pouz.

Genus: *Armillaria* (Fr. ex Fr.) Staude
***Armillaria mellea* (Vahl. ex Fr.) P. Kumm.**
Period: autumn, on the stumps of fruit-tree, *Arrhenatheretalia.*
Genus: *Calocybe* Donk
***Calocybe gambosa* (Fr. ex Fr.) Donk**
Period: spring, *Arrhenatheretalia* and *Brometalia erecti.*

Genus: *Marasmius* Fr.
***Marasmius oreades* (Bolton ex Fr.) Fr.(Figure 1.)**
Period: spring and autumn, the prevalent fungi of this area,*Arrhenatheretalia* and *Brometalia erecti.*
Family:*Coprinaceae*

Genus: *Coprinus* Pers.
***Coprinus comatus* (O. F. Müll. ex Fr.) Pers.**

Period: autumn, very rare in stady area, *Arrhenatheretalia.*

***Coprinus micaceus* (Bull. ex Fr.) Fr.**
Period: autumn, *Arrhenatheretalia.*

Family: *Agaricaceae* Fr.

Genus: *Agaricus* L. ex Fr.
***Agaricus campestris* L. ex Fr.**
Period: autumn, widespread species, *Arrhenatheretalia* and *Brometalia erecti.*

***Agaricus arvensis* Schaef.**
Period: autumn, *Arrhenatheretalia.*

***Agaricus urinascens* (F. H. Møller ex Jul. Schaff.) Singer**
Period: autumn, rare species, *Arrhenatheretalia.*

***Agaricus praeclaresquamosus* Freemann**
Period: autumn, very rare species-only two colonies, *Arrhenatheretalia.*

Agaricus sp.
Period: autumn, *Arrhenatheretalia.*

Genus: *Macrolepiota* Sing.
***Macrolepiota procera* (Scop. ex Fr.) Sing.**
Period: autumn, *Arrhenatheretalia* and *Secalinetalia.*

Genus: *Lepiota* (Pers. ex Fr.) S. F. Gray
***Lepiota cristata* (Bolt. ex Fr.) P. Kumm.**
Period: summer and autumn, poisonous fungi, *Arrhenatheretalia.*

Family:*Strophariaceae* Sing. & Smith.

Genus: *Hypholoma* (Fr.) P. Kumm.
***Hypholoma fasciculare* (Huds. ex Fr.) P. Kumm.**
Period: autumn, on the stumps of fruit-tree, *Arrhenatheretalia.*

***Hypholoma sublateritium* (Fr.) Quél.**
Period: spring and autumn, on the stumps of fruit-tree, *Arrhenatheretalia.*

Genus: *Stropharia* (Fr.) Quél.
***Stropharia coronilla* (Bull. ex Fr.) Quél.**
Period: autumn, *Arrhenatheretalia* and *Brometalia erecti.*

***Stropharia semiglobata* (Batsch. ex Fr.) Quél.**
Period: summer and autumn, rare species, *Brometalia erecti.*

Order :*Lycoperdales* Clements

Family:*Lycoperdaceae* Chevall.

Genus: *Bovista* Pers. ex Pers.
***Bovista nigrescens* Pers. ex Pers.**
Period: summer and autumn, *Arrhenatheretalia* and *Secalinetalia.*

***Bovista plumbea* Pers. ex Pers.**
Period: summer and autumn, *Arrhenatheretalia* and *Secalinetalia.*
Genus: *Calvatia* Fr.
***Calvatia utriformis* (Bull. ex Pers.) Jaap**
Period: spring and autumn, *Arrhenatheretalia.*

Genus: *Vascellum* F. Šmarda
***Vascellum pratense* (Pers. em Quél.) Kreisel**
Period: autumn, *Arrhenatheretalia* and *Secalinetalia.*

The first fungus that appears in the spring and can be found already in March, is *Hypholoma sublateritium*, followed by *Calvatia utriformis* in April. The main part of the spring season begins in May, with the advent of *Calocybe gambosa* and *Marasmius oreades*.
In the summer appear *Bovista nigrescens, B. plumbea, Stropharia semiglobata* and *Lepiota cristata*. Most of the fungi appear in the autumn. The most common are: *Marasmius oreades, Agaricus campestris, A. arvensis, Coprinus micaceus* and others. At the end of the season, in the late autumn, appears *Hygrocybe virginea*.
The most widespread species of this region are *Marasmius oreades*, then *Agaricus campestris, Hypholoma fasciculare* and *Coprinus micaceus*.
The rarest are: *Agaricus urinascens, A. praeclaresquamosus, Hygrocybe pratensis* and *Stropharia semiglobata*.
Most of these fungi are common in meadows of the order *Arrhenatheretalia*, fewer species can be found in meadows of the order *Brometalia erecti*. The lowest number of species is found on tertiary habitat of the order *Secalinetalia*.

CONCLUSIONS

- **These are first data for fungi of investigated area.**
- **In total, in this research we found: 2 orders, 6 families, 14 genus and 23 species.**
- **Major families are: *Agaricaceae* and *Lycoperdiaceae*.**
- **The prevalen fungus of the explored area is *Marasmius oreades*.**
- **Largest number of fungi was found in autumn.**
- **Most species of fungi that grow in the meadows belongs to the order *Arrhenatheretalia*.**
- **Rarest species are: *Hygrocybe pratensis* var. *pratensis*, *Agaricus urinascens*, *A. praeclaresquamosus* and *Stropharia semiglobata*.**
- **Only a few species grow on both secondary and tertiary ecosystems: *Macrolepiota procera, Bovista nigrescens, B. plumbea* and *Vascellum pratense***

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THE EFFECT OF CONCENTRATION, EXPOSURE TIME AND TYPE OF COLCHICINE TREATMENT ON THE MORPHOLOGICAL CHARACTERISTICS OF FRENCH MARIGOLD (*Tagetes patula* L. var. *nana)*

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ABSTRACT

Because of easy growing, numerous brightly coloured inflorescences and exceptionally long flowering period, French marigold (*Tagetes patula* L. var. *nana,* Asteraceae) is one of the most important annual plants in horticulture. The number and size of flowers and plant height are important factors for mass production of ornamental plants, and it is necessary to increase their phenotypic variability. That can be accomplished by using mutagenic factors, of which alkaloid colchicine is the most commonly used. The effect of colchicine on morphological characteristics of plants may vary, depending on concentration, exposure time and type of colchicine treatment.

In this work, two groups of French marigold plants were treated with the 0.01%, 0.05% and 0.08% water solution of colchicine, during 1 and 3 days. Colchicine was applied in two different ways: one group of plants developed from treated seed, and the other had newly-formed buds wrapped in cotton wool dipped in colchicine solution. The control group of plants was treated with clean water. After the development of plants, the height, number of leaves and number of inflorescences were measured on three occasions. The results showed that colchicine treatment had the significant effect on all three investigated characteristics of French marigold plants.

Key Words: Colchicine, Tagetes patula, morphological characteristics

INTRODUCTION

Because of fast growing rate, plenty of flowers, long flowering period and cheap production, the annual ornamental plants are used for planting in flowerbeds, terraces and balconies (Vujković *et al*, 2003), and for filling the empty spaces between perennial plants or shrubs (Brooes, 2002). The French marigold (*Tagetes patula* L. var. *nana,* Asteraceae) is one of the most used annual flowering plants. It has a shrubby appearance, height 20-65 cm, and numerous inflorescences, in golden yellow or brownish-red colour, that appear from mid-June to the end of October. The French marigold is widely used in public green areas, but also in private gardens (Ljujić–Mijatović & Mrdović, 1998). Horticultural practice and the results of many surveys show that the number and size of flowers, height of plants and the length of flowering period are the most important characteristics when it comes to mass production of flowering plants and their use in landscape design. That is the reason why the increasing of phenotypical variability of ornamental plants is especially important (Brickell, 1992). According to Jarebica & Kurtović (1997), the term variability implies the process of creating differences between the individuals of the same biological species. Every change in the structure of genetic material, whose appearance cannot be assigned to the recombination of genes or chromosomes is referred to as mutation (Đokić, 2000; Jarebica & Kurtović; 1997, Mišić, 1999). Mutations most often appear after the exposure to the mutagenic factors, and their effect mainly depends on the concentration and the exposure time (Đokić, 2000). Among the chemical mutagenic factors, the alkaloid colchicine has the most important place in inducing plant mutations (Đokić, 2000; Jelaska, 1994; Jarebica & Kurtović, 1997). Colchicine prevents the formation of mitotic spindle during the mitosis, and after the centromeres have been divided, the sister chromatids do not go to the poles of the mitotic spindle, but stay grouped in one cell, making it tetraploid (4n). If the colchicine treatment is applied through the longer period of time, chromosomes keep dividing, thus increasing the ploidy of the cell (Borojević & Borojević, 1976). The active concentrations of colchicine are between 0.025% and 1%, and the exposure time may vary from 2 hours to several days (Đokić, 2000). The induced polyploidy has been used in floristry for a long time. According to Crane & Lawrence (1952), one of the

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RESULTS AND DISCUSSION

The results showed that colchicine treatment had the significant effect on all three investigated characteristics of Tagetes *patula* L. var. *nana* plants

1. Plant height

The average height (cm) and standard deviations of French marigold plants, treated by seed-dipping and bud-wrapping method, in three different concentrations (0.01%, 0.05% and 0.08%) during 1 and 3 days, and the control group of untreated plants are presented in table 2.

Table 2: The average height of Tagetes patula L. var. nana plants (cm)

% colchicine		0.01 %		0.05%		0.08%		0% (control)
type of treatment		seed	bud	seed	bud	seed	bud	
date	days							
04.05.	1	13.11±2.88	12.267±1.75	10.91±1.68	12.17±2.09	9.42±1.34	13.25±1.34	6.51±1.44
	3	12.09±2.10	13.46±1.69	11.17±1.38	11.48±2.02	9.25±1.76	11.85±2.03	
29.06.	1	39.92±4.96	23.62±3.31	36.68±8.55	21.57±3.41	36.91±4.67	19.71±1.99	14.73±1.66
	3	33.02±5.11	24.89±3.42	60.52±10.87	23.06±3.46	36.03±7.73	20.9±3.04	
31.08.	1	110.74±9.95	101.96±19.49	104.49±12.09	83.52±17.72	107.84±18.56	84.34±11.56	46.86±9.26
	3	118.35±11.29	113.7±17.81	110.57±11.85	97.63±18.12	92.97±11.65	92.53±17.47	

Every time the observations were made, all groups of treated plants had the larger average height than the plants from the control group. When the plants were first measured (04.05.2009.), the fastest growth was observed in plants whose buds were treated with 0.01% colchicine during 3 days, and all plants that were treated with the bud-wrapping method were higher than the plants developed from treated seeds. The second time when the plants were measured (29.06.2009.), the situation was different: all of the plants developed from treated seed were higher than plans treated with the same concentration of colchicine, during the same exposure time, but with the bud-wrapping method. The similar situation was observed on 31.08.2009., when seed-treated plants also had the larger average height than those treated with bud-wrapping method. The results from the last measurement, when the plants were fully developed, were tested with Tukey (HSD) test, in order to determine if the differences between treatments have affected the height of the plants. The results are presented in table 3, which shows that almost all of the plants that developed from treated seeds had significantly larger average height than the plants from the control group, but when it comes to plants that were treated with bud-wrapping method, only those who received a 0.01% colchicine solution (during both 1 and 3 days) were significantly taller than the untreated plants.

Table 3: Analysis of the differences between the plant height with a confidence interval of 95%

			seed					bud						control
			1 day		3 days			1 day			3 days			
% colchicines			0.05	0.08	0.01	0.05	0.08	0.01	0.05	0.08	0.01	0.05	0.08	
seed	1 day	0.01	0.830	0.301	1.305	0.163	2.648	1.264	4.180*	4.050*	0.594	1.948	2.755	5.065*
		0.05		0.541	2.182	1.015	1.859	0.443	3.425*	3.293	1.456	1.143	1.968	4.331*
		0.08			1.642	0.474	2.399	0.984	3.966*	3.833*	0.915	1.684	2.508	4.871*
	3 days	0.01				1.167	4.041*	2.626	5.607*	5.475	0.727	3.325	4.150*	6.513*
		0.05					2.874	1.458	4.440*	4.308*	0.441	2.158	2.983	5.346*
		0.08						1.415	1.566	1.434	3.315	0.716	0.109	2.472
bud	1 day	0.01							2.982	2.849	1.899	0.700	1.524	3.887*
		0.05								0.132	4.881*	2.282	1.457	0.906
		0.08									4.749*	2.150	1.325	1.038
	3 days	0.01										2.599	3.424*	5.787*
		0.05											0.825	3.188
		0.08												2.363

Critical value: 3.370

first ornamental plants whose morphological characteristics (colour and size of flower) have been changed by colchicine treatment was *Delphinium elatum* L.. Seneviratne *et al.* (2002) induced different sizes and shapes of leafs and flowers in African violet (*Saintpaulia ionantha* H.Wendl.) using different concentrations of colchicine. Treating *Bacopa monnieri* (L.) Pennel with colchicine enlarged number of leaves and flowers per plant (Escandon *et al,* 2006). Morphologically, most polyploids differ from diploids only by very expressed gigantism, which can affect the whole plant, or just some of its organs (Krush, 1973; Mišić, 1999). Producing polyploids is a difficult and time-consuming task, so it is important to find the most effective way to produce polyploid plants and use them in horticultural practice (Borojević & Borojević, 1986).

MATERIALS AND METHODS

The experimental part of this work was carried out in the laboratory of the Faculty of Agricultural and Food Sciences of the University of Sarajevo, and in the greenhouse and production areas of the Fruit greeneryvPlantarium in Srebrenik, during year 2009. The seed of *Tagetes patula* L. var. *nana* that was used in the experiment was gathered from the green areas of JKP "Park" - Sokolović kolonija. The colchicine powder was obtained from the Semikem – Sarajevo, and the 0.01%, 0.05% and 0.08% water solutions were prepared in laboratory of the Faculty of Agricultural and Food Sciences of the University of Sarajevo. On 18.02.2009. the seeds were placed in Petri dishes (50 seeds in each dish) on the blotting paper, and left in the thermostat in the temperature of 22° C. One group of seeds was treated with colchicine solutions (0.01%, 0.05% and 0.08%), and the other with distilled water, as presented in table 1.

Table 1: The colchicine treatments used in the experiment

group of seeds/plants		1	2	3	4	5	6	7	8	9	10	11	12	13 (control)
% colchicine	no. of days													
thermostat (treated seeds)														
0.01%	1	*												
	3		*											
0.05%	1			*										
	3				*									
0.08%	1					*								
	3						*							
0%								*	*	*	*	*	*	*
seed tray (treated buds)														
0.01%	1	*	*	*	*	*	*	*						
	3								*					
0.05%	1									*				
	3										*			
0.08%	1											*		
	3												*	
0%														*

After 7-15 days, when most seeds have germinated, seedlings were planted in sterilised substrate in 30x40 cm seed trays, and transferred in the greenhouse. After the formation of leaf buds, the plants developed from the untreated group of seeds were treated by wrapping newly-formed buds in cotton wool dipped in 0.01%, 0.05% and 0.08% colchicine solution (table 1). The control group of plants was treated with distilled water. In the beginning of April, the plants were planted in jiffy pots (4 cm in diameter), and repotted in plastic 12x12 cm pots one month later. After the danger of late spring frosts has passed, on 05.05.2009. the plants were bought outside of the greenhouse. The standard agrotechnical practices were conducted during the vegetative period, and the complex liquid fertilizer Flortis 7-8-7 was applied once a month, from April to August. Three times during the vegetative period (04.05.2009., 29.06.2009. and 31.08.2009.) the height of plants was measured and leaves and inflorescences were counted. For every combination of colchicine concentration, exposure time and the type of treatment, 30 plants were observed. The results were tested with Tukey HSD (*Honestly Significant Difference*) test, with a confidence interval of 95%, using MS Excel 2007 and XLSTAT 2010.

2. Number of leaves per plant

The average number of leaves and standard deviations of plants are presented in table 4.

Table 4: The average number of leaves per plant in Tagetes patula L. var. nana

% colchicine		0.01 %		0.05%		0.08%		0% (control)
treatment type		seed	bud	seed	bud	seed	bud	
date	days							
04.05.	1	8±0	5.33±1.30	8±0	6±1.13	8±0	5.33±1.30	4±0
	3	8±0	5.83±0.83	8±0	6.5±1.17	8±0	6.08±1.08	
29.06.	1	36.1±4.34	46.67±13.46	35±6.09	47.92±10.47	49±8.69	36.17±5.87	29.12±11.39
	3	69.73±12.73	54.75±6.76	69.77±12.72	45.08±5.33	55.7±15.67	47.42±8.85	
31.08.	1	1207.17±250.45	748±233.76	1127.23±216.69	616.33±261.92	997.2±186.68	559.33±216.39	77.73±24.39
	3	1079.1±240.30	1062.33±216.63	936.9±116.43	949.5±275.58	930.2±177.01	940.17±203.72	

All groups of treated plants had more leaves than the plants from the control group every time the observations were made. On 04.05.2009., all of the plants that have developed from the treated seeds, had the average 8 leaves, more than bud-wrapped plants. On 29.06.2009., the most leaves were counted in plants developed from seeds treated with 0.05% solution during 3 days. On 31.08.2009., the seed-treated plants have also had the larger average number of leaves than those treated with bud-wrapping method.

Table 5: Analysis of the differences between the number of leaves with a confidence interval of 95%

			seed					bud						control
			1 day		3 days			1 day			3 days			
% colchicine			0.05	0.08	0.01	0.05	0.08	0.01	0.05	0.08	0.01	0.05	0.08	
seed	1 day	0.01	1.108	2.460	1.558	3.082	3.181	5.061*	6.432*	7.025*	1.789	2.963	3.061	4.746*
		0.05		1.383	0.460	2.019	2.120	4.042*	5.443*	6.050*	0.696	1.897	1.997	3.697*
		0.08			0.922	0.636	0.737	2.659	4.061*	4.667*	0.687	0.514	0.614	3.914*
	3 days	0.01				1.558	1.660	3.582*	4.983*	5.590*	0.236	1.437	1.536	4.237*
		0.05					0.101	2.023	3.425*	4.031*	1.322	0.122	0.022	4.679*
		0.08						1.922	3.323	3.930*	1.424	0.223	0.123	4.577*
bud	1 day	0.01							1.401	2.008	3.346	2.145	2.045	4.345*
		0.05								0.607	4.747*	3.546*	3.447*	3.746*
		0.08									5.354*	4.153*	4.053*	4.353*
	3 days	0.01										1.201	1.300	5.001*
		0.05											0.099	4.800*
		0.08												4.701*

Critical value: 3.370

The results of the Tukey HSD test show that all treated plants had significantly more leaves than the plants from the control group. Also, the plants developed from the treated seed had significantly more leaves than those treated with bud-wrapping method.

3. Number of inflorescences per plant

The inflorescences of French marigold plants were counted twice, on 29.06.2009. and 31.06.2009., when all the plants had at least one fully-bloomed inflorescence. The average numbers of inflorescences and standard deviations are presented in table 6.

Table 6: The average number of inflorescences per plant in Tagetes patula L. var. nana

% colchicine		0.01 %		0.05%		0.08%		0% (control)
treatment type		seed	bud	seed	bud	seed	bud	
date	days							
29.06.	1	4.67±1.54	8.75±2.83	6.1±1.79	3.33±1.92	4.9±1.39	5.33±1.77	8.4±2.72
	3	7.73±1.39	17.67±5.24	6.83±1.51	11.33±2.84	5.93±1.82	10.33±3.39	
31.08.	1	183.4±57.10	72.5±23.23	215.03±64.31	79.58±22.58	304.57±79.38	72.67±16.4	50.5±16.25
	3	207.77±71.86	143.25±31.34	172.23±63.08	105.08±20.87	166.7±58.49	116.33±31.28	

On 29.06.2009. the plants from the control group had more inflorescences than most treated plants, except for those whose buds were exposed to the colchicine during the time period of 3 days. Second time when the inflorescences were counted, the situation was different: all of treated plants had more inflorescences than the plants from the control group. The plants that were developed from the treated seeds had more inflorescences than those treated with bud-wrapping method, for every combination of colchicine concentration and exposure time. The results from the second time inflorescences were counted were tested with Tukey (HSD) test, and the results are presented in table 7.

Table 7: Analysis of the differences between the number of inflorescences with a confidence interval of 95%

			seed					bud						control
			1 day		3 days			1 day			3 days			
% colchicine			0.05	0.08	0.01	0.05	0.08	0.01	0.05	0.08	0.01	0.05	0.08	
seed	1 day	0.01	1.522	5.572*	1.174	0.482	0.637	3.673*	4.668*	4.982*	1.779	3.511*	3.000	4.441
		0.05		4.141*	0.356	2.049	2.208	5.312*	6.329*	6.650*	3.375*	5.146*	4.624*	6.097*
		0.08			4.496*	6.190*	6.348*	9.453*	10.470*	10.791*	7.516*	9.287*	8.765*	10.238*
	3 days	0.01				1.693	1.852	4.957*	5.973*	6.294*	3.020	4.790*	4.268*	5.741*
		0.05					0.159	3.263	4.280*	4.601*	1.326	3.097	2.575	4.048*
		0.08						3.105	4.121*	4.442*	1.168	2.938	2.416	3.889*
bud	1 day	0.01							1.017	1.338	1.937	0.166	0.688	1.785
		0.05								0.321	2.954	1.183	1.705	3.232
		0.08									3.275	1.504	2.026	2.553
	3 days	0.01										1.771	1.249	4.722*
		0.05											0.522	3.951*
		0.08												4.473*

Critical value: 3.370

The results of the Tukey HSD test show that all treated plants, except for those who were treated by the bud-wrapping method during 1 day, had significantly more inflorescences than the untreated plants. The plants that have developed from the treated seed had significantly more leaves than those treated with bud-wrapping method.

CONCLUSIONS

After observing the effect on the colchicine on morphological characteristics of *Tagetes patula* L. var. *nana* plants, the following conclusions can be derived:

- **Colchicine treatment increases the height, number of leaves and number of inflorescences of *Tagetes patula* L. var. *nana* plants.**
- **The plants developed from treated seed are taller than plans treated with the same concentration of colchicine, during the same exposure time, but with the bud-wrapping method.**
- **The most leaves are formed in plants developed from seeds treated with 0.05% solution during 3 days.**
- **Plants developed from colchicine-treated seeds have the larger average number of leaves than those treated with bud-wrapping method.**
- **The plants that were developed from the treated seeds had more inflorescences than those treated with bud-wrapping method, for every combination of colchicine concentration and exposure time.**

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MACROFUNGI OF PRUSAC AND ITS SURROUNDING AREA

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ABSTRACT

This study was based on macrofungi specimens collected from Prusac and its surrounding area in Bosnia and Herzegovina. The research of scientific publications has shown that there is no information of macrofungi in this area. The researches were conducted in the forest and meadow ecosystems which constant surface and transect of different lenghts at early spring, spring and autumn in 2008. A total of 68 macrofungi belonging to 19 families were determined for Prusac and its surrounding area. The families including the biggest number of species are as follows: *Tricholomataceae* (17 species), *Russulaceae* (8 speces), *Agaricaceae* (7 species) and *Hygrophoraceae* (6 species).

Key Words: Macrofungi, biodiversity, ecosystem, fungi, aspects.

INTRODUCTION

Macrofungi are important components of forest ecosystems. Determining the mycobiota of a region is very important in order to catalogue potentially ones and effectively utilise the mycorrhizal and edible ones (Peksen and Caraca, 2003). Biodiversity of fungi in Bosnia and Herzegovina is very poorly researched. Such is the case with the biodiversity of fungi in Prusac and its surrounding area. After examining scientific literature (Bešlija, 1997; Božac, 1978, 1995, 2003; Đuričić and Elazar, 1963; Foht ,1979, 1987, 1990; Pace, 1977; Poler, 1991; Uščuplić, 2004) we did not find any information about the distribution of the fungi in the wider or the narrower area of the Prusac.

The purpose of this study was to determine the macrofungi of the region from different ecosystems during early spring, spring-summer and autumn.

MATERIAL AND METHODS

Prusac located in Central Bosna between Bugojno and Donji Vakuf and belongs eurosiberian region and teritory of Inner Dinarides. The climate of this area is moderate continental.

Geological bases of investigated area are: limestone, dolomitic limestone and dolomite from

Mesosoic period, majority Trias (Katzer 1903: 194).

Soils are rendzina and calcomelanosol.

We are used two different methods during research: constant surface (300 m^2) and transects with different lengths (100-500 m^2).

The research was conducted in the forests and meadows ecosystems during early spring,

Spring-summer and autumn seasons in 2008. Within the forest ecosystems we studied following orders: *Erico-Pinetalia, Vaccinio-Piceetalia* and *Fagetalia* and for meadows ecosystems order *Arrhenatheretalia.*

The fungi were identified according to: Bertraux (1966), Božac (2005), Breitenbach an Kränzlin (2000), Candusso (1997),Foht (1979, 1987, 1990), Galli (2003),Gerhardt (1997), Hansen and Knudsen(1992, 1997), Pace (1977) and Pilat (1951).

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RESULTS AND DISCUSSION

In this study, the mushrooms collected in different ecosystems of Prusac are given under classes and families. Their localities, distibutions, habitats and collecting times are also given.

Meadows ecosystem
Class: *Basidiomycetes*

Family: *Agaricaceae* Fr.
1. *Agaricus campestris* L. ex Fr.: meadow above school (Novi Prusac), *Arrhenatheretalia*, autumn.
2. *Lepiota cristata* (Bolton ex Fr.) P. Kumm.: meadow above school (Novi Prusac), *Arrhenatheretalia*, autumn.
3. *Macrolepiota gracilenta* Fr.: meadow above school (Novi Prusac) and medow below Srt, *Arrhenatheretalia*, autumn.
***4.* *M. procera* (Scop. ex Fr.) Singer: meadow above school (Novi Prusac), *Arrhenatheretalia*, autumn.**

Family: *Tricholomataceae* Heim ex Pouz.
5. *Calocybe gambosa* (Fr.) Donk.: Han Čardak, *Arrhenatheretalia*, early spring
6. *Clitocybe geotropa* (Bull.ex Fr.) Quél.: medow below Srt, *Arrhenatheretalia*, autumn.
7. *Marasmius oreades* (Bolton ex Fr.) Fr.: medow below Srt, *Arrhenatheretalia*, autumn.
8. *Melanoleuca gramopodia* (Bull. ex Fr.) Pat.: meadow above school (Novi Prusac) and medow below Srt, *Arrhenatheretalia*, autumn.

Family: *Hygrophoraceae* Roze ex Maire
9. *Camarophyllus niveus* (Scop. ex Fr.) Karsten

Family: *Lycoperdiaceae* Clements
10. *Vascellum pratense* (Pers. Ex Pers.) Kreisel: meadow above school (Novi Prusac), medow below Srt and Ajvatovica, *Arrhenatheretalia*, autumn.

Forests ecosystems
Class: *Ascomycetes*

Family: *Morchellaceae* Rchb.
1. *Morchella conica* Fr. ex Pers., Ajvatovica till Ajvaz-dedo rock, *Vaccinio-Piceetalia*, early spring.

Class: *Basidiomycetes*

Family: *Amanitaceae* Pouzar
1. *Amanita citrina* (Schaeff.) Pers.: below Srt, *Fagetalia*, spring-summer.
2. *A. fulva* Singer: below Srt, *Fagetalia*, spring-summer.
3. *A. rubescens* (Pers. ex Fr) Gray, below Srt, *Fagetalia*, spring-summer.
4. *A. vaginata* (Bull. ex Fr.) Quél.: below Srt, *Fagetalia*, spring-summer.

Family: *Agaricaceae* Clements
5. *Agaricus silvicola* (Vittad.) Sacc.: behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia*, autumn.
6. *Cystoderma carcharias* (Pers.) Fayod: above Novi Prusac, *Fagetalia*, autumn.
7. *Lepiota cristata* (Bolton ex Fr.) P. Kumm.: between Han Čardak and Skandar, *Erico-Pinetalia*, autumn.
8. *Macrolepiota mastoidea* (Fr.) Sing.: behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia*, autumn.

Family: *Pluteaceae* Kotl. & Pouzar
9. *Pluteus atricapillus* (Secr.) Singer: behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia*, autumn.

Family: *Coprinaceae* Roze ex Overrem

10. *Coprinus comatus* (Mull. ex Fr.) S. F. Gray: Skandar, *Vaccinio-Piceetalia*, autumn.

11. *C. micaceus* (Bull. ex Fr.) Fr.: between Han Čardak and Skandar, Skandar, *Erico-Pinetalia*, spring-summer, autumn.

12. *Psathyrella hydrophilla* (Bull. ex Merat) R. Mre.: behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia*, autumn.

Family: *Entolomataceae* Mos.

13. *Clitopilus prunulus* (Scop. ex Fr.) P. Kummer: above Novi Prusac, *Fagetalia*, autumn.

Family: *Tricholomataceae* Heim ex Pouz.

14. *Armillaria mellea* (Vahl. ex Fr.) Karst.: behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia*, autumn.

15. *Collybia butyracea* (Bull. ex Fr.) P. Kummer: Han Čardak, *Fagetalia*, autumn.

16. *C. butyracea* (Bull. ex Fr.) P. Kummer var. *asema* Fr.: behind Ajvaz-dedo rock, toward the meadow, between Han Čardak and Skandar, *Vaccinio-Piceetalia*, autumn.

17. *C. fusipes* (Bull. ex Fr.) Gray: below Srt, *Fagetalia*, spring-summer.

18. *Laccaria laccata* (Scop. ex Fr.) Bk. E Br.: above Novi Prusac, *Fagetalia*, autumn.

19. *Lepista nuda* (Bull. ex Fr.) Cke.: behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia*, autumn.

20. *Melanoleuca cognata* (Fr.) Kontr. et Maubl.: Ajvatovica till Ajvaz-dedo rock, *Vaccinio-Piceetalia*, early spring.

21. *Mycena pura* (Pers. ex Fr.) P. Kummer: above Novi Prusac, *Fagetalia*, between Han Čardak and Skandar, behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia*, autumn.

22. *Oudemansiella radicata* (Relhan ex Fr.) Sing.: behind meadow Ajvatovica till Ajvaz-dedo rock, *Vaccinio-Piceetalia*, autumn.

23. *Strobilurus esculentus* (Wulf. Ex Fr.) Sing.: Ajvatovica till Ajvaz-dedo rock, *Vaccinio-Piceetalia*, early spring.

24. *Tricholoma batschii* Gulden: behind Ajvaz-dedo rock, toward the meadow, Stražnica, between Han Čardak and Skandar, Han Čardak , *Erico-Pinetalia* and *Vaccinio-Piceetalia*, autumn.

25. *T. terreum* (Schff. ex Fr.) P. Kummer: between Han Čardak and Skandar, Han Čardak, *Erico-Pinetalia*, autumn.

26. *T. vaccinum* (Pers. ex Fr.) P. Kummer: Skandar, between Han Čardak and Skandar, *Vaccinio-Piceetalia*, autumn.

Family: *Strophariaceae* Sing. Ex Smith

27. *Hypholoma fasciculare* (Huds. ex Fr.) P. Kummer: below Srt, *Fagetalia*, spring-summer, Skandar, *Vaccinio-Piceetalia*, autumn.

28. *H. sublateritium* (Fr.) Quél.: Skandar, behind meadow Ajvatovica till Ajvaz-dedo rock, behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia*, autumn.

29. *Stropharia aeruginosa* (Curt. ex Fr.) Quél.: behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia*, autumn.

Family: *Cortinariaceae* Roze

30. *Cortinarius glaucopus* (Schff. ex Fr.) Fr.: above Novi Prusac, *Fagetalia*, autumn.

31. *C. percomis* Fr.: Skandar, between Han Čardak and Skandar, behind Ajvatovica till Ajvaz-dedo rock, behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia*, autumn.

32. *C. sp.* behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia*, autumn.

33. *Hebeloma cristuliniforme* Quél.: above Novi Prusac,.between Han Čardak and Skandar, *Fagetalia* and *Vaccinio-Piceetalia*, autumn.

Family: *Russulaceae* Roze

34. *Lactarius deterrimus* Gröger: behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia*, autumn.

35. *L. piperatus* (L. ex Fr.) S. F. Gray: below Srt, *Fagetalia*, spring-summer.

36. *L. sanguifluus* (Paulet ex Fr.) Fr.: Han Čardak, *Erico-Pinetalia*, autumn.

37. *L. torminosus* (Schff. ex Fr.) Gray: above Novi Prusac, *Fagetalia,* autumn.
38. *L. volemus* (Fr. ex Fr.) Fr.: below Srt, *Fagetalia,* spring-summer.
39. *Russula cyanoxantha* Schff. ex Fr.: below Srt, *Fagetalia,* spring-summer.
40. *R. heterophylla* (Fr.) Fries: below Srt, *Fagetalia,* spring-summer.
41. *R. queleti* Fr.: Skandar, behind meadow Ajvatovica till Ajvaz-dedo rock, behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia,* autumn.

Family: *Hygrophoraceae* Roze ex Mre
42. *Hygrophorus agathosmus* (Fr.) Fries: Skandar, *Vaccinio-Piceetalia,* autumn.
43. *H. camarophyllus* (Alb. & Schwein. ex Fr.) Dumée: Han Čardak, *Erico-Pinetalia,* autumn.
44. *H. cossus* (Sow. ex Berk.) Fr.: above Novi Prusac, *Fagetalia,* autumn.
45. *H. nemoreus* (Lasch) Fr.: behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia,* autumn.
46. *H. pudorinus* Fr.: behind meadow Ajvatovica till Ajvaz-dedo rock, *Vaccinio-Piceetalia,* autumn.

Family: *Gomphidiaceae* Jülich
47. *Chroogomphus rutilus* (Schff. ex Fr.) Miller: between Han Čardak and Skandar, *Erico-Pinetalia,* autumn.

Family: *Boletaceae* Chevalier
48. *Leccinum aurantiacum* S. F. Gray: Han Čardak, *Fagetalia,* autumn.
49. *L. griseum* (Quél.) Singer: above Novi Prusac, *Fagetalia,* autumn.
50. *Suillus granulatus* (L. ex Fr.) Kuntze: Skandar, Stražnica, between Han Čardak and Skandar, *Erico-Pinetalia,* spring-summer, autumn.
51. *S. luteus* (L. ex Fr.) Gray: Skandar, between Han Čardak and Skandar, Han Čardak, *Erico-Pinetalia,* spring-summer, autumn.

Family: *Cantharellaceae* J. Schröt.
52. *Cantharellus cibarius* Fr.: above Novi Prusac, *Fagetalia,* autumn.

Family: *Hydnaceae* Chevall.
53. *Hydnum repandum* L. ex Fr.: above Novi Prusac, *Fagetalia,* autumn.

Family: *Clavariaceae* Chevall.
54. *Ramaria aurea* (Schaeff. Ex Fr.) Quél.: above Novi Prusac, *Fagetalia,* behind meadow Ajvatovica till Ajvaz-dedo rock, *Vaccinio-Piceetalia,* autumn.

Family: *Lycoperdiaceae* Chevall.
55. *Calvatia excipuliformis* (Schaeff. Ex Pers.) Perdeck:Skandar, *Vaccinio-Piceetalia,* autumn.
56. *Geastrum fimbriatum* Fr.: behind meadow Ajvatovica till Ajvaz-dedo rock, behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia,* autumn.
57. *Lycoperdon perlatum* Persoon: behind meadow Ajvatovica till Ajvaz-dedo rock, *Vaccinio-Piceetalia,* autumn.

Family: *Phallaceae* Corda
58. *Phallus impudicus* L. ex Pers.: behind Ajvaz-dedo rock, toward the meadow, *Vaccinio-Piceetalia,* autumn.

In the vicinity of forest order *Fagetalia* on the locality above Novi Prusac, there are planted a few black pines near which we found the following species of fungi:
1. *Tricholoma terreum* (Schff. ex Fr.) P. Kummer,
2. *Suillus granulatus* (L. ex Fr.) Kuntze,
3. *Chroogomphus rutilus* (Schff. ex Fr.) Miller

As a results of this study, 10 species in meadows ecosystems and 59 species in forests ecosystems were identified for Prusac and its surrounding area. *Lepiota cristata* was found in both meadow and forest ecosystems.

Most important edible mushrooms are:*Agaricus campestris, Macrolepiota procera, Suillus granulatus, S. luteus* and *Tricholoma terreum.*

Small number of species is a consequence of several factors: very high temperature in the year 2008, adverse geological surface (dolomite) for the mushroom growth in certain areas of the terrain, the density of the herbal layer in some forest, adverse impact of wind and boundedness of space for research due to minefields.

As we researched this area, we found a small number of fungi due to the variety of reasons. One of the most important is dolomite geologic surface that is on most of the researched area. Fungi are best developed on soil with an acidic pH reaction. Dolomite is very basic rock and creates unfavorable conditions for the development of fungi.furthermore, the vegetation of black pine forest on dolomite with its plant assembly precludes significant development of fungi. Especially *Erica carnea* L. with its bushy growth and high density, in addition to the unfavorable pH values, prevents further growth of fungi.

Part of studied are was under the influence of wind, which is very unfavorable for the development of fungi.

Season 2008 was very dry with high temperatures wich further influenced the diversity of fungi.

Part of the terrain could not be investigated due to the danger of mines.

Locals of Prusac have very little knowledge of fungi. From conservations with them, we

Concluded that most of them are familiar with two to five species of fungi (morel, bolete, parasol, chantarelle and field mushroom). Gathering fungi is not source of income for these people. We think that the cause of the poverty of areas with fungi.

CONCLUSIONS

- **This is the first data about biodiversity of fungi in this area.**
- **We are found 10 species in meadows and 59 species in forests ecosystems.**
- **A total of 68 species of fungi was found belonging to 18 families.**
- **Most numerous families are: *Tricholomataceae* (with 17 species), *Russulaceae* (8 sp.), *Agaricaceae* (7 sp.), *Hygrophoraceae* (6 sp.)**
- **Most important edible mushrooms are:*Agaricus campestris, Macrolepiota procera, Suillus granulatus, S. luteus* and *Tricholoma terreum.***
- **Unfavorable natural conditions which prevent growth of fungi on the large part of studied area are: unfavorablegeological base, density of herb layers and negative impact of wind.**

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ELEMENTS OF GARDEN ART OF RESIDENTAL RENTED HOUSES-VILLAS IN AUSTRO-HUNGARIAN PERIOD IN SARAJEVO AS A DOCUMENT OF SPACE IDENTITY PRESERVATION

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ABSTRACT

Research of garden architecture of Austro-Hungarian period of Bosnia and Herzegovina is mainly based on park agglomerations which arose in that period. However, the complex administration of the Monarchy started the construction of multi-residential houses for numerous clerks, and their original garden solutions are not sufficiently explored. These authentic unities of Western European style buildings and green areas around them are especially important for the preservation of Bosnian and Herzegovinian garden heritage and merit necessary treatment. The aim of this paper is to identify and valorize garden architecture of residential houses-villas, on the basis of found documentation, and to propose garden solutions for four Austro-Hungarian period houses-villas in Old Town and Centre communities with the reconstruction method, in order to offer a contribution to garden heritage research and to preserve and protect authentic complexes of Sarajevo from Austro-Hungarian period.

Key Words*:* Garden elements, residential houses-villas, Austro-Hungarian period, space identity preservation, Sarajevo

INTRODUCTION

The urban areas of Sarajevo, as described by Evliya Çelebi in his travelogue, was characterized by large green areas in the living zones of the city (Kreševljaković, 1969), where the private gardens and backyards formed an unique complex with family houses (Ljujić-Mijatović & Švrakić, 2006). After the arrival of Austro-Hungarian Monarchy, most family houses are replaced with western-style residential block buildings, that were built from each side of the road, with no green areas around them. That was one of the reasons why the first public green areas, located outside of the living zones, were formed in this period, and their style was mainly affected by the style of the surrounding buildings, inspired by gothic, romantic and rennaisance architecture. That can be seen in ground plans of Great Park in Sarajevo, Spa Park Ilidža, Botanical Garden of the National Museum of Bosnia and Herzegovina and park around Islamic Law School (Krzović, 1987; Kurto, 1998). The main garden elements of rennaisance, romantic and gothic style are clipped hedges, used to border paths and form parterres (mostly made of boxwood - *Buxus sempervirens* L.), climbers, used to cover or accentuate buildings, clipped evergreen shrubs or small trees used as structural plants, and geometrically shaped flowerbeds with brightly-colored plants in one or two colors (Gothein, 1929). The green areas have a geometrical relationship with the house to which they belong (Turner, 2005). Although most houses in Austro-Hugarian period in Sarajevo were built in the block-building style, there was certain number of residental houses that were builted separately, as a house-villa with its own green area. Those green areas, located in front of or around residential buildings-villas in Sarajevo are not sufficiently explored. Since they represent a valuable document of the time that they were created in, it is necessary to try to identify and valorize the plant structure in them, and propose alternative solutuins, in order to preserve and protect garden heritage from Austro-Hungarian period. Since there is no authentic data (photographs or garden plans), the only renewal method that can be used on those green areas is the method of reconstruction (Obad Šćitaroci, 1992).

MATERIALS AND METHODS

The object of this work are the green areas around Austro-Hungarian period houses, located in ihe Old Town (Budžak 6 and Avdage Šahinagića 17) and Center (Bolnička 7) municipalities in Sarajevo. The ground plans, photographs and old postcards of Austro-Hungarian houses in Sarajevo with original gardens around them, and the written data about the structure and style of gardens formed during Austro-Hungarian Monarchy in Europe were used for identification of plant material. The data about houses-villas whose green areas were the subject of this paper were obtained from the Municipal Court,

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the Land-Registry Office, the Historical Archive of Sarajevo and the Institute of Cultural and Historical Heritage. The floristic structure and valorization of present condition of plant material was made for every residential house-villa. Since it was impossible to obtain the authentic photographs or planting plans of investigated green areas, the proposals for the reconstruction of green areas were given using the previously identified plants.

RESULTS AND DISCUSSION

After inspecting the Austro-Hungarian period photographs and postcards of Sarajevo, obtained from the Historical Archive of Sarajevo and the Institute of Cultural and Historical Heritage, it can be concluded that the trees were mostly planted in alleys or rows on the side of the buildings, and they had geometrically-shaped crowns (*Aesculus hippocastanum* L., *Platanus* × *acerifolia* Willd., *Acer pseudoplatanus* L., *Tilia cordata* Mill, *Catalpa bignonioides* Walter, *Populus nigra* 'Italica'). Clipped evergreen shrubs (*Buxus sempervirens* L.) were used in front of the buildings, in geometrical shape, clipped hedge or parterre-like structure. The flowering plants were used in just only or two colors, placed in geometrically-shaped flowerbeds, flowerboxes on windows and terraces, or combined with climbing or tree roses (*Rosa* × *hybrida* Vill.). The walls of most buildings were decorated with climbers (*Hedera helix* L. and *Wisteria sinensis* (Sims) DC).

1. Residential house-villa in Bolnička 7 street

The plants that are currently present on the green area around the villa in Bolnička 7 street are listed in table 1. and presented in figure 1.

Table 1. The floristic structure of Bolnička 7 green area

Scientific name	Type	No. of plants	Condition	Location
Acer pseudoplatanus L.	Deciduous tree	2	Good	Good
Fraxinus ornus L.	Deciduous tree	4	Good	Good
Ligustrum vulgare L.	Deciduous shrub	1	Bad	Bad
Picea abies (L.) H.Karst.	Evergreen tree	1	Bad	Bad
Prunus cerasifera Ehrh.	Deciduous tree/shrub	1	Good	Bad
Rosa × *hybrida* Vill.	Flowering shrub	1	Bad	Bad

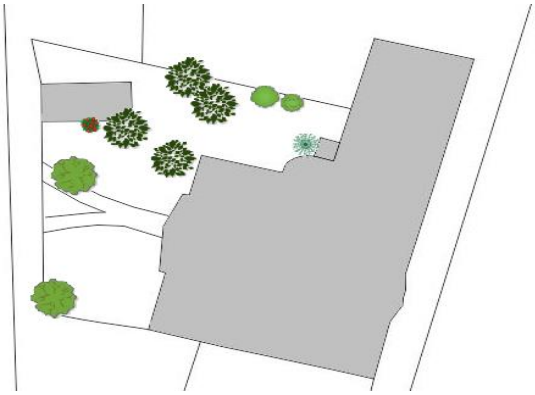

Fig. 1. The present situation at the Bolnička 7 green area

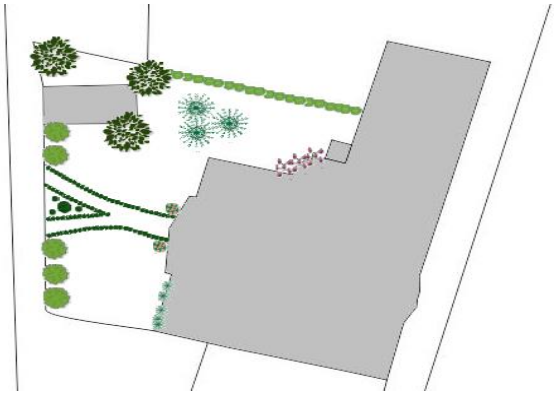

Fig. 2. The proposed solution of the Bolnička 7 green area

The green area of Bolnička 7 Villa is relatively large, and divided in two sections by a concrete path. There are 10 plants on this green area: two Acer pseudoplatalus L. trees, well developed, without damage and located in front of the villa; four Fraxinus ornus L. trees, located on the northern side of the villa, undamaged and well developed; one Prunus cerasifera Ehrh. formed as a shrub and well developed, but located on the northern side of the villa's green area, next to fence so that it is not visible from the front street; one Ligustrum vulgare L. shrub, planted in the shadow, under Prunus cerasifera and very poorly developed, one Picea abies (L.) H. Karst tree, very poorly developed and located very close to the building, and one Rosa × hybrida Vill. shrub, very damaged and dry, located in the shadow, under the Fraxinus ornus tree. In order to accentuate the building, the horticultural solution of this green area was given. The proposed solution of Bolnička 7 green area contains short clipped box (Buxus sempervirens L.), on each side of the path, one large and three smaller ball-shaped Buxus sempervirens L. shrubs,

placed by the path, between the two entrances in the front yard, five Platanus ×acerifolia Willd trees in the form of an alley by the street, three Tilia cordata Mill. trees to provide shade and three Picea abies Mill. trees for the wintertime structure of the garden. The northern sife of the garden is enclosed by trimmed Ligustrum vulgare L. hedge. The color is provided by two pink tree roses (Rosa × hybrida Vill.) on each side of the main entrance, and climbing Wisteria sinensis (Sims) DC on the wall above the back entrance, on the northern side of the villa, and annual flowering plants in the windowboxes. The front wall is partially covered with climbing ivy (Hedera helix L.) (Figure 2).

2. Residential house-villa in Budžak 6 street

The green area around the Budžak 6 villa is smaller than the one in the Bolnička 6 street, but very poorly used. There are 11 plants on this green area: one well developed Acer pseudoplatalus L. tree, located on the eastern side of the villa; two shrubs of Berberis thunbergii 'Atropurpurea', well developed but unclipped and planted randomly on each side of the main entrance; one Buxus sempervirens L. shrub, clipped in the round form, placed on the very border of the green area, where it has no ornamental function; one Fraxinus ornus L. tree, with a lot of broken branches, located behind the building; one Malus domestica Borkh. tree, planted under Acer pseudoplatalus, with a lot of dry and broken branches and three very poorly developed Rosa × hybrida Vill. shrubs, planted in front of the main entrance. The plants that are currently present on the green area around the villa in Budžak 6 street are listed in table 2. and presented in figure 3.

Table 2. The floristic structure of Budžak 6 green area

Scientific name	Type	No. of plants	Condition	Location
Acer pseudoplatanus L.	Deciduous tree	1	Good	Good
Berberis thunbergii 'Atropurpurea'	Deciduous shrub	2	Good	Bad
Buxus sempervirens L.	Evergreen shrub	1	Good	Bad
Fraxinus ornus L.	Deciduous tree	1	Bad	Bad
Malus domestica Borkh.	Deciduous tree	1	Bad	Bad
Rosa × *hybrida* Vill.	Flowering shrub	3	Bad	Good

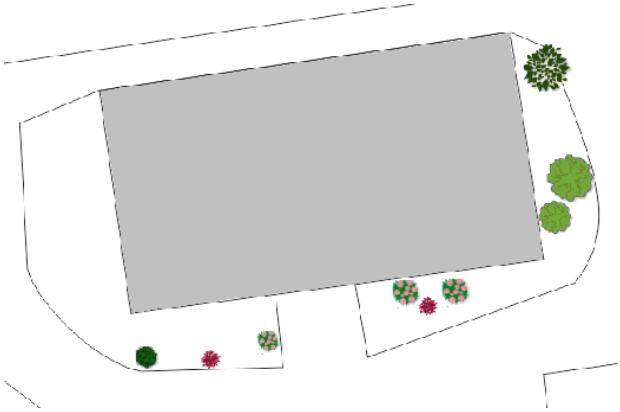

Fig. 3. The present situation at the Budžak 6 green area

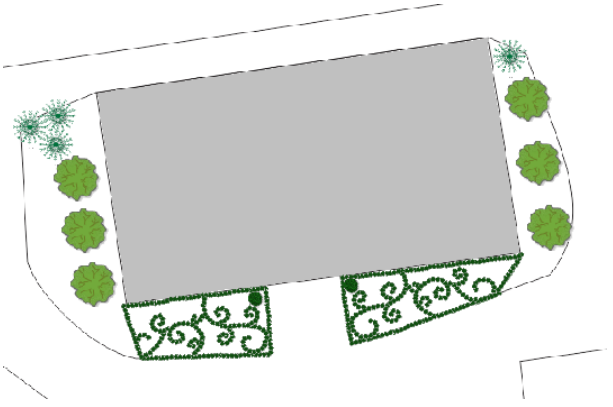

Fig. 4. The proposed solution of the Budžak 6 green area

In order to provide the ornamental effect through the entire year, the proposed solution contains parterre-like structure in front of the building, made of short clipped box (*Buxus sempervirens* L.), and two larger cone-shaped *Buxus sempervirens* L. shrubs, placed on each side of the entrance. The empty places in the parterre are planted with annual and biennial flowering plants of single color. On the sides of the building, there are six *Aesculus hippocastanum* L. trees, which provide shadow and color in the springtime, and four *Picea abies* Mill. trees, for the wintertime structure (Figure 4).

3. Residential house-villa in Avdage Šahinagića 17 street

The villa in Avdage Šahinagića 17 street has its entire front yard covered in concrete, with just two small areas for planting. The currently present plants on the green area around the villa in are listed in table 3. and presented in figure 5.

Table 3. The floristic structure of Avdage Šahinagića 17 green area

Scientific name	Type	No. of plants	Condition	Location
Aster amellus L.	Flowering perennial	>20	Bad	Good
Rosa × *hybrida* Vill.	Flowering shrub	4	Bad	Good

The square-shaped flowerbed in front of the villa is encircled by purple-flowering *Aster amellus* L. plants, that are mostly dry, and there are also four very damaged *Rosa* × *hybrida* Vill.shrubs. There are no evergreen plants, so this green area has no ornamental function during winter. The large square-shaped flowerbed in the front of the villa, by the proposed solution (Figure 6.) is encircled by short trimmed *Buxus sempervirens* L., and also contains two ball-shaped box shrubs. The trimmed box is also used on the small planting area on the eastern side of the entrance: short box hedge in front, and four topiaries in the back. The color is provided by roses (*Rosa* × *hybrida)* Vill.): two red climbers on each side of the entrance and one white tree rose in the large flowerbed, as well with annual and biennial flowering plants in single color.

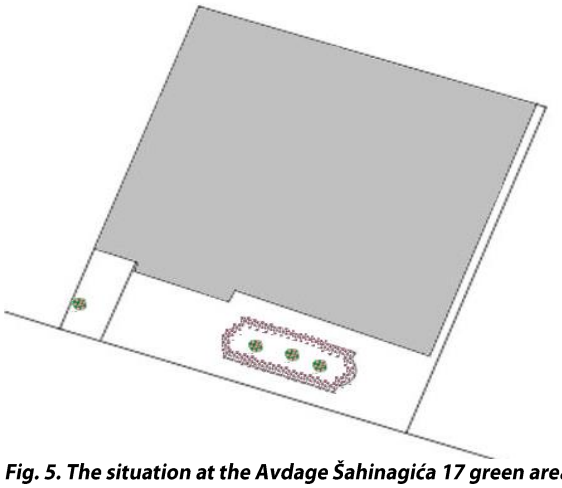

Fig. 5. The situation at the Avdage Šahinagića 17 green area

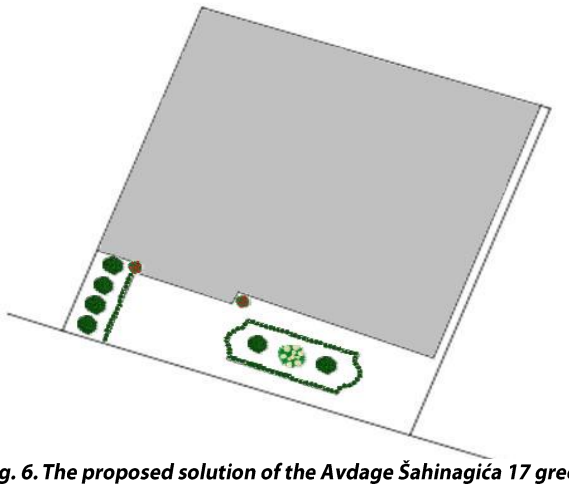

Fig. 6. The proposed solution of the Avdage Šahinagića 17 green area

CONCLUSIONS

After the identification and valorization of green areas of three Austro-Hungarian period houses-villas in Sarajevo, the following conclusions can be made:

- **Although most houses in Austro-Hugarian period in Sarajevo were built in the block-building style, there was certain number of residental houses that were builted separately, as a house-villa with its own green area.**
- **During the Austro-Hungarian period in Sarajevo the trees were mostly planted in alleys or rows on the side of the buildings, and they had geometrically-shaped crowns, evergreen shrubs (*Buxus sempervirens* L.) were clipped in geometrical shapes, hedges or parterre-like structures. The flowering plants were used in just only or two colors, placed in geometrically-shaped flowerbeds, or combined with roses (*Rosa* × *hybrida* Vill.). The walls of most buildings were decorated with climbers (*Hedera helix* L. and *Wisteria sinensis* (Sims) DC).**
- **The present condition of green areas around most historically valuable Austro-Hungarian villas in Sarajevo is very unsatisfactory. That also applies to the green areas around villas in Budžak 6, Avdage Šahinagića 17 and Bolnička 7 street.**
- **The plants found in investigated green areas around the villas in Bolnička 7, Budžak 6 and Avdage Šahinagića 17 are either in a bad condition (*Ligustrum vulgare* L, *Picea abies* (L.) H.Karst, *Rosa* × *hybrida* Vill., *Fraxinus ornus* L., *Malus domestica* Borkh., or are badly located (*Ligustrum vulgare* L., *Picea abies* (L.) H.Karst, *Prunus cerasifera* Ehrh., *Rosa* × *hybrida* Vill., *Berberis thunbergii* 'Atropurpuea', *Buxus sempervirens* L., *Fraxinus ornus* L., *Malus domestica* Borkh., *Aster amellus* L.).**

- **The proposed solutions of garden areas of investigated houses-villas contain clipped box (*Buxus sempervirens* L.), the deciduous *Platanus ×acerifolia* Willd, *Tilia cordata* Mill. and *Aesculus hippocastanum* L. trees, evergreen *Picea abies* Mill. trees, flowering *Rosa* × *hybrida* Vill., climbers *Wisteria sinensis* (Sims) and *Hedera helix* L. and annual flowering plants.**

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THE EFFECTS OF AMINOETHOXYVINYLGLYCINE (AVG) ON FRUIT QUALITY OF 'EKSI BIR CV.' NECTARINE

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ABSTRACT

'Eksi Bir' nectarine cultivar is an early maturing variety mostly produced in Antalya region which is important for early fruit production in Turkey. This variety is the most important for the early market. ReTain (15% AVG) is a plant growth regulator used for prevention of pre-harvest fruit drop and for increasing fruit weight and firmness. The aim of this research was to determine the effects of pre-harvest AVG treatments on fruit quality of 'Eksi Bir' nectarine cultivar. For this purpose, 125 ppm of aminoethoxyinylglycine (AVG) was sprayed onto fruits and leaves around the fruits of 5-year-old nectarine (*Prunus persica var. nucipersica* Schneid. cv. Eksi Bir) trees at 1, 3 and 4 weeks before the predicted harvest date. Fruit length (mm), fruit width (mm), fruit weight (g), fruit firmness (N), kernel weight, length of fruit stalk, titratable acidity (%), soluble solid contents (%), pH (%), fruit colour (L*, a*, b*,C*, h*), ethylene production (µL/kg.h) and respiration rate (µL/kg.h) were determined at harvest time.

Key Words: AVG (aminoethoxyinylglycine), 'Eksi Bir cv.' Nectarine, Fruit quality, Harvest time

INTRODUCTION

Aminoethoxyvinylglycine (AVG) is a known inhibitor of ACC synthase (ACS) activity (Yu and Yang, 1979) which converts S-adenosylmethionine (SAM), which is the major methyl group donor for numerous transmethylation reactions. 1-amino-cyclopropane-1-carboxylic (ACC), the immediate precursor of ethylene is the rate-limiting enzyme in ethylene biosynthesis (Bregoli et al., 2002). AVG is the active ingredient of a chemical (ReTain®) that in field trial was shown to reduce fruit abscission and to improve fruit quality (Byers, 1997). ReTain plant growth regulator, containing 15% w/w AVG, was registered in Australia in October 2001 for use in apples, peaches and nectarines (Rath and Prentice, 2004). Pre-harvest spraying with ReTain (15 % AVG) has been demonstrated to delay ripening and reduce pre-harvest drop of fruits in apples, peaches, nectarines and other climacteric fruits (Autio and Bramlage, 1982; Park et al., 1999; Bregoli et al., 2002). However, the effects of AVG depend on application concentration and time, cultivar and environmental conditions (Matoo et al., 1977; Kim et al. 2004). In a study conducted in a commercial orchard of 'Arctic Snow' nectarines, application of 125g AVG/ha 7 days before anticipated first harvest gave a 2.75 day harvest delay based on standard commercial maturity criteria. This harvest delay shifted the ReTain-treated fruit to larger fruit size categories, giving a 12.3% increase in yield compared to the untreated fruit (Rath and Prentice, 2004). Çetinbaş and Koyuncu (2011) also reported that application of AVG (100-150-200 ppm) to 'Monroe' peach resulted in a reduction of 7-21-30 days of harvest time and increased fruit weight by 3-47%, fruit firmness by 35-73% compared to control fruits.

This study was conducted in Antalya, one of the most important early fruit production centers for nectarines in Turkey. 'Eksi Bir' nectarine variety is the most important one for early marketing and for the export market. Therefore, this study examined the effects of pre-harvest application of ReTain on different application times on harvest delay, fruit size, fruit quality, ethylene production, and respiration rate of 'Eksi Bir' nectarine.

MATERIAL AND METHODS

Trees (6-year-old) of *Prunus persica var. nucipersica* Schneid cv. Eksi Bir, grafted on GF305 seedling rootstock and trained to a free open-vase, were selected for their size and fruit load uniformity. They were sprayed with ReTain (Valent BioSciences Corp., USA), a commercial product containing 15% (w/w) AVG. ReTain was applied as an aqueous solution, containing 0.05% (v/v) of a surfactant (Tween-20), at dose corresponding to 125 ppm onto fruits and leaves around the fruits until runoff. The spraying was performed with a hand pump sprayer at 7, 21 and 30 days before commercial harvest (DBH). Fruits were harvested at a commercial maturity stage when the ground colour changed from green to yellow-red at intervals of 3-4 days for yield and fruit assessment. The fruits picked at the harvest time were immediately transported to the post-harvest physiology laboratory. Fruits were harvested 3 times on 14

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May (first harvest), 17 May (second harvest), 20 May (third harvest). The data used for analysis in this paper comes from the second harvest because the highest percentage of mature fruit picked was in the second harvest. The fruit weight, fruit colour (measured with a Minolta Chroma Meter CR-300 using the CIE L*, a*, b*, c*, h*), fruit firmness (using a Lloyd LF Plus Universal Test Machine), and soluble solids content (SSC) (using a digital Palette PR–32 Atago refractometer) were measured. The colour was measured on both sides of the fruit. Fruit firmness was tested at two points on the fruit surface with a plunger having 8 mm diameter tip. Titratable acidity (TA) was determined by using a digital burette (Digitrate Isolab 50 m*l*) through titration of 10 ml of diluted juice with 0.1 N NaOH up to pH 8.1, and the TA was expressed as malic acid. Ethylene production (µL/kg.h) and respiration rate (µL/kg.h) were determined in fruit placed in closed jars after keeping for 1 day at room temperature (20±1 °C) (1 kg of fruit was closed in each jar and the volume of each jar was 4 liters). The respiration rate was measured with a gas analyzer. The ethylene production rate was determined using gas chromatography with a flame ionization detector (Gunes et al., 2001). The experiment was set up according to the split plot experimental design with 3 replications with each replication composed of one tree. 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

Fruit maturity and harvest time

'Eksi Bir' nectarine fruits have been harvested sequentially. The fruit treated at 125 ppm, which matured during the same period, were harvested seven days before the estimated harvest time. The application of 125 ppm advanced the maturation and three days after the period and these fruits were harvested for the first time on the mentioned date. The fruits of the control group and 7 DBH AVG group constituted the group first harvested. The second harvest was performed immediately when the fruits of groups 21 and 30 DBH AVG were suitable for harvest. The third harvest of the trial was performed for all fruits on May 20. As a result, the control groups and 7 DBH AVG applications were harvested in three periods while 21 and 30 DBH AVG applications were harvested in two periods. Therefore; the application of AVG at 125 ppm dose 21 and 30 days before the harvest delayed the maturity and made the harvest period more compact.

Fruit size and firmness

The evaluation results of the effects of AVG applications on some fruit quality features are given in Table 1. The AVG applications increased the fruit sizes in comparison with the control groups and the increase has been statistically significant ($P<0.05$). The diameters of the fruits expanded by 8.4% and the weight of fruits increased by 35% particularly with 30 DBH AVG treatment. In addition to the important increase of fruit size, the AVG application was very effective when applied on the 30 and 21 days prior to the estimated harvest time. The effect of AVG applications on fruit firmness was statistically significant ($P<0.05$). The AVG application 30 DBH has the highest value (48.92 N) in terms of fruit firmness, followed respectively by 21 DBH (47.93 N) and 7 DBH (44.83 N).

Soluble Solids (SSC) and Titratable Acidity Contents and Ph

The effects of AVG applications on SSC and pH have been found statistically significant ($P<0.05$) but effect on TA was not significant (Table 2). The AVG applications increased the soluble solid contents of the fruits. The highest SSC (14.00%) was obtained with 30 DBH application where fruits had the lowest pH value (2.20).

Table 1. The effect of AVG doses on some fruit characteristics of 'Eksi Bir' nectarine cultivar

Application	Fruit width (mm)	Fruit length (mm)	Fruit height (mm)	Fruit weight (g)	Firmness (N)
Control	54.07b	51.44c	53.07b	82.23b	43.71b
7 DBH	53.90b	53.34b	54.24b	84.64b	44.83b
21 DBH	54.00b	52.03bc	54.58b	96.29a	47.93a
30 DBH	58.61a	57.16a	59.79a	110.97a	48.92a

With each column. values followed by the same letter are not significantly different at P < 0.05 level according to Duncan's multiple range test.

Ethylene production and respiration rate

AVG applications reduced the production of ethylene and the respiration rate in comparison with the control group. The effects of the applications on the production of ethylene and the respiration rate have been statistically significant (P<0.05) (Table 2). The lowest ethylene production rate was 0.237 µL/kg.h at 30 DBH AVG application whereas the highest rate of the ethylene production (0.237 µL/kg.h) was obtained from the control group. The effects of AVG applications on respiration rate were parallel to ethylene production and the respiration rate of the control group was higher than that of the AVG applied groups.

Table 2. The effect of AVG on fruit chemical characteristics of 'Eksi Bir' nectarine cultivar

Application	SSC (%)	TA (%)	pH	Ethylene production (µL/kg.h)	Respiration rate (µL/kg.h)
Control	13.40b	0.12	2.24ab	0.237a	26.90a
7 DBH	13.70ab	0.13	2.26a	0.234a	24.59b
21 DBH	13.60b	0.12	2.23ab	0.151b	22.71c
30 DBH	14.00a	0.13	2.20b	0.100b	20.74d

With each column. values followed by the same letter are not significantly different at P < 0.05 level according to Duncan's multiple range test.

Fruit colour

The effects of the AVG applications on fruit colour are indicated in Table 3. The effects of AVG applications on all colour values have been found statistically significant, except for a* which presents the red colour (P<0.05). The highest values were obtained from 21 DBH AVG application as L* (38.15), b* (23.90) and h* (35.88). The lowest values of L* (33.75), b* (18.57) and h* (29.40) were obtained from the control fruits.

Table 3. The effect of AVG on colour characteristics of 'Eksi Bir' nectarine cultivar

Application	L*	a*	b*	C*	h*
Control	33.75b	33.96	18.57b	37.50b	29.40b
7 DBH	36.68ab	32.05	22.91a	40.96a	33.57a
21 DBH	38.15a	33.59	23.90a	40.52ab	35.88a
30 DBH	36.17ab	32.48	21.87ab	40.60ab	32.08ab

With each column. values followed by the same letter are not significantly different at P < 0.05 level according to Duncan's multiple range test.

DISCUSSION

The control groups and 7 DBH AVG applications were harvested three times during the 7-day harvest period, whereas 30 and 21 DBH AVG applications were harvested twice during the four-day harvest period. These results are important for reducing the harvest cost which has a big share in the production cost. Moreover, these applications delayed the harvest for 3 days and shortened the harvest period by 3 days. According to many researches performed on peaches and nectarines, the harvest time is delayed and the fractional harvest period shortens when the AVG are applied, which are parallel to our results (Ju et al., 1999; Sing et al., 2003; Rath and Prentice, 2004; McGlasson et al., 2005; Noppakoonwong et al., 2005). The AVG applications caused an apparent increase in the fruit weight. Such increases proved to be very important on the early nectarine fruit weight, and it was determined that the 30 and 21 DBH AVG applications were very effective on fruit weight. According to a research on "Arctic Snow", it has been reported that when AVG is applied as 125 ppm eight days before the estimated harvest time, the fruits were bigger and heavier than the fruits of the control group (McGlasson et al., 2005). The AVG application

of 125 ppm was done 7 and 14 days before the estimated harvest time and it delayed the harvest of 'Tropic Beauty' peach variety for 7 days and increased the fruit size by 10% according to Noppakoonwong et al. (2005). The positive effects of AVG application on fruit firmness was also displayed in our study. The fruit firmness increased between 2.56% and 11.92% with AVG applications compared to that of the control fruits. There are many researches (Singh et al., 2003; Rath et al., 2004) about the positive effects of AVG on fruit firmness in stone fruits however in addition to this, Launder and Jerie (2000) pointed out that AVG application increased the fruit firmness between 12% and 60% in pome fruit approximately. Çetinbaş and Koyuncu (2011) found out that the firmness of fruits treated with AVG are firmer (35-70 %) than those of control groups in 'Monroe' peach variety under Eğirdir conditions in Turkey. Rath and Prentice (2004) emphasized that AVG application of 125 ppm increases the firmness, the weight and SSC in 'Arctic Snow' peach variety if applied 7 days before the estimated harvest time. In our study, the AVG applications increased SSC, as in other studies, and the highest increase was observed in 30 DBH AVG application. Likewise, a study on peach varieties 'Q'Henry', 'Summerset', 'Zee Lady' and the 'Elegant Lady' has shown that AVG application increased SSC and TA in 'Q'Henry' and 'Summerset' peach varieties if applied 15, 10 and 5 days before the estimated harvest time. In our study, the effects of the AVG applications on color values were important on L*, b*, C* and h*, but not on value a*. L* refers to the brightness and darkness of the colour, and value b*, signifies the rise in yellow background colour but lower red blush when AVG is applied. The effects of AVG application on coloration were different in different studies. Singh et al. (2003) stated that the effects of AVG applications on pigmentation varies according to the varieties and they have no effects on 'O'Henry' and 'Summerset' peach varieties, but on 'Zee Lady' peach variety the red colour on a yellow background was lowered. This result shows parallelism with our study. In another study carried out on peach varieties 'Tatura 204', 'Golden Queen', and 'Taylor Queen' there were delays in coloration in AVG applied fruits but at harvest they have the same coloration as those of the control group (Rath et al., 2004). Fruit softening is known to be one of the ripening processes that are most sensitive to ethylene. Fruit softening in peaches and nectarines are correlated with an increase in ACC and ethylene production. AVG applied as a pre-harvest spray to peaches inhibits ethylene synthesis (Boller et al., 1979; Kim et al., 2004; Rath and Prentice, 2004). The ethylene production and the respiration rate decreased with the applications and the lowest ethylene production and respiration rate were measured on 30 DBH AVG treated fruit. Kim et al. (2004) stated that AVG lowered the amount of ethylene and the respiration rate of the 'Mibaekdo' peach variety and also the application dose affected in the same way as in the findings of Bregoli et al. (2002) for 'RedHaven' peach variety. In our study, the effect of the application time was significant on ethylene production and respiration rate. The ethylene production and the respiration rates were low in 30 and 21 DBH AVG applications; whereas the 7 DBH AVG treated fruit had similar figures with that of the fruits of the control group. Since there was no delay in the harvest time and the fruit quality (weight and firmness) lagged behind those of fruits treated with 30 and 21 DBH AVG, the performance of 7 DBH AVG application seems to be directly linked to its ethylene production. On this ground, it is very important that the AVG applications are used for preventing the fruits from producing ethylene long before its natural occurance. In the Yang cycle, the primary molecule of ethylene is amino-cyclopropane-1-carboxylic (ACC). It is already known that ACC turns into the ethylene in aerobic environments (Taiz and Zieger, 2008). This shows that the synthesis of ACC is a biosynthetic step that restrains ethylene production in the tissues of the plants.

CONCLUSION

With this study, especially the notable effects of the AVG applications of 21 and 30 DBH are proven in terms of harvest time and duration and the fruit quality features of 'Eksi Bir' nectarine variety. This effect is considered to have arisen since AVG application restrains the production of ethylene which maintains the flow between the fruit stalk and the fruit. Ethylene is the major element of maturity and the restraining of ethylene cause delay in the cycle between the acid and the sucrose. Likewise the delay of harvest and maturity of the fruits like peach, apple, pear, apricot, and plum results from the delay between AVG and the ethylene (Lurie et al., 1997; Taiz and Zieger, 2008). This study also showed that the

most appropriate application time of AVG for 'Eksi Bir' variety is between 30 and 21 days before the estimated harvest time. The notable part of 'Eksi Bir' variety grown in Antalya, Turkey is its potential to export in the very early season. For this reason, the duration of the shelf life is spent during transportation. It is obvious that AVG applications increase the fruit firmness and it not only reduces the loss of quality during transportation but also extends the shelf life period. We think that these findings are also profitable for producers since they can create a market jointly due to the shortened harvest period of nectarines and peaches.

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THE EFFECTS OF AMINOETHOXYVINYLGLYCINE (AVG) AND GIBBERELLIC ACID (GA_3) ON FRUIT QUALITY OF '0900 ZIRAAT' CV.' SWEET CHERRY

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ABSTRACT

'0900 Ziraat' sweet cherry cultivar is a late maturing variety mostly produced in Isparta region and this region is an important sweet cherry production area in Turkey. ReTain (AVG) is a plant growth regulator used for prevention of pre-harvest fruit drop and increasing fruit firmness. Gibberellins play an important role in fruit set and development. Due to their role in fruit development, gibberellins are widely used to improve fruit size. The aim of this research was to determine the effects of pre-harvest AVG, GA_3 and AVG+GA_3 applications on the fruit quality of '0900 Ziraat' sweet cherry cultivar. For this purpose, treatments of AVG (50 ppm), GA_3 (20 ppm) and AVG + GA_3 were applied at straw-yellow stage (about 30-35 days prior to the harvest). Fruit width (mm), fruit length (mm), fruit weight (g), fruit firmness (N), seed weight, peduncle length (mm), peduncle thickness (mm), peduncle weight (g), titratable acidity (%), soluble solid contents (%), pH (%), fruit colour (L*, a*, b*,C*, h*) and respiration rate (µL/kg.h) were determined at harvest time.

Key Words: AVG (aminoethoxyvinylglycine), GA_3 (gibberellic acid), fruit quality, 0900 Ziraat cv. sweet cherry

INTRODUCTION

Sweet cherry (*Prunus avium* L.) is an important fruit crop for the Turkey stone fruit industry, and Turkey is also the biggest exporter and supplies 23.64% of the world's sweet cherry exports with 57.019 tons (FAO, 2007). However, the export potential of sweet cherry fruit is limited due to its fruit quality and short shelf life. The most important factor in the increase of sweet cherry export is due to '0900 Ziraat' sweet cherry cultivar whose fruit is large and firm, fruit pedicles are long durable in transportation and has a longer storage period (Aşkın et al., 2008). The increase in the demand for sweet cherry recently has gradually increased the importance of storage potential and the fruit quality (Yıldırım and Koyuncu, 2010). The fruit quality of sweet cherry may also be affected by some chemical applications before and after the harvest other than the classical applications (Muskovics et al., 2006). Gibberellic acid (GA_3) applied at ≈30 ppm at the beginning of stage III of fruit development is currently a standard application for sweet cherry growers in United States to improve quality and delay maturity (slowing of color development) (Lenahan et al., 2008). Cline and Trought (2007) reported increased size and firmness of 'Bing' and 'Sam' sweet cherries with repeated or singular foliar applications at 10 or 40 mg L^{-1} GA_3, respectively. Improvements in fruit quality by GA_3 application also have been reported for 'Lambert' (Facteau et al., 1985; Demirsoy and Bilginer, 2000) as well as 'Sweetheart' (Kappel and MacDonald, 2002). In recent years, Application of AVG (aminoethoxyinylglycine) treatment is one of the methods used to increase fruit quality and especially fruit size and firmness. AVG is the active ingredient of a chemical (ReTain®) that in field trial was shown to reduce fruit abscission and to improve fruit quality (Byers 1997). Pre-harvest spraying with ReTain® has been demonstrated to delay ripening and reduce pre-harvest drop of fruits in apples, peaches, nectarines and other climacteric fruits (Autio and Bramlage 1982; Park et al., 1999; Bregoli et al., 2002). AVG inhibits the activity of 1-amino-cyclopropane-1-carboxylic acid (ACC) synthase in the ethylene biosynthesis pathway (Boller et al., 1979), and can block ethylene production in many fruits (Yang et al., 1982). Çetinbaş et al. (2012) found that AVG applied to commercial orchards in Turkey delayed fruit color and increased fruit size and firmness of '0900 Ziraat' sweet cherries.

The effects of pre-harvest spray of AVG, GA_3 and AVG in combination with GA_3 on harvest time and fruit quality at harvest are yet to be investigated in '0900 Ziraat' sweet cherry grown in Isparta-Turkey. The objectives of this study were to investigate the effects pre-harvest applications of AVG, GA_3 alone and AVG in combination with GA_3 on harvest delay, fruit ethylene production, changes in fruit color, and fruit quality at commercial harvest.

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MATERIAL AND METHODS

Experiments were conducted at the commercial sweet cherry orchard located in Eğirdir-Isparta. The uniform trees, 12-years-old cv. '0900 Ziraat' sweet cherry on Gisela 5 rootstock, spaced at 3x5 m were used. Trees were trained to vogel central leader system and pruned in late winter and standard cultural practices including pesticide sprays were provided to the trees for several years. Experimental design was a randomized block, with 4 treatments and 3 replicates using single tree for per treatment. ReTain® containing 15% AVG, obtained from Valent BioSciences Corp., USA, as 50 ppm plus 1% (v/v) Tween 20 as a surfactant, ProGibb containing 100% GA_3, obtained from Sumitomo Corp., Turkey, at 20 ppm plus 1% (v/v) Tween 20 and AVG (50 ppm) + GA_3 (20 ppm) plus 1% (v/v) Tween 20 onto fruits and leaves around the fruits until runoff. The applications were made when the fruits and leaves were at the straw-yellow stage (about 30-35 days prior to the harvest). The fruits picked at the commercial harvest time were immediately transported to the post-harvest physiology laboratory in ice containers. The measurement of 20 fruits were determined using digital caliper for fruit width (mm), fruit length (mm), peduncle length (mm), peduncle thickness (mm). Fruit, seed and peduncle weight (g) were determined by a digital scale sensitive to 0.01g. The fruit colour was determined with a colorimeter (Minolta Chroma meter CR-100) using the L*, a*, b*, C* and h* scale. Fruit firmness (using a Lloyd LF Plus Universal Test Machine) was tested at one point on the fruit surface with a plunger of 5 mm diameter. Titratable acidity (TA) was determined using a digital burette (Digitrate Isolab 50 m*l*) by titration with 0.1 N NaOH up to pH 8.1, using 10 ml of diluted juice, and the TA was expressed as citric acid. Respiration rate (µL/kg.h) was determined for fruits kept in a closed jar for 1 day at room temperature (20±1 °C) (200 g of fruit was closed in each jar and the volume of each jar was 2 litres). The measurement of the respiratory rate was done with a gas analyzer. 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 $P<0.05$ level.

RESULTS AND DISCUSSION

Fruit maturity and harvest time

The applications significantly delayed the ripening of '0900 Ziraat' cherry fruits. Skin colour development was significantly delayed by the AVG, GA_3 and AVG + GA_3 applications; colour development suitable for commercial harvest (red/black) was delayed for 2 days by both the AVG and GA_3 applications and more than 4 days by the AVG + GA_3 application. While the control fruits were harvested on 26 July, AVG-treated and GA3-treated fruits were harvested on 28 July and AVG + GA_3-treated fruits were harvested on 30 July. Our data was in agreement with previous reports on AVG (Ju et al., 1999; Sing et al., 2003; Noppakoonwong et al., 2005) and GA_3 (Lenahan et al., 2008; Yıldırım and Koyuncu, 2010). Webster et al. (2006) showed that AVG and GA_3 applications delayed the harvest time.

Fruit size, peduncle size and seed weight

The delayed harvest time of 2-4 days caused positive effect on the sweet cherry fruit quality characteristics. The applications significantly ($P<0.05$) increased the fruit width, length and weight in the '0900 Ziraat' sweet cherry cultivar. The heaviest fruits (15.07g) were obtained from the AVG + GA_3 application with a 34% increase in weight when compared to control. The lowest and highest fruit weight values were 9.95, 13.07 and 13.24 g in control, AVG and GA_3 applications, respectively. The largest size and the highest length were also obtained from the AVG + GA_3 application (Table 1). Like our findings, Webster et al. (2006) found that 250 ppm AVG application and 50 ppm GA_3 application increased fruit weight in the 'Colney' sweet cherry variety. It was found that GA_3-treated fruits were heavier than the AVG-treated fruits. According to a research on '0900 Ziraat', it has been reported that when an AVG application of 50 ppm is applied 25 days before the estimated harvest time, it affects both the fruit size and weight, and thus the fruits are bigger and heavier than the fruits of the control group (Çetinbaş et al., 2012). The fruit size is one of the most important quality parameters in sweet cherry. The demand for sweet cherry is optimum at 10 g fruit weight and 25 mm fruit width on the average (Horvitz et al., 2003). For this reason, the bigger fruits could bring great benefits for the marketing of sweet cherries. It was reported that in previous studies that GA_3 applications increased cell division and elongation and had a positive effect on fruit size (Usenik et al., 2005; Cline and Trought, 2007). In this study, the applications increased seed weight (Table 1). This increase in the seed weight was statistically significant ($P<0.05$). The

highest seed weight was found with AVG + GA_3 application while the lowest seed weight was with control fruits. Yıldırım and Koyuncu (2010) found that GA_3 increased '0900 Ziraat' seed size. The effects of all applications on peduncle thickness have been found statistically significant ($P<0.05$) but not on peduncle length and weight (Table 1). The highest peduncle length and thickness was in AVG + GA_3-treated fruits. The sweet cherry becomes deformed more quickly than the other fruits because of the rapid water consumption and high respiration. For this reason, a long and thick peduncle is a desired feature in sweet cherry as it extends its shelf-life. It was also reported in previous studies that GA_3 had a positive effect on extending the peduncle of the fruit (Yıldırım and Koyuncu, 2010).

Table 1. The effect of applications on fruit characteristics of '0900 Ziraat' sweet cherry cultivar

Application	Fruit width (mm)	Fruit length (mm)	Fruit weight (g)	Seed weight (g)	Peduncle length (mm)	Peduncle thickness (mm)	Peduncle weight (g)
AVG	25.97b	27.01c	13.07b	0.85ab	49.23	1.92b	0.17
GA_3	28.66ab	27.76b	13.24b	0.82b	48.98	1.91b	0.17
AVG+GA_3	29.44a	29.82a	15.07a	0.94a	49.93	2.09a	0.17
Control	22.25c	24.30d	9.95c	0.58c	48.95	1.75c	0.15

With each column. values followed by the same letter are not significantly different at P < 0.05 level according to Duncan's multiple range test.

Fruit firmness and respiration rate

The effects of all tested applications on fruit firmness have been found to be statistically significant ($P<0.05$). The application of AVG + GA3 has the highest ratio (16.88 N) in terms of fruit firmness, followed respectively by AVG (15.03 N) and GA3 (14.12 N). The lowest fruit firmness was found with control fruits (13.25 N) (Table 2). The positive effects of the AVG application on fruit firmness are also confirmed in our study. There are many researches reporting positive effects of AVG (Singh et al., 2003; Rath et al., 2004; Çetinbaş et al., 2012) and GA3 (Kappel and MacDonald, 2002; Yıldırım and Koyuncu, 2010) on fruit firmness of stone fruits. All applications significantly reduced the respiration rate of the cherry fruits (Table 2). The effects of applications on fruit respiration rate were found statistically significant ($P<0.05$). The respiration rate of control fruits was the highest (136.65 µL/kg.h) while AVG-treated fruits had the lowest rate (91.13 µL/kg.h). AVG treatment of climacteric fruit, such as peach, apple, pear, and plum, results in reduced ethylene production and respiration rate, and fruit ripening is delayed (Launder and Jerie, 2000; Singh et al., 2003; Jobling et al., 2003; Rath et al., 2004; McGlasson et al., 2005; Çetinbaş and Koyuncu, 2011). However, ethylene production by non-climacteric fruit is low, and changes in fruit quality during ripening are not accompanied by increased ethylene production and respiration rate (Biale and Young, 1981). Sweet cherry fruit are nonclimacteric (Biale, 1960; Blanpied, 1972), and exogenous ethylene has no effect on respiration rate or firmness loss during fruit ripening (Li et al. 1994). Our study also determined that AVG and GA3 applications significantly reduced the respiration rate. Çetinbaş (2010) found that GA3 applications (100, 200 and 300 ppm) decreased ethylene production and respiration rate in 'Monroe' peach cultivar.

Table 2. The effect of applications on fruit firmness and fruit chemical characteristics of '0900 Ziraat' sweet cherry cultivar

Application	Firmness (N)	SSC (%)	TA (%)	pH (%)	Respiration rate (µL/kg.h)
AVG	15.03b	18.43	0.79	3.61	91.13c
GA_3	14.12ab	17.73	0.78	3.61	120.77ab
AVG+GA_3	16.88a	19.47	0.82	3.67	106.56bc
Control	13.25b	18.57	0.88	3.59	136.65a

With each column. values followed by the same letter are not significantly different at P < 0.05 level according to Duncan's multiple range test.

Soluble solids contents, titratable acidity and pH

Effects of tested applications on soluble solid contents (SSC), titratable acidity (TA) and pH were not statistically significant (Table 2). The highest SSC was found in AVG+GA_3-treated fruits (19.47%) and the lowest SSC was found in GA_3 (17.73%) and AVG (18.43%)-treated fruits, respectively. All applications had a decreasing effect on TA value. The highest TA was obtained in control fruits (0.88%) and the lowest TA was obtained in GA_3-treated fruits (0.78%). All applications increased pH value, and the highest pH was found in the AVG+GA_3-treated fruits (3.67%).

Fruit colour

Effects of applications on fruit colour (L*, a*, b*, C*, h*) are given in Table 3. Significant ($p<0.05$) differences were observed between applications in terms of fruit colour L*, a*, b*, and h*. The difference in fruit colour C* was not significant. The highest L* value was 33.55 with AVG+GA_3, while the lowest L* value was 30.42 with AVG-treated fruits. The AVG and AVG+GA_3 applications increased b* value which means yellowness. All applications decreased a* value, redness, but this decrease is less in GA_3-treated fruits than the other applications. AVG effected on late ripening and also on late coloration of fruits, for this reason in our study a* value decreased in the second year. Similar to our findings, Webster et al. (2006) found that 250 ppm AVG application delayed the coloration in 'Colney' sweet cherry. Previous studies showed varying effects of AVG treatment on fruit colour. Çetinbaş et al. (2012) found that AVG treatments decreased in '0900 Ziraat' sweet cherry cultivar, implying that the effect of AVG treatments on colour development may vary.

Table 3. The effect of applications on colour characteristics of '0900 Ziraat' sweet cherry cultivar

Application	L*	a*	b*	C*	h*
AVG	30.42b	21.07b	10.29ab	22.91	22.87b
GA_3	31.91ab	24.71ab	10.98ab	27.06	23.70ab
AVG+GA_3	33.55a	21.21b	12.94a	29.73	25.54a
Control	30.90b	27.62a	8.08b	24.05	22.52b

With each column. values followed by the same letter are not significantly different at P < 0.05 level according to Duncan's multiple range test.

CONCLUSION

In this study, it was observed that the pre-harvest applications delayed the harvest date up to 2 to4 days. AVG+ GA_3 application delayed the harvest date by 4 days which resulted in an increase of weight by 34% and fruit firmness meaning a higher acceptance by the consumer. GA_3 applications' positive effect on fruit quality is displayed in many studies. In our study, GA_3 in combination with AVG increased fruit quality of '0900 Ziraat' sweet cherry cultivar. Based on the results regarding the effects on weight, firmness, and ethylene production, application of 20 ppm GA_3 in combination with 50 ppm AVG concentration at the straw-yellow stage can be recommended for '0900 Ziraat' sweet cherry variety. These findings can provide great benefits for the marketing of sweet cherries.

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VERTICAL FARMING

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ABSTRACT

Today, the world population is approaching 7 billion. This figure is expected to exceed 9 million by 2050. Because of the decrease in agricultural lands that will nourish people, the crop losses caused by emerging new pests and diseases, climate change and environmental pollution, the development of alternative agricultural systems in order for the production needed to be made to feed people has become compulsory. Therefore, "Vertical Farming" which is one of the agricultural systems where the yield quantity to be received from the unit area is high, is progressing on the way to becoming an agricultural system that will rapidly develop in the future. However, for sustainable production and energy in this system; engineering, architecture, technology and experiences are needed to be used all together. Thus, in this agricultural system, with advanced technology, production made in an area of 4.000-30.000 m^2 is being achieved in an area of 1.000 m^2; the risk of crop loss dependent on conditions like aridity, floods, pests and disease, etc. is eliminated. By virtue of the utilization of renewable energy resources (solar, wind, etc.), environmental pollution and fossil fuel consumption decreases. Because it will play a key role in enabling human beings to survive on other planets, it is an agricultural system that will obtain the status it deserves as an important system in the near future.

Key Words: Vertical farming, soilless culture, LED, rockwool, space

INTRODUCTION

World population will be approximately 9 billion by the year 2050. Additional area required to feed this population using available technologies equals to the size of Brazil. It will be difficult to deal with this situation without an alternative system (Despommier, 2010a; Despommier 2010b). Furthermore, according to climate change scenarios until 2090-2099, CO_2 concentration which is currently 380 ppm will increase to 730 ppm; concentration of gases which cause destruction of ozone layer will increase and atmosphere will gradually heat up. By the year 2099, temperature of the atmosphere will rise by 1.8 – 4.0 ^{0}C and as a result of the melting of glaciers in poles; sea level will increase approximately by 26-59 cm. As a result of this situation, people will have to emigrate from the areas which will be under water, whose climate has changed and the likelihood of armed conflicts will increase (Climate Change, 2007). Therefore, to find a solution for all these problems in the future, human beings have to seek ways to develop environmentally friendly production techniques and technologies which protect the ecosystem.

WHAT IS THE VERTICAL FARMING?

Vertical Farming (VF) System is a complex structure in a standard building, which is established by designing to the smallest detail, where agricultural production, composting, energy production and recycling of waste are realized to eliminate the anxiety of modern cities and environmental destruction (Despommier et al., 2011). Thanks to this structure, product amount per unit area is higher since it is not affected from the effects of climate change. Since the introduction of this system as an idea in 2001, different projects have been designed and preceded to the stage of construction (Despommier and Ellingsen, 2008).

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Figure 1. Different Vertical Farm Projects (Chris Jacobs – Gordon Graff - The Living Tower by SOA Architects) (www.eoearth.org)

Advantages of Vertical Farming

a) **Year-round crop production; 1 indoor acre is equivalent to 4-6 outdoor acres or more, depending upon the crop (e.g., strawberries: 1 indoor hectare = ~30 outdoor hectares).**

b) **VF creates new employment opportunities.**

c) **All VF food will be grown organically employing chemically defined diets specific to each plant and animal species: no herbicides, pesticides and low fertilizers.**

d) **VF converts black and gray water into potable water by engineering the collection of the water realized through evapotranspiration.**

e) **It adds energy back to the grid via methane generation from composting non-edible parts of plants and animals.**

f) **VF would greatly reduce the incidence of many infectious diseases (*H5N1, Salmonella typhi, Escherichia coli, Listeria monocytogenes* etc.). that are acquired at the agricultural interface by avoiding use of human feces as fertilizer for edible crops.**

g) **VF dramatically reduces fossil fuel use (no tractors, plows, equipments.).**

h) **VF eliminates agricultural runoff.**

i) **VF would allow farmland to be returned to the natural landscape, thus restoring ecosystem functions (e.g., increases biodiversity) and services (e.g., air purification).**

j) **VF holds the promise of no crop failures due to droughts, floods, pests, etc.**

k) **VF eliminates much of the need for storage and preservation, thus reducing dramatically the population of vermin (rats, mice, etc.) that feed on reserves of food.**

l) **VF creates sustainable environments for urban centers.**

m) **VF converts abandoned urban properties into food production centers.**

n) **VF could provide year round production of medically valuable plants (e.g., the anti-malarial plant-derived artemesinin).**

o) **VF could be used for the large-scale production of sugar (sucrose) to be used in the revolutionary new method for the production of non-polluting gasoline.**

p) **VF may prove to be useful for integrating into refugee camps**

q) **VF offers the promise of measurable economic improvement for tropical and subtropical LDCs.**

r) **VF could reduce the incidence of armed conflict over natural resources, such as water and land for agriculture**

s) **We cannot go to the moon, Mars, or beyond without first learning to farm indoors on earth (Despommier et al., 2011; Despommier, 2010a; Despommier 2010b; Despommier and Ellingsen, 2008).**

Disadvantages of Vertical Farming

a) **The initial phase will be cost intensive, and certain flaws integrated in the system that may appear during its initial run can still dampen efforts for its full maximization.**
b) **Heating, temperature, electric, lightning and pollination are the factors which might negatively affect the system if they are not managed well.**
c) **There will be fewer variety of foods to choose from because not all plants and vegetables are suitable in a controlled and limited environment. Because of this can be marketing problems**
d) **The public will find it hard to reconcile with the idea of using black water for food production.**
e) **Number of qualified personnel who will operate these systems is low.**
f) **It will be difficult to make the society accept and integrate to this system particularly after the inclusion of animals in this system (Despommier et al., 2011; Despommier, 2010a; Despommier 2010b; Despommier and Ellingsen, 2008).**

CONSTRUCTION OF VERTICAL FARMING SYSTEM AND OPERATION OF THE SYSTEMS

I) Construction and Exterior Structure

In Vertical Farming, energy is produced by solar panels, wind turbine (Figure 1) and power system rotated by steam turbines where plant wastes are turned into pellet and burned (Figure 2 I-c). Titanium oxide coated surface prevents bead like appearance on the glass due to contaminating balls, rain drops and after the rain (Figure 1). All controls (climate, irrigation, heating, ventilation etc.) in Vertical Farming building are managed in the control room for 24 hours thought the year (Chamberlain, 2007; Impact Lab, 2008).

II) Systems and Interior Structure

a) Evaporation and Recycling Systems: The moisture is trapped inside the pipes accumulated in the celling in each floor tanks to evapotranspiration recovery system; the moisture is condensed and collected. Water vapor (moisture) emitted from the plants in the media is condensed by contacting the pipes in which super cold liquid flows and condensed water is collected by the system after it drops. Based on estimations, in a vertical farming system, approximately 220.000 m^3 water can be collected on annual basis (Figure 2 I-a).

b) Production Areas and Growing Systems: Fruits and vegetables are determined with an electronic eye. In addition, robotic arms equipped with mechanical nozzle enable the crops to be harvested by distinguishing them better according to color system by sniffing the presence of specific alcohols. Space (maximum area) is important in the area. Therefore, this structure can have two floors (Figure 2 I-b). Drained water after irrigation is collected in the center by the pipes and is sent to filtering system. Mechanism for plant nutrition provides the plants which stand alone or are arranged in order with pre-determined and programmed water amounts and when needed, extra lighting like an ink spraying printer. Parameters such as humidity, temperature and nutrient solution can be monitored from computer screens. LED lamps (artificial lighting) are used as source of lighting and the light required by the plant can be adjusted (Figure 2 I-b). (Chamberlain, 2007; Impact Lab, 2008).

Figure 2. Systems – I (Interior structure) and Technical Sections – II (Floors) in Vertical Farming (Chamberlain, 2007; Impact Lab, 2008)

c) Pelletizing Systems and Energy Sources: Wastes produced from Vertical Framing or high number of restaurants and landfill sites can be included in this process. Plant wastes are dried and fragmented or grinded; then they are compressed and turned into a clean fuel in pellet form. Steam energy is obtained

by heating water with this fuel and turbines are rotated with the pressure of this steam and electrical energy is produced (Figure 2 I-c), (Chamberlain, 2007).

d) "SlurryCarb" Machine (EnerTech) alternative power system: The device is heated and waste in the form of slurry is compressed and thus carbon and water based components are decomposed. The machine extracts water and solid particles and sends to power generator. The slurry which looks like carbon is burned in steam turbines to produce energy and electricity is produced with the high pressurized steam of the obtained hot water. Stabilized water (black-water) discharged from the system is treated with bacteria killing chemicals and is then turned into humus after drying system. The discharged water is filtered by bioremediators such as cockle shell, bamboo and water plants until it becomes usable for farming (Figure 2 I-d), (Kuang, 2008).

e) Aquaponic Systems: The tanks in which plants are planted move with the slow and undulating movement of the tank with conveyor system. The mixers distribute the old nutrient solution. At the end of a long journey which lasts for weeks, the plants become ready for harvesting. Trout and tilapia fish containing high protein can be grown under the plants. Ammonia loaded waters sediments towards a pebble bed spread on the soil. Bacteria turn this into nitrogen and thus water is cleaned and fish wastes become fertilizers to the plants (Figure 2 I-e), (Kuang, 2008).

Figure 5. Crops which are planned to be produced (www.verticalfarm.com)

III) Technical Sections and Floors

Harvested plants are sent to the shopping center below through an elevator system (Figure 2 II-a). The crops are grown by agricultural engineers and botanists Figure 2 II-b). The plants are grown in tanks filled with porous, rockwool, vermiculite-stone mixture. They are arranged in order on a rotating system called cylindrical barrel or the car. The lighting system in the center provides necessary light for the plants (Figure 2 II-c). Energy saving LED lamps specially adjusted for each plant species (for example only red light for lettuce) are used (Kuang, 2008; Impact Lab, 2008). The system periodically rotates and at each rotation, plant roots contact to the cup below which contains nutrient solution and the plant nutrition is provided in this manner (Kuang, 2008).The staff passes from air doors; wear jump suit sand prevent

entrance of diseases and pesticides (Figure 2 II-c). Poultry farming is a type of farming which requires minimum space (Figure 2 II-d) and has the highest meat yield per kilo according to agricultural standards. The customers can do shopping in sales areas under the buildings (Figure 2 II-e) and goods can be transported to other sections by electric vehicles (Impact Lab., 2008). A wide variety of plants are planned to be produced in the system (Figure 5). In this context, research is being made for growing fruit trees and vegetables and the buildings are designed accordingly. However, if growing conditions are provided, this system can be applied to all crops which are viable for soilless agriculture.

CONCLUSION

In the future, production areas will gain more importance to meet food shortage due to climate change and population growth. Since allocation of new production areas for agriculture will bring very serious problems, the establishment of these types of systems will gain impetus in time. In near future, this type of farming system is expected to meet food and nutrient needs of the people particularly in large cities at a higher level. The fact that efficiency and quality will increase in obtained products since the system contains environmentally friendly production techniques; recycles solid and liquid waters and is not affected from environmental conditions, makes it inevitable that number of these types of systems will increase each day.

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UPTAKE OF SOME HEAVY METALS BY BARLEY AND ALFALFA ON THE COAL ASH DISPOSAL SITES

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ABSTRACT

In the vicinity of Tuzla, located in northeastern Bosnia and Herzegovina, a thermo electric power plant provides heat and electricity to private households and industry. The power plant is fed with coal excavated from mines near Tuzla.

One of the by-products of energy generation from coal is huge amounts of combustion residues which need to be disposed of. In Tuzla, residues are pumped into settlement ponds in natural valleys bordered by dams. Five coal ash disposal (CAD) sites, covering an area of approximately 170 ha, with more than 40 million m^3 of coal combustion residues have been established around Tuzla.

Due to the fact that residual ash from coal combustion is highly alkaline due to high concentration of bicarbonates, and generally known to contain a wide variety of potentially toxic trace elements – in case of Tuzla particularly Ni, Cr, Cu and As, is it must be assumed that CAD sites of such magnitude constitute a serious environmental problem.

To achieve the goal of remediation of the landfills, a more broad, comprehensive and multidisciplinary set of scientific research are needed. This paper focuses on the content of toxic elements of deposited ash and soil used as cover, and the uptake of toxic elements by the two common crops in this area: barley and alfalfa.

Key Words: Ash, soil, heavy metals, barley, alfalfa

INTRODUCTION

In the city of Tuzla, located in Bosnia & Herzegovina, there is a thermo electric power plant (Termoelektrana „Tuzla"), which provides heat and electricity to private households and to the industry within this area. The power plant is fed with hard coal excavated from mines in the vicinity of Tuzla. The combustion of coal poses a potential hazard to air and soil quality. Apart from SO_2, NO, and fine dust emissions (Lighty *et al.*, 2000) slag and ashes are generated during the combustion process. Besides heat and power generation huge amounts of residues, namely ash are produced by the power plant, which are currently disposed through pumping into settlement ponds bordered by dams in natural valleys (Sandhu *et al.*, 1993). This is common practice throughout Europe. As a result of the ongoing power generating process throughout the last decades a total of four disposal sites have been established around Tuzla: Dreznik, Plane, Divkovici 1 and 2 and Jezero. So far, the total amount of deposited material is 40 million m^3 and covers the area of more than 500 ha.

Besides the significant loss of agricultural land, there are more important negative impacts of the landfills on the environment, as distinct pollutants, such as: potential sources of excessive radiation, increased content of heavy metals and radionuclides, excessive alkalinity of the substrate and leachate (pH 10-12), high content of soluble salts, physically and chemically adverse impacts on the environment by fly ash, air and groundwater pollution, content of toxic, physiologically active substances in the food chain, etc.

The field experiment was established on the Dreznik landfill in order to investigate plant uptake of the some heavy metals depending on the soil cover depth. The results of this experiment for barley and alfalfa are presented in this paper.

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MATERIALS AND METHODS

Dreznik is one of four ash disposal sites located in the vicinity of "Tuzla" power plant. The completion of ash deposition and application of soil cover as a part of the site abandonment was done in 1991. Nowadays, the site is mainly used as crop and pasture land. Grown crops are selected spontaneously by the surrounding farmers: maize, potatoe, wheat, some vegetable plants, red clover and lucerne. The entire site was covered with soil from surrounding hills. The thickness of the soil cover ranges from approximately 10 cm to some 25 cm at best. Quality of covered topsoil is very diverse since material has been hastily brought (borrowed and collected) from different sources, in order to avoid the problem of wind erosion in order to reduce the pressure on the people from surrounding villages.

Planned research subjects were:

a) Reconnaissance of the terrain in order to set up the experimental plots at the landfill surface. Cover soil was applied on the most of ash deposits during the previous recultivation activities, but it differs in depth. During this phase, the suitable locations for experimental plots at Dreznik were chosen depending on the soil cover depth (10, 20 and 30 cm). There were four experimental plots, as follows: pure slag and ashes without cover (treatment "A"), cover soil with 10 cm depth (treatment "B"), cover soil with 20 cm depth (treatment "C") and cover soil with 30 cm depth (treatment "D"). The plot experiment was set in a way that for each crop there were 20 repetitions. Area of one experimental plot was 7.5 m^2 (5 m x 1.5 m).

b) To investigate the substrate - deposited slag and ash, as a product of coal combustion, as well as the soil used as cover.
The total concentration of heavy metals was measured in *Aqua regia* extract, according to DIN Methods for DIN-method for garbage classification. After 24 h of shaking ash/soil extracts, reading of results was performed using atom adsorption spectrometry.
The obtained results were compared with maximum tolerable values for researched elements in soil (Scheffer/Schachtschabel, 1992; Adriano, 2001)

c) In order to measure the uptake of metals by plants, the concentration of experimental plant tissues was analyzed. Samples taken from the field were dried at 40°C for 24 h and were subsequently digested after grinding in a Teflon coated rotary mill with nitric acid ($HNO_3$65%, suprapur) for 7 h at 170°C. The concentrations of the digest were detected by atom adsorption spectrometry or inductive coupled plasma spectrometry.

RESULTS AND DISCUSSION

Analysis of ash and cover soil

Extraction in *Aqua regia* has shown that deposited ashes are highly enriched with Cr, Ni, Cu and As. (Figure 1 and 2). Other standard inorganic pollutants such as B, Co, Zn, Se, Mo Cd and Pb were within normal ranges for soils (Scheffer/Schachtschabel, 1992; Adriano, 2001). The sample analysis of the cover soil reveals that the soil used for covering the ash and slag in landfills is largely contaminated with Cr and Ni and to a lesser extent with Cu. Average content of Cr was 443.4 mg/kg, with the highest content under plot treatment D (476.0 mg/kg). A similar situation was with Ni, reaching an average concentration of 587.5 mg/kg with the highest content under plot treatment D (632.3 mg/kg). Average content of As and Cu was 58.7 mg/kg and 82.3 mg/kg, with the highest content on the ash only plot (treatment A).

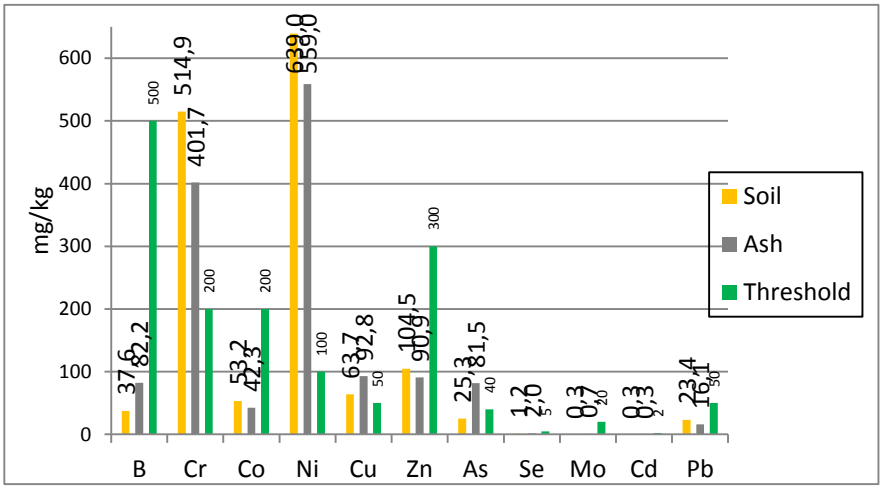

Figure 1. Average contents of some elements in cover soil, and ash with treshold values

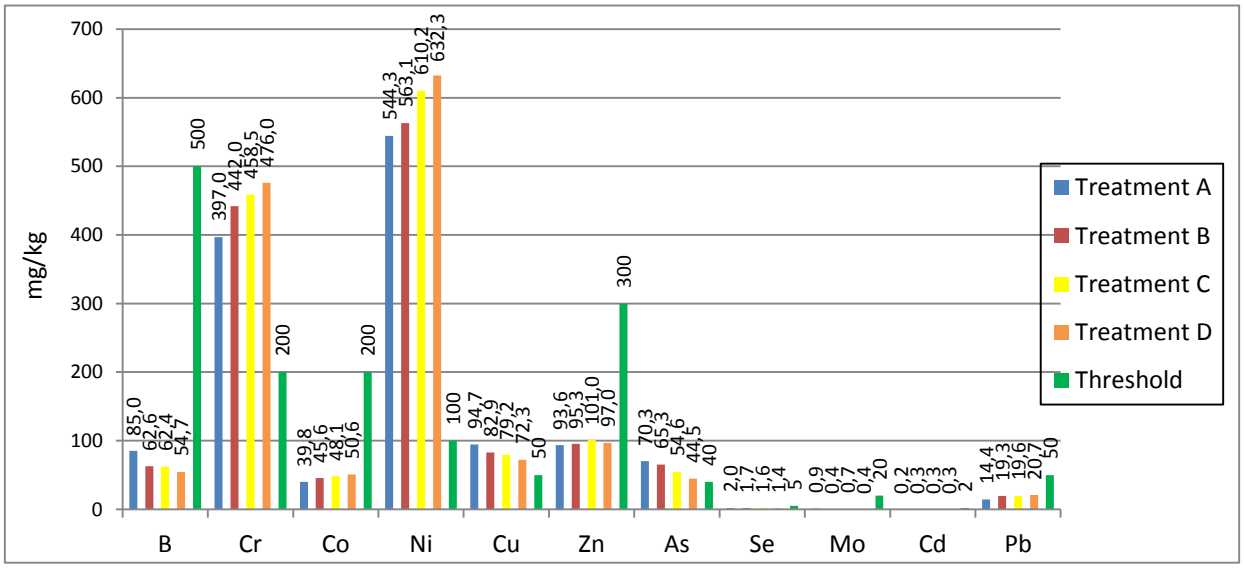

Figure 2. Average content of researched elements under diferrent treatments at the Dreznik experimental plot

In general, the content of elements such as Cr, Ni, Cu and As is above threshold value (Scheffer/Schachtschabel, 1992; Adriano, 2001). As and Cu are found mostly in ashes, while Cr and Ni originate from soil, but also from the ash. Co, Zn and Pb are more present in soil, while B, Se, Mo were more present in the ash. Content of Cd was the same in soil and ash.

It is important to emphasize the average pH value of soil cover was 7.8, while the ash beneath the soil cover was 8.4. Among these soil properties, soil pH was found to play the most important role in determining metal speciation, solubility from mineral surfaces, movement, and eventual bioavailability of metals, due to its strong effects on solubility and speciation of metals both in the soil as a whole and particularly in the soil solution (Mühlbachová et al., 2005; Zhao et al., 2010). A negative correlation between soil pH and heavy metal mobility and availability to plants has been well documented in numerous studies. For example, with decreased soil pH, the dramatic increases in heavy metal desorption from soil constituents and dissolution in soil solution were observed for Cd, Pb and Zn (Bang and Hesterberg, 2004). The mobility and bioavailability of heavy metals also increase with decreased soil pH

(Du Laing et al., 2007), thus enhancing the uptake of heavy metals by plants, which could be potentially harmful for animals which are grazing these plants as well for humans who consume agricultural products grown on these soils (Keefer, 1993).

Plant responses

During the experimental field research, two agricultural crops (Barley and Alfalfa) were analyzed through four experiment treatments (Figure 2).

Table 1. Average element content in Barley (dry mater, mg/kg)

Element	Treatments								Normal range*
	A	B	C	D	A	B	C	D	
	leaves				edible part				
B	2,49	3,06	2,27	2,47	1,03	0,58	0,82	0,55	5 - 100
Cr	1,71	0,76	1,69	1,21	1,09	1,06	1,04	0,75	0,1 - 1,0
Co	0,03	0,02	0,03	0,03	0,05	0,00	0,01	0,00	0,04 - 1,0
Ni	1,06	0,67	0,94	1,34	2,17	1,06	1,25	1,68	0,1 - 3,0
Cu	3,31	4,47	3,93	3,87	3,83	5,13	4,67	4,62	2,0 - 20,0
Zn	19,15	22,66	19,56	20,72	27,08	30,71	33,36	27,04	5 - 100
As	0,55	0,23	0,45	0,00	0,19	0,03	0,12	0,00	0,1 - 1,0
Se	0,24	0,15	0,17	0,04	0,21	0,25	0,15	0,06	0,1**
Mo	1,44	1,11	0,54	0,14	0,83	0,79	0,56	0,26	0,05 - 1,50
Cd	0,01	0,03	0,02	0,03	0,00	0,01	0,01	0,01	0,05 - 0,40
Pb	0,07	0,06	0,05	0,08	0,02	0,00	0,00	0,00	0,1 - 6,0

**Normal ranges for plants (Scheffer/Schachtschabel, 1992; Adriano, 2001)*
*** Normal content of selenium in plants (Grbeša, 2004)*

Table 2. Average element content in Alfalfa (dry mater, mg/kg)

Element	Treatments												Normal range*
	FIRST SWATH				SECOND SWATH				THIRD SWATH				
	A	B	C	D	A	B	C	D	A	B	C	D	
B	28,20	24,71	24,54	21,79	31,51	25,12	22,59	23,19	25,54	23,96	27,60	25,50	5 - 100
Cr	0,52	0,55	0,57	0,45	0,96	0,82	0,60	1,13	1,02	0,54	0,52	0,51	0,1 - 1,0
Co	0,13	0,08	0,07	0,07	0,14	0,08	0,06	0,11	0,13	0,06	0,07	0,07	0,04 - 1,0
Ni	10,36	6,60	7,20	5,92	9,28	4,72	6,28	5,42	10,13	4,02	6,89	6,03	0,1 - 3,0
Cu	6,65	8,54	8,37	7,93	4,88	7,37	6,84	8,02	4,61	7,52	7,15	6,52	2,0 - 20,0
Zn	15,72	17,04	26,38	15,75	64,44	52,87	29,68	14,32	17,29	15,45	19,30	22,55	5 - 100
As	0,64	0,08	0,43	0,11	0,60	0,20	0,26	0,17	0,48	0,08	0,14	0,04	0,1 - 1,0
Se	0,44	0,33	0,22	0,27	0,40	1,39	0,23	1,09	0,33	0,48	0,32	0,31	0,1**
Mo	1,40	0,86	0,53	0,23	1,12	1,02	0,33	0,29	2,30	0,79	0,60	0,37	0,05 - 1,50
Cd	0,02	0,03	0,03	0,03	0,01	0,03	0,03	0,03	0,01	0,02	0,02	0,03	0,05 - 0,40
Pb	2,84	0,11	0,09	0,09	0,23	0,24	0,17	0,23	0,20	0,12	0,08	0,13	0,1 - 6,0

**Normal ranges for plants (Scheffer/Schachtschabel, 1992; Adriano, 2001)*
*** Normal content of selenium in plants (Grbeša, 2004)*

Plant analyses of selected agricultural crops and their parts at the experimental sites gave evidence that toxic elements found in soil and ash has been transferred to the plants in some cases. Results (Table 1) show that Barley had high Cr and Se uptake. Uptake of Cr in leaves is slightly higher than in edible part (grain), while there is no significant difference of Se content in leaves and edible part. Content of other elements was within the normal range for plants. Higher uptake of Cr and Se in leaves was present in all treatments, except the uptake of Cr in treatment B and Se in treatment D. Higher uptake of Cr and Se in edible part was present in treatments A, B and C, while in case of treatment D the content was within the normal range for plants.

Results for Alfalfa are presented in Table 2. The elements which were above the normal range for plants are Ni and Cr. Slightly higher content of Cr was found in second swath at treatment D and third swath at treatment A. There was a large uptake of Ni in all plant samples regardless of the treatment and swath, but it is evident that the uptake was the highest on ash only plot (treatment A).

The contents of toxic metals in soil and ash are in close relation with content of Cr and Ni in crops. Although the content of Se was in normal range for soils, the reason for higher uptake of this element is the result of its greater availability at increasingly alkaline conditions (Neal, 1995). The average pH of TE Tuzla ash disposal sites varies between 7.8 and 9.7 depending on the age of site, while the wet deposition process water of the active site Divkovici II showed pH values between 11.6 and 12.1. pH at site Dreznik, which is abandoned in 1991, it is reduced to 7.8 in the surface layer. In contrast, mean pH of coal ash beneath a soil cover was significantly higher (8.4) indicating reduced ash weathering under soil covers (Dellantonio, 2008).

Although the content of some heavy metals in researched crops and was increased, these results indicate that the uptake of heavy metals in plant material was lesser than in previous similar studies on the same location with other crops such as potato and maize, where the higher uptake of As and Mo was established in addition of Ni, Cr and Se (Čustović and Žurovec, 2011).

CONCLUSIONS

These results reflect a relatively high threat of toxic elements entering the food chain. Ash and even cover soils sampled at the investigated sites contain high concentration of Cr, Ni, Cu and As, which exceed tolerable thresholds for agricultural land use. Although this does not pose a phytotoxicity problem for the plants, it may be potentially harmful for animals which are grazing these plants as well for humans who consume agricultural products grown on these soils.

Results show that Barley had high Cr and Se uptake. Uptake of Cr in leaves is slightly higher than in edible part (grain), while there is no significant difference of Se content in leaves and edible part. In case of alfalfa, the elements which were above the normal range for plants are Ni and Cr. There was a large uptake of Ni in all plant samples regardless of the treatment and swath, but it is evident that the uptake was the highest on ash only plot. Further investigations of the soils and substrates which were used for covering the sites need to be carried out in order to fully understand their actual source of contamination.

The average pH value of soil cover was 7.8, while the ash beneath the soil cover was 8.4. The bioavailability of toxic elements in soil and ash is highly influenced by soil pH. With decreased soil pH, the dramatic increases in heavy metal desorption from soil were observed for most of researched heavy metals. It is reasonable to assume that the bioavailability of these toxic elements will increase in time, as the leaching of surface layers will continue due to weathering effects of the climate. The exception of this rule is Se, as the reason for higher uptake of this element is the result of its greater availability at increasingly alkaline conditions. Same goes for Mo, but in this case the higher content of this element has not been established.

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COMPARISON OF SOME PHYSICAL AND CHEMICAL PROPERTIES OF GRAPE MOLASSES IN SIYAH DIMRIT CLONES

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ABSTRACT

Siyah Dimrit (Siyah Dimlit) grape variety is grown extensively around Burdur province and used mostly as grape molasses. In this sudy, grape maturity was determined according to the values of soluble solid and titratable acidity in the Siyah Dimrit Clones. Grape molasses were produced using traditional technique. In order to determine differences among the clones, samples of grape molasses were analysed interms of soluble solid, titratable acidity, pH, ash and sensory analysis.

In terms of the investigated parameters, statistically significant differences were found among clones (p≤0,05). In the grape molasses samples, soluble solid ranged from 78,7 to 86,0%, titratable acidity 1,27 to 3,25 g/L (tartaric acid eq.), pH 4,39 to 5,14, ash 1,64 to 2,18% and the total sensory analysis scores were determined between 13 and 23. According to grape maturity index and grape molasses sensory values, S16 and S9 clones had the highest scores.

Key Words: Molasses, Siyah Dimrit, Grape, Quality

INTRODUCTION

Turkey has one of the most suitable climate conditions for grape growing in the world. Turkey is ranked sixth and fourth in terms of grape production and growing area respectively. According to Turkish Statistical Institute (TurkStat), 4.255.000 tons grapes have been produced in 477.785 ha vineyard area in Turkey (TurkStat, 2010). It is estimated that 37% of grape production devoted for drying, 30% for table grape, 30% for various grape products and 3% for making wine.

Grape molasses is produced from grape juice or raisins extract with or without addition of calcium carbonate to adjust acidity and followed by concentration in the sun or under vacuum (Anonymous, 2008). It is the best nutritious dietary supplement for all ages due to its carbohydrates balanced fructose and glucose natural sugar profile, iron and calcium profile, antioxidant agents, vitamins, minerals and proteins.

The importance of molasses (pekmez) is significant in terms of human nutrition and human health because of its organic acids, mineral matters and vitamin contents. pekmez can fulfil the most of daily calcium requirement, iron, potassium and magnesium needs for a human. Particularly, interms of baby feeding the balance of aminoacid is very important, and it is available in pekmez after breast milk (Batu, 2011).

Karaca et all. (2011), various concentrations of three different molasses (grape, mulberry and carob) used in yoghurt manufacture, and the physicochemical, mineral and sensory properties of set-type yoghurts determined. They stated that the addition of molasses may provide some functional benefits to yoghurt and enriched mineral content. Panelists gave the highest sensory scores to yoghurts produced with grape molasses and preferred 10% concentration of each molasses.

Siyah Dimrit (Siyah Dimlit) grape variety is grown extensively around Burdur province and used mostly as grape molasses. This study was carried out to determine the differences among the clones of Siyah Dimrit grape variety in terms of molasses quality properties.

MATERIAL AND METHODS

Material

Experimental vineyard was established in a distance of 3x1.65 m interrow and grafted on 110R rootstock which was determined according to soil analysis. In the study, there are twelve grapevines from each clone.

Siyah Dimrit Clones in the collection vineyard of Manisa Viticulture Research Station were used. Must production over 60% of the 8 clones (S04, S05, S08, S09, S10, S14, S16, S17) were selected for molasses production.

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Methods

Siyah Dimrit Clones which were handled in the study, cluster and berry weight, soluble solid (˚brix), titratable acidity (g/L) analyses were done the just after harvest. Harvest time of grapes were determined according to soluble solid and titratable acidity values.

Grape molasses were produced using traditional technique (fig. 1) and they were stored in 250cc glass jars at room temperature.

Soluble solid (˚brix), titratable acidity (g/L) (tartaric acid equivalent), pH and ash % values were determined in samples of grape molasses. pH values were measured directly from the pH meter (Hanna HI 221), for titratable acidity, 10 ml of diluted samples were titrated with 0,1 N NaOH to an end point of pH 8.1 (Cemeroğlu, 1992) and was converted to tartaric acid equivalents. Ash % values of samples were determined at 550±10 ºC by burning in ash oven (AOC, 1990).

Molasses samples were scored over 1-5 points according to sensory properties by 10 panelists and sensory test scoring criteria and definitions used by modifying Özdemir et al., 2004. The panelists have been studying at viticulture or food science and technology as a researcher for at least five years. In the sensory analysis, five point scale ranged from extremely dislike "1" to extremely like "5" was used.

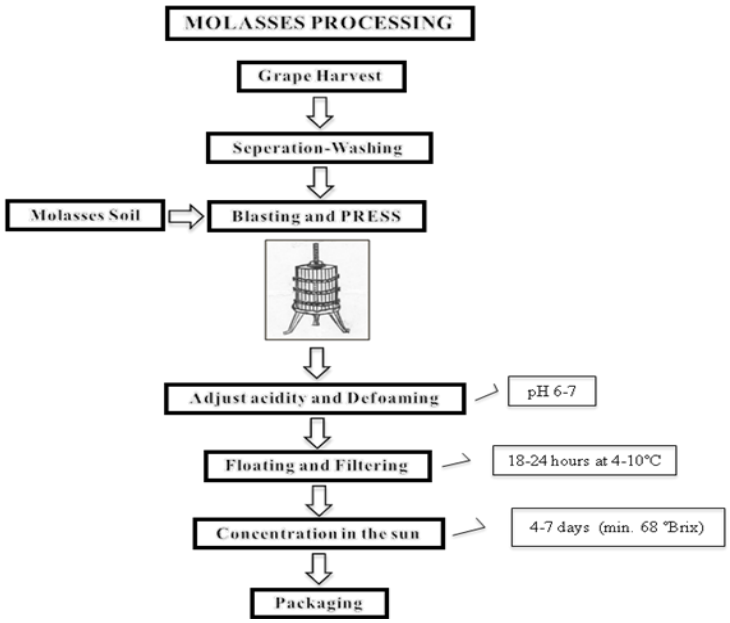

Figure 1. Molasses Processing

The analyzes and evaluations were carried out in three replications and two paralleled. Datas were performed with the statistical software of SAS version 8.2 (SAS, 1999-2001). Analysis of variance (ANOVA), and significant differences($p \leq 0.05$) were identified using Duncan's multiple range test .

RESULTS AND DISCUSSION

Evaluation of the Findings Obtained from Fresh Grape Samples

Siyah Dimrit clones had 325 g average cluster weight, 2.2 g berry weight and blue-black skin.

Soluble solid and titratable acidity were determined in during the maturation of the clones and their some quality properties were investigated. Findings and evaluations of these analyses and measurements related to these varieties are given below (Tab. 1).

Siyah Dimrit Clones which were handled in the study, grape maturity was determined according to the values of soluble solid and titratable acidity. Soluble solid (21.4-24.0) and titratable acidity values (3.88-4.98) of the clones shown that they were suitable for molasses production. S9 and S16 clones had the highest maturity index values.

Table 1. Measurement and analyses performed on fresh grape samples

	S-04	S-05	S-08	S-09	S-10	S-14	S-16	S-17
Soluble solid (˚brix)	22.4	23.2	24.0	23.6	22.0	23.0	23.2	21.4
Titratable acidity (g/L)	4.29	4.98	4.20	4.00	4.72	4.15	3.88	4.50
Maturity index	52	47	57	59	47	55	60	48
Must production (%)	61.7	60.7	63.0	65.0	67.7	63.7	62.3	63.7
Cluster weight (g)	406	231	229	333	375	190	293	329
Berry weight (g)	2.4	2.2	2.1	2.3	2.3	2.2	1.9	2.1
Harvest time	11.08	11.08	11.08	11.08	11.08	11.08	12.08	12.08

Evaluation of Findings Obtained from Grape Molasses Samples

Chemical Analysis of Grape Molasses

The changes in values of soluble solid (˚brix), ash%, pH and titrable acidity in molasses samples are shown Table 2.

Statistical differences were detected among molasses samples in terms of ˚brix, ash%, pH and titrable acidity values (p≤0.05).

Molasses ˚brix value varies depending on the grape variety and time of concentration in the sun. It seems that difference between the molasses samples is due to differences in time of concentration in the sun.

According to grape molasses standard (TS 3792) (Anonymous, 2008) ˚brix value of the molasses should be at least 68%. In this respect ˚brix value of all samples were above the limits. The values were found to be in compatible with the findings of other researchers (Toker and Hayoğlu, 2004; Köylü, 1997).

According to grape molasses standard (TS 3792) pH values of S4, S9, S14, S16 clones were classified as sweet molasses (4.90-6.0) while S5, S8, S10, S17 clones as sour molasses (3.50-4.89).

Ash values of molasses samples were ranged from 2.18 to 1.64. According to the grape molasses standard, ash content must be maximum 2.5%. In this study ash content of all samples is below the reference limit value.

Table 2. Physical and chemical properties of molasses samples

Clones	˚Brix	Ash%	pH	Acidity (g/L)
S4	78.67±2.31^{b}	1.89±0.04^{c}	5.10±0.14^{a}	1.52±0.13^{e}
S5	80.67±1.53^{b}	1.85±0.02^{c}	4.40±0.05^{c}	3.25±0.01^{a}
S8	86.00±1.73^{a}	2.18±0.11^{a}	4.39±0.02^{c}	3.13±0.04^{b}
S9	81.33±1.15^{b}	1.58±0.03^{d}	5.14±0.02^{a}	1.31±0.03^{f}
S10	80.00±0.01^{b}	2.02±0.03^{b}	4.79±0.04^{b}	2.35±0.08^{c}
S14	84.67±1.15^{a}	2.13±0.11^{ab}	5.11±0.11^{a}	1.51±0.09^{e}
S16	81.33±0.58^{b}	1.64±0.03^{d}	5.13±0.04^{a}	1.27±0.02^{f}
S17	80.33±1.53^{b}	1.88±0.08^{c}	4.75±0.04^{b}	2.09±0.06^{d}
p values	0.0001	0.0001	0.0001	0.0001

Values with the different letters within each column are significantly different for p≤0.05

Sensory Analysis of Grape Molasses

Sensory properties of the product is one of the most important factors that determine consumer preferences. According to grape molasses standard (TS 3792) (Anonymous, 2008); Grape molasses should have a specific aroma, taste and color, it should not have burn taste, and foreign odor, it's appearance must be specific and homogeneous, it should not be crystallized, solid molasses should have its own color, but it should have high viscosity. Evaluated sensory scoring of molasses samples were complied with TS 3792.

Sensory poperties of molasses samples such as taste, consistency, colour, clarity and general appearance were analyzed and determined. Grape molasses samples were scored over 1-5 points in sensory analysis and the following numerical values were used in scoring (Tab. 3).

In the study we determined the clones which have the highest rank to indicate the sensory differences of molasses produced from these clones. The highest total sensory values were observed in S4, S9, S14, S16 samples, while the lowest value were found in S8.

S16 clone's taste, colour, clarity and the general evaluation scores were higher than other clones evaluated by panelists. The S9 clone was scored with regard to higher consistency, colour and general evaluation (Tab. 3).

Özdemir et al. (2004) studied the effect of different boiling methods on molasses, they have shown that consumers were mostly preferred molasses produced at atmospheric pressure than under vacuum cooking. In the open boiled molasses taste score was 2.95.

Table 3. Sensory analysis of the molasses

Clones	Taste	Consistency	Colour	Clarity	General	Total Score
S4	4.14±1.57^{bac}	3.57±1.51^{ba}	4.14±1.57^{a}	4.14±1.07^{ba}	4.14±1.07^{ba}	20.13±5.40
S5	2.71±1.38^{dc}	3.57±0.98^{ba}	3.86±1.07^{ba}	3.86±1.07^{ba}	3.00±0.01^{bc}	17.00±2.00
S8	2.71±0.76^{dc}	1.86±1.07^{c}	2.71±0.76^{b}	3.29±1.38^{b}	2.43±0.98^{c}	13.00±2.58
S9	4.14±1.57^{bac}	4.71±0.76^{a}	4.43±0.98^{a}	4.43±0.98^{ba}	4.43±0.98^{a}	22.14±5.01
S10	3.00±1.15^{bdc}	3.57±0.98^{ba}	4.43±0.98^{a}	4.14±1.07^{ba}	3.00±1.15^{bc}	18.14±3.02
S14	4.43±0.98^{ab}	4.43±0.98^{ba}	3.86±1.07^{ba}	4.43±0.98^{ba}	3.86±1.07^{ba}	21.01±3.27
S16	4.71±0.76^{a}	4.43±0.98^{ba}	4.71±0.76^{a}	5.00±0.01^{a}	3.86b±1.07^{a}	22.71±2.43
S17	2.42±1.51^{d}	3.29±1.38^{b}	3.86±1.07^{ba}	4.14±1.07^{ba}	3.00±1.15^{bc}	16.71±5.09
p values	0.0029	0.0004	0.0391	0.1507	0.0048	0.0002

Values with the different letters within each column are significantly different forp≤0.05

CONCLUSIONS

Results of the analysis and sensory scoring of molasses samples were evaluated together and it was determined that the findings of all clones complied with TS 3792.

By this study, it was determined the differences among the clones of Siyah Dimrit grape variety in terms of molasses quality properties. At first, in Siyah Dimrit Clones which were in the study, grape maturity was determined according to the values of soluble solid and titratable acidity. The statistically significant differences were found among grape molasses samples in terms of values of soluble solid, titratable acidity, pH, ash and sensory analysis scores.

S4, S9, S14, S16 clones were displayed high sensory scores.

As results of analysis of fresh grape and grape molasses in the clones were evaluated together; aspects of grape maturity index and molasses sensory analysis values, S16 and S9 clones were indicated the highest scores. These clones should be consider for the production of quality molasses and more detailed studies can be done in the future.

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EFFECT OF FERTILIZATION ON CABBAGE YIELD CHARACTERISTICS

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ABSTRACT

Cabbage is the most common leafy vegetable in Croatia, where due to climatic diversity it can be grown all year round. The aim of this study was to determine the effect of different fertilization on growth and yield of cabbage in the summer-autumn cultivation. Seedlings of cabbage cultivar Parel were planted in soil fertilized with mineral, mineral-organic and organic fertilizers. Field trial was established at randomized block design with four replications at two locations Križevci and Sinj.

Plants planted in Sinj achieved greater height, rosettes and stem diameter than those in Križevci. Significantly higher plants were recorded in treatment with mineral fertilizer. Plants fertilized with organic fertilizer had smaller rosettes and stem diameter than plants fertilized with mineral and mineral-organic fertilizer. Cabbage harvested in Sinj had greater heads height and width and a longer stem inside the heads. Cabbage on the location Sinj achieved significantly higher yield, head weight, head efficiency and the percentage of dry matter than cabbage in Krizevci, while applied fertilizers had no effect on the same characteristics.

Type of fertilization had no significant effect on the parameters of the head and yield, while the selection of location was crucial for cabbage growing in the summer-autumn season.

Key Words: cv. Parel, mineral fertilizer, off season production, organic fertilizer

INTRODUCTION

Cabbage (*Brassica oleracea* var. *capitata*) is the most important leafy vegetable crop in Croatia grown on more than 9000 ha (Lešić et. al. 2004.). Due to Croatian geographical and climate variability, cabbage for fresh consumption can be grown all year around. In Dalmatia (coastal part) cabbage is grown during late summer, autumn and winter until early spring, while in Križevci region it is mostly grown during spring and autumn. In Sinj karst field cabbage is grown for a long time and Ožanić (1955) noted that in 19th century it was important crop in this area.

Cabbage has high requirements for all nutrients, especially nitrogen, and cabbage demands for achieving high yields ranged from 130 to 310 kg N/ha (Lešić et. al. 2004, Sanderson and Ivany, 1999). Nitrogen over use in modern agriculture is of major importance with respect to both environmental concerns and the quality of plant products. Cabbage, as other cruciferous vegetables, has high nutritional value and contains specific sulphur compounds glucosinolates that increase its antioxidant activity.

Cabbage has good responsiveness on animal manure application in quantity of 40 t/ha. Organic fertilization enhances soil biological activity, improves nutrient mobilization and soil structure and increases soil water retention. Systems relying on organic fertilizers as plant nutrient sources have different dynamics of nutrient availability than those using mineral fertilizers. Sustainable crop production with integrated use of mineral and organic fertilizer has proved to be highly beneficial. Several studies have shown the positive effect of combined use of mineral and organic fertilizers in fields that continuously for a few years received only N, P and K, without any micronutrient or organic fertilizer (Chand et al. 2006; Kaur et al. 2005).

In the past, agricultural production was focused on maximizing the quantity of vegetables produced for commercial market (Pavla and Pokluda, 2008) while in the last few decades the organic management of crops has gained great popularity because of increased consumers' awareness of the health problems that come from food grown under conventional and intensive farming. Differences between organic and conventional farming systems, especially in soil fertility management, may affect the nutritive composition of plants.

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The aim of our study was to determine the influence of three different fertilization systems (mineral, mineral-organic, organic) on cabbage growth and yield in summer- autumn growing season in Križevci and Sinj area.

MATERIAL AND METHODS

Field experiment was established at two locations in Croatia: Križevci (continental region) on Agriculture school experimental field and Sinj (Mediterranean hinterland) on private farm Žanko in Summer-Autumn season of 2011 year. Table 1 shows the mean decade temperature for both locations.

Table 1. Temperature (°C) per decade during the cultivation of cabbage cv. Parel at locations Križevci and Sinj

Decade	Location	
	Križevci	Sinj
1. VIII	20.5	22.4
2. VIII	15.8	23.5
3. VIII	16.8	23.6
1. IX	19.7	22.0
2. IX	13.5	20.6
3. IX	11.3	18.8
1. X	11.9	14.9

The recorded rainfall during the vegetation period was 188.6 mm for the location Križevci and 179.8 mm for Sinj (data not shown). Soil samples on both locations were taken in standard procedure as average sample of few samples. Chemical analysis showed (Table 2) that the soil in Križevci is slightly acidic, low to moderate in organic matter with high content of available P nad K, while the soil in Sinj is alkaline, moderate in organic matter with very low P and low K availability.

Table 2. Soil chemical properties on experimental fields.

Location	Depth (cm)	pH		Organic matter (%)	N (%)	AL – method Mg/100 g tla	
		H2O	1M KCL			P2O5	K2O
Križevci	0-30	6.79	6.23	2.54	0.19	26.72	33.28
Sinj	0-30	7.70	7.13	3.49	0.26	2.57	14.27

The study was conducted with very early variety (vegetation period – 61 days) Parel F1 (Bejo Zaden, Netherlands) treated with 3 types of fertilization (mineral, organic-mineral and organic fertilizers). Parel variety is used for fresh consumption and cabbage heads can reach 1.5 kg. Fertilizers were applied on deep cultivated soil and incorporated with power harrow.

Mineral fertilization (MF) was imposed with addition of complex mineral fertilizer NPK 7-14-21 (Petrokemija, Croatia), KNO3 (Yara, Israel) i KAN 27% (Petrokemija, Croatia) with equivalent of 220 kg/ha N, 76 kg/ha P2O5 i 270 kg/ha K2O for planned total yield of 60 ton/ha. All complex NPK fertilizer was incorporated in soil before planting, while KNO3 and KAN were applied in 2 occasions. Organic-mineral fertilization (OMF) was done before planting with pelleted dehydrated organic fertilizer (Orgevit, Romania) in highest recommended quantity (3 t/ha) that supplied 120 kg/ha N, 75 kg/ha P2O5 i 69 kg/ha K2O. Differences in N and K2O quantities were added in two applications with KNO3 and KAN. Organic fertilization (OF) was conducted with pelleted dehydrated organic fertilizer Orgevit in quantity of 3 t/ha. There was no additional fertilizer in this treatment. Additional MF and OMF fertilization treatments were done 20 and 40 days after planting.

Field trial was established as randomized block design with four repetitions and 30 plants per treatment. Sowing was done on 2nd August 2011 in Križevci and 4th August in Sinj. Seedlings with substrate cube and 4 - 5 developed leaves were planted in 3-row strips spaced 70 cm apart, 50 cm distance in row and 100 cm between strips. After planting, every plant was watered with 1 L of tap water. Every plot was 7 m2 (1.4 x 5 m) and all measurements were conducted on 8 plants in the middle row. During cabbage growing all standard procedures for crop maintenance were done (cultivation, irrigation, spraying) taking into consideration harvest time.

Following vegetative parameters were measured during the experiment: plant height (from ground to the highest plant part), rosette diameter (mean of two measured diameters, one in row line, another vertically) and stem diameter (measured under plant head same as for rosette).

Plants were harvested on 7th October in Križevci and 10th October in Sinj. Harvest time was determined due to external traits of heads maturity, head hardness or beginning of last outer leaf curling (Lešić et. al. 2004). After the harvest, heads weight was noted and total yield calculated. Heads were cut on longer side and head length, width and stem length in head were measured. Stem part was divided from head and weighed to calculate stem portion in total head weight (head efficiency). Head dry weight was determined gravimetrically after drying on 70oC.

Statistical analysis was conducted with StatView software (SAS program package, Version 5.0) and SAS (SAS institute, 1999).

RESULTS

Vegetative parameters

Plant heights were in the range from 19.5 cm to 22.8 cm (Table 3). Plants grown on Sinj location were higher (22.8 cm) than those grown on Križevci location. Plants treated with mineral fertilizers were highest (21.8 cm), while there were no significant height differences between plants treated with organic-mineral and organic fertilization.

Rosette diameter values were in the range 42.9 cm - 51.6 cm and were significantly higher at Sinj location (Table 3). Plants treated with organic fertilizers had smaller rosette diameters (45.4 cm) than other two treatments. Location and fertilizer showed significant interactive effect on rosette diameters (Table 3). Rosette diameters in Križevci did not show differences between treatments, while Sinj diameters showed significant differences depending on the fertilization type. Plants grown with mineral fertilizers had biggest diameter while those grown with organic one had the smallest.

Stem diameter was significantly bigger in Sinj than Križevci, varying between 1.58 cm - 3.63 cm (Table 3). Smaller diameter was measured in plants treated with organic fertilizers compared to other two treatments where significant differences have not been found. Location and fertilization had also interactive effect on stem diameter. Stem diameter in Sinj was significantly different, and bigger in plants grown with mineral fertilizers than in those grown with organic-mineral and organic fertilization. Plants in organic-mineral treatment had bigger stem diameters than ones grown with organic fertilizers. Plants grown in Križevci did not show differences between fertilizers.

Cabbage heads on Sinj location were 16.8 cm high and were significantly higher than heads from Križevci (Table 3). Fertilizer type did not influence cabbage heads height.

Heads width varied from 12.4 cm to 15.7 cm (Table 3). Plants grown in Sinj had significantly wider heads and fertilization treatment did not show significant differences in this parameter.

Head stem height varied between 5.3 cm - 7.3 cm (Table 3). Same as in other heads parameters head stem height was significant higher in Sinj, without differences depending on fertilizer treatment.

Table 3. Effect of location and fertilizer type on plant height (cm), rosette (cm) and stem (cm) diameter, head height (cm) and width (cm) and head stem height (cm) of cultivar Parel F1 in summer- autumn season

Treatments	Plant height	Rosette diameter	Stem diameter	Head height	Head width	Head stem height
Location						
Križevci	19.5 b[1]	42.9 b	1.58 b	13.4 b	12.4 b	5.3 b
Sinj	22.8 a	51.6 a	3.63 a	16.8 a	15.7 a	7.3 a
Fertilizer						
Mineral	21.8 a	48.2 a	2.64 a	15.1	14.0	5.9
Org.-Mineral	20.8 b	48.2 a	2.66 a	14.4	13.7	6.2
Organic	20.7 b	45.4 b	2.52 b	14.5	13.2	6.1
Significance						
Location (L)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Fertilizer (F)	0.029	0.003	0.0013	0.13	0.21	0.78
L x F	0.45	0.003	0.0008	0.98	0.82	0.92

[1] Means with different letters in columns differ significantly between location or fertilizer type according to LSD test ($P \leq 0.05$).

Yield parameters

Head weight was in the range from 0.83 kg to 1.82 kg (Table 4). Heads harvested at Sinj location were significantly heavier than heads from Križevci. Fertilizer treatment did not significantly affect head weight.

Table 4. Effect of location and fertilizer type on head weight (kg), marketable yield (t/ha), percentage of head efficiency (%) and percentage of dry mater (%) of cultivar Parel F1 in summer- autumn season.

Treatments	Head weight	Yield	Head efficiency	Dry mater
Location				
Križevci	0.83 b[1]	23.7 b	4.8 b	6.7 b
Sinj	1.82 a	51.9 a	3.4 a	7.8 a
Fertilizer				
Mineral	1.40	39.9	3.8	7.4
Org.-Mineral	1.34	38.3	4.4	7.1
Organic	1.23	35.2	4.1	7.2
Significance				
Location (L)	<0.0001	<0.0001	<0.0001	<0.0001
Fertilizer (F)	0.13	0.13	0.27	0.68
L x F	0.4	0.4	0.44	0.21

[1] Means with different letters in columns differ significantly between location or fertilizer type according to LSD test ($P \leq 0.05$).

Total yield ranged from 23.7 t/ha to 51.9 t/ha (Table 4). Plants from Sinj had significantly higher yield than Križevci plants. Fertilization treatment did not influence total cabbage heads yield.

Percentage of stem weight in total head weight was 4.8 in Križevci, compared to 3.4% in Sinj (Table 4). Fertilizers did not show effect on this trait.

Dry weight percentage changed from 6.7 to 7.8 % (Table 4). More dry weight was measured in Sinj plants and fertilizer treatment did not affect cabbage heads dry weight.

DISCUSSION

Plant height was significantly influenced by fertilization system and growing location, while stem height was influenced only with location. Plants fertilized with MF were higher than plants grown with OMF and OF. These results are consistent with Hasan and Solaiman (2012) who noted that MF had faster nutrient effect and OF needed longer period for nutrients releasing. Same authors showed that stem height also depended on type of fertilizers. Olaniyi and Ojetayo (2011) mentioned that plants grown with OF were higher than plants fertilized with OMF and MF. One of the reason for these results are probably 14 days earlier application of organic fertilizer than other ones, while in our case we applied all fertilizers at the same time.

Rosette and stem diameters traits showed significant interaction between location and fertilization treatment, leading us to conclusion how, depending on location, used treatments affect observed parameters. Fertilization treatments in Križevci did not significantly influence observed traits, while in Sinj parameters values were affected with fertilizer type. The biggest diameters were measured in MF treatment and smallest one in OF. Hasan and Solaiman (2012) reported that leaves were longer when mineral fertilizer was used, what in our experiment could influence rosette diameter. It can be assumed that absence of this effect in Križevci was more influenced with ecological parameters (temperature).

Head traits were influenced by location and not by fertilization system. In contrast with our results Sarker et. al. (2003) found that OMF affected diameter, but not head height. Different influence on these traits was also found by Olaniyi and Ojetayo (2011) reporting that beside fertilizer, the cultivar had significant influence. Location affected the heads dry mater percentage while fertilizer type did not have influence, what is in contrast with Olaniyi and Ojetayo (2011) observation where OF treatment had higher dry matter than MF.

Growing location had significant effect on head weight and total yield. Recorded head weight and yield were 2.2-fold higher in Sinj than in Križevci. Olaniyi and Ojetayo (2011) and Sarker et. al. (2003)

reported that differences in head weight and yield depended on fertilizer type. These contrasting results could be due to different climate at growing locations in our case.

Westerveld et. al. (2003) showed that head parameters and total yield increased with higher N rates. Based on soil properties analysis, it can be assumed that plants N uptake from organic matter was higher in Sinj than in Križevci. In addition, plants fertilized only with organic fertilizer got 100 kg/ ha less N, but that did not affect total yield.

CONCLUSION

Data collected in this experiment showed us that Sinj is better location for growing cabbage cultivar Parel F1 in summer-autumn season. Different fertilization treatments applied in this growing season did not affect yield and head traits. Organic fertilizers application at recommended rate can achieve high yield with reduction in N rates.

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CORRELATION AND PATH ANALYSIS BETWEEN FRESH EAR YIELD AND YIELD COMPONENTS IN SWEET CORN

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ABSTRACT

Breeding sweet corn hybrids that have good fresh ear yield potential will contribute to the sweet corn production and industry of Turkey. Fresh ear yield is the most important objective in the sweet corn breeding programs. The knowledge on relationships between fresh ear yield and some yield components can be used in breeding programmes. In the present study, relationships between fresh ear yield and some yield characteristics were determined by correlation coefficients and path analysis. The study was carried out in Antalya and Konya provinces of Turkey in 2010. Four candidate sweet corn hybrids and three commercial checks were used in the research. According to the results; Fresh ear yield was statistically significant and positively correlated with plant height and ear length. Significant and negative correlations were found between duration of tasseling and fresh ear yield. Path analysis showed that plant height and ear length had the most direct positive effect on fresh ear yield.

Key Words: Sweet corn, hybrids, correlations, path analysis, selection

INTRODUCTION

Field corn is produced primarily for animal feed and industrial uses. However, sweet corn is grown for human consumption. Fresh sweet corn ears have a sweeter taste, because the endosperm contains sugar as well as starch. Sweet corn is favourable for fresh consumption because of its delicious taste, delicate crust, and soft-sugary texture compared to other corn types (Oktem, 2008). The usage of sweet corn canned, frozen or fresh is getting increase in Turkey. To meet consumer need it is very important to breed hybrids that have good yield potential. Fresh ear yield is the main target for sweet corn breeding programs. In the selections, knowledge on relationships between fresh ear yield and some yield components can help breeders for final decisions.

Information about correlative characters in sweet corn has been still very limited. The direct and indirect effects of specific yield components could be precisely identified and applied in breeding programs of sweet corn by determining of inter-relationship among fresh grain yield and yield components (Ilker, 2011).

The objective of the study was to determine the relationships among fresh ear yield and some yield components using simple correlation coefficients and path analysis.

MATERIAL AND METHODS

In the present study, four developed standard sweet corn hybrids (BT-1, BT-2,BT-3, BT-4) and three commercial checks (Merit, Sunshine and Jubilee) were tested.

Two experiments were carried out at the Bahri Dagdas International Agricultural Research Institute, Konya (37052'N, 32035'E) and West Mediterranean Agricultural Research Institute, Antalya (36052'N, 30045'E) in Turkey in 2010. Experiments were conducted in a Randomized complete block design with three replications. Plots consisted of four rows, 5 m long and row spacing was 0.7 m. Border rows were also included to eliminate border effects. After emergence, plants were thinned to approximately 0.2 m.

Fertilization and plant protection measures were done according to local recommendations. Nitrogen was applied 2 times: 10 kg before sowing and 10 kg at the fifth leaf stage. Duration of tasseling, plant height, ear height, ear diameter, ear length and fresh ear yield per plot were measured. Harvests were done manually and late varieties were harvested as they came to maturity.

In order to know variation, analysis-of-variance (ANOVA) was conducted on the data for both locations. Correlation coefficients between fresh ear yield and yield components were computed using combined data which includes each replication of each location. Path coefficients calculated according to

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the method of Dewey and Lu (1959). TARIST statistical software was used for analysis (Açıkgöz et al., 1994).

RESULTS

The analysis of variance showed that there was no significant interaction between the locations and hybrids (LxH) for nearly all traits analyzed except duration of tasseling. According to investigated traits, significant differences identified between two locations except ear height. Hybrids were different in terms of duration of tasseling, ear diameter, ear length and fresh ear yield. Plant height and ear height were not significant in both locations.

Correlation coefficients between fresh ear yield and yield components in sweet corn hybrids calculated were shown in Table 1. Positive and statistically significant relationships were found between fresh ear yield and plant height (0.307) and ear length (0.547). Duration of tasseling were negatively and significantly correlated with fresh ear yield (0.516). Negative and significant correlations also were determined between ear height and ear length (0.335).

The results of direct and indirect path coefficients between fresh ear yield and other variables in sweet corn genotypes are summarized in Table 2. It can be seen from the table path coefficient of plant height and ear length had high and positive direct effects, but duration of tasseling, ear height and ear diameter had negative direct effect on fresh ear yield.

Table 1. Correlation coefficients between fresh ear yield and yield components in sweet corn hybrids

Traits	Fresh Ear Yield	Duration of tasseling	Plant Height	Ear Height	Ear Diameter	Ear Length
Fresh Ear Yield	1.000	-0.516**	0.307*	-0.223	-0.166	0.547**
Duration of Tasseling	-	1.000	-0.090	0.149	-0.180	-0.687
Plant Height	-	-	1.000	0.154	-0.280	0.198
Ear Height	-	-	-	1.000	-0.048	-0.335*
Ear Diameter	-	-	-	-	1.000	-0.133
Ear Length	-	-	-	-	-	1.000

Plant height had the largest direct effect on fresh ear yield in analyzed traits. Duration of tasseling (0.03), ear diameter (0.04) and ear length (0.03) had low positive indirect effects via plant height on fresh ear yield. On the other hand second greatest direct effect on fresh yield was obtained from ear length and duration of tasseling had a high indirect effect via ear length on fresh ear yield. The biggest negative direct effect on fresh yield was determined in duration of tasseling trait (-0.39).

Table 2. **Direct and indirect path coefficients between fresh ear yield and other variables in sweet corn genotypes**

			Indirect Effects									
Traits	Direct effects		Duration of Tasseling		Plant Height		Ear Height		Ear Diameter		Ear Length	
	Px	%	Px	%	Px	%	Px	%	Px	%	Px	%
Duration of Tasseling	-0.39	67.9	-	-	-0.01	3.4	-0.02	3.9	0.02	5.0	-0.11	19.6
Plant Height	0.21	61.4	0.03	9.9	-	-	-0.02	6.5	0.04	12.7	0.03	9.1
Ear Height	-0.15	49.5	-0.05	18.9	0.03	10.9	-	-	0.00	2.5	-0.05	17.9
Ear Diameter	-0.16	50.2	0.07	21.8	-0.06	18.9	0.00	2.2	-	-	-0.02	6.7
Ear Length	0.16	29.9	0.26	48.9	0.04	7.8	0.05	9.2	0.02	3.9	-	-

*[x]P, path coefficient; *, ** P < 0.05 and P < 0.01, respectively*

DISCUSSION AND CONCLUSIONS

Plant height and ear length positively and significantly correlated with fresh ear yield and path analysis revealed that these traits had also great positive direct effect on fresh ear yield. Although, generally plant height positively correlated with fresh ear yield (Saleh et al., 2002; Kashiani et al., 2010) the direct effect of the trait was found ineffective in some studies (Oktem , 2008; Ilker, 2011).

Since ear length was found positively correlated with fresh ear yield and had direct and indirect effect on fresh ear yield in reported different studies, (Sujiprihati et al., 2003; Parakash et al., 2006; Oktem , 2008; Ilker, 2011; Selvaraj and Nagarajan, 2011) it can be used in the selections.

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INVESTIGATIONS ON POPULATION CHANGES, DAMAGE RATE AND BIOLOGY OF *AULOCOPHORA FOVEICOLLIS* (LUCAS, 1849) (COLEOPTERA: GALERUCINAE) IN IZMIR, TURKEY[1]

Firdevs ERSİN DOĞAN[2] Ferit TURANLI[2]

ABSTRACT

In this study, the damage caused by *Aulocophora foveicollis* (Lucas, 1849) (Coleoptera: Galerucinae) on Çeşme and Davut Bey melon varieties has been investigated in İzmir, Turkey. The study was carried out in 2011 in Çeşme and Menemen districts, where melon is extensively grown in İzmir. Three fields in each localities, adult populations were monitored and damage evaluation was done with weekly investigations. In the scope of population monitoring studies, pest were detected only in Çeşme not in Menemen. The average number of adults was 0.8 per leaf during the growing season and it reached to 2 adults per leaf in July as highest level. Regarding to results of damage rate studies, the 73 % of the plants were found as damaged by the pest in September as maximum level. Studies to determine the average durations of different biological stages were done in controlled climate room at 25±1°C, 60 % relative humidity, 16:8 (L:D). According to results, egg stage was found 12.8 days, larval and pupal stages were 30 days and 15 days respectively.

Key Words : Chrysomelidae, Galerucinae, *Aulocophora foveicollis*, melon, Izmir

INTRODUCTION

Cultivation of the plants belongs to Cucurbitaceae family are severely affected by a number of insect pests among which, the red pumpkin beetle *Aulocophora foveicollis* (Lucas, 1849) (Coleoptera: Galerucinae) are the most damaging and major pests. The beetle causes heavy damage during early phase of plant growth in India, Greece, South Europe, Alegeria, Egypt, Cyprus, Aden, Persia, Ceylon, Nepal and Burma (Nath and Ray, 2012). *A. foveicollis* overwinter in adult stage in diapause condition under dry leaves or inside the soil. In spring (between April and May), together with beginning of warm weather, they are reported to be seen in the melon fields and cause damage by feeding melon leaves (Butani and Jotwani, 1984). The pest gives 2-4 generations per a year. After mating, female leave her eggs in the soil either one by one or in small groups near the root of the plants (Anonymous, 2008). With this study, we investigate the status of the pest which has an economic importance in terms of melon farming in Çeşme and Menemen districts. For this purpose population changes, damage rate and biology of the pest were studied.

MATERIAL AND METHODS

Material

The major materials of this research were Kırkağaç and Çeşme melon varieties and adults of Aulocophora foveicollis which were reared in climate rooms with 25±1 °C temperature, 60-70 % relative humidity and 16:8 (L:D) photoperiod in the climate room in Department of Plant Protection, Faculty of Agriculture, Ege University.

Method

Field studies have been carried out in Çeşme (3000 decares) and Menemen (1500 decares) districts, where melon is extensively grown in İzmir. The population density of the pest in previous years was the main reason for choosing these two districts of Izmir for study (Anonymous, 2009). Studies were conducted in 3 fields where melon named Çeşme variety is grown in Çeşme district, one in Çiftlikköy with 2 decares (N 38°292059, E 26°287,279) (Çeşme 1), two in Ovacık with 4 decares (N 38°261199, E 26°33,101) (Çeşme 2) and 4 decares (N 38°261,199, E 26°33144) (Çeşme 3). The studies in Menemen were also carried out in 3 fields. The first field was 500 m² (N38°35,091'E027°02,291) where Çeşme variety is grown, in the farm of Faculty of Agriculture, Ege University and two other fields where melon named Davutbey variety is grown 5 and 15 decares of another farm. (N38°17,655'E028°00,1720).

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Weekly observations to evaluate population changes and damage of A. foveicollis were done on randomly chosen 25 plants in each 1 decar of experimental fields for entire study period. Damage rate was determined according to damage on one leaf of each chosen plant.

Population changes of Aulocophora foveicollis (Lucas)

Population changes of the pest were monitored with the counting of the adults on chosen plants.

The damage rate of Aulocophora foveicollis (Lucas)

Put forward the damage rate of the pest were observed with the eaten parts of the melon leaves. For this purpose a scale (1-5) which was created by Bora and Karaca (1970), were used (Table 1, Figure 1). The values of this scale were given according to percentage of the damage on leaf of each chosen plant. Afterwards, average of the scale values were taken to get one value for each field.

Table 1. The scale used for the estimate the damage of adult Aulocophora foveicollis (Lucas)

Scale value	Damage rate (%)
1	0 (no damage)
2	10
3	20
4	50
5	80

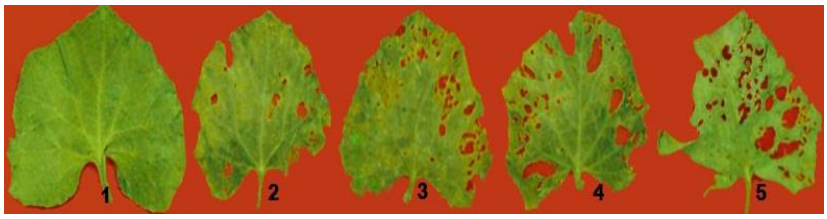

Figure 1. Damaged leaves corresponding to the scale values.

Studies on the biology of Aulocophora foveicollis (Lucas)

For these studies melon variety named Kırkağaç which were grown in transparent plastic glass filled with peat were used as host plant of the pest. The individuals which were collected from the field and brought to the laboratory were used for this purpose. Those individuals were kept in climatic rooms in culture jar with 20 cm diameter and 27 cm height, in which melon plants were placed. Furthermore, 30 individuals were left into the culture jar regardless of the sexual ratio.

Some of the eggs laid by the adult female insects were taken precisely with a humidified sable brush and placed one by one in ependorf tubes which contain humidified filter paper. Ependorf tubes containing eggs were put in the climate room until hatching. The newly hatched larvae were placed just beside the roots of melon seedlings by the humidified sable brush (Figure 2). Seedlings were chanced with healthy ones every two days. Last instar larvae were left to become pupae and afterwards adult.

Figure 2. Aulocophora foveicollis (Lucas) larvae left on the roots of melon seedlings (original).

RESULTS

Population changes of Aulocophora foveicollis (Lucas)

Within the scope of survey in Menemen, no individuals of the pest were determined.

In the field studies in Çeşme between June-September 2011, population fluctuation depending on the average number of adult per leaf was given in Figure 3. According to the results in the fields chosen in Çeşme, the highest value was 0.6 individuals per leaf in Çeşme 2; and it reached its maximum value with 0.8 individuals in Çeşme 3. In Çeşme 1, on the other hand, population was quite high that agricultural pest control was started on June 3, 2011. Despite pest control, during the week after the application (June 10, 2011), pest population reached again 1.5 individual per leaf. By the end of July, population reached 2.0 individuals per leaf. However, in August, although there was no application, a decrease was seen in population; the average number of adults per leaf was detected as 0.8 individuals in all fields.

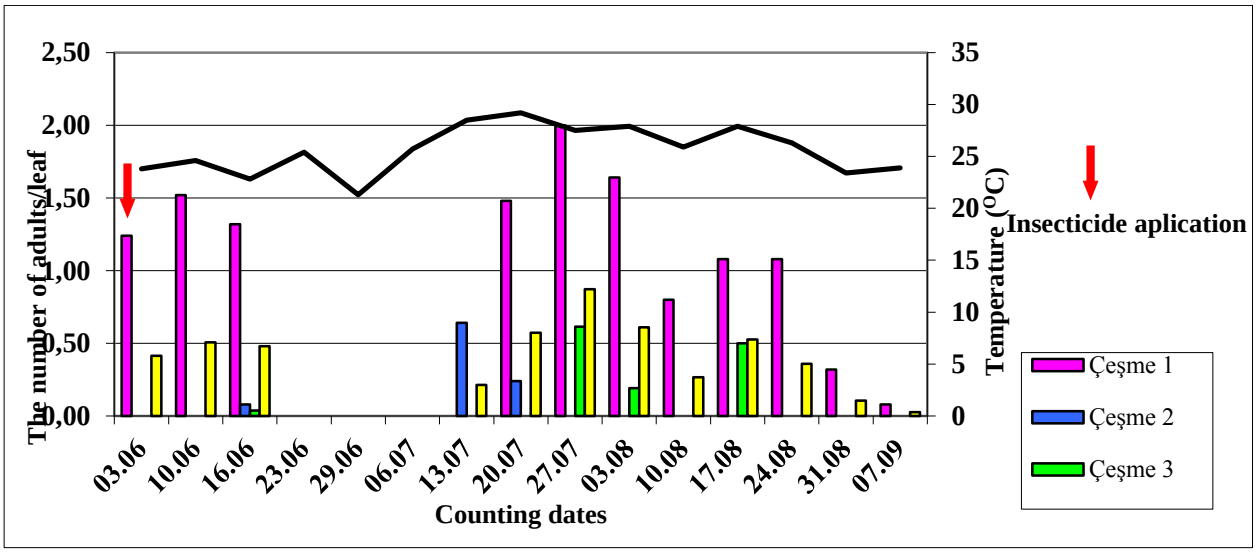

Figure 3. Population changes of Aulocophora foveicollis (Lucas) in Çeşme district in 2011.

Damage rate of Aulocophora foveicollis (Lucas)

However, since the damage occurred only in the fields chosen in Çeşme district, the damage rates could be calculated only for this region (Figure 4). Especially in Çeşme 1, the damage rates were higher on August 24, August 31 and September 7, 2011. The population was very low in other two fields (Çeşme 2 and 3). Unlike the other two fields, in Çeşme 1, an insecticide with an active ingredient of malathion (Nivathion) was applied by the farmer for pest control on June 3, 2011.

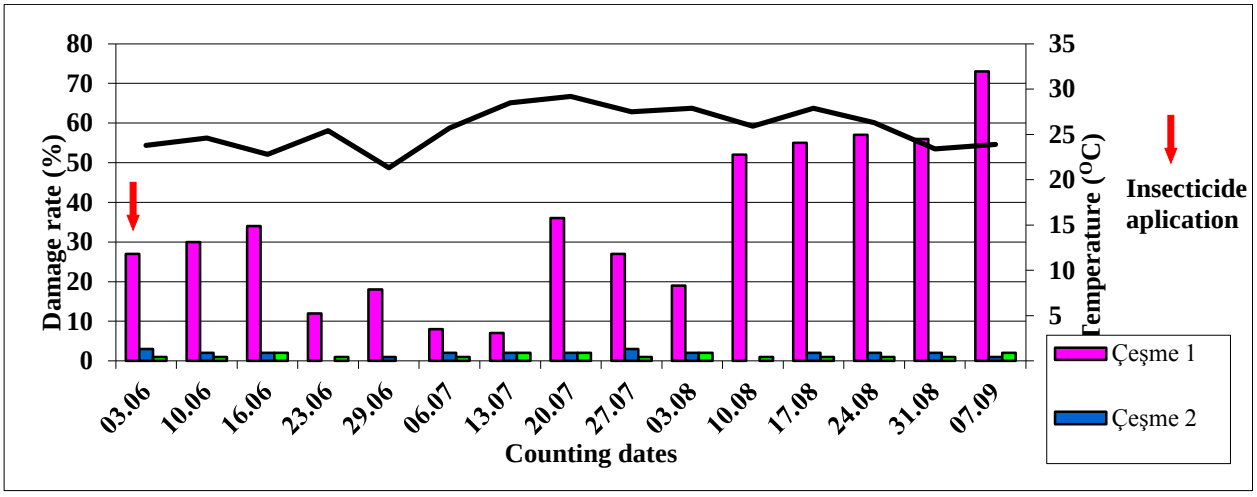

Figure 4. Damage rates of Aulocophora foveicollis (Lucas) in the fields of Çeşme district in 2011.

Biology studies of Aulacophora foveicollis (Lucas)

The lenghts of A. foveicollis eggs (n=11) are 0.9 mm and color of newly laid is yellow, and they turn white close to hatching. The color of the larvae is lemon yellow, the length of last instar larvae is (n=11) 9-10 mm and dorsal of the head is black, the ventral is yellow. At the end of the abdomen, there is an appendages which is helping the larvae as an additional leg. The larvae can attach itself to the host plant firmly by means of this additional leg. The length of pupae (n=11) is 6-6.5 mm and there are thin hairs on the pupae which is light yellow or creamy in colour (Figure 5).

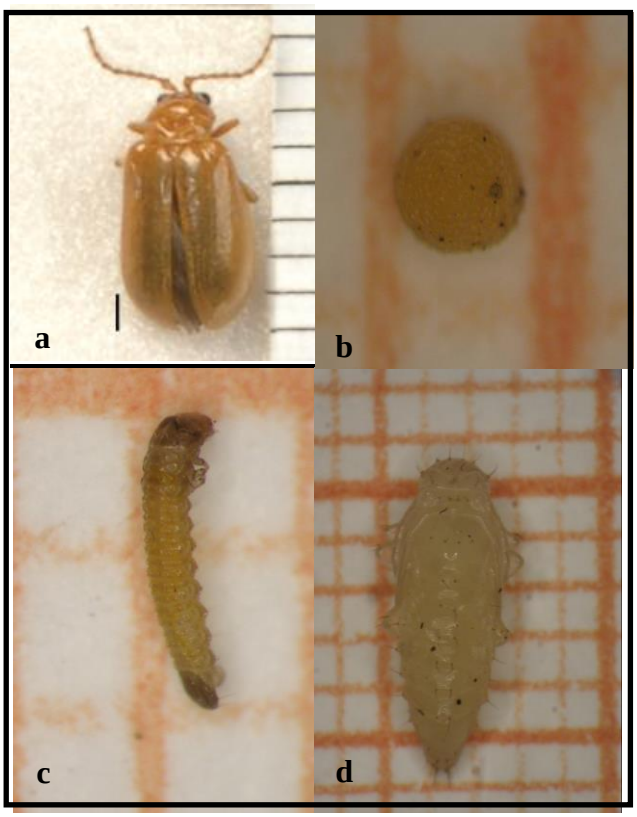

Figure 5. Aulocophora foveicollis (Lucas) adult (a), egg (b) (x 12), first instar larvae (c), pupae (d) (original).

The body of adult is black, the average length (n=585) is (6.5-7.1) 6.8 mm. The head is orange in colour, the width is almost the same as the pronotum width. Pronotum is rusty or yellowish orange in colour, there are two small black spots behind the eyes. Elytra is also rusty or yellowish rusty in colour and is smooth on the surface. Elytra separate towards at the end of the abdomen. The legs are also rusty-coloured. Female and male differentiation was made considering the morphological structure of abdomen end. In females, abdomen end stretches outward opening up like a hose; whereas in males, it is closed and suppressed from the top and has the shape of a groove towards the top (Figure 6).

In order to calculate the average number of eggs laid per female, studies were carried out with the individuals obtained from melon fields out of the experimental area. Two male and one female released to the culture jar but no eggs obtained from that experiment. Therefore, the average number of eggs left per female could not be determined. Some eggs were obtained in the culture jar that used for transportation of the individuals from field to laboratory. They were used for observations of different biological parameters of the pest.

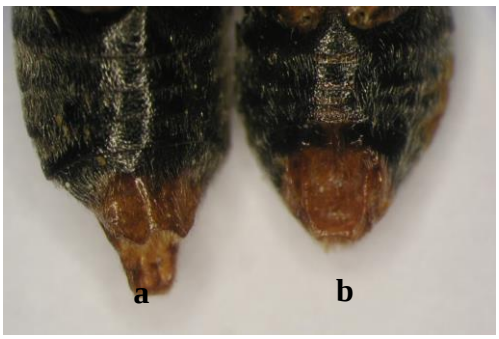

Figure 6. Pygdium of female (a) male (b) of *Aulocophora foveicollis* (Lucas).

Duration of different biological stages of Aulocophora foveicollis (Lucas)

Egg stage

Average incubation period for all the eggs obtained from adults were 12.8 days. In literature, ovipositon period of females was reported to be 8-11 days and incubation period was reported as 9-14 days (Anonymous, 2008).

Larval stage

According to results of the studies on larval stage, longevity of its is 30 days. This finding is parallel with the literature (Anonymous, 2008). The last instar larvae were separate from the root and become pupae inside the soil (Figure 6).

Figure 6. Aulocophora foveicollis (Lucas) last instar larvae (a), the roots of undamaged (b) and damaged (c) melon seedlings (original).

Pupal stage

As a result of the studies on pupal stage, duration of this stage was 15 days. According to literature, pupal stage was reported as 8-18 days depending on temperature (Anonymous, 2008).

Adult stage

Studies to rearing laboratory culture of the pest were failed and no adults were obtained. As a consequence of this, duration of adult stage could not be determined.

CONCLUSION

With this study, it was stated that *A. foveicollis* is very common pest in Çeşme district and it is a problem in terms of melon production. The possible reason why the species is a problem for this region is that the production scale is small and farmers are not willing to use pesticides. The reason for the low population in Menemen district is that agricultural production is large-scaled and focuses on getting maximum yield from a unit area in this region; therefore, continuous insecticide applications keeps the pest population at low level. Another reason can be that producers prefer their own local seeds and obtain the seeds from the previous year's in Çeşme region; while in Menemen, commercial varieties are produced predominantly. The pest should be considered within the scope of integrated pest management in the areas where melon farming is made in Çeşme and Menemen districts. Thus, it is thought that correct pest control methods will increase the amount of melon production in Çeşme.

In the Pest Control Technical Directory of the Ministry of Food , Agriculture and Livestock of Turkey, making the decision to application of control measurements for *A. foveicollis* , the field should be searched diagonally for adult individuals on the green parts of 100 plants and adult pest control should be started when 1-2 adults are seen per plant. Results of this study are confirm that 1-2 adults per plant is economic threshold level as indicated in technical directory.

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CHARACTERIZATION OF APPLE GERMPLASM FROM *ON-FARM* COLLECTIONS LOCATED IN THE MUNICIPALITY STARI GRAD, SARAJEVO

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Jasmin GRAHIĆ[1] Silvio ŠIMON[4]

ABSTRACT

In this study, ten SSR primers that are able to discriminate between apple cultivars were used to examine 31 apple accessions from *on-farm* collections located in the Municipality Stari Grad, Sarajevo. A number of new alleles were detected. Among the analyzed accessions, several homonyms and synonyms were obtained. Some of the apple genotypes were in fact international, commercial cultivars, while many others can be considered as autochthonous. It would be interesting to investigate a wider regional study using the same SSR markers to identify new plant genetic resources.

Key Words: Microsatellite, apple, plant genetic resources

INTRODUCTION

Autochthonous apple germplasm in Bosnia and Herzegovina (B&H) holds significantly higher genetic and morphologic diversity compared to modern apple cultivars grown in this country (Gaši et al. 2010, 2011). Since genetically heterogeneous material represents a potential source of positive pomological traits and resistance to biotic and abiotic stresses (Kellerhals et al., 2004), old B&H apple cultivars could be interesting for future apple breeding programs and therefore need to be collected. In order to conserve the mentioned genetic diversity, an *ex situ* apple collection "Srebrenik" (Spionica, 44˚45'45''N 18˚29'49''E) has been established in 2000.

SSR markers have been shown great promise as tools for managing *Malus ex situ* germplasm collections as well as for collection and preservation strategies of these genetic resources (Hokanson et al. 1998). Recently microsatellite markers have been used for genetic assessment of 39 accessions, 24 traditional Bosnia and Herzegovina (B&H) cultivars and 13 modern international cultivars, maintained at the main *ex situ* apple collection in the country ("Srebrenik") (Gaši et al. 2010). The molecular analyses revealed a clear differentiation between traditional B&H cultivars and some of the most widely cultivated modern cultivars in the region (significant values for both Fst and AMOVA between the mentioned groups of accessions).

In recent years an effort has been underway to fill the gaps in the apple collection "Srebrenik". During the original collecting missions, in the end of 90ies, which resulted in establishing of the main *ex situ* apple collections in the country, the capital Sarajevo with the surrounding area was omitted. In order to ensure that the existing apple collection represents as much as possible of the diverse B&H apple germplasm, Sarajevo region has been surveyed for local apple cultivars. The results indicate a presence of large number local cultivars that are grown in the mentioned region. However, without knowing the genetic identity of these genotypes, it is impossible to determine if local cultivars from the surveyed areas can be considered part of autochthonous B&H apple germplasm, or they are mostly mislabeled international cultivars.

The main goals of this study were to: (i) examine the identity of local apple cultivars from the Sarajevo region, using SSR markers; (ii) to identify synonyms and homonyms and (iii) to determine if the local cultivars are autochthonous or international.

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MATERIAL AND METHODS

A total of 31 accessions sampled from a number of backyards and small farms in Sarajevo (Tab. 1) were analyzed in this study. Each accession was, according to the information provided by the farmers, supposedly a local, autochthonous cultivar. Tissue samples (leaves) for DNA analyses were collected in the spring of 2011, right after the blooming, from a single tree for each accession from Sarajevo and East Bosnia. DNA extraction was performed with Qiagen DNeasy® Plant Mini Kit (Qiagen, Valencia, California, USA) according to the manufacturer's protocol.

Table 1. Local name, code, collecting site and GPS information for each of the 31 local apple cultivars from Sarajevo region.

Local name	Code	Collecting site	Latitude	Longitude	Altitude
Crvenika	SG1	Škaljića sokak	43.87053°N	18.45034°E	780.60 m
Cvjetača	SG2	Mošćanica	43.86728°N	18.45403°E	650.10 m
Mađarica	SG3	Mošćanica	43.86728°N	18.45402°E	650.10 m
Lederka	SG4	Škaljića sokak	43.87053°N	18.45034°E	780.60 m
Šarenika	SG5	Širokača	43.84962°N	18.43134°E	715.70 m
Petrovača	SG6	Obhodža	43.86099°N	18.44752°E	643.40 m
Bobovača	SG7	Mošćanica	43.86728°N	18.45402°E	650.10 m
Žuta	SG8	Brusulje	43.87410°N	18.45681°E	717.80 m
Crvenka	SG9	Hrid-Jarčedoli	43.84866°N	18.45955°E	817.50 m
Zečije uši	SG10	Hrid-Jarčedoli	43.84866°N	18.45955°E	817.50 m
Cvjetača	SG11	Širokača	43.84687°N	18.42527°E	740.70 m
Crvena lederica	SG12	Širokača	43.84687°N	18.42527°E	740.70 m
Siva lederica	SG13	Širokača	43.84687°N	18.42527°E	740.70 m
Senabija	SG14	Širokača	43.84687°N	18.42527°E	740.70 m
Šarenika kasna	SG15	Širokača	43.84630°N	18.42599°E	767.50 m
Šupa	SG16	Obhodža	43.86099°N	18.44752°E	643.40 m
Cvjetača	SG17	Obhodža	43.86099°N	18.44752°E	643.40 m
Kanada	SG18	Obhodža	43.86099°N	18.44752°E	643.40 m
Kolarača crvena	SG19	Obhodža	43.86099°N	18.44752°E	643.40 m
Budimka	SG20	Obhodža	43.86099°N	18.44752°E	643.40 m
Mirisavka	SG21	Obhodža	43.86099°N	18.44752°E	643.40 m
Petrovača	SG22	Škaljića sokak	43.87053°N	18.45034°E	780.60 m
Bistrica	SG23	Škaljića sokak	43.87055°N	18.45035°E	780.60 m
Dobrinjka	SG24	Škaljića sokak	43.87055°N	18.45035°E	780.60 m
Lederica	SG25	Baruthana 13	43.87633°N	18.45574°E	745.75 m
Limun	SG26	Škaljića sokak	43.87045°N	18.44926°E	742.40 m
Ljepocvjetka	SG27	Brusulje	43.87410°N	18.45681°E	717.80 m
Šarenika	SG28	Škaljića sokak	43.87045°N	18.44926°E	742.40 m
Senabija	SG29	Baruthana 13	43.87633°N	18.45574°E	745.75 m
Šarenika slatka	SG30	Širokača	43.84962°N	18.43134°E	715.70 m
Srebrenka	SG31	Škaljića sokak	43.87055°N	18.45035°E	780.60 m

Ten primer pairs (Tab. 2) used for SSR amplifications, previously published by Gianfranceschi et al. (1998) and Liebhard et al. (2002), were already used for genetic assessment of 37 apple accessions, maintained at the ex situ apple collection "Srebrenik".

PCR amplification of SSR sequences was performed in the Veriti TM Thermal Cycler (Applied Biosystems, Foster City, California, USA) using fluorescent labeled primers, which enabled the detection of PCR products using ABI 3130 Genetic Analyzer (Applied Biosystems). All PCR amplifications were performed as described in Gianfranceschi et al. (1998). The PCR product was diluted with ddH20 (1:50), then added to 8.75 µl HiDi and 0.25 µl Genescan 500 LIZ size standard. The data was analyzed using the software package GeneMapper 4.0 (Applied Biosystems).

Table 2. Microsatellite (simple sequence repeats – SSR) code and DNA sequences of ten primer pairs used in the analysis of local apple cultivars from Sarajevo region.

SSR code	*Forward primer*	*Reverse primer*
CH04E02**	GGCGATGACTACCAGGAAAA	ATGTAGCCAAGCCAGCGTAT
CH05E04**	AAGGAGAAGACCGTGTGAAATC	CATGGATAAGGCATAGTCAGGA
CH01H02*	AGAGCTTCGAGCTTCGTTTG	ATCTTTTGGTGCTCCCACAC
CH02C02a**	CTTCAAGTTCAGCATCAAGACAA	TAGGGCACACTTGCTGGTC
CH01H10*	TGCAAAGATAGGTAGATATATGCCA	AGGAGGGATTGTTTGTGCAC
CH05E03**	CGAATATTTTCACTCTGACTGGG	CAAGTTGTTGTACTGCTCCGAC
CH01H01*	GAAAGACTTGCAGTGGGAGC	GGAGTGGGTTTGAGAAGGTT
CH02D08**	TCCAAAATGGCGTACCTCTC	GCAGACACTCACTCACTATCTCTC
CH02C06*	TGACGAAATCCACTACTAATGCA	GATTGCGCGCTTTTTAACAT
CH02C02b**	TGCATGCATGGAAACGAC	TGGAAAAAGTCACACTGCTCC

**Gianfranceschi et al. (1998) ** Liebhardt et al. (2002)*

Calculating gene diversity (Nei, 1978) was performed with the aid of population genetics software SPAGeDI 1.2 (Hardy and Vekemans, 2002) (available at www.ulb.ac.be/sciences/ecoevol/). The genetic distance between the accessions (Bruvo et al. 2004), based on two-phased mutation model (Di Rienzo et al. 1994), was calculated using GenoDive software. Both softwares are part of the GenoType/GenoDive package (Meirmans and VanTienderen, 2004). Construction of UPGMA dendrogram, based on the above mentioned genetic distance was performed in MEGA 4 software (Molecular Evolutionary Genetics Analysis), (Kumar et al. 2008). In the cluster analysis, molecular data for 37 reference accessions (24 well known autochthonous B&H cultivars and 13 international cultivars widely grown in the region), were included. Reference cultivars served to distinguish which of the local apple cultivars from Sarajevo belonged to autochthonous and which to international germplasm.

RESULTS

Ten primer pairs managed to amplify 106 different alleles, or 10.6 alleles per locus. Number of detected alleles per locus ranged from four alleles for CH02C02B, to 17 alleles for CH05E03 (Tab 3.). Gene diversity that was calculated varied among the loci, from 0.60 to 0.92 and was in average 0.79.

Table 3. Number of alleles per locus, gene diversity (Nei, 1978) and allele size range (bp) based on ten SSR loci for 31 local apple cultivars from Sarajevo.

SSR marker	No. of alleles	Range (bp)	He
CH01H01	11	105/131	0.87
CH05E03	17	157/193	0.92
CH05E04	10	149/176	0.68
CH01H02	6	235/249	0.77
CH02C02a	15	130/188	0.92
CH04E02	8	139/166	0.66
CH01H10	8	95/117	0.73
CH02D08	12	208/254	0.88
CH02C02b	4	75/119	0.60
CH02C06	15	218/265	0.86
Mean	10.6		0.79

Cluster analysis based on the Bruvo genetic distance, classified all the analyzed apple accessions in a large number of clusters (Fig. 1). While autochthonous reference cultivars differentiated clearly from the international ones, apple accessions from Sarajevo were distributed more or less equally among the mentioned reference groups. Among the 68 analyzed accessions (31 local cultivars from Sarajevo and 37 reference accessions), cluster analysis revealed 22 homonyms and seven synonyms. Therefore, out of 68 accessions, 61 represent unique genotypes.

DISCUSSION

Average number of alleles per locus, obtained in this study (10.6), was higher than the one obtained by Guarino et al. (2006) in a similar study (7.83), where the authors investigated 48 local, Italian apple accessions together with eight well-known, international cultivars. Higher values were observed by Pereira-Lorenzo et al. (2007) (12.3), who studied 26 foreign apple and 114 local cultivars from three regions in Spain. Average number of alleles per locus detected here was very similar to the number obtained in a previous study on apple germplasm in Bosnia and Herzegovina (10.4) (Gaši et al. 2010).

Average gene diversity estimated in this study was 0.79, higher then values published by Hokanson et al. (2001) (0.623), Liebhard et al. (2002) (0.74) and Guarino et al. (2006) (0.73) and lower then detected among 109 traditional Spanish cultivars (0.80) (Pereira-Lorenzo et al., 2007).

Cluster analysis revealed that the local apple cultivars from Sarajevo in fact represent a mixture of autochthonous and international germplasm, but possesses a high level of diversity which is important to conserve.

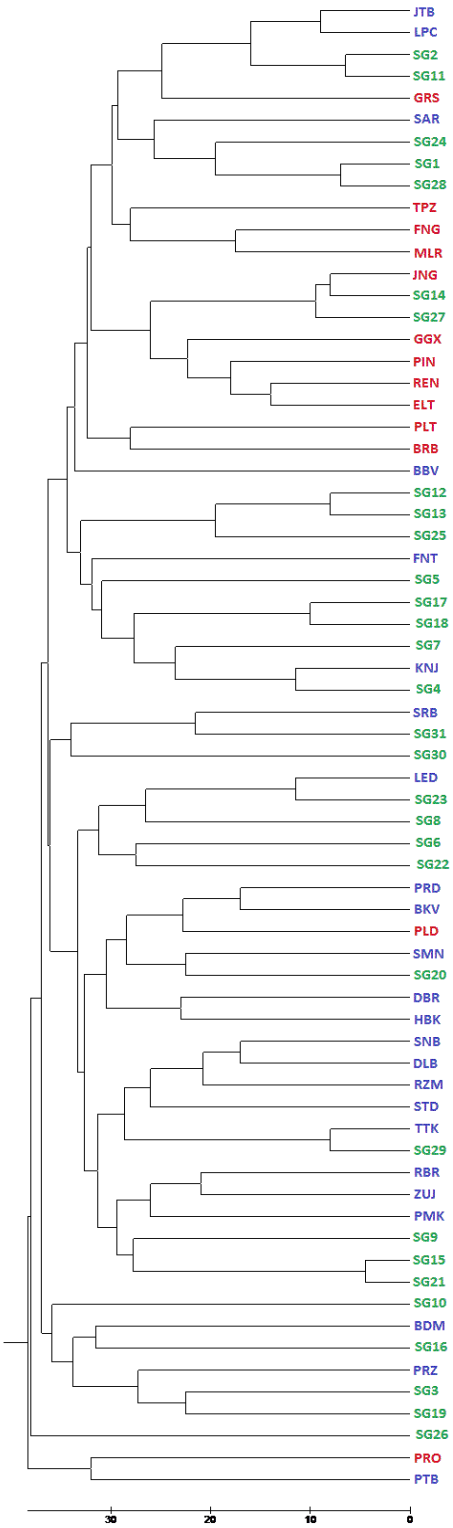

Figure 1. UPGMA cluster analysis based on Bruvo genetic distance computed from polymorphisms on 10 SSR loci in 31 apple accessions.

CONCLUSION

Considering the high level of diversity detected among local apple cultivars from Sarajevo, that is not present in previously analyzed *ex situ* collection we propose a wider regional study, using the same methodology which will help to construct an *ex situ* collection that better represents Bosnian apple germplasm and its diversity.

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THE ROLE OF EXTENSION EDUCATIONAL FACTORS ON PREVENTING POST-HARVEST WASTE OF POTATO IN VIEWPOINTS OF POTATO GROWERS OF RAZAN COUNTY

Omran GHAFARI [1] Ali SHIRDEL [1] Asghar BAGHERI [1]

ABSTRACT

Annually about 25 percent of potato production in the country is wastes, from which 15 percent is related to post harvest wastes. In order to solve the problem of agricultural post harvest wastes we should promote the level of knowledge, technology and human resources. In the other hand, market risk should be reduced. In this survey, attitudes of the potato growers regarding the role of extension education programs in preventing post harvest wastes of the potato has been studied. Statistical population of this study was potato growers of Razan County in 2012. A sample of 250 potato growers selected from the statistical population (N= 546) for data collection. Stratified random sampling method was used in this study. The questionnaire was validated by a panel of experts. Preliminary A pilot test conducted for reliability. Cronbach's alpha coefficient was estimated at 97 percent. The result showed that training of disinfection, storage methods, appropriate warehouse ventilation, training, inventory control, humidity, light and temperature control training, the optimal size of the warehouse, training of pests control and healing have an impact in the prevention of post harvest waste. Also we found a significant relationship between post harvest waste reduction and age, education, store and variety.

Key Words: Extension education, waste, potato growers, Razan County

INTRODUCTION

With increasing world population, especially in the past half century, the importance of food production and storage and processing research has increase to promote crop yield. World Food Organization has announced the world populations by 2030 to more than 8 billion people will the food supply for the population to pursue efforts in the field of agriculture and related sciences. But increase performance alone may not answer nutritional requirements of countries, especially when the cultivation of various etiologies dropped and prices of agricultural products and horticultural per unit area due to the high input rate increases (Asadi & Hasandokht, 2005). Increase in agricultural output due to the climatic conditions, the limitation of water resources and lands with production potential, in many parts of the world may not be possible and there considerable advances in the recent decades, in food production has increased only about 20 percent thus in the productivity of food should be produced, especially water and soil and waste materials increases food as possible is reduced (Ahmadi Zadeh & Albozahr, 2005). Agricultural waste was known as loss of a part of products in various stages of production. It includes the weight or value which destroys without any use (Azizi, 2004). An agricultural crop waste has been well discussed by experts in especially in agriculture developing countries. While the percentage of waste in the process of agricultural crop production in developed world is about 5 to 6 percent, the rate of crop waste in developing countries is about 25 to 30 percent (Ahmadi Zadeh & Albozahr, 2005). The basic measures to reduce the amount of waste are essential to increase food production and increase in productivity (Ahmadi Zadeh & Albozahr, 2005). General purpose of this research was to investigate the role of extension educational factors in preventing of the potato postharvest waste from growers perspective of Razan County of Hamadan province.

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Specific objectives include identifying the individual characteristics of potato farmers, identifying and prioritizing the extension educational factors in the prevention of postharvest waste of potato, and the relationship between potato growers' view points and individual characteristics and extension educational factors to prevent post harvest waste of potato in the county of razan. The County with over than 6716 hectares of cultivation area and production rate of about 239058 tons of potato plays an important role potato production of the country. Suitable climate and soil fertility can be an advantage is the reason of having in potato production. Lack of grading and packaging units and lack of technical storage of potato are problems in the county.

MATERIAL AND METHODS

Descriptive-correlational research method was used in this study which carried out in 2012 in Razan County. The population of the study consisted of potato farmers (N= 564) a samples 250 farmers selected by use of Morgan's sampling table. Stratified proportional sampling method was used in this study. A questionnaire was developed to collect the data. Validity of the research's tool was approved by a panel of the faculty members of the Department of Agricultural Management in the University Mohaghegh Ardebil and University of Tehran as well as some local experts working on the area of Potato gardening. The reliability of the main scales of the questionnaire was examined by Cronbach alpha Coefficients ranged from 92 the data were analyzed by SPSS software. Descriptive and inferential statistics were used to analyze the collected data. Descriptive statistics included frequency values and inferential statistics included correlation coefficient and factor analysis.

RESULTS

Individual and professional characteristics of respondents

Findings from the research showed that average age of the potato farmers 40.74 years. The age of the most potato farmers (40.2 percent) has been between 41-50 years, and level of education of majority of them (32 percent) was very low means innate. 68.8 percent of respondents household have a monthly income of zero and 28/4 percent of respondents have a monthly income of between 100 to 500 dollars, and 8.2 percent of respondents with incomes more than 500 dollars can be. Average farming experience of potato farmers 45.18 and SD 45.10 and most of them (38%) were under 15 years of farming experience. Cultivated potato varieties were 6 groups with names Agria, Santa, Marfona, Bamba, Rambus and Spirit. Most of the respondents cultivated variety of Agria (7.44 percent) and lowest number of respondents cultivated variety of Bamba (2.1%). According to this research finding, 55.2% of respondents less than 1000 square meters of cultivated area and 44.8% of respondents had cultivated more than 1000 square meters.

Factors that prevent potato waste:

Considering Table 1, factors that are the influencing factors of educational advocacy to prevent waste of potatoes was determined and respondents' views on each of the effects of these factors based on a Likert scale with 5 buoy was measured. The results showed that on the opinion of the potato growers the factors including temperature control (4.17), the education of healing (4.05), education of controlling the humidity of store (4) and education of controlling the light of the store (3.98) are the factors that have most effect on the prevention of the rate of potato waste after harvest.

Table 1: relationship between extension educational factors and farmers views toward postharvest wastes prevention

Buoy	The average rating	Standard deviation	Rating
Education of temperature control in store	4/17	0/88	1
Education of healing	4/05	0/95	2
Education of humidity control in store	4	1/4	3
Education of light control in store	3/98	0/97	4
Education of air conditioning in store	3/97	1/05	5
Education of sorting and ranking in store	3/92	1/09	6
Education of sterilizing in store	3/91	1/01	7
Education of pest control in store	3/79	1/19	8
Education of packing	3/76	1/06	9
Education of establishing a technical store	3/68	1/13	10
Education of the useful size of store	3/52	1/06	11
Education of sterilizing the agricultural machines that are used before harvest	3/46	1/17	12

The relationship between individual characteristics and perspectives of potato growers about the factors to prevent waste

Age, farming experience, the size of potato cultivation area and the variety of potato that they cultivated was asked in the model of distance and perspective of potato growers were also measured by Likert type (or five options). Because the independent variable was in the model of distance and the dependent variable was in the model of ranking of the Kendal tau correlation coefficient was used for data analyzing.

According to Kendall tau correlation coefficient between the age of potato growers and their views towards the prevention of waste from the potato post harvest obtained 0.196. It can be assumed that variables at 0.01 significance level. It can be judged 99% between the age of potato growers and their view of post harvest waste there was a significant negative relationship. According to Kendall tau correlation coefficient between the farm size of potato growers and their views to prevent waste post harvest obtained 0.182. at level 0.01 significant level. So we can judge at the level of 99 percent there is a significant relationship between the sizes of potato growers cultivated area and their views toward prevention of the waste.

Based on Kendall tau correlation coefficient there was significant relationship between preventing the postharvest potato and the varieties of potato .

CONCLUSION

The results showed that based on existing data from potato growers views the factors including, temperature control, the education of healing, education of controlling the humidity of store and education of controlling the light of the store are the factors that have most effect on the prevention of the rate of potato waste in post harvest stage and this results are corresponded with the results of (Goudarzi, 2003) and teaching the post harvest techniques is the most basic step in reduction of post harvest waste (Prigojin, 2003). There is a significant relationship between the potato farming experiences and view of preventing post harvest waste of potato. Based on this result farming experience has positive effect on farmers view toward waste management. Significance relationship between the farm size their views of waste means that larger farmers had positive views toward waste preventing. In the case of the factor of variety must be mentioned that some of the potato varieties are resistant to storage conditions and some of them are sensitive. For this reason, the waste is generated in some of varieties and there was not for others. Because that after harvesting of potato it kept in stock for a period of time, selection and release of varieties that are more resistant to storage conditions can reduce waste. There was important point that many farmers are not aware of the terms of storing and varieties. Therefore, to reduce this kind of waste, it is necessary to give the necessary training to farmers in the mentioned fields.

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FACTORS INFLUENCING THE APPLICATION OF WASTE MANAGEMENT OPERATIONS IN POTATO PRODUCTION IN RAZAN COUNTY

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ABSTRACT

The main objective of this descriptive-survey research is to investigate the application of waste management operations in potato production in Razan County. Statistical population of the study consisted of 564 potato growers. 250 samples based on the number of samples of Morgan's table were obtained and stratified proportional sampling method was conducted. Stratified proportionate random sampling technique was used for the study. A questionnaire was used to collect the data. Validity of the research's tool was approved by some of the faculty members of the Department of Agricultural Management in the University Mohaghegh Ardabili and University of Tehran and local experts working on the area of potato farming. The reliability of the main scales of the questionnaire was examined by Cronbach alpha Coefficients ranged from 76. The data were analyzed by SPSS software. Results Show that, there were positive significant relationships between application of waste management operations inp with educational level and farming experience of farmers at one percent level. In addition, there were significant negative relationships between application of waste management operations in potato with the farmer's age, size, extent of production, volume of supply, the total waste, pre-harvesting waste, harvesting waste and post-harvesting waste at one percent level.

Key Words: Waste Management, potato, Razan Couty.

INTRODUCTION

With population growth, agriculture will need to produce enough supply of food to feed an expected more than eight milliard people by 2030 (FAO 1992) and this additional production must be achieved with productivity of production factors and decrease of agricultural waste (Hoghooghi 1998). Advanced technologies in agriculture have been a dominant method for food production, resulting increase of agricultural products (Mutlu 2007) and increase of agricultural waste as well. Totally, agricultural waste in developing countries is about 35 percent of agricultural crop products annually (Bayat 2003), which imposes irrecoverable costs. Since agricultural waste decrease is an important way for agricultural sustainability, there is the need to understand factors influencing agricultural waste and to reduce them. Resende (1979) stated that key factors for food losses were management experience, harvesting practices, packaging methods, and handling at the retailers. Fehr and Romao (2001) indicated that administrative shortcomings were identified as a basic reason for agricultural waste. Also, fruit and vegetables deteriorate during the operations of handling, transport, packaging, store, selling and consumption. Tadesse (1991) found that information management and formation of talents were management procedures for reducing food losses during transportation and commercial distribution. Chaim (1999) suggested modifications to the wholesale structure to reduce losses. Polopolus (1982) advocated a standardization of packaging material for fruits and vegetables in order to reduce losses. In order to improve the safety of fresh fruits, many preservation methods are actually used in many countries, aiming at the destruction of the pathogens or inhibition of their growth. Kader and Ben-Yehoshua (2000) include refrigerated store, controlled and modified atmosphere store, low pressure or hypobaric store. Certain compounds, such as calcium, silicon and borate, which directly inhibit the growth of patho genic fungi, have been highly successful in controlling a number of post-harvest diseases (Qin and Tian 2005; Qin et al. 2007). The strategy of chemical control has concentrated on treatments that protect the product from infection or inhibition of the pathogen growth in incipient infections. Also, some biotechnologies, such as biological control with antagonistic yeasts (Janisiewicz and Korsten 2002) and resistance induction (Droby et al. 2002; Tian and Chan 2004), have been used to control post harvest diseases in various fruits. The same scenario regarding the importance of agricultural waste decrease is going in Iran. Agriculture is the major sector contributes to the growth of Iran's economy (Nooripoor et al. 2008). Razan County lies between 25 to 40 north latitude and between 44 and 63 east longitudes. It is located in the northern hemisphere in west Iran, and has temperate and climate conditions. With its geographical position, possibilities and soil conditions, there is a large variety of horticultural products in this country. Potato is one of the most important fruits for investing in Iran (Mahdavi and Zanjirian 2003).

The total amount of potato produced in 2005 was 330 millions tons which increased production 4 fold in 2000 (FAO 2008). Based on statistics, the total quantity of potato in Razan County in 2006 was 222364

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tons and Razan County has the greatest contribution, with 6342 hectare, and 222364 tons (in average 42 ton/ha) but a large amount of these potato is converted to waste annually. Hence, this study aimed to investigate the application of waste management operations in potato production in Razan County of Hamadan Province of Iran.

Purpose and Objectives

The main purpose of the study was to be: factors influencing the application of waste Management operations in potato production in Razan county the special objectives of the study were: 1) Economic characteristics farmers in the operations of to reduce waste the potato.

2) Social characteristics farmers in the operations of to reduce waste the potato.

MATERIAL AND METHODS

This study was a descriptive-correlation research, carried out in 2012 in Razan County. The population of the study consisted of potato farmers (N= 564) samples 250 based on the number of samples of Morgan's table were obtained and stratified proportional sampling method was conducted. Stratified proportionate random sampling technique was used for the study. A questionnaire was developed to collect the data. Validity of the research's tool was approved by some of the faculty members of the Department of Agricultural Management in the University Mohaghegh Ardabili and University of Tehran as well as some local experts working on the area of Potato gardening. The reliability of the main scales of the questionnaire was examined by Cronbach alpha Coefficients ranged from 76 the data were analyzed by SPSS software. Descriptive and inferential statistics were used to analyze the collected data. Descriptive statistics included frequency values and inferential statistics included correlation coefficient and factor analysis.

RESULTS

Individual and professional characteristics of respondents

Findings of the research showed that average age of the potato farmer was 40.74 years. The age of the most the potato farmers (40.2 percent) has been between 41-50 years and level of education of majority of them (32 percent) was very low means innate. Farming experience of most of potato farmers (91.60) was lower than 15 years. The majority of the potato farmers (90.8 percent) were land owners and only (9.2 percent) of them are the land renters. Average cultivating level of respondents is 8.64 hectares and 54.4 percent of respondents between were planted 1-5 hectares of potato lands. The average potato production of the respondent was 36.4 tons per hectare while 38.8 percent of respondents had produced between 31- 40 tons of potato per hectare, 32.2 percent of respondents had produced between 21-30 tons of potato per hectare and 19.6 percent of them had harvested more than 41 tons of potato per hectare. The lowest production levels belonged to 8.4 percent of respondents who had between 0-21 tons production per hectare. The average rate of postharvest waste was 35.35 percent of the product (table 1).

Table 1. Application rate of waste management operations in the planting stage

Buoy	The average rating	Standard deviation	Rating
Follow the row spacing and planting depth	4.73	1.07	1
Follow alternate culture	4.36	1.20	2
Planting of certified seed potatoes	2.98	1.60	3
Use of suitable machinery and sterilization of them	2.45	1.46	4
Cover crops	2.15	1.37	5

Table 2. Application rate of waste management operations in the growing stage

Buoy	The average rating	Standard deviation	Rating
Control weeds, pests, diseases	4.82	0.93	1
Suitable irrigation and on time	4.80	1.07	2
Integrated pest control with diseases	2.44	1.47	3
Collect and the bury the weeds for compost fertilizer	2.10	1.11	4
Biological control	1.30	0.70	5

Table 3. Application rate of waste management operations in the harvesting stage

Buoy	The average rating	Standard deviation	Rating
Detopping plant before harvesting	4.82	1.35	1
Harvest after the complete yield	4.73	1.05	2
Avoid injury to tubers during harvest and transport	3.72	1.33	3
Do not move and stir the potatoes after harvest prior to planting	3.70	1.26	4
Separation of infected potatoes and eliminate them before the product transfer to store	3.50	1.66	5

Table 4. Application rate of waste management operations in the post harvest stage

Buoy	The average rating	Standard deviation	Rating
Avoid to put the potatoes in direct sun light in store	4.28	1.19	1
Suitable packaging	4.31	1.47	2
Operations of healing	2.34	1.36	3
Disinfecting potatoes before store with Chemical solutions	1.79	1.24	4
Existing potato processing factory in the region	1.65	0.97	5

Table 5. Percent of wastes in the different stages: planting, growing, harvesting and post harvest

Buoy	The average rating	Standard deviation	Rating
Post harvest phase	14.6	6.05	1
Pre-harvesting phase	9.16	7.74	2
Harvest phase	8.50	5.85	3
Plant phase	2.57	3.32	4
Percent of total waste	35.33	-	-

Table 6. Relationship between the application of waste management operations and socioeconomic variables

Variable	Coefficient	Correlation coefficient	The significance level
Age	Pearson	-0.835**	0.000
Education	Pearson	0.680**	0.000
Experience of potato cultivation	Pearson	0.499**	0.000
Area under cultivation	Pearson	-0.390**	0.000
Production rate per hectare	Pearson	-0.202**	0.001
Waste planting	Pearson	-0.027**	0.748
Waste pre-harvesting	Pearson	-0.246**	0.000
Waste harvest	Pearson	-0.020**	0.749
Waste Post harvest	Pearson	-0.287**	0.000

DISCUSSION AND CONCLUSION

Research relative findings of application rate of waste management operation at the planting stage showed that the compliance of row spacing, planting depth, compliance of alternative planting, on time irrigation and planting date have higher precedence and green fertilizer. the use of appropriate machinery and disinfect them," and "planting certified seed potatoes were in the lowest precedence. Research findings relation to application rate of waste management operation at the plant stage showed that the pre-harvesting showed that the control weeds, pests and suitable diseases irrigation and the time have the highest precedence and integrated pest control with diseases, collect and the bury the weeds for compost fertilizer, biological control were in the lowest precedence. Research findings relation to application rate of waste management operation at the harvest stage showed that the detopping plant before harvesting and harvest after the complete yield have the highest precedence and avoid injury to tubers during harvest and transport, do not move and stir the potatoes after harvest prior to planting, separation of infected potatoes and eliminate them before the product transfer to store were in the lowest precedence. Research findings relation to application rate of waste management operation at the post harvest stage showed that the avoid to direct sunlight the potatoes in store and suitable packaging in highest precedence and operations of healing, disinfecting potatoes before store with chemical solutions, existing potato processing factory in the region were in the lowest precedence. This

shows the low influence of modern technology in the studied region about planting, pre-harvesting, harvest and post-harvest. These results with findings of (Kafaya, 2005) and (Asiedu, 2005) are consistent. It should be noticed that some the traditional skills do not help much to improve waste reduce and need of potato farmers to new technologies in these areas increases. The results of correlation analysis showed that the total rate waste of potato and variables age, area under cultivation, production per hectares, had a significant positive relationship on the one percent level. Also between this variable and educational level and experience of potato growing had negative and significant relation on the one level of a percent. These results are consistent with findings of (Kafaya, 2005). Research showed that the application rate of reducing the waste management operations and variables educational level and experience of potato cultivation, have a significant positive relationship on the one percent level and between this variable and age, area under cultivation, production rate, total waste, planting waste, waste pre-harvesting, harvest waste, post-harvest waste there was a significant negative relation on the level of one percent. These results are consistent with findings of (Prigojin, et al. 2003) and (FAO, 1991).

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FRUIT ANTIOXIDANT ACTIVITY, TOTAL PHENOLIC CONTENT AND SUGAR COMPOSITION OF SOME SWEET CHERRY (*Prunus avium* L.) CULTIVARS

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ABSTRACT

In this research total antioxidant activity, total phenolic and fructose, sorbitol and glucose contents of 22 sweet cherry cultivars (Venüs, Fercer Arcina, Sweetheart, Summit, Regina, Belge, Glacier, Rainer, Cristalina, Kordia, Sylvia, Techlovan, Octavia, Star, Newmoon, Lapins, Noir de Meched, Precoce de Bernard, Veysel, 0900 Ziraat, Sunburst, and Maclein Heimer) were determined. These sweet chery cultivars had grown at cherry collection orchard of Atatürk Central Horticultural Research Institute. In this research, the cultivars showed different fruit characteristics according to analyze result of total phenolic content, antioxidant activity and sugar fractions (fructose, sorbitol and glucose).

As a result of this study, the sum of sugars (glucose, fructose and sorbitol) ranged between 192.06 and 109.6 g/l fresh weight (FW). Total phenolic contents ranged between 125.2 and 70.4 mg gallic acid equivalents/100 g FW, and antioxidant activity ranged between 884.1 and 193.3 µm as trolox equivalent antioxidant capacity /100 g FW.

Key Words: Sweet cherry, total phenolic content, antioxidant activity, sugar.

INTRODUCTION

Sweet cherry (*Prunus avium L.*) is a important commercial and one of the most popular temperate fruit. Sweet cherry fruits contain various phenolic compounds which contribute to total antioxidant activity. Moreover the health benefits of cherries and their polyphenols against human diseases such as heart diseases, cancers and diabetes were reported (Serrano (2009); Gonçalves (2004)). Therefore, it is very important to determine the amount of total phenolic contents in sweet cherry. Sweetness and skin color influence the consumer acceptance of sweet cherry fruits. Sweetness in the sweet cherry fruit is mainly due to glucose and fructose. Thus the amount of sugar in the fruit should be determined for each cultivar (Usenik, 2008). Antioxidant activity and phenolic composition are genotype dependent and are influenced by climatic conditions (Prvulović, 2011).

Our objectives were to determine the total phenolic, antioxidant and sugar properties of fruit of selected 22 sweet cherry cultivars.

MATERIAL AND METHODS

Plant Material

Fruits of 22 sweet cherry cultivars were taken as material from the cherry collection orchard of Atatürk Central Horticultural Research Institute. These cultivars were Venus, Fercer Arcina, Sweetheart, Summit, Regina, BELGE, Glacier, Rainer, Cristalina, Kordia, Sylvia, Techlovan, Octavia, Star, Newmoon, Lapins, Noir de Meched, Precoce de Bernard, Veysel, 0900 Ziraat, Sunburst, and Maclein Heimer. Fruits of sweet cherry cultivars were harvested in 2010 from twelve-year old trees.

Extraction and Quantification of glucose, fructose and sorbitol

Fruit samples were analyzed for the content of individual sugars (glucose, fructose and sorbitol). Cores of fruits were removed and homogenized with a blender. Mashed fruit (10 g) was filtered by a coarse filter. The supernatant was filtered through a 0.45 µm cellulose ester filter, transferred to a vial and used for quantitative analyses.

Analysis of sugars were performed using an Agilent "HP1100 series" HPLC with refractive index detector (1100 RID). Separation of sugars was carried out using a Agilent Zorbax Carbohydrates column

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(5µm, 4.6x250 mm). Column temperature was maintained at 30°C. The samples were eluted according to the isocratic method described by Öz et al. (2004).

Determination of Antioxidant Activity

Antioxidant activity was measured by using FRAP assay method (Thaipong et al. 2006). The stock solutions included 300 mM acetate buffer (3.1 g $C_2H_3NaO_2$ - $3H_2O$ and 16 mL $C_2H_4O_2$), pH 3.6, 10 mM TPTZ (2, 4, 6-tripyridyl-s-triazine) solution in 40 mM HCl, and 20 mM $FeCl_3$ - $6H_2O$ solution. The fresh working solution was prepared by mixing 25 mL acetate buffer, 2.5 mL TPTZ solution, and 2.5 mL $FeCl_3$ - $6H_2O$ solution and then warmed at 37 °C before using. Fruit extracts (150 µL) were allowed to react with 2850 µL of the FRAP solution for 30 min in the dark condition. Readings of the prepared samples [ferrous tripyridyltriazine complex was the blank] were then taken at 593 nm. The standard curve was linear between 25 and 800 mM trolox. Results were expressed in g Trolox equivalent kg-1 Dry Weight.

Determination of Total Phenolic Content

Total phenolic content was determined by the Folin-Ciocalteu method (Thaipong et al. 2006). The 150 µL of extract, 2400 µL of nanopure water, and 150 µL of 0.25 N Folin-Ciocalteu reagent were combined in a plastic vial and then mixed well by using a vortex equipment. The mixture was allowed to react for 3 min then 300 µL of 1 N Na_2CO_3 solution was added and mixed well. The solution was kept at room temperature (23°C) in the dark for 2 h. The absorbance was measured at 725 nm with a spectrophotometer (Hitachi). Total phenolic content of the samples were calculated by using a gallic acid (0 - 0.1 mg mL-1) standard curve. The results were expressed in gallic acid equivalents (GAE mg kg-1 fresh mass).

RESULTS

Sugars

Glucose, fructose and sorbitol contents of the sweet cherry fruits were shown in Table 1. Generally, glucose was found as the highest sugar type, followed by in order fructose and sorbitol. Rainer cultivar had the highest whereas Precoce de Bernard cultivar had the lowest glucose content. The fructose content varied between 51.77 g/l FW (cv. Veysel) to 82.31 g/l FW (cv. Sylvia). The content of sorbitol varied from 1.61 g/l FW (cv. Teclovan) to 11.08 g/l FW (cv. Venüs). Sorbitol was not detected in four cultivars (Sweetheart, Star, Precoce de Bernard, and Maclein Heimer). Sumburst cultivar possessed the highest on the other hand Veysel cultivar had the lowest content of sum of glucose, fructose and sorbitol.

Table 1. Mean Glucose, fructose and sorbitol contents (g/l) of different sweet cherry cultivars

Cultivars	Fructose	Glucose	Sorbitol	Total
Venüs	78.10	67.04	11.08	156.22
Fercer Arcina	76.13	85.16	6.69	167.98
Sweetheart	57.23	94.28	ND	151.51
Summit	69.17	78.93	1.73	149.83
Regina	67.62	66.42	3.71	137.74
BELGE	69.03	58.01	5.44	132.47
Glacier	68.53	63.57	5.66	137.75
Rainer	78.17	107.69	6.21	192.06
Cristalina	68.82	86.25	2.63	157.69
Kordia	62.54	58.45	4.68	125.66
Sylvia	82.31	79.69	4.72	166.71
Techlovan	62.33	92.59	1.61	156.53
Octavia	69.16	68.57	4.79	142.52
Star	69.66	62.76	ND	132.41
Newmoon	55.25	55.46	3.82	114.53
Lapins	75.75	76.02	7.26	159.02
Noir de Meched	72.05	63.47	7.82	143.31
Precoce de Bernard	61.42	53.72	ND	115.14
Veysel	51.77	54.32	3.55	109.64
0900 Ziraat	54.09	81.18	1.66	136.93
Sunburst	75.71	88.78	6.81	171.29
Maclein Heimer	56.48	88.48	ND	144.96

ND: not detected

Total Phenolic Content

The total phenolic contents were found in different sweet cherry cultivars by using Folin-Ciocalteu procedure. The total phenolic contents of 22 sweet cherry cultivars were shown in Table 2. Total phenolic content was within the range of 70.42 to 125.18 mg GAE/100g FW. The total phenolic contents were found consistently higher in Regina than the other tested cultivars.

Antioxidant Activity

Antioxidant activities were measured in methanol extract by using FRAP (ferric reducing antioxidant power) assays from a single extract and measurements were repeated three times. The antioxidant activity values expressed as trolox equivalent antioxidant capacity were shown in Table 2. Antioxidant activity of 22 sweet cherry cultivars was found between 193.33-884.07 µm trolox equivalents/100g FW. The highest antioxidant activity was measured in Regina and the lowest in Cristalina.

Table 2. Total phenolic content (mg GAE/100g FW) and antioxidant capacity (µm TE/100g FW) of different sweet cherry cultivars

Cultivars	Antioxidant activity	Total phenolic contents
Venüs	781.99	83.833
Fercer Arcina	811.85	105.11
Sweetheart	361.16	108.36
Summit	235.93	110.02
Regina	884.07	125.18
BEL6E	326.44	85.42
Glacier	318.57	77.80
Rainer	331.99	77.56
Cristalina	193.33	96.77
Kordia	717.18	99.63
Sylvia	446.11	114.39
Techlovan	812.08	110.03
Octavia	470.88	86.06
Star	713.01	116.45
Newmoon	314.86	103.04
Lapins	552.13	81.37
Noir de Meched	312.32	106.37
Precoce de Bernard	820.42	91.21
Veysel	815.79	85.34
0900 Ziraat	377.59	95.82
Sunburst	721.34	122.09
Maclein Heimer	858.61	97.96

DISCUSSION AND CONCLUSION

The main sugars are glucose and fructose in sweet cherry (Serrano et al., 2005). Sweet cherry fruit may contain sorbitol which is a sugar derivative however does not contain sucrose which is a group of sugar alcohol (Karaçalı, 2009). In this study, fructose, glucose and sorbitol contents of 22 sweet cherry cultivar have been identified by HPLC. As a result of this study, the amount of glucose varied between 53.72 and 107.69 g/l, fructose between 51.77 g/l and 82.31 g/l FW, and sorbitol between 1.61and 11.08 g/l FW. Sorbitol was not detected in four cultivars. According to the study of Usenik et al., (2008) glucose, fructose and sorbitol contents of 13 cherry cultivars ranged as glucose 61.8-118.4 g/kg, fructose 47.6-101.5 g/kg and sorbitol 4.45-7.26 g/kg. Alique et al. (2005) determined glucose, fructose and sorbitol contents of Ambrun'es cherry cultivar which were 3.6 g/100 g, 3.7 g/100 g and 1.9 g/100 g respectively.

The differences between the cited references and this study may be due to the differences in cultivars and climatic conditions.

Strong correlations are reported between antioxidant capacity and total phenolic content of sweet cherry (Vangdal & Slimestad, 2006; Go´mez et al., 2009). Our results also showed strong correlations between antioxidant capacity and total phenolic content. In this research determined total phenol content of sweet cherry fruit at similar levels with red currants, red raspberries and strawberry but have lower content than blueberries and other dark colored fruits (Jakobek et al., 2007). Usenik et al. (2008), found that total phenolic content within a range of 44.3 and 87.9 mg GAE/100 g FW while Kim et al. (2005) measured the average total phenolic content of Hartland, Hedelfingen, Regina and Black Gold sweet cherry cultivars as 110 mg GAE/100 g FW. Goncalves et al. (2004) determined higher values for Burlat, Saco, Summit and Van cherry cultivars (92.7-264 mg GAE/100 g FW).

In this research the difference in the sweet cherry cultivars in terms of total phenolic content was due to genetic variations since all samples were taken from trees at the same age and grown under the same ecological conditions. It is well-known that phenolic compounds contribute to nutritional value and fruit quality in terms of color, taste, aroma and flavor. They also provide beneficial health effects for consumers (Hage et al., 2007; Prvulović et al., 2011).

Sweet cherry fruits are a significant source of different phenolic compounds and could be considered also as a good source of natural antioxidants. The results of our research showed that large variability between cultivars in fructose, glucose, sorbitol and total phenol content and antioxidant activity. The results also suggest that the antioxidant activity of sweet cherries is not solely related to total phenolic content as exemplified by fruits of Maclein Heimer cultivar that contained low phenolic content but had a very high antioxidant activity. This result indicates that antioxidant activity depended on phenolic fractions and different chemical attributes which is specific for cultivars.

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EFFECT OF TEMPERATURE ON REPRODUCTION PARAMETERS OF POTATO TUBERWORM, *Phthorimaea operculella* (LEPIDOPTERA: GELECHIIDAE)

Ali GOLIZADEH[1]

ABSTRACT

The potato tuberworm, *Phthorimaea operculella* (Zeller), is the most destructive pest of potato crops (*Solanum tuberosum* L.) in tropical and subtropical zones. Its development and reproduction is strongly influenced by temperature as a key climatic factor. Reproduction parameters of *P. operculella* were studied at six constant temperatures (16, 20, 24, 28, 32 and 36°C), 65±5% RH and a photoperiod of 8:16 (L:D) hours on potato tuber. The population failed to survive at 36°C. The gross fecundity rate ranged from 46.1±10.0 at 16°C to 133.8±19.7 at 24°C. The gross fertility rate varied from 38.3±8.3 at 16°C to 121.3±17.8 at 24°C. The net fecundity and fertility rates were increased with increasing temperature up 28°C and the decreased at 32°C. The highest value of net fecundity and fertility rates were 82.8±10.3 and 72.1±9.0 at 28°C, respectively. The lowest value of both related parameters was observed at 16°C. The number of eggs laid by female per day was ranged from 2.8±0.6 at 16°C to 17.5±2.2 at 28°C. Moreover, the mean number of fertile eggs per female per day was ranged 2.3±0.5 at 16°C to 15.2±1.9 at 28°C. These findings could be considered in pest management program for potato tuberworm in potato fields and storerooms.

Key Words: Demography, potato tuberworm, reproduction parameters, solanaceae, temperature

INTRODUCTION

The potato, *Solanum tuberosum* L. (Solanaceae), is one of the most important vegetable crops worldwide (Flanders et al., 1998). The potato tuberworm, *Phthorimaea operculella* (Zeller) (Lepidoptera: Gelechiidae) is one of the most common and destructive insect pests of potato in the tropical and subtropical potato-production regions (Malakar and Tingey, 2006). *P. operculella* larvae infest potato in both field and storage. Female adult moths deposit eggs directly on potato foliage and tuber. In the field larvae feed on foliage, stems and tubers and causes most damage to potato tubers (Rondon, 2010). They make slender tunnels throughout the tuber which severely reduce marketability of the crop because of the unsightly feeding tunnels and the introduction of bacteria and fungus rots (Trivedi and Rajagopal, 1992). Damage occurs principally in storerooms, where previously infested tubers lead to continuous generations of potato tuberworm and damage to uninfected potatoes in storage.

Demographic studies have several applications including analyzing population stability and structure, estimating extinction probabilities, predicting life history evolution, predicting outbreak in pest species and examining the dynamics of colonizing or invading species. It provides researchers with prominent information on mortality, life span, and biology of an insect (Carey, 2001). A number of extrinsic and intrinsic factors have been shown to affect reproduction parameters. These include temperature, geographical origin of insect and host plant (Gilbert and Raworth, 1996). Temperature is the most important and critical climatic factor with the greatest effect on the developmental rate, reproduction, survival and subsequently fertility life table parameters of arthropods (Roy et al., 2003). It directly influences the activity and seasonal population dynamics of insects by affecting the birth, death and growth rates of individual insects and sets the limits of their biological activities (Huffaker et al., 1999; Huey and Berrigan, 2001). These effects of temperature on biological traits of insects have been modeled, and models of temperature-dependent population growth and reproduction are useful in predicting insect activity and population dynamics under field conditions (Jervis and Copland, 1996; Roy et al., 2003). Knowledge of the adaptation of insects to climatic conditions plays a crucial role in pest management through the prediction of the timing of development, reproduction, and dormancy or migration (Roy et al., 2002).

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Study on the effect of temperature on *P. operculella* can provide valuable insight into the population dynamics of this pest especially in storerooms, where the temperature is relatively constant. Documenting the variation in reproduction parameters among different temperature conditions is critical for understanding population dynamics and subsequently use the information obtained for pest management. The objective of this study is to evaluate the effect of selected constant temperatures on different biological traits and subsequently reproduction parameters of *P. operculella* on potato tuber under laboratory conditions.

MATERIAL AND METHODS

Rearing of *P. operculella* colony. The initial population of potato tuberworm was collected from infested potato stores with *P. operculella* in the Ardabil province, north western Iran. The stock culture of *P. operculella* was initiated on potato tubers Agria cultivar in the breeding cage. The breeding cage contained potato tubers as larval food and sand as a pupation medium. The moths were provided with a long cotton wick soaked with honey solution (10%) placed in the cage. Agria potato cultivar used in this study is the most common cultivated potato cultivar in Iran. To obtain the same aged eggs of potato tuberworm, about 20-25 pairs of both sexes of newly emerged moths were put inside oviposition cups together. The oviposition cups consisted of a clear and cylindrical Plexiglas container covered with muslin. A filter paper on the muslin provided an oviposition site for moths. The moths readily laid eggs on the lower surface of filter papers. After 10-12 h, filter paper was taken and the eggs were used for experiments.

Reproduction parameters. All experiments were carried out in a growth chamber set at one of six constant temperatures including 16, 20, 24, 28, 32 and 36 (± 1)°C, each at 65 ± 5% RH and a photoperiod of 8:16 (L:D) hours. To estimate survival rate of the egg stage, at least 200 eggs were used at each temperature in Petri dishes (10.0-cm-diameter). Lids of Petri dishes were cut off and covered with fine mesh gauze for ventilation. The Petri dishes were checked and the number of hatched eggs was recorded daily. Development of larvae and pupae was observed in the growth chamber at the same conditions. To evaluate the development at each constant temperature, each newly hatched *P. operculella* larva was transferred to a clear plastic cup (15-cm-diameter and 8-cm-height) containing a piece of potato tuber. Cup lids were cut-off and covered with fine mesh gauze for ventilation. At least fifty larvae were monitored at each temperature. Larvae normally leave tubers before pupation. All cups were checked daily, and development of larvae, pupated individuals and their survival were recorded until adult emergence. Potato tuberworm reproduction was examined at five constant temperatures. Reproduction at 36°C was not included because previous experiments showed that there was no survival at this temperature and all individuals died during immature stages. At each temperature treatment, 15-20 mating pairs were used. Each pair was placed in a clear plastic cup (15-cm-diameter, 8-cm-height) and the number of eggs laid was recorded daily. Daily monitoring continued until the death of the adults. In this way, immature survival and time to maturity and adult fecundity were recorded and used to calculation of some important reproduction parameters (Table 1) (Carey 1993).

Statistical analysis. Effect of temperature on the reproduction parameters were analyzed using one-way ANOVA. If significance differences were detected, multiple comparisons were made using the SNK procedure. Statistical analysis was performed using the SPSS v. 16.0 statistical program (SPSS, 2007). Differences in reproduction parameters were tested for significance by estimating variances through the Jackknife procedure and Jackknife pseudo-values were subjected to analysis of variance using the SPSS statistical programs (Maia et al., 2000).

Table 1. The equations of some reproduction parameters (Carey, 1993)

Parameter	Equation
Gross fecundity rate	$\sum_{x=\alpha}^{\beta} M_x$
Gross fertility rate	$\sum_{x=\alpha}^{\beta} h_x.M_x$
Net fecundity rate	$\sum_{x=\alpha}^{\beta} L_x.M_x$
Net fertility rate	$\sum_{x=\alpha}^{\beta} L_x.h_x.M_x$
Mean number of eggs laid per female per day	$\sum_{x=\alpha}^{\beta} L_x.M_x / \sum_{x=\varepsilon}^{\omega} L_x$
Mean number of fertile eggs per female per day	$\sum_{x=\alpha}^{\beta} L_x.h_x.M_x / \sum_{x=\varepsilon}^{\omega} L_x$

α (alpha) is the age of first reproduction and β (beta) is the age of last reproduction; L_x is midpoint survival; M_x is female fecundity at age X to age X+1 and h_x is hatching rate.

RESULTS

Potato tuberworm developed to adulthood successfully at 16 to 32°C. The population failed to survive at 36°C, and all first instar larva died at this temperature. The reproduction parameters of *P. operculella* at each temperature was calculated and results has been represented in Table 2. Reproduction parameters of *P. operculella* were significantly affected by temperature (Table 2). The gross fecundity rate increased significantly as temperature increased from 16 to 24°C ($P < 0.001$, $F = 6.114$, $df = 4,72$). At 28°C, the value decreased but did not vary significantly with respective value at 24°C. The highest and lowest gross fecundity rate was observed at 16°C (46.1 eggs) and 24°C (133.8 eggs), respectively. The gross fertility rates were significantly different among constant temperatures ($P < 0.001$, $F = 8.344$, $df = 4,72$). This parameter showed similar variation trend and ranged from 38.3 eggs at 16°C to 121.3 eggs at 24°C.

Net fecundity rate that is a function of gross fecundity rate and survival rate, was significantly increased with increasing temperature from 16 to 28°C ($P < 0.001$, $F = 11.321$, $df = 4,72$) and then decreased at 32°C. The lowest and highest value of this parameter was obtained at 16°C (25.3 eggs) and 28°C (82.8 eggs), respectively. The net fertility rates were significantly different among temperatures ($P < 0.001$, $F = 15.547$, $df = 4,72$), and the highest rate was 72.1 at 28°C and the lowest rate was 21.1 at 16°C, respectively. The number of eggs laid per female per day of potato tuberworm was significantly enhanced with temperature in the range of 16-28°C ($P < 0.001$, $F = 12.192$, $df = 4,72$) and reached a peak of 17.5 eggs at 28°C. The number of fertile eggs per female per day showed similar variation trend at tested constant temperatures and its value significantly differed among temperatures ($P < 0.001$, $F = 14.244$, $df = 4,72$). The lowest value of both later parameters was observed at 16°C (Table 2).

Table 2. Reproduction parameters of P. operculella on potato tubers at different constant temperatures.

Parameter	Temperature (°C)				
	16	20	24	28	32
Gross fecundity rate	46.07±9.98c	70.56±8.94c	133.80±19.68a	117.61±14.66ab	84.79±11.14bc
Gross fertility rate	38.32±8.30b	61.48±7.79b	121.28±17.84a	102.46±12.77a	59.97±7.88b
Net fecundity rate	25.32±5.48b	45.01±5.71b	76.52±6.21a	82.80±10.31a	44.32±5.75b
Net fertility rate	21.06±4.56b	39.21±4.97b	69.36±5.63a	72.14±8.98a	31.35±4.07b
No. of eggs laid per female per day	2.78±0.60c	7.46±0.95b	13.53±1.10a	17.47±2.17a	13.54±1.76a
No. of fertile eggs per female per day	2.31±0.50d	6.50±0.82c	12.26±1.00ab	15.22±1.89a	9.58±1.24bc

Means followed by the same letters within a row are not significantly different (P < 0.05; SNK after one-way ANOVA).

DISCUSSION

An accurate description of biology and fertility life table parameters is important in well understanding of a pest population dynamics and could be used as an essential decision tool in planning an ecologically sound pest management program. Temperature has been considered one of the most important ecological factors to influences the development, reproduction and survival of insects. Therefore, the precise description of the relationship between temperature and life history parameters is critical to the studies of population dynamics of insects. In this study, we investigated the variation in *P. operculella* reproduction parameters at different constant temperatures. Estimation of fertility life table parameters under a given constant temperature range when including the total life cycle, such as development rate, mortality, and reproduction, allow estimation of temperature-dependent growth potential of the insect pests (Greenberg et al., 2005; Dong et al., 2007).

Developmental time of the immature life stages of potato tuberworm has been reported by different authors (Chauhan and Verma, 1990; Mariy et al., 1999; Sporleder et al., 2004). The effects of temperature on development and mortality of potato tuberworm immature stages were investigated by Sporleder et al. (2004) at constant temperatures ranging from 10 to 32°C. *P. operculella* development data reported here partially differ with their results. However, to the authors' knowledge, no study has been conducted particularly on the effect of various constant temperatures on the reproduction parameters of this species. In the current study, the population reproduction parameters of *P. operculella* were investigated at a relative broad temperature ranges from 16 to 36°C on potato tuber. The construction and analysis of fertility life table parameters are important tools in the measurement of population growth capacity of a species under specific conditions (Southwood and Henderson, 2000). The life cycle of *P. operculella* varies significantly depending upon various factors, such as host plants and environmental conditions, under which it develops. The temperatures encountered by *P. operculella* female moth played a critical role in its reproductive success. The reproduction parameters along with population growth parameters could be representative the physiological qualities of a species in relation to its capacity to increase. Among related parameters, fecundity is indicating total eggs produced by moths and fertility is showing only hatched eggs at each temperature. Thus, in fertility, the ratio of hatched eggs has been considered. In net reproduction, the probability of individual survival is considered while this probability is ignored in gross reproduction. The gross fecundity and fertility rates were strongly positively correlated to temperature from 16 to 24°C and *P. operculella* performs much better at 24°C because of its high fecundity, when

comparing with lower temperatures. However, the higher survival rate at 28°C led to the highest values of net fecundity and fertility rates at this temperature point. This result suggested that 28°C is within the suitable temperature range, and it is the optimal temperature for *P. operculella* reproduction among the examined temperatures.

CONCLUSION

Our findings showed that temperature is a key factor on the reproduction of potato tuberworm. Although insects are not subjected to constant temperatures under field conditions, the results from controlled laboratory studies can provide valuable insight into the survival and reproduction of insects. Under storeroom conditions temperature is relatively stable; consequently, the acquired result would be more helpful in pest management program in potato storages. However, more knowledge of pest activity under field temperature conditions to obtain more applicable results would be important.

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EFFECTS OF GLOBAL CLIMATE CHANGE ON AGRICULTURE

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ABSTRACT

Global climate change is "*global warming*" (sensu lato) that comes to mind first when it is demonstrated in all areas of the today's life, especially from the agriculture. However, diminishing of water resources; precipitation reductions at the national and regional levels and this type roll-off-rate; the reduction of the cuttings in the forests, etc. caused the negative impact(s) for the global warming. Particularly, human-induced (*anthropogenic*) and the growing impact of atmospheric emission based "*greenhouse gases*" that have extremely negative effects to agricultural production. Global climate change, especially global warming, which can emerge has extremely negative impact(s) on agriculture sector. It reveals that its reasons and possible measures must be taken in a certain plan and program without delaying. In this paper, aforementioned factors will be itemized as headings and related suggestions will be made.

Key Words: Global warming, gas emission, global climate change, yield and production

INTRODUCTION

Increasing of the temperature in the surface of the earth as a result of the greenhouse effect of the gases oscillating in the atmosphere is called "*Global Warming*" (Ulukan 2011). This situation may be considered as the increase in the temperature of the earth as a result of keeping some part of various light rays from the atmosphere without being reflected due to a blanket effect (surrounding the earth) as well. It is well known that all living organisms desire certain temperature degrees for growth and development even for sustaining their living. However here the subject shall be assessed in agricultural terms and the impact of global warming and greenhouse gases shall be examined. Particularly in recent years although it is a known reality that it is necessary to increase agricultural production for the solution of the problem of hunger that increased due to the gradual increase of the population, since the new fields to be made available for agriculture are insufficient and global warming suffers from negative impacts of desertification, erosion it is rather difficult to realize an agricultural production of desired level and such factors including the increasing population pressure urbanization, mistaken land use, forest fire(s), genetic erosion, etc. triggered the increase in natural disasters; furthermore it was emphasized that due to its richness in biodiversity. Turkey should pay particular significance and the effects of climate change should be detected carefully and attentively, and attention should be attracted to the fact that the country would be very vulnerable toward the harmful and severe impacts of global warming (Korkmaz 2007; Ulukan 2011).

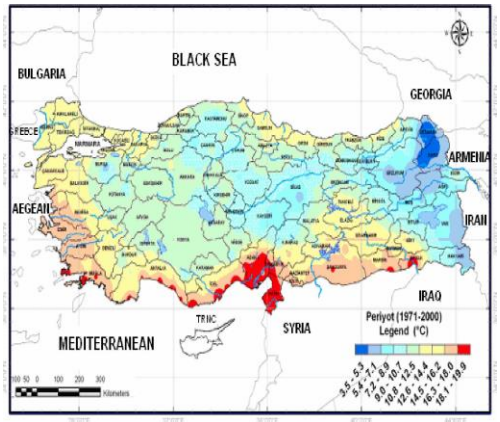

Figure 1. Long term temperature avarage (Şensoy et.al. 2008)

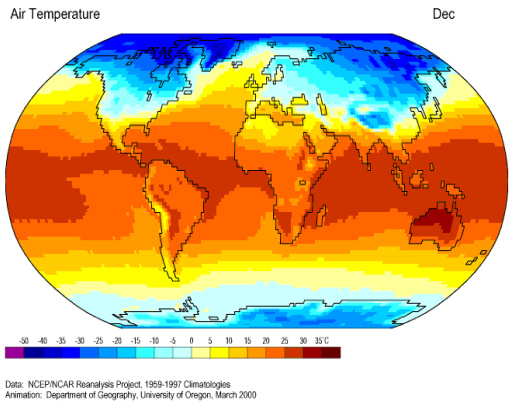

Figure 2. Impacts of global heating on the earth (Anonymous 2012a)

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Examining the average temperature values indicated in Figures 1-2. One shall understand easily how the earth and our country were affected by this problem. As one can see in the relevant figures as well, a significant part of our country is under the threat of desertification. Particularly, the temperature increases in the Regions of Aegean, Mediterranean and Southeast Anatolia attract the attention and depending on this increase significant problems arise in agriculture sector as well as it is the case in all other sectors. Particularly, increase of temperature in winter months, early coming of spring and delay of autumn, the change of migration periods in animals, shifting of (1-2) months in blossoming or flowering period are among "*climate change*" indicators (Peng et al. 2004; Cline 2008). Climate change poses a danger for agricultural products of the developing countries as well (İpekçi and Atay 2012). Those plant and animal species that cannot resist those changes either diminish or completely disapear (Ulukan 2011). Particularly the increase of CO_2 level to the increase in temperature is of great significance in terms of herbal production in agriculture (Hale and Orcutt, 1987; Fuhrer 2003); so much that temperature increase alone may cause insufficiency of rains as well, and in line with this the decrease in fresh water sources shall cause the agricultural product pattern in the country and creation of different product patterns (Öztürk 2009).

Figure 3. Undeveloped form of corn plant due to global heating (Anonymous 2012b)

Figure 4. Example of effect of global heating on insufficient plant development (Anonymous 2012b)

The primary plant existing intensely in the production pattern is wheat (*Triticum* spp.) which is followed by corn (*Zea* spp.). As it is the case with other plants in terms of effect (Fig. 4), the corn plant failed to grow sufficiently as a result of aridity caused by global warming (Fig. 3); either the plant failed to germinate and sprout sufficiently fast and provide seedling establishment and development (Fig. 3), or its growth was not provided sufficiently due to increasing temperature, failure to reach sufficient amount of moisture to grow in the environment with high probability (Fig. 4).

Figure 5. The effect of global heating on plants (Anonymous 2012c)

Figure 6. The effect of global heating on soil (Anonymous 2012 d)

Similarly (Figures 5-6), herbal production and earth which is the living environment of plants was too much affected by global heating; in other words, performing herbal production of desired level became quite difficult. Particularly compared to the field plants the cultivation of which requires water and input more (for instance in corn and trefoil (*Trifolium* spp.) the negative effect of global warming shall arise as spreading in time but more dramatically (Ulukan and Gürsoy 2011). One of the natural elements included in the climate system is the greenhouse effect (Öztekin and Özyılmaz 2010) and this situation creates greenhouse effects by keeping the infrared rays reflected from the surface of the earth by gases in the atmosphere including CO_2 (corrosion of organic substance, respiration of humans and animals, volcanic eruptions, burning fossil fuels), CH_4 (as a result of coal, petrol and natural gas production), H_2O (arising from oceans, lakes and rivers), N_2O (earth processing, use of fossil fuels) (Öztekin and Özyılmaz 2010). Dealing with this impact alone, while it is a fact providing benefit for the human beings and other living organisms, its increase became the source of worry (Uzmen 2007).

Table 1. Gas emission in Turkey on yearly basis (mil t CO_2) (Source: Anonymous 2012e)

Year	CO_2	CH_4	N_2O	F Gases	Total
1990	141,36	33,50	11,57	0,60	187,03
1995	173,90	46,87	16,22	0,52	237,51
2000	225,43	53,30	16,62	1,66	297,01
2005	259,61	52,38	14,18	3,73	329,90
2006	259,61	52,38	14,18	3,73	329,90
2007	276,72	53,33	15,55	4,05	349,64
2008	307,92	55,58	12,35	4,13	379,98
2009	297,12	54,29	11,57	3,51	366,50
2010	299,11	54,37	12,53	3,64	369,65

(The data are not included emissions arising from use of land and usage change as well as the sinks.)

As seen in Table 1, greenhouse gas emission increases gradually in our country. However, the amount of greenhouse gases which have vital effect being more than normal and continuity of this increase causes corruption in climatic balances of the Earth and causes some part of light rays from the Sun to be absorbed by ozone layer and the gases in the atmosphere (Fuhrer 2003). CO_2 increase may have an effect of increasing efficiency in certain agricultural products (C_3 plants) at the beginning but as the increase continues it shall start to poison the plants (Helms et al. 1996, Lobel and Field 2007; Kahundri et al. 2008).

CONCLUSION

Our earth was subjected to the enormous climatic changes for during geologic history of 4,5 billion years and even in some periods its geography changed in certain periods (Ulukan 2011). Considering that climatic changes are included in the term of geography, we can say that the natural balance corrupted. All living organisms were and are affected by the corruption of natural balance but plants were affected differently by these due to both photosynthesis mechanisms and other biochemical and physiological properties (For example being of C_3, C_4 and CAM group).

Particularly gaining an acidic structure as a result of mixing of CO_2 in the environment as a consequence of a gradually increasing concentration particularly in the water of soil which they have to make use of for growth and development and this structure having a disintegrating impact on the structure of the plant is another significant problem encountered in this regard. Under these and similar conditions summarized above partially, cultivation of plants which have an undeniable place in the nutrition of human beings and animals has become difficult to be performed at desired level and in an environment where global heating has become a perceivable problem. In this context; the studies

performed indicate that despite the fact that heating in global dimension and climatic corruptions (or changes) show certain ambiguities and measures are taken against these, the situation shall continue to aggravate in the future as well and may cause significant problems (Ulukan 2011). It is stipulated that global warming in the future shall be more critical depending on greenhouse gas emission and the increase in the emission affected by the climatic changes.

In this regard the importance of the issue should be well understood by everybody and a good environmental awareness both socially and individually shall be created and effective seminars, congresses, workshops, panel, conferences etc. with high number of participants organized. All these should be organized periodically in order to discuss the measure(s) that may be taken and the policy/policies to be followed and all obtained results should be shared with the public and relavant organization(s) in timely and effective way.

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THE IMPACT OF ANTHROPOGENIC MEASURES ON PHYSICAL-CHEMICAL PROPERTIES OF SOIL, ON SILICEOUS SUBSTRATES IN THE REGION OF CAZIN AND VELIKA KLADUSA

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ABSTRACT

This paper focuses on researching physical and chemical properties of natural and anthropogenized soils developed on siliceous substrates in the area of Cazin and Velika Kladusa municipalities. The research was performed on the following soil types: Cambisol developed on schist in the municipality of Cazin (the soil used as natural pastures and gardens); and Cambisol on slate in the municipality of Velika Kladusa (soil used as natural pasture and artificial meadow). Opening of main profiles was conducted on the above mentioned soil types, where samples were taken by horizons, while sampling for average samples was performed by probe. General objective of this research was to identify the extent to which the changes induced by anthropogenization have a retrograding or prograding influence on these soils. The analysis included the following soil quality indicators: bulk density, aggregate stability, soil organic matter content, pH level, content of accessible forms of P_2O_5 and K_2O, analysis of the soil adsorption complex. Additionally, it included the content of readily available forms of heavy metals (Pb, Ni, Cd, Zn, Mn) in average samples.

In general, it can be stated that the yields of major field crops grown on soils formed on siliceous substrates are below the line of productivity potential. This implicates the requirement for improving these soils through a proactive anthropogenic action.

Key Words: Siliceous substrata, slate, profile, anthropogenization.

INTRODUCTION

In the research area developed are two series of soils, one on carbonate substrata (limestone and dolomites), specific for their type affiliation as well as depth, content of skeleton, content of soil organic matter and agro-ecological properties in general, while the other series of soil formed on siliceous substrata that are the subject of this paper's research.

The siliceous substrata are represented mainly by alevrolits, sandstones, clay and shales. Developed on these substrata are the soils of uniform physical and chemical properties that are generally characterized by substantial depth and acidity, as well as mostly favorable water-air regime. The anthropogenic impact on soils formed on siliceous substrata has serious implications; through deforestation and ploughing of natural meadows and forests in order to create more arable land, man has changed the vegetation cover being a natural ecosystem, and improved agro-ecological properties of these types of soil to a considerable extent.

MATRIALS AND METHODS

The selection of research site and soil types on siliceous substrata in the area of Cazin and Velika Kladusa was made based on BiH Basic Pedology Map in 1:50.000 scale, with supporting interpretations for the research area. Two profiles were opened in each of the soil types. One profile was opened in arable-anthropogenized soil, and the other in natural soil that was not subjected to human influence. Depth of the opened profiles reached up to 100 cm.

Sampling of individual samples from the profile was performed by horizons in three replications, in disturbed state in plastic bags and in undisturbed state in Kopecky cylinders (the paper shows average values). For sampling average samples we used Pürkhauer-soil sampler, while samples were taken from 30 sites determined by grid method, from depths of 0-10 and 10-20 cm. Laboratory research, i.e. sample analysis were performed in accordance with standard methodology. Samples taken in Kopecky cylinder were used for determining bulk density of soil. Samples taken in disturbed state were used for determining: pH reaction of soil, content of humus, physiologically active P_2O_5 and K_2O, as well as for analyzing the soil adsorptive complex by Kappen. Analysis of the content of accessible forms of heavy

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metals (Pb, Ni, Cd, Zn, Mn) was performed at the Sector for Laboratory Research of the Federation Institute of Agro-Pedology, on average samples taken from depth of 0-10 cm.

RESULTS AND DISCUSSION

Cambisol, Cazin

The research site for Dystric cambisol on mica-like slate is located in the municipality of Cazin, on the left side of the Cazin-Velika Kladuša regional road. The soil texture examination results indicate that this is a clayey loam, where content of silt is predominant in all horizons. Level of clay content grows with depth which is indicative of the process of argilogenesis, as well as of erosion of fine clay particles from the surface. According to the data from meteorological station, average annual air temperature in this region is 10.8 °C, while average precipitation level during the year is 1,245 mm. The relief is hilly to mountainous, characterized by high population density and busy countryside roads. A large share of the population is involved in agricultural activities; these are mainly small-scale agricultural holdings with a few large animals or crop production. Since this is a hilly relief, a large number of land parcels are intensively cultivated, and because of steep inclination the erosion is extremely pronounced. The profile of natural soil was opened in natural pasture, while the profile of anthropogenized soil was opened in garden.

Table 1. Physical properties of the soil, Cazin

Way of use	Horizon	Depth in cm	Soil texture			Bulk density	Stability of structural aggregates
			sand	silt	clay	g/cm^3	
Natural pasture	A	0 – 17	31,2	41,0	27,8	1,3	2
	Bv	17 – 60	25,9	37,8	36,3	1,3	3
	BC	60 – 100	24,5	40,6	34,8	1,5	3
Garden	Ap	0 – 33	28,6	45,4	25,9	1,1	3
	Bv	33 – 75	30,3	37,4	32,2	1,4	4
	BC	75 – 100	45,2	32,0	22,7	1,5	4

Difference in depth of the surface horizon between these two ways of land use is of anthropogenic origin, as tillage leads to deepening of the Ap horizon, which was the case here. Stability of macro-structural aggregates by Gračanin-Seker method was slightly better in natural than in anthropogenized soil; this occurrence is also explained by tillage. Values of Vsg in the surface horizon were also somewhat higher in natural (1,3 g/cm3) than in anthropogenized soil (1,1 g/cm3).

Table 2. Chemical properties of the soil, Cazin

Way of use	Horizon	Depth in cm	pH		Content of SOM	Content (mg/100 g of soil)	
			H2O	1M KCl	%	P2O5	K2O
Natural pasture	A	0 – 17	5,3	4,3	1,8	1,4	11,5
	Bv	17 – 60	5,6	4,2	0,4	0,8	5,7
	BC	60 – 100	5,3	4,7	0,1	1,1	9,7
Garden	Ap	0 – 33	6,3	5,2	3,3	1,6	25,6
	Bv	33 – 75	6,0	4,4	0,5	1,7	7,6
	BC	75 – 100	6,0	4,5	0,2	1,0	12,6

A more favorable pH reaction (5,2 pH in 1M KCl) of soil used as garden (medium acid reaction by Schefer- Schachatschable) relative to the soil used as natural pasture (very acid reaction) is an indicator of positive impact of anthropogenization. (Vukadinovic et al., 2008), suggest that low pH causes a variety of problems, causes deficiency of calcium and magnesium, aluminum toxicity and / or manganese, reduced availability of phosphorus, low efficiency of nitric acid and potassium fertilization, necrosis of leaves and fruits, and poor soil structure.

Application of organic and mineral fertilizers aimed at feeding the plants in garden soil also reflects on a higher content of soil organic matter (SOM) - humus than in natural pasture. Additionally, the content of K2O is evidently higher in anthropogenized than in natural soil, whereas the levels of P2O5 content in natural and anthropogenized soil are uniform. Resulovic et al. 1998 lists values of P2O5 content within areas Mutnik, Šestanovac, Ćoralići, canton Cazin, which are <1 mg/100 per gram soil, while the value of K2O 10,9 – 15,3. mg/100 per gram soil.

Table 3. Characteristics of adsorptive complex by Kappen, average sample, Cazin

Way of use	Depth in cm	Hydrolytic acidity (H)	Content of exchangeable base (S)	Total adsorption capacity (T)	Base saturation (V)
		cmolc/kg-1	cmolckg-1	cmolckg-1	%
Natural pasture	0 – 10	8,1	16,4	24,5	66,9
	10 – 20	7,1	14,7	21,8	67,4
Garden	0 – 10	2,9	21,5	24,4	88,0
	10 – 20	3,2	17,5	20,7	84,3

Anthropogenization had a positive impact on increased levels of the content of exchangeable bases (S)adržaja zamjenjivih baza (O5 su poprilično ujednačene na svim dubinama profila. 1,1, total capacity of adsorption (T) and level of saturation with soil adsorptive complex bases (V), which becomes apparent in a comparison of the values of these elements between natural pasture and garden (anthropogenized) soil.

Table 4. **Content of accessible forms of heavy metals in average sample, Cazin**

Way of use	Depth in cm	Content of accessible forms of heavy metals in mg kg-1 of soil				
		Pb	Ni	Zn	Mn	Cd
Natural pasture	0 – 10	3,1	1,4	1,9	72,1	0,0
Garden	0 – 10	2,3	0,8	1,8	31,4	0,0

The content of accessible forms of heavy metals in this type of soil did not exceed permissible limits, regardless of the way of its use. The study" Land Resources USC" Resulović et al.1998. lists the contents of heavy metals in the area Mutnik Cazin, 21.1 Fe, 10.9 Mn, Cu, 2.0, 8.8 Zn, Cd, trace, Co 0, Pb, 2.6 mg kg-1.

Cambisol on Shales, Velika Kladusa

The profile opening sites are located in the vicinity of the regional road Velika Kladusa– Cazin, some 300 m away. Soil texture shows that these are the soils of heavier mechanical composition, clayey loam, where content of clay increases with depth. Average annual air temperature in this area is 10.8 oC, while average precipitation level during the year is 1.245 mm. Relief is slightly rolling with inclination up to 3 %. A significant portion of the population of this area is involved in agriculture, especially in berry fruit production – mostly raspberry and strawberry – that has been intensified in the past several years.

Table 5. Physical properties of the soil, Velika Kladusa

Way of use	Horizon	Depth in cm	Soil texture			Bulk density	Stability of structural aggregates
			sand	silt	clay	g/cm3	
Natural pasture	A	0 – 29	30,2	40,2	29,6	1,1	2
	Bv	29 – 64	31,6	37,9	30,5	1,4	3
	BC	64 - 100	37,3	18,8	43,8	1,4	3
Artificial meadow	Ap	0 - 20	24,0	46,8	29,2	1,1	2
	Bv	20 – 54	21,3	45,8	32,8	1,3	3
	BC	54 - 100	22,8	41,8	35,4	1,4	4

Vsg values are almost identical in both methods of land use. Stability of structural aggregates in A and Ap horizons is very good, it corresponds with turbidity image No. 2 and is better relative to deeper horizons, which can be explained by a higher content of humus in A and Ap horizons.

Table 6. Chemical properties of the soil, Velika Kladusa

Way of use	Horizon	Depth in cm	pH		Content of SOM	Content (mg/100 g of soil)	
			H2O	KCl	%	P2O5	K2O
Natural pasture	A	0 – 29	5,2	4,2	2,9	2,3	15,1
	Bv	29 – 64	4,8	3,8	0,4	0,3	7,4
	BC	64 - 100	4,6	3,6	0,2	1,8	10,0
Artificial meadows	Ap	0 - 20	6,4	5,5	2,9	3,0	18,7
	Bv	20 – 54	6,1	5,2	0,8	2,6	8,6
	BC	54 - 100	5,8	4,6	0,4	0,7	8,5

pH reaction in 1M KCl of anthropogenized soil ranges from 5.5 in Ap horizon to 4.6 in BC, while in natural soil, the pH in 1M KCl ranges from 4.2 in A horizon to 3.6 in BC horizon. The study done by Imamovic, Š. and Vrlec Ž., the soil map of Bosnia Petrinja section 3, claim that the sporadic acidity ranges from pH 4.02 to 5.28, and the substitution acidity pH ranges from 3.68 to 4.50.

Levels of the humus content in both anthropogenized and natural soil are identical. This is still a good indicator since there is no reduction in the content of organic matter caused by tillage, which is prevented by the application of organic matter (manure). Values of physiologically active phosphorus in both anthropogenized and natural soil are extremely low. Content of accessible potassium is at a medium level, while differences related to the way of use are also small. Research Resulović et al.1998. showed that the pH value of the soil at the sites below Slapnica, Rajnovac, Pec municipality Great Kladuša ranged in value of pH in H2O 6.2 to 6.6 and the pH in KCl at 5.2 to 5.5. The study done by Imamovic, Š. and Vrlec Ž. as well claims that the content of P_2O_5 on acid brown soil was 0.07 mg/100 gram while content of physiologically active K_2O ranges from 3.8 to 15.0 mg/100 gram.

Table 7. Characteristics of adsorptive complex by Kappen, average sample, Velika Kladusa

Way of use	Depth in cm	Hydrolytic acidity (H)	Content of exchangeable base (S)	Total adsorption capacity (T)	Base saturation (V)
		cmolckg-1	cmolckg-1	cmolckg-1	%
Natural pasture	0 – 10	10,0	14,7	24,8	59,3
	10 – 20	9,1	17,5	26,6	65,8
Artificial meadow	0 – 10	3,5	3,8	7,3	51,6
	10 – 20	5,5	2,7	8,3	33,5

Values of H, S and T by Kappen's method are two times bigger in natural than in anthropogenized soil. The reason for pronouncedly higher values of H, S and T in natural soil may be found not only in the nature of parent substrate which can be mosaic-like and in small distances, but also in the way that land is used.

Table 8. Content of accessible forms of heavy metals in average sample, Velika Kladusa

Way of use	Depth in cm	Content of accessible forms of heavy metals in mg kg-1 of soil				
		Pb	Ni	Zn	Mn	Cd
Natural pasture	0 – 10	5,0	1,3	1,6	19,4	0,0
Artificial meadow	0 – 10	5,4	0,5	7,6	10,1	0,1

No increased levels of the content of accessible metals in average samples were identified in any profiles in the locality of Velika Kladuša.

CONCLUSIONS

Positive anthropogenic impact on Cambisol on mica-like slate in the municipality of Cazin is clearly indicated by the results of the analysis. Reason for this is certainly the regular application of manure as well as mineral fertilizers by the land owners. Content of potassium was somewhat higher in anthropogenized than in natural soils. pH value was definitely more favorable in anthropogenic than in natural soils, in both examined soil types. In case of Dystric cambisol on mica-like slate that was used as garden, the content of soil organic mater (SOM) was higher than in natural soil, due to organic matter input (manure) during the basic soil tillage. All this can be characterized as a favorable anthropogenic impact on the examined soil from this area.

pH reaction in 1M KCl of Cambisol on mica-like slate in the locality of Velika Kladusa was more favorable in anthropogenized than in natural soil, where the levels in surface horizons reached 5,5 in anthropogenized and 4.6 in natural soil. The levels of SOM content clearly show that there was no reduction of SOM content in anthropogenized soil as a result of tillage thanks to the input of organic matter (manure).

Implementation of pedo-meliorative measure of calcification and humization would contribute to achieving positive effects in such soils, primarily through reducing the acidity and toxic effect of Al^{3+} ion (as a consequence of extremely high acidity), as well as chemical immobilization of phosphates, which can be done with regular application of mineral fertilizers having a pronounced P formulation.

Along with the application of other regular agro-meliorative actions and sowing material of high genetic potential, it could result in bigger yields on these land areas. It should be noted no increased contents of accessible forms of examined heavy metals were recorded in average samples.

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BIOLOGICAL ACTIVITY OF LIGNANS AND THEIR DERIVATES

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ABSTRACT

Lignans and its derivatives are widely distributed in plants and are most abundant in flax seeds, wheat germ, rye, and other vegetables and fruits. They belong to the group of phytoestrogens and in humans and animals may exhibit estrogen or antiestrogen activity that is associated with their ability to bind to estrogen receptors. In addition, they are attributed with antioxidant, anticancer, antimicrobial, anti-inflammatory and immunomodulatory activity.

Numerous studies now confirm the beneficial effects on human health and explain the mechanisms of action of phytoestrogens, although the views of experts sometimes disagree as to their actual effectiveness and ultimate impact.

In this paper, the references on lignans have been systematically reviewed in the following aspects: classification, metabolism and pharmacological activities.

Key Words: Lignans, phytoestrogens, biological activity

INTRODUCTION

Lignans belong to a group of polyphenols whose structure is determined by the union of two C6-C3 (phenyl propane) units linked at the central carbon atom of the side chain (Howarth, 1936). The major classes of lignans are the C8-C8′ (or β-β′) coupled lignans, referred to as lignans. Neolignans have structures where the coupling between the subunits occurs by bonding other than C8- C8′. When the carbons are linked by an ether oxygen atom the compound is named oxyneolignan. Sesquineolignans and dineolignans have three and four C6-C3 units respectively (Moss, 2000).

The range of natural structures encountered is very diverse and can be exemplified with a proposed classification according to their skeleton: furofuran, furan, dibenzylbutane, dibenzylbutyrolactone, aryltetralin, arylnaphthalene, dibenzocyclooctadiene, and dibenzylbutyrolactol. These subgroups are based upon the way in which oxygen is incorporated into the skeleton and the cyclization pattern.

Lignans are often classified as mammalian or plant lignans. Plant lignans are group of secondary metabolites, synthesized via phenylpropanoid pathway derived from hydroxycinnamyl alcohols, allylphenols or hydroxycinnamic acids, which are oxidatively coupled from radicals produced by the actions of laccases or peroxidases (Davin and Lewis, 2003). They are present at considerable concentrations in a diversity of food sources such as nuts, grains, seeds, fruits and vegetables. The major lignans identified in food are secoisolariciresinol diglucoside (SDG) and matairesinol with traces of pinoresinol, lariciresinol and isolariciresinol (Mazur, 1998). Plant lignans will be converted to mammalian lignans (nowadays called enterolignans) by the microflora in the mammalian gut. There are two forms of mammalian lignans, enterolactone (ENL) and enterodiol (END) (Axelson *et al.*, 1982; Coulman *et al.*, 2005). These compounds differ from their precursors by the presence of some hydroxyl group replacing methyl groups on the aromatic ring. Several dietary plant lignans (pinoresinol, lariciresinol, syringaresinol, hydroxymatairesinol, sesamin, arctigenin are secoisolariciresinol) can be metabolised to enterolignans in the gut (Axelson *et al.*, 1982; Borriello *et al.*, 1985; Heinonen *et al.*, 2001).

METABOLISM

In foods, lignans occur as glycosidic conjugates, and when consumed by human, lignan glycosides are probably hydrolyzed in part by gastric acid (Xu *et al.*, 1995). Hydrolysis may occur in the intestinal lumen by bacterial β-glucosidases or in enterocytes by cytosolic β-glucosidases (Setchell *et al.*, 2002). Deglycosylation cleave the sugar moieties and release the biologically active aglycones. Aglycons can be partially absorbed into systemic circulation (Laerke *et al.*, 2009) or further biotransformed by bacteria to specific metabolites. Gut microflora can metabolize plant lignans further into mammalian lignans (Axelson & Setchell 1981, Borriello *et al.* 1985). Both enterolignans and plant lignans are detected in human serum and urine (Bannwart *et al.*, 1989; Adlercreutz *et al.*, 1995; Smeds *et al.*, 2006), suggesting

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that both types of lignans are absorbed from the gut. Lignans can be reconjugated in the intestinal epithelium during absorption or in the liver by UDP-glucuronosyltransferases and sulphotransferases (Morton *et al.*,1994; Dean *et al.*, 2004, Jansen *et al.*, 2005). Additional metabolism beyond glucuronidation or sulphation may also occur in the liver; enterolactone and enterodiol with extra hydroxyl groups have been identified in human urine after flaxseed ingestion (Jacobs *et al.* 1999). Oxidative metabolism has been suggested to be a means of disposing of lignans from the mammalian body (Wang 2002). Conjugated lignans are excreted through urine and bile and undergo enterohepatic circulation. Lignans, re-excreted *via* the bile, duct into the intestinal tract, deconjugated by the bacterial b-glucuronidases and sulphatases, and reabsorbed by the intestinal cells (Kurzer and Xu, 1997).

BIOLOGICAL ACTIVITIES

Numerous biological effects have been shown for mammalian lignans. Plants containing lignans have been used extensively in popular medicine. Evidence is, however, sparse and inconsistent and mostly limited to *in vitro* experiments.

Even though enterolactone has structural similarities to endogenous estrogens, no estrogenic activity of enterolactone has been observed *in vivo* (Setchell *et al.*, 1981, Waters and Knowler 1982, Saarinen *et al.*, 2001). Also lignans have been proposed to modulate production and bioavailability of sex hormones. According to several *in vitro* studies high concentrations of enterolactone inhibit enzymes which converted testosterone to 17b-estradiol, estrone, 5a-dihydrotestosterone or androstenedione (Adlercreutz *et al.*, 1993; Wang *et al.*, 1994; Saarinen *et al.*, 2002; Evans *et al.*, 1995). Furthermore, synthesis of sex hormone-binding globulin (SHBG) in the liver was stimulated by the high concentration of enterolactone (Adlercreutz *et al.*, 1992). Several studies also demonstrated connection beetween high concentration of enterolactone and decreased binding of steroid hormones to SHBG (Martin *et al.*, 1996; Schottner *et al.*, 1997, 1998). These effects, in theory, could induce lower lifetime exposure to sex hormones, which potentially could lower the risk of breast and prostate cancers. However, *in vivo* studies and clinical trials showed no enzyme inhibition and only minor effects of lignan supplementation on serum sex hormones and SHBG (Brooks *et al.*, 2004; Saarinen *et al.*, 2002; Schultz *et al.*, 1991)

Antioxidant activity. On the basis of several *in vitro* studies, enterolactone has been suggested to possess antioxidant activity (Kitts *et al.*, 1999; Pool-Zobel *et al.*, 2000; Prasad, 2000; Saarinen *et al.*, 2000) and the ability to inhibit the Na+K+ pump (Braquet *et al.*, 1986). The relevance of these findings in the understanding of enterolactone action *in vivo* is, however, unclear.

Anticancer. In the past decade, lignans have received particular attention and many studies suggest that lignans can in prevention of chronic diseases such as cancer through anti-oxidant, anti-estrogenic and other potential mechanisms. A lignan-rich diet has retarded or reduced experimentally induced tumors in several tissues, including the mammary gland (Rickard *et al.*, 2000; Tou and Thompson, 1999; Saarinen *et al.*, 2001, 2002; Dabrosin *et al.*, 2002) and prostate (Zhang *et al.*, 1997; Landstrom *et al.*, 1998; Bylund *et al.*, 2000).

First descriptive study that showed lower urinary excretion of enterolactone in breast cancer patients than in controls was done in 1982 (Adlercreutz *et al.*, 1982). To date five epidemiological studies have assessed the association between blood or urinary enterolactone concentration and the risk of breast cancer, and three of these studies have found an inverse association. Two studies contradict those of the case-control studies, with no association being observed for urinary enterolactone excretion (den Tonkelaar *et al.*, 2001) and only a marginal inverse association for serum enterolactone concentration (Hulten *et al.*, 2002). Moreover, no associations have been found between dietary intake of plant or mammalian lignans and breast cancer risk in cohort studies (Horn-Ross *et al.*, 2001, 2002; Keinan-Boker *et al.*, 2004).

High circulating enterolactone has not been associated with reduced risk of prostate cancer in a large prospective study based on population cohorts from Finland, Sweden, and Norway (Stattin *et al.*, 2002), and no relationship between dietary intake of lignans and prostate cancer was observed in a case-control study conducted in the United States (Strom *et al.*, 1999).

Antidiabetic. Several reports suggest that lignans has potential in the prevention and treatment of obesity and diabetes (Pan et al., 2007; Prasad, 2000b) even though the mechanisms by which lignans exert their beneficial effects on diabetes are unclear. Lignans has been reported to modulate numerous targets that have been linked to obesity and insulin resistance and it was suggested that the antioxidant

activity may be playing role for its antidiabetic activity. It has been shown that lignans downregulate tumor necrosis factor α (TNF-α) and interleukin-6 (IL-6) production.

Effect on cardiovascular system. There is a promising association between lignans and decreased risk of cardiovascular disease even though their is still no compelling evidence in epidemiological studies that lignans present in the very small quantities typical of usual Western diets, decrease coronary heart disease and cardiovascular disease mortality. Intervention studies assessing the effects of a lignan-rich diet on risk factors of cardiovascular disease (CVD) have been few, but they have consistently reported a reduction in serum lipids, both plasma total and low-density lipoprotein cholesterol (Jenkins *et al.*, 1999; Lucas *et al.*, 2002). Consumption of lignans has also been inversely associated with both plasma triglycerides and CVD risk metabolic score in middle-aged women in the United States (de Kleijn *et al.*, 2002). More research is needed to confirm or reject these associations. Intervention studies using higher doses of lignans have found positive associations with some cardiovascular risk factors. Secoisolariciresinol diglucoside enriched products are available today and some cardiovascular risk reducing associations were noted with their use, there is some support for a role of lignans in cardiovascular disease risk reduction.

CONCLUSION

The results of studies outlined in this review provide a current understanding on the biological effects of lignans and their relevance to human health. The extensive survey literature reviewed that lignans and lignan-related compounds, due high structural diversity, are a plentiful source of potential drugs candidate in relation to its safety and efficacy. There is obviously an extraordinary range of medicinal properties and this area continues to be a fruitful research topic. However, their vital role in animal biology has not been fully exploited. A vigorous research programme is needed to answer questions about the health effects identified in animal experiments and *in vitro* studies.

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GRAPE-GROWING ZONING IN ALBANIA USING VITICULTURAL CLIMATIC INDICES

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ABSTRACT

Albania is an ancient hearth of grapevine cultivation and wine production, distinguished for the high variability of autochthonous grape populations. Under modern market forces, the sustainable development of viticulture should be considered under a well-defined ecosystem to raise the effectiveness of investment and quality of production. Grape growing and wine production with present knowledge and experience are largely weather and climate driven. The climatic indices available to describe the viticultural regions are above all thermal at the level of the grape-growing cycle. The methodology of this study is based on two solid viticultural climatic indices, the Heliothermal Index (HI) and the Cool Night Index (CI) combined with GIS mapping using a database of climatic data for the last 70 years for 137 stations. The output of this study is a series of maps showing classes of viticultural climates re-grouping the viticultural regions on a better climatic basis rather than geographical basis which is not always pertinent due to the high hypsometric variations of the territory. This enables a better zoning of both local and foreign cultivars, especially for the new introductions.

Key Words: Heliothermal Index, Cool Night Index

INTRODUCTION

Albania is an ancient hearth of grapevine cultivation and wine production, distinguished for the high variability of autochthonous grape populations. The favourable geographic position in the Mediterranean basin, close to the Adriatic and Ionian seas, the variable topographic and hydrologic features, its rich forest fauna and soil typologies, has made Albania a site of high diversity (Kullaj, 2008). The classical Albanian viticulture, descendant of the ancient Hellenic-Illyrian civilisation has existed until recently in the form of microscopic oasis in several areas of Albania. Under modern market forces, the sustainable development of viticulture should be considered under a well-defined ecosystem to raise the effectiveness of investment and quality of production (MBUMK, 2007).

Grape growing and wine production with present knowledge and experience are largely weather and climate driven. The climatic indices available to describe the viticultural regions are above all thermal at the level of the grape-growing cycle. In fact, temperature influences composition and quality of grapes. The Thermal Index of Winkler has allowed the classification, in five large regions of California, according to the different categories of degrees-days established by this index. Huglin (1978) has developed the Heliothermal Index of Huglin, which is applicable at a world-wide range, established over a period which is closest to the average cycle of the grapevine. The day temperatures influence the coloration, but the effect of conditions of cool night's temperatures on it is even stronger (Singleton and Esau, 1969; Kliewer and Torres, 1972; Kliewer, 1973; Tomana et al., 1979; Fregoni and Pezzutto, 2000).

Despite the worldwide popularity spanning several centuries, viticulture and enology until very recently have been largely ignored by "geographers" from both old and new world wine countries (Unwin, 1996). The *Terroir* concept has gained wide recognition in modern day viticultural zoning.

In general, the climate in all the territory of Albania is characterised by a cold and wet winter and a hot and dry summer. The hottest months are July and August, with an average temperature of 22.9 – 22.8°C and the coldest month is January – February with 4.1 – 5.7°C. In all the country, the optimum daily temperatures for growth and development of vegetation are 25 – 32°C, within the optimum limits of photosynthesis.

In general, the climatic conditions of the viticultural areas in Albania, starting from the coastal lowlands 0 - 100 m up to 900 – 1000 m fulfil the following optimal average temperatures:

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- **Bud-burst stage 8 – 10° C**
- **Flowering stage 18 – 22° C**
- **Berry softening and *veraison* stage 22 – 25° C**
- **Ripening stage 20 – 24 ° C**
- **Harvesting stage 18 – 22° C (depending on the ripening of cultivars and destination of the product)**

The old official zoning in Albania is based on the definition of the safety limit for expansion of viticulture, at – 14°C in the coldest winter months (January - February) and at –3°C during spring time (April – May (late frosts damaging the vegetation).

The new official zoning refers to the EU viticultural classification in which Albania is part of Climatic Zone C, with sub-zones characterised based on the viticultural vocation and wine-naming for each zone.

- **Coastal and low-hilly western area of Albania –I and II viticultural zone based on the old zoning; European viticultural zone C III B.**
- **Hilly – premountainous areas, away from the sea influence – viticultural areas II and III; European viticultural zone C III A**
- **Mountainous areas – viticultural zones III and IV; Europian viticultural zone C II**

However, the current official zones (I – IV) correspond with the classes of climate (Figure 2) and do not take too much in consideration the high hypsometric variation within these zones. Thus, within the same viticultural zone, there are patches of a different viticultural climate, making the recommendations not accurate. In this study, we followed the géoviticulture concept (Carbonneau and Tonietto, 1998) in order to identify such changes within each viticultural zone.

MATERIALS AND METHODS

Heliothermal Index (HI), Drought Index (DI) and Cool Night Index (CI) define a Multicriteria Climatic Classification System (Géoviticulture MCC System) for grape growing regions worldwide (Tonnieto and Carbonneau, 2004).The methodology of this study was based on (HI) and (CI) combined with GIS mapping.

Heliothernal index (HI) is calculated according to Eq.(1)

$$HI = \sum_{01.04}^{30.09} \frac{[(T-10) + (Tx-10)]}{2} d$$

where T is daily average and Tx daily maximum temperature, Tb base temperature (10°C) and d is coefficient of the length of the day.

Cool night index (CI) equals mean minimum air temperature (Tmin) in the month of ripening (September).

A series of climatic data was collected using different sources (meteorological bulletins, various publications, etc.) from 137 stations (Table 1). Each station was coded using the first two letters of the district plus the first three letters of the location, making it easier for the Albanian reader to understand the proper location of the station by just looking at the code in the map.

Spatial data was aggregated/disaggregated to match the demarcating registration boundaries (Vaudour and Shaw, 2005) by assigning of a boundary to the quantifiable variable (HI and CI).

Table 1. List of meteorological stations and their geographical locations (continues)

No	Station	CODE	Altitude	Coordinates	No	Station	CODE	Altitude	Coordinates
1	B. Curri	BCqyt	360	42°21′ / 20°04′	69	Lajthizë	PUlaj	720	42°05′ / 20°08′
2	Ballsh	MKball	190	40°36′ / 19°44′	70	Larushk	KRlar	28	41°27′ / 19°42′
3	Belsh	ELbel	180	40°59′ / 19°53′	71	Lefter Talo	SRlef	130	39°47′ / 20°06′
4	Berat	BEqyt	226	40°43′ / 19°57′	72	Lekbibaj	BClek	270	42°17′ / 19°56′
5	Bilisht	KObil	890	40°37′ / 20°59′	73	Lene-Martanesh	MRlen	1000	41°24′ / 20°10′
6	Bishnicë	PGbish	1344	40°56′ / 20°26′	74	Leskovik	ERles	920	40°09′ / 20°36′
7	Bixë	MTbix	1200	41°20′ / 20°06′	75	Levan	FRlev	6	40°41′ / 19°28′
8	Borsh	VLbor	10	40°03′ / 19°51′	76	Lezhë	LEqyt	10	41°47′ / 19°38′
9	Brataj	VLbra	270	40°16′ / 19°40′	77	Librazhd	LBqyt	250	41°11′ / 20°19′
10	Bulqizë	BUqyt	635	41°31′ / 20°18′	78	Linzë	TRlin	275	41°21′ / 19°53′
11	Burrel	MTburr	309	41°36′ / 20°00′	79	Liqenas	PGliq	858	40°47′ / 20°54′
12	Bushat	SHbush	20	41°58′ / 19°32′	80	Luaras	ERlua	1000	40°24′ / 20°35′
13	Bushkash	MTbush	173	41°40′ / 19°55′	81	Lukovë	SRluk	222	39°59′ / 19°55′
14	Bushtricë	KUbush	1000	41°52′ / 20°20′	82	Lushnjë	LUqyt	19	40°57′ / 19°42′
15	Cërrik	CEqyt	80	41°01′ / 19°58′	83	Llakatund	FRllak	27	40°31′ / 19°32′
16	Cukal	SHcuk	1350	42°08′ / 19°43′	84	Llongo	GJllon	650	39°50′ / 20°23′
17	Çërravë	PGcer	825	40°51′ / 20°43′	85	Mali i Robit	DRmro	22	41°15′ / 19°32′
18	Çorovodë	SKcor	410	40°30′ / 20°13′	86	Mamuras	LAmam	35	41°34′ / 19°41′
19	Çukë	SRcuk	6	39°50′ / 20°03′	87	Muzinë	DVmuz	400	39°56′ / 20°12′
20	Dajç-Zadrimë	LEdaj	40	41°55′ / 19°36′	88	Nivicë	SRniv	780	40°14′ / 19°54′
21	Dajt	TRdaj	650	41°23′ / 19°55′	89	Peqin	PEqyt	53	41°03′ / 19°45′
22	Dajt-Rrëze	TRdar	980	41°22′ / 19°54′	90	Orikum	VLori	25	40°19′ / 19°29′
23	Dardhë	KOdar	1310	40°31′ / 20°50′	91	Peshkopi	DIpesh	657	41°41′ / 20°26′
24	Divjakë	LUdiv	10	40°50′ / 19°40′	92	Petresh	ELpet	455	41°06′ / 20°00′
25	Domgjon	MRdom	600	41°58′ / 20°09′	93	Përmet	PRqyt	240	40°14′ / 20°21′
26	Dorëz	TPdor	370	40°23′ / 19°49′	94	Pogradec	PGqyt	720	40°54′ / 20°39′
27	Dushar	KOdush	830	40°40′ / 20°23′	95	Potom	SKpot	980	40°29′ / 20°23′
28	Dushk	LUdush	50	41°00′ / 19°40′	96	Poliçan	SKpol	755	40°08′ / 20°21′
29	Dvoran	KOdvo	900	40°32′ / 20°43′	97	Përrenjas	LBpërr	590	41°04′ / 20°32′
30	Dhërmi	VLdhë	145	40°09′ / 19°38′	98	Pukë	PUqyt	810	42°02′ / 19°54′
31	Elbasan	ELqyt	100	41°05′ / 20°03′	99	Radhimë	VLradh	200	40°42′ / 19°29′
32	Ersekë	ERqy	1030	40°20′ / 20°41′	100	Rrapsh	MMrap	820	42°24′ / 19°29′
33	Fier	FRqyt	12	40°44′ / 19°31′	101	Razëm	MMraz	1050	42°21′ / 19°34′
34	Frashër	PRfra	970	40°22′ / 20°26′	102	Rrëshen	MRrrësh	100	41°46′ / 19°54′
35	Fshat-Klos	MRklo	390	41°29′ / 20°06′	103	Roskovec	FRros	55	40°44′ / 19°42′
36	Fushë-Lurë	DIlur	1040	41°49′ / 20°13′	104	Sarandë	SRqyt	23.2	39°52′ / 20°00′
37	Gërmenj	ESgër	1200	40°14′ / 20°40′	105	Sazan	VLsaz	60	40°28′ / 19°17′
38	Gllavë	TPglla	875	40°29′ / 19°58′	106	Selenicë	VLsel	100	40°31′ / 19°39′
39	Gojan i Vogël	PUgoj	340	41°57′ / 20°00′	107	Selishtë	DIsel	810	41°37′ / 20°16′
40	Goranxi	GJgor	210	40°02′ / 20°12′	108	Sinjë	BRsinj	760	40°39′ / 19°52′
41	Gramsh	GRqyt	200	40°52′ / 20°11′	109	Stjar	DVstj	98	39°56′ / 20°04′
42	Grabovë	GRgra	1250	40°47′ / 20°24′	110	Stravaj	LBstr	745	41°00′ / 20°25′
43	Grekan	GRgre	180	40°56′ / 19°57′	111	Sukth	DRsuk	20	41°22′ / 19°33′
44	Gjinar	ELgjin	815	41°02′ / 20°11′	112	Sheqeras	KOsheq	817	40°44′ / 20°47′
45	Gjirokastër	GJqyt	193	40°05′ / 20°09′	113	Shëngjin	LEshën	1.5	41°48′ / 19°35′
46	Gjonbabas	KOgjon	1150	40°34′ / 20°29′	114	Shirokë	LEshir	10	42°03′ / 19°27′
47	Himarë	VLhim	30	40°06′ / 19°45′	115	Shishtavec	KUshi	1326	41°59′ / 20°36′
48	Iballë	PUiba	730	42°11′ / 19°59′	116	Shkodër A	SHa	42.7	42°06′ / 19°32′
49	Kalasë	DVkal	320	40°01′ / 19°57′	117	Shkodër Q	SHqyt	28.3	42°04′ / 19°31′
50	Kamëz	TRkam	56	41°22′ / 19°45′	118	Shtyllë	KOshty	1150	40°32′ / 20°32′
51	Kastriot	DIkas	650	41°40′ / 20°24′	119	Shupenzë	BZshup	480	41°32′ / 20°25′
52	Kavajë	KVqyt	16	41°11′ / 19°33′	120	Tepelenë	TPqyt	220	40°18′ / 20°01′
53	Këlcyrë	PRkël	182	40°19′ / 20°11′	121	Tirana A	TRa	88.9	41°20′ / 19°47′
54	Klenjë	BZkle	1200	41°22′ / 20°18′	122	Tirana Q	TRqyt	126.7	41°19′ / 19°49′
55	Kodër-Shëngj.	MRshën	513	42°16′ / 19°47′	123	Tropojë	BCtro	393	42°24′ / 20°10′
56	Konispol	SRkon	400	39°39′ / 20°11′	124	Theth	SHthe	740	42°23′ / 19°44′
57	Koplik	SHkop	70	42°13′ / 19°26′	125	Ujanik	SKuja	1150	40°39′ / 20°12′

No	Station	CODE	Altitude	Coordinates	No	Station	CODE	Altitude	Coordinates
58	Korçë	KOqyt	899	40°36′ / 20°44′	126	Ura e Shtrenjtë	SHura	125	42°08′ / 19°39′
59	Korthpule	PUkor	560	41°58′ / 19°48′	127	Velipojë	SHvel	5	41°52′ / 19°22′
60	Krane	SRkra	26.5	39°54′ / 20°06′	128	Vermosh	SHver	1143	42°35′ / 19°42′
61	Krujë	KRqyt	560	41°30′ / 19°47′	129	Vithkuq	KOvith	1250	40°31′ / 20°35′
62	Krumë	KUkru	434	42°11′ / 20°24′	130	Voskopojë	KOvos	1180	40°38′ / 20°35′
63	Kryevidh	KVkye	140	41°06′ / 19°31′	131	Vlora A	VLa	1.1	40°28′ / 19°29′
64	Kuç	VLkuc	610	40°10′ / 19°50′	132	Xarrë	SRxarr	40	39°43′ / 20°03′
65	Kuçovë	KVqyt	31.9	40°48′ / 19°54′	133	Xhafzotaj	DRxhaf	15	41°20′ / 19°31′
66	Kukës	KUqyt	354	42°02′ / 20°25′	134	Tale	LEtal	6	41°43′ / 19°38′
67	Kurbnesh	MRkur	760	41°47′ / 20°05′	135	Zalli i Kalisë	DIzall	520	41°52′ / 20°19′
68	Laç	LAqyt	25	41°38′ / 19°43′	136	Zogaj-M. Bardhë	BCzog	534	42°17′ / 20°18′
137	Zvirinë	KOzvi	825	40°47′ / 20°44′					

RESULTS

The output of this study are two maps showing classes of viticultural climates (Figure 1 and 2) re-grouping the viticultural regions on a better climatic basis rather than geographical basis which is not always pertinent due to the high hypsometric variations of the territory. This enables a better zoning of both local and foreign cultivars, especially for the new introductions.

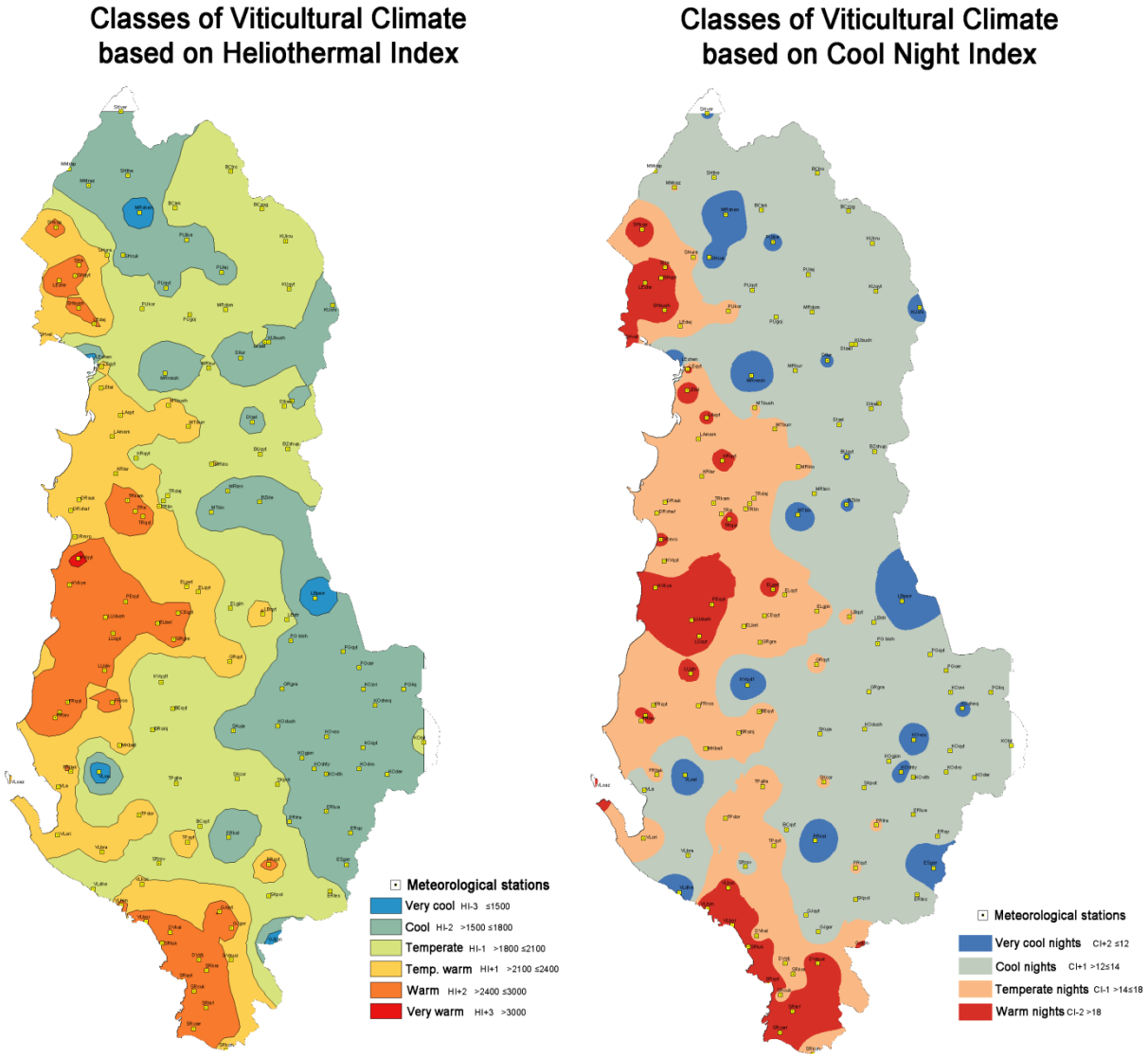

Figure 1. Maps showing the geographical distribution of classes of viticultural climate based on Heliothermal Index (left) and Cool Night Index (right).

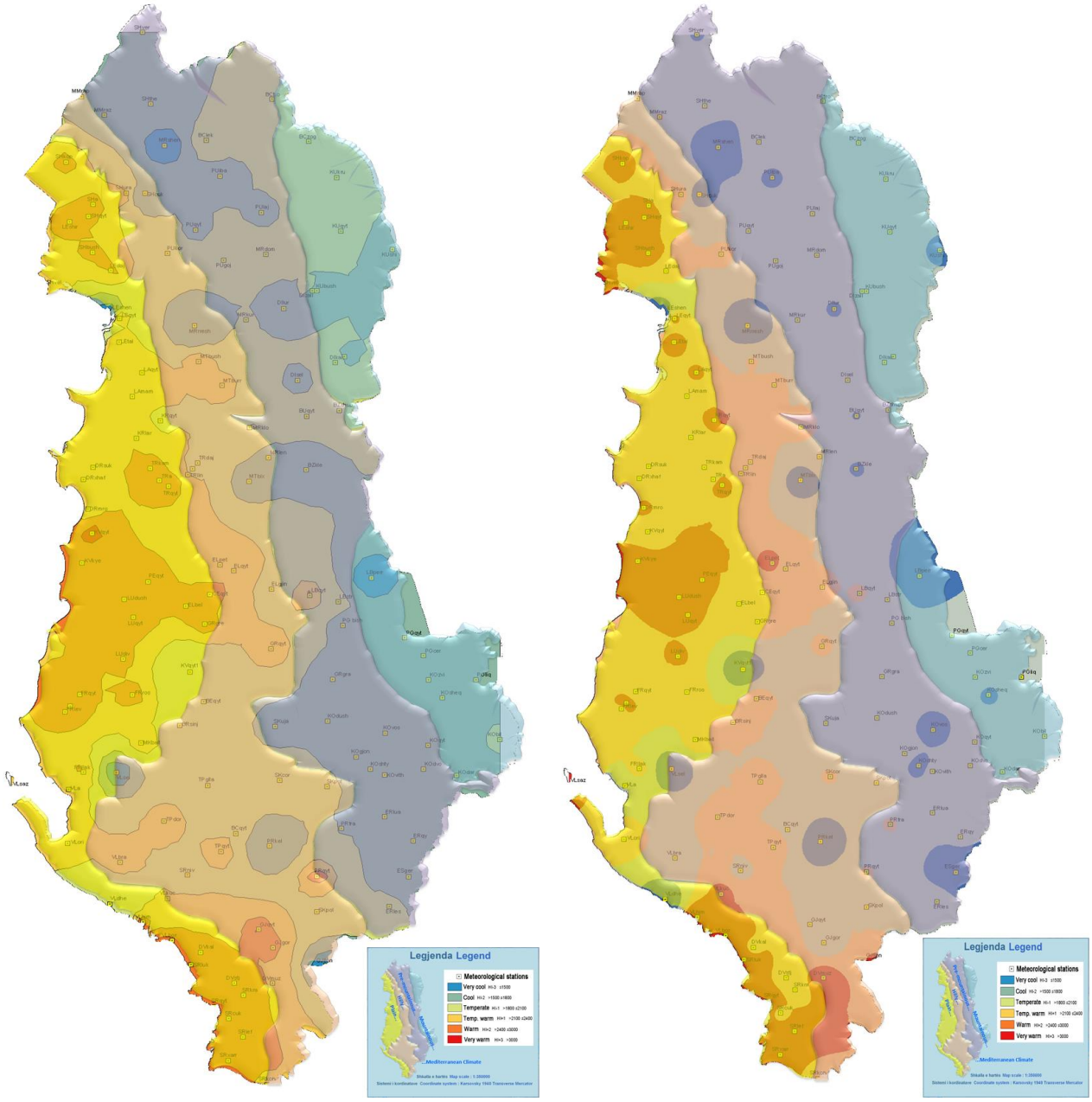

Figure 2. Maps showing the geographical distribution of classes of viticultural climate based on Heliothermal Index (left) and Cool Night Index (right) with an overlayer of the classes of climate in Albania on which official zoning is based. Note that within the same climate there is a variability of viticultural climates.

DISCUSSIONS AND CONCLUSIONS

The use of the two viticultural climatic indices, the Heliothermal Index (HI) and the Cool Night Index (CI) combined with GIS mapping for viticultural zoning in Albania enables the grouping of measuring stations entirely based on climatic indices, without being influenced by the geographic division of the territory. This is an advantage compared to the existing official zoning (MBUMK, 2007) which doesn't consider the high hypsometric changes of the Albanian relief as well as the many mesoclimates of a

region. This methodology enables to show the high variability found even within the small Albanian territory.

This study has to be completed by calculating the dryness index (Tonnieto and Carbonneau, 2004) for a better viticultural zoning. Moreover, there is a need to verify the entire range of local and foreign cultivars as well as their climatic requirement and allocate them to each climatic zone. Another interesting aspect would be to study the climatic changes in the future and their effect on the viticultural zoning.

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COMPUTER-BASED AMPELOGRAPHIC CHARACTERISATION OF MAIN ALBANIAN GRAPEVINE CULTIVARS

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ABSTRACT

Albania is distinguished for the high variability of local grape populations. The favourable geographic position in the Mediterranean basin, close to the Adriatic and Ionian seas, the variable topographic and hydrologic features, its rich forest fauna and soil typologies, has made Albania a site of high diversity. So far, ampelographic works in Albania have used classical methods which are very laborious and subject to human error both in terms of measurements and calculations. This study uses a new methodology, computer-based, which minimises the errors and facilities data processing and analysis. The study used the ampelographic software, SuperAmpelo v.1 for the ampelometric characterisation of the main Albanian grapevine cultivars, namely 'Shesh i Zi', 'Shesh i Bardhe', 'Kallmet' dhe 'Vlosh'. Ten leaves collected from 10 vines were measured on 72 points, with 80 computed values and additionally 35 OIV codes. Results show a high inter- and intra-tree variation which is attributable to the high leaf dimorphism which characterises grapevine. This is also an indication for the need to carry out proper formal homologation of these cultivars to maintain their genetic true-to-type. An ampelographic table has been compiled with measurements, including the profile of the leaf.

Key Words: Ampelography, Ampelometry, Superampelo, Nervatures

INTRODUCTION

Albania is an ancient hearth of grapevine cultivation and wine production, distinguished for the high variability of autochthonous grape populations. The favourable geographic position in the Mediterranean basin, close to the Adriatic and Ionian seas, the variable topographic and hydrologic features, its rich forest fauna and soil typologies, has made Albania a site of high diversity (Kullaj, 2008).

The four wine cultivars under this study represent the most important ones originating from different parts of Albania.

'Sheshi i Zi' has originated in central Albania but due to his high values it has been planted in other coastal and hilly regions up to 700 m. It occupies more than 60% of the plantings and is one of the most preferred cultivars for wine making. In the new plantings, it occupies 25.1% of planting structure in Tirana, 14.3% in Durrës, 11.2% in Berat, 10.6% in Fier, 10% in Elbasan, 6.3% in Shkodër, 4.4% in Gjirokastër, 2.8% in Lezhë, etc (MBUMK, 2007). Bud bursting takes place on the first decade of April and flowering in the second half of May. Depending on the region, maturation takes place in the second half of September – first half of October. It has an medium to high vigour, high and constant yields. It is compatible with the main rootstocks and all growing systems depending on the bud and clusters per plant.

'Sheshi i Bardhë' is the second most common local grapevine cultivar in Albania. Similar to 'Shesh i Zi', it has originated from Central Albania and planted in a broader area but more restricted than 'Shesh i Zi'. However, 'Sheshi i Bardhë' occupies 75.7% of the new planting structure in our country, with 23.8% in Tirana, 18.3% in Durrës, 11.2% in Berat, 15.9% in Fier, 9% in Elbasan, 9.2% in Shkodër, 10% in Gjirokastër, 6.9% in Lezhë, etc (MBUMK, 2007). Bud burst, flowering, maturation and compatibility with main rootstocks and trainings systems is similar to 'Shesh i Zi'.

'Kallmeti' represents one of the best known local cultivars, clonally selected (clone 61/5) for a lower ratio of female functional flowers to hermaphrodite flowers. It has originated from Shkodra region and Zadrima but it has gained recognition abroad with the name 'Scadarka'. Bud burst takes place in the first week of April while flowering in the third week of May. Clusters mature in the second part of August until the first half of September. It has a medium vigour, with high and stable productivity and good compatibility with all rootstocks and training systems.

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'Vloshi' has originated from the south of Albania but its origin is unknown. Bud burst takes place during the second week of April whilst flower in the end of May. It matures in the first decade of October. It has a medium growth and high productivity. Goes well with the main rootstocks and training systems.

So far, ampelographic works in Albania have used classical methods which are very laborious and subject to human error both in terms of measurements and calculations. This study uses a new methodology, computer-based, which minimises the errors and facilities data processing and analysis.

MATERIALS AND METHODS

The study was conducted during the end of summer of 2010 and 2011. Mature leaves of 'Shesh i Zi', 'Shesh i Bardhë', 'Kallmet' and 'Vlosh' cultivars were collected at the grapevine collection at the Agricultural Technology Transfer Centre of Vlora and private autochthonous vineyards in the area of origin of the above cultivars. Ten typical leaves were collected from ten random plants of each cultivar, avoiding leaves damaged by diseases and pests. The lower side of fresh leaves where veins are clearly visible, where scanned using a HP Scanjet 4400c scanner. Scanned leaves were analysed using SuperAmpelo is a program designed to help Vitis germplasm cataloguing. The software, developed in Microsoft Visual Studio.Net and compatible also with Microsoft Access 2000 Data Base, allows to measure leaves, clusters, berries, and seeds, and to record the main descriptive ampelographic characters (Soldavini et al. 2009). Main carpometric indices were also measured.

RESULTS

cv. 'Shesh i Zi'

Distances

Length: 88,4 ± 18,8	Width: 88,3 ± 18,5	L.+ petiole: 121,5 ± 24,6	OP: 65,6 ± 13,8
ON1: 65,5 ± 13,8	N2N2': 75,7 ± 15,2	N3N3': 88,8 ± 19,5	N4N4': 53,0 ± 13,7
SPSP': 10,4 ± 3,4	ON2: 59,8 ± 12,5	ON2': 59,0 ± 12,4	ON3: 44,9 ± 9,1
ON3': 44,6 ± 10,7	ON4: 34,7 ± 8,6	ON4': 35,1 ± 8,1	O3N4: 30,1 ± 7,3
O3'N4': 30,4 ± 7,0	O4N5: 17,4 ± 4,0	O4'N5': 17,0 ± 4,0	OO3: 6,4 ± 1,5
OO3': 6,3 ± 1,6	OS': 40,9 ± 9,7	OS': 41,4 ± 10,0	OI: 35,9 ± 9,0
OI': 34,3 ± 9,0	HN2: 5,2 ± 1,5	HN2': 5,0 ± 1,5	HN4: 4,4 ± 1,2
HN4': 4,5 ± 1,4	BN2: 7,0 ± 1,8	BN2': 6,7 ± 1,7	BN4: 7,2 ± 1,8
BN4': 7,5 ± 2,0	FN2: 28,2 ± 6,0	FN2': 25,9 ± 6,2	

Angles

Al: 48,1 ± 5,5	Al': 47,9 ± 4,0	Be: 42,9 ± 4,7	Be': 6,3 ± 4,9		
Ga: 57,4 ± 7,9	Ga': 60,4 ± 5,2	Om: 41,1 ± 4,1	Om': 38,5 ± 4,4		
Et: 43,1 ± 6,1	Et': 46,4 ± 5,1	Ta: 47,9 ± 8,3	Ta': 45,2 ± 5,4		
Pi: 43,1 ± 18,4	De: 106,5 ± 7,8	Lam: 66,8 ± 12,9	Mu: 61,1 ± 4,5		
Ep: 73,9 ± 5,3	Ep': 71,2 ± 6,8	Al+Be: 91,0 ± 7,8	Al'+Be': 54,2 ± 7,1		
Al+Be+Ga: 148,4 ± 13,8	Al'+Be'+Ga': 114,5 ± 8,3				

Ratios

L x W: 8116,7 ± 2996,0	L x W: 1,056 ± 0,125	RP: 0,648± 0,088	RS: 0,716 ± 0,073	
RS': 0,72 ± 0,075	RI: 0,778 ± 0,026	RI': 0,778 ± 0,026	R2: 0,860 ± 0,049	
R2': 0,899 ± 0,069	R3: 0,650 ± 0,068	R3': 0,650 ± 0,068	R4: 0,388 ± 0,037	
R4': 0,402 ± 0,032	R5: 0,213± 0,028	R5': 0,213± 0,028	AlBe/OSOI: 0,019	
AlBe/OSOI': 0,022 ± 0,007	HBN2: 0,848 ± 0,180	HBN2': 0,749 ± 0,0136		
HBN4: 0,811 ± 0,094	HBN4': 0,811 ± 0,094	Calc. Surf.: 8675± 3401,1		

OIV codes

OIV601: 1	OIV607: 5	OIV614: 1	OIV067: 3
OIV602: 1	OIV608: 1	OIV615: 3	OIV079-1: 3
OIV603: 3	OIV609: 9	OIV616: 1	OIV081-1: 1
OIV604: 7	OIV610: 9	OIV617: 3	OIV083-2: 1
OIV605: 3	OIV612: 3	OIV066-4: 1	OIV092: 1
OIV606: 3	OIV613: 3	OIV066-5: 3	OIV093: 1

cv. 'Sheshi i Bardhë'

Distances

Length: 145,0 ± 44,3	Width: 132,6 ± 45,6	L.+ petiole: 186,1 ± 67,4	OP: 82,5 ± 34,3
ON1: 103,6 ± 34,2	N2N2': 124,7 ± 44,2	N3N3': 127,5 ± 46,3	N4N4': 62,5 ± 32,8
SPSP': 11,0 ± 8,0	ON2: 90,8 ± 32,1	ON2': 90,1 ± 29,8	ON3: 64,6 ± 23,6
ON3': 64,0 ± 23,0	ON4: 51,9 ± 17,1	ON4': 51,8 ± 16,5	O3N4: 45,4 ± 15,1
O3'N4': 45,1 ± 14,0	O4N5: 25,5 ± 8,9	O4'N5': 27,9 ± 8,0	OO3: 8,9 ± 3,4
OO3': 8,8 ± 3,7	OS: 62,2 ± 29,3	OS': 66,3 ± 27,1	OI: 53,2 ± 22,4
OI': 52,3 ± 21,1	HN2: 7,1 ± 3,0	HN2': 6,7 ± 3,0	HN4: 5,6 ± 3,9
HN4': 6,1 ± 2,8	BN2: 9,7 ± 4,0	BN2': 4,5 ± 1,4	BN4: 10,6 ± 4,8
BN4': 10,0 ± 3,6	FN2: 43,6 ± 19,2	FN2': 45,4 ± 16,0	

Angles

Al:	53,4 ± 6,3	Al':	53,6 ± 6,8	Be: 52,4 ± 7,3	Be': 13,0 ± 8,5
Ga:	58,5 ± 6,9	Ga':	63,0 ± 7,1	Om: 42,7 ± 6,7	Om': 44,5 ± 5,2
Et:	53,3 ± 7,4	Et':	50,8 ± 4,7	Ta: 48,3 ± 5,2	Ta': 49,2 ± 6,2
Pi:	30,3 ± 25,2	De:	99,1 ± 9,1	Lam: 65,5 ± 17,0	Mu: 54,6 ± 7,5
Ep:	72,4 ± 7,2	Ep':	76,7 ± 7,7	Al+Be: 105,8 ± 11,3	Al'+Be': 66,6 ± 12,2
Al+Be+Ga: 164,3 ± 15,4		Al'+Be'+Ga': 129,6 ± 17,2			

Ratios

L x W: 21023,8 ± 64,9	L x W: 1,106 ± 0,093	RP: 0,786 ± 0,102	RS: 0,666 ± 0,102
RS': 0,726 ± 0,116	RI: 0,814 ± 0,076	RI': 0,810 ± 0,064	R2: 0,873 ± 0,050
R2': 0,871 ± 0,061	R3: 0,622 ± 0,058	R3': 0,615 ± 0,052	R4: 0,442 ± 0,065
R4': 0,439 ± 0,031	R5: 0,252 ± 0,062	R5': 0,273 ± 0,024	A+B/OSOI:0,019
A'+B'/OSOI': 0,439 ± 0,031		Surf.: 14457 ± 109	

OIV codes

OIV601: 3	OIV607: 5	OIV614: 1	OIV067: 3
OIV602: 3	OIV608: 3	OIV615: 3	OIV079-1: 3
OIV603: 3	OIV609: 7	OIV616: 1	OIV081-1: 1
OIV604: 9	OIV610: 9	OIV617: 3	OIV083-2: 2
OIV605: 5	OIV612: 1	OIV066-4: 1	OIV092: 1
OIV606: 5	OIV613: 3	OIV066-5: 3	OIV093: 1

cv. 'Kallmet'

Distances

Length: 175,1±19,2	Width: 178,8 ± 19,2	L.+ petiole: 248,46 ± 35,0	OP: 116,1 ± 20,1
ON1: 132,3 ± 17,8	N2N2': 164,2 ± 13,6	N3N3': 172,8 ± 17,3	N4N4': 87,1 ± 17,0
SPSP': -22,6 ± 6,6	ON2: 119,7 ± 15,3	ON2': 123,8 ± 15,3	ON3: 83,5 ± 10,0
ON3': 89,6 ± 8,2	ON4: 58,7 ±9,3	ON4': 65,9 ± 8,6	O3N4: 52,3 ± 8,0
O3'N4': 57,8 ± 9,0	O4N5: 22,7 ± 5,2	O4'N5': 29,6 ± 6,4	OO3: 14,5± 6,5
OO3': 11,6 ± 3,3	OS: 82,0 ± 14,4	OS': 81,6 ± 16.9	OI: 69,8±10,5
OI': 72,2 ±10,7	HN2: 10,4 ± 2,7	HN2': 11,6 ± 1,2	HN4: 9,3 ± 1,8
HN4': 10,0 ± 3,2	BN2: 14,8 ± 12,9	BN2': 13,8± 1,5	BN4: 13,3 ± 2,3
BN4': 13,1± 1,6	FN2: 53,3 ± 7,2	FN2': 58, ±59,8	

Angles

Al: 46,5 ± 2,4	Al': 47,2 ± 3,7	Be: 40,0± 8,0	Be': 12,5 ± 5,8
Ga: 73,3 ± 41,3	Ga' 49,5 ±5,3	Om: 42,2± 4,1	Om': 43,0 ± 5,8
Et: 46,1 ± 5,5	Et': 47,0 ± 1,7	Ta: 49,4 ± 9,6	Ta': 44,5 ± 2,5
Pi: 52,7± 18,1	De: 105,0± 8,5	Lam: 68,6 ± 119,4	Mu: 60,1 ± 7,1
Ep: 70,0 ± 7,6	Ep': 65,1 ± 7,1	Al+Be: 86,5±10,3	Al'+Be': 59,6 ± 6,3

Al+Be+Ga: 159,8 ± 42,0 Al'+Be'+Ga': 109,1± 6,9

Ratios

L x W: 31590,1 ± 6479, L x W: 0,980 ± 0,042 OP/N1: 0,880 ± 0,101 RS: 0,683 ± 0,068
RS': 0,658± 0,96 RI: 0,834 ± 0,034 RI': 0,804 ± 0,075 R2: 0,910± 0,092
R2': 0,939 ± 0,054 R3: 0,636 ± 0,073 R3': 0,682 ± 0,040 R4: 0,397 ± 0,047
R4': 0,439 ± 0,052 R5: 0,210 ± 0,035 R5': 0,225 ± 0,044 AlBe/OSOI:0,010±0,002
AlBe/OSOI': 0,010 ± 0,002 Surf.: 21644 ± 4684

OIV codes

OIV601: 5	OIV607: 5	OIV614: 3	OIV067: 3
OIV602: 7	OIV608: 3	OIV615: 5	OIV079-1: 3
OIV603: 7	OIV609: 7	OIV616: 5	OIV081-1: 1
OIV604: 9	OIV610: 7	OIV617: 7	OIV083-2: 1
OIV605: 7	OIV612: 3	OIV066-4: 3	OIV092: 1
OIV606: 7	OIV613: 5	OIV066-5: 5	OIV093: 3

cv. 'Vlosh'

Distances

Length: 108,8± 23,2	Width: 98,6 ± 26,5	L.+ petiole: 191,2 ± 26,8	OP: 56,4 ± 1,7
ON1: 82.4 ± 18,2	N2N2': 89,5 ± 22,4	N3N3': 96,7±28,3	N4N4': 54,0 ± 20,2
SPSP': -16,4 ± 8,6	ON2: 69,2 ± 16,3	ON2': 96,2 ± 14,1	ON3: 49,2 ± 15,4
ON3': 47,9 ± 13,9	ON4: 13,9 ± 8,0	ON4': 50,6 ± 8,6	O3N4: 42,0 ± 5,9
O3'N4': 17,6 ± 5,1	O4N5: 21,6 ± 4,7	O4'N5': 15,9 ± 4,9	OO3: 10.2 ± 2,1
OO3': 37,8 ± 11,1	OS: 59,2± 16,1	OS': 34,4 ± 12,1	OI: 52,7±7,1
OI': 30,5 ± 11,8	HN2: 8,7 ± 2,4	HN2':8,3 ±2,5	HN4: 6,7 ± 1,4
HN4': 6,6 ± 2,4	BN2: 12,3 ± 2,8	BN2': 10,9± 4,4	BN4: 8,0 ± 1,8
BN4': 7,8 ± 2,9	FN2: 52,1 ± 17,8	FN2': 33,8 ±8,6	

Angles

Al: 55,7 ± 10,2	Al': 57,7 ± 8,6	Be: 53,9± 7,6	Be': 103,3 ± 9,4
Ga: 57,5 ± 9,1	Ga' 72,8 ±28,0	Om: 46,6 ±10,6	Om': 48,3 ±7,3
Et: 50,2 ±7,3	Et': 54,2 ± 7,4	Ta: 59,9 ± 13,1	Ta': 59,7 ± 12,3
Pi: 30,5 ± 39,7	De: 1163,4 ± 15,5	Lam: 57,7 ± 24,6	Mu: 52,4 ± 5,1
Ep: 74,8 ± 13,1	Ep': 78,8 ± 11,6	Al+Be: 109,7±14,6	Al'+Be': 71,6 ± 13,6

Al+Be+Ga: 104,8 ± 11,4 Al'+Be'+Ga': 60,9 ± 10,5

Ratios

L x W: 23889,1 ± 6669,1 L x W: 0,955 ± 0,095 OP/N1: 0780± 0,092 RS: 0,6181 ± 0,166
RS': 0,575 ± 0,132 RI: 0735± 0,72 RI': 0758 ± 0,1034 R2: 0,902± 0,068
R2': 0,896± 0,063 R3: 0,674 ± 0,064 R3': 0,689 ± 0,070 R4: 0,384 ± 0,061
R4': 0,417 ± 0,084 R5: 0,205 ± 0,055 R5': 0,227 ± 0,066 AlBe/OSOI:0,017±0,004
AlBe/OSOI': 0,030 ± 0,010 Surf.: 7221 ± 3257

OIV codes

OIV601: 3	OIV607: 7	OIV614: 1	OIV067: 3
OIV602: 5	OIV608: 3	OIV615: 5	OIV079-1: 3
OIV603: 5	OIV609: 7	OIV616: 5	OIV081-1: 1
OIV604: 7	OIV610: 9	OIV617: 5	OIV083-2: 1
OIV605: 5	OIV612: 3	OIV066-4: 3	OIV092: 3

OIV606: 5 OIV613: 5 OIV066-5: 5 OIV093: 3

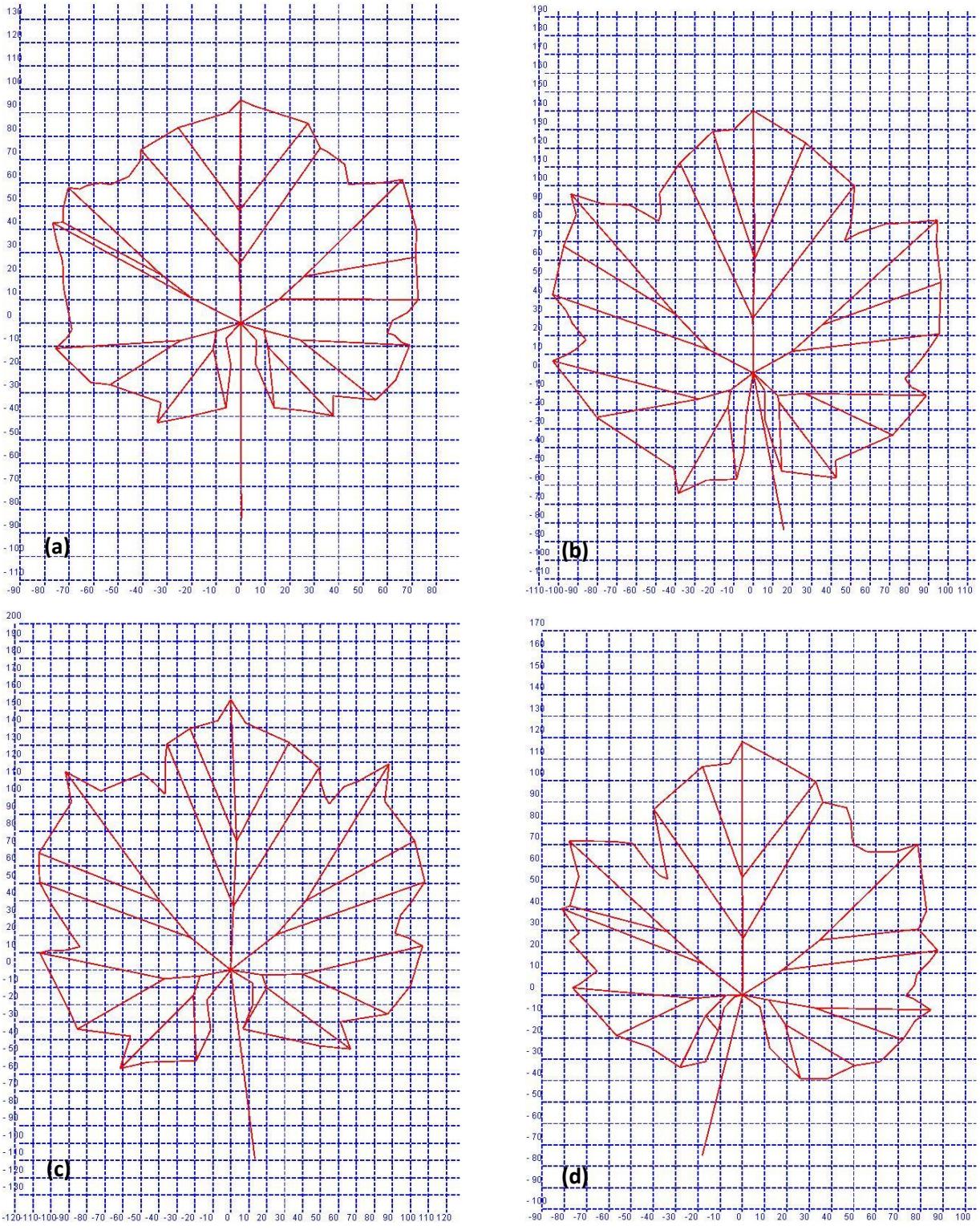

Figure 1. Standard leaf profile of all cultivars (a-Sheshi Zi; b-Sheshi Bardhë; c-Kallmet and d-Vlosh) processed with SuperAmpelo

Table 1. Results of carpometric measurements for all the cultivars under study

Carpometric indices	*Sheshi Zi*	*Sheshi Bardhë*	*Kallmet*	*Vlosh*
Average cluster weight (gram)	**303**	**293**	**307**	**259.6**
Cluster length (cm)	**19.1**	**19.1**	**24.6**	**20.7**
Cluster width (cm)	**12.6**	**12.6**	**10.6**	**14.8**
Number of berries per cluster	**145**	**156**	**163**	**167**
Rachis weight (gram)	**11.3**	**12.3**	**11**	**1.5**
Average berry weight (gram)	**2.1**	**1.9**	**1.8**	**9.2**

DISCUSSIONS AND CONCLUSIONS

Autochthonous cultivars are part of the natural and environmental heritage and represent a valuable instrument for improving the local economies. They risk to disappear (genetic erosion), mainly due to the competition with international cultivars.

Beside the characterisation of the diversity by characterising typical autochthonous cultivars, this study valorises this autochthonous heritage, a bench-mark in the road toward rural economic development.

Results show a high inter- and intra-tree variation which is attributable to the high leaf dimorphism which characterises grapevine. This is also an indication for the need to carry out proper formal homologation of these cultivars to maintain their genetic true-to-type.

This description completes and makes more accurate existing ampelographic descriptions found in literature (Çakalli and Susaj, 2004; Sotiri, 1972, 1977; Sotiri et al., 1973; Susaj and Susaj 2004; Sallaku, et al. 2006). This is part of the valorisation efforts for our local grapevine cultivars.

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METABOLIC CHARACTERISATION OF MAIN ALBANIAN GRAPE CULTIVARS

Endrit KULLAJ [1] Adriatik ÇAKALLI [2]

ABSTRACT

Albania, located at the heart of the Mediterranean, has a millennial viticultural tradition and a wide germplasm to be valorised. Among this rich germplasm, four cultivars for winemaking have been mostly valued and commercialised in Albania. However, there is a need for further characterisation and evaluation, especially in terms of metabolic and enological characterisation. The research presented here attempts to characterise the metabolic contents of these four cultivars, namely 'Shesh i Bardhe', 'Shesh i Zi', 'Kallmet' and 'Vlosh'.

The study was conducted during 2009 using samples of wine of the above cultivars produced by 19 different wineries in Albania. The content (mg/l) of polyphenols, flavonoids, anthocyanins, flavans and proantocyanidins was measured using standard protocols of high performance liquid chromatography (HPLC).

High variation of values was observed both between cultivars and wines. 'Kallmet' and 'Vlosh' show interesting values of colouring intensity, high contents of total anthocyanins and polyphenols. However, disequilibrium exists in terms of tannin content so that in different samples, the T/A ratio show instability of the wine in time. More stable values are recorded in the case of wines from 'Shesh i Zi'.

Key Words: Polyphenols, Flavonoids, Anthocyanins, Flavans, Proantocyanidins

INTRODUCTION

Albania, located at the heart of the Mediterranean, has a millennial viticultural tradition and a wide germplasm to be valorised. Among this rich germplasm, four cultivars for winemaking have been mostly valued and commercialised in Albania. However, there is a need for further characterisation and evaluation, especially in terms of metabolic and enological characterisation. The scientific evidence for the so-called "French Paradox", which is associated with the antioxidant properties of the phenolic compounds in red grapes has raised great interest in red grape cultivars in the last decade (Vacca, et al. 2009). In fact, the health benefits of red wines have been well documented in numerous scientific papers (Renaud and De Logeril, 1992; Kanner et al., 1994; Burns et al., 2000; Lòpez-Vèlez et al., 2003; Corder et al., 2006). The importance of phenolic compounds for wine quality is also very well known, as they are responsible for important properties such as colour, bitterness and astringency (Gawel, 1998; Boulton, 2001; Brossaud et al., 2001).

The four wine cultivars under this study represent the most important ones originating from different parts of Albania. Origin, distribution and phonological descriptions are published elsewhere in this volume (Computer-based ampelographic characterisation of main Albanian grapevine cultivars). Below there is a description of the main cluster and berry characteristics found from a literature review (Çakalli and Susaj, 2004; Sotiri et al., 1973).

'Sheshi i Zi' (SHZ) has an medium cluster, about 250 gr, cylindrical – conical form, medium to highly compact. Berries are of medium size, spherical, weighting 3 – 3.8 gr, with a thick skin, juicy flesh of medium firmness; blue to violet colour, without a particular flavour, with 2 – 3 seeds. It accumulates 23 – 27% sugar and 6 – 8 gr per litre of tartaric acid.

'Sheshi i Bardhë' (SHB) has a medium cluster, of about 290 g, cylindrical – conical or cylindrical form, compact to highly compact. Berries are of medium size, spherical, with an average weight of 3 gr, with a skin on medium thickens, juicy flesh of medium firmness; yellow colour, with bronze tincture, simple aroma, with 2 – 3 seeds. It accumulates 21 – 25% sugar and 6 – 7 gr per litre of tartaric acid.

'Kallmeti' (KLL) has a medium cluster, about 300 gr, with a conical or pyramidal form and medium compactness. Berries are of medium size, spherical or elliptical, 1.8 gr, with a medium to thin skin, with

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red to pink colour; juicy flesh, of medium firmness, without colour or flavour, with seeds. It accumulates about 21 % of sugar and 4 – 5 gr per litre of tartaric acid.

'Vloshi' (VLO) medium cluster, about 260g in weight, with a cylindrical – conical form. Berries have are spherical, medium sized, 9 gr on average, with a thin skin, red colour; juicy but firm flesh, without colour or flavour. Accumulates 21 % sugar and 6 – 7 gr per litre of tartaric acid.

Innovations in agronomic, technological and marketing strategies have been adapted to optimise the quality of wines (Vacca, et al. 2009). So far, there have been no studies to characterise the metabolic contents of these cultivars.

MATERIALS AND METHODS

The study was conducted during 2009 - 2010 on must and wine samples of representative clusters collected during their technological maturity (soluble solids %/titratable acidity ratio stable) and belonging to grapevine collection located at the Agricultural Technology Transfer Centre of Vlora. Clusters between 1 m and 20 cm above the soil were chosen. Titrable acidity, pH and sugar content were measured in musts of the grape varieties under study. Two replicates of 500 g of berries for each variety were frozen at -18°C until polyphenol extraction. Polyphenol extraction was based on Mattivi method (Mattivi et al., 2002a), as it is able to extract polyphenols from grape skins and seeds, simulating the maceration process of red winemaking. Spectrophotometric determinations were carried out on the extracts according to the methods of Di Stefano et al. (1989).

Total anthocyanins, total flavonoids, non-anthocyanic flavonoids, proanthocyanidins, total polyphenols, flavans were determined in the extracts of the grape skins and seeds. Hydroxycinnamic acid was extracted from the flesh.

Wines of the cv. under study possibly from different areas and others international cultivars used were the following (code in bracket before the description): SHZV1: Sheshi i Zi from Durres region, SHZV2: Sheshi i Zi from Berat region; SHZV3: Sheshi i Zi from Tirana region; SHBV4: Shesh i Bardhë from Mirdita region; KVLV5: Kallmet + Vlosh from Lezha region; KLLV6: Kallmet from Lezha region; KLLV7: Kallmet from Mirdita region; KLLV8: Kallmet from Tirana region; KLLV9: Kallmet from Shkodra region; KLLV10: Kallmet; CERV11: from local cv. 'Ceruja'; ZADV12: from local cv. 'Zadrima'; MERV13: Merlot from Durres region; MERV14: Merlot from Delvine region; RIEV15: Riesling from Durres region; RIEV16: Riesling from Delvina region.

RESULTS

The series of tables below shows the parameters measured. Results show a high inter- and intra-variability between the cultivars under study. This could also be due to the lack of proper homologation of these cultivars to maintain their genetic true-to-type. As a result, samples of the same cultivars collected from the collection may have changes between them.

Table 1. Various measures on samples used for HPCL analysis

Cv.	Weight of 25... (g)				No of seeds
	berries	skins	flesh	seeds	
SHZ	76.4	8.4	50.4	2.4	45
SHB	52.3	5.5	32.3	0.5	15
KLL	45.8	5.5	18.1	1.2	32
VLO	71.7	8.5	50.7	3.2	56

Table 2. pH, sugar content and total acidity at harvest (2009 – 2010)

Cv.	pH		Sugar content (°Brix)		Total Acidity	
	2009	2010	2009	2010	2009	2010
SHZ	3.55	3.40	20.20	22.30	5.90	4.6
SHB	3.25	3.20	19.50	19.00	7.20	6.2
KLL	3.47	3.80	19.60	25.87	7.95	4.6
VLO	3.35	3.10	19.05	20.00	7.15	5.3

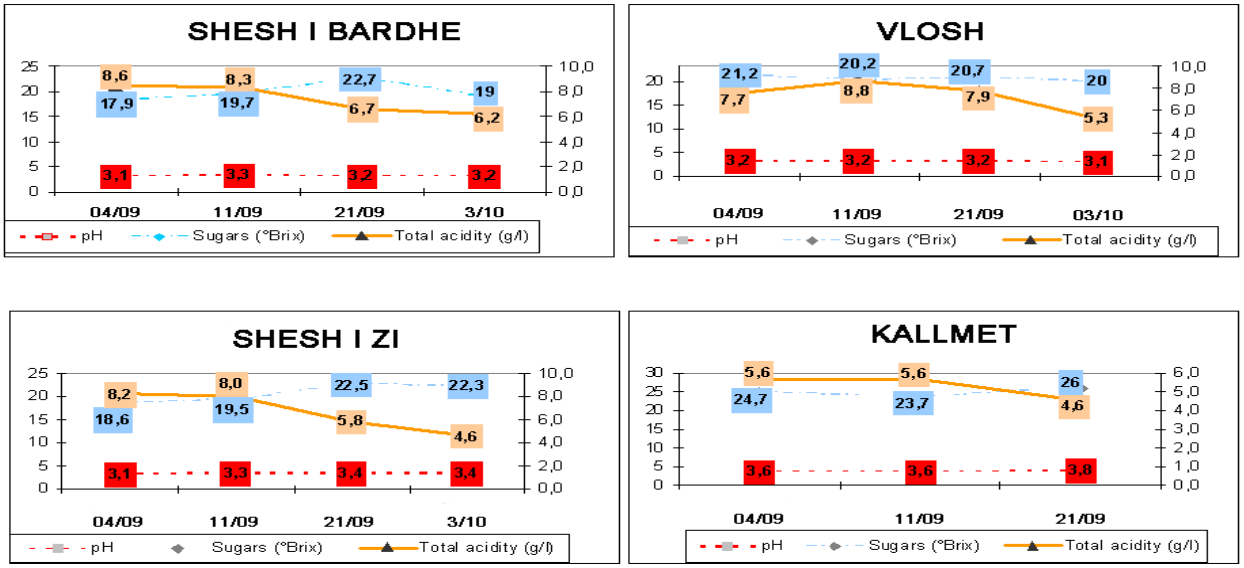

Figure 1. Ripening curves of cultivars under study showing the dynamics of pH, sugars and total acidity (average values of year 2009 – 2010)

Table 3. Extractability of tannins and anthocyanins from seeds of 'Sheshi i Zi' and 'Vlosh'

Cv.	Samples	abs AB	cm MT	cm AB	Total flavonoids (mg/l)
Sheshi i Zi	1	0.053	3.0	11.2	23.40
	2	0.225	7.5	11.2	248.30
	3	0.043	2.7	11.2	17.08
	4	0.050	2.8	11.2	20.60
	5	0.035	2.8	11.2	14.42
	6	0.120	2.4	11.2	42.38
	7	0.212	5.0	11.2	155.97
	8	0.060	2.8	11.2	24.72
Vlosh	1	0.086	5.0	11.2	63.27
	2	0.072	5.1	11.2	54.03
	3	0.065	2.1	11.2	20.09
	4	0.150	6.8	11.2	150.09
	5	0.110	4.2	11.2	67.98
	6	0.095	2.5	11.2	34.95
	7	0.280	5.8	11.2	238.96
	8	0.250	5.4	11.2	198.64

*Table 4. Phenolic profiles in the skin and seeds (2009 - 2010)**

Berry part	Indices	Year	SHZ	SHB	KLL	VLO
SKIN	Total anthocyanins (mg/kg)	2009	1271.84	0	818.69	288.69
		2010	1125.72	0	n.m.	752.39
	Total flavonoids (mg/l)	2009	2873.16	504.16	1756.42	954.11
		2010	2468.32	1125.64	n.m.	919.28
	Non-anthocyanic flavonoids (mg/l)	2009	n.m.	n.m.	n.m.	n.s.
		2010	1375.93	1125.64	n.m.	576.73
	Proanthocyanidins (mg/kg)	2009	2084.80	788.00	1644.80	1111.5
		2010	1117.09	1223.92	n.m.	1290.57
	Total polyphenols (mg/kg)	2009	3584.59	1429.90	3274.75	2330.63
	Total polyphenols (mg/l)	2010	1717.67	1316.69	n.m.	932.50
	Flavans (mg/l)	2009	4515.22	1655.78	5404.74	2613.98
		2010	2553.22	1574.20	n.m.	1507.31
SEEDS	Total flavonoids (mg/l)	2009	518.25	355.62	1192.63	624.51
		2010	670.09	1435.53	n.m.	388.46
	Proanthocyanidins (mg/kg)	2009	1050.56	592.23	2228.85	1330.97
		2010	421.09	811.44	n.m.	396.29
	Total polyphenols (mg/kg)	2009	2237.70	994.1	4831.1	2724.2
		2010	417.76	747.87	n.m.	272.29
	Flavans (mg/kg)	2009	1824.30	1217.3	5069.7	2378.0
		2010	29.08	1102.13	n.m.	72.70
FLESH	Hydroxycinnamic acid (mg/l)	2009	70.78	32.15	42.67	34.50
		2010	54.11	74.87	n.m.	72.70

** Values are the means of two replicates for each extraction*
n.m. – not measured

Table 5. Some parameters of the wines

Wine code	pH	Volat.ac. (g/l)	free SO2 (mg/l)	total SO2 (mg/l)	TAV	Density (20°/20°)	Total dry extract (g/l)	Colour. intens.	Tona-lity	NaOH
SHZV1	3.7	0.8	40	77	11.2	0.9968	30.5	1.8	1.0	4
SHZV2	3.5	0.4	81	84	12	0.9949	28	1.5	0.8	3
SHZV3	3.7	0.9	85	112	12.3	0.9930	23.6	1.4	1.0	2.06
SHBV4	3.3	0.2	80	111	11.9	0.9927	24.3	0.4	1.0	1.3
KVLV5	3.5	0.3	87	100	12	0.9960	30.7	2.7	0.6	2.5
KLLV6	3.5	0.3	69	99	11.8	0.9952	28	1.4	0.7	2.3
KLLV7	3.8	0.6	87	137	13.1	0.9927	25.5	1.4	0.5	1.3
KLLV8	3.4	0.2	113	115	12.2	0.9928	23.1	1.6	0.8	1.7
KLLV9	3.7	0.5	32	58	11.3	n.m.	22.2	0.5	0.9	1.9
KLLV10	3.8	0.3	28	45	11.7	n.m.	28.6	0.5	0.9	1.5
CERV11	3.9	2.1	50	74	11.2	0.9922	18.6	0.9	1.0	n.m.
ZADV12	3.7	1.0	17	51	11.3	n.m.	25.1	0.6	0.8	4.1
MERV13	3.7	0.9	56	148	12.3	0.9968	35.7	1.8	0.9	4.1
MERV14	3.5	1.0	87	104	12	0.9851	20.8	1.5	0.6	2.4
RIEV15	3.4	0.7	66	197	11	0.9921	15.8	0.4	1.0	3.8
RIEV16	3.8	0.5	92	98	12.2	0.9831	22.7	0.5	1.0	2

n.m. – not measured

Table 6. Results of spectrophotometric determinations from the wine

Wine code	Polyphenols	Total	Total	Flavans (mg/l)	Proanthocyanidins	T/A
SHZV1	252.9	1843.2	270.8	442.9	688.3	2.5419
SHZV2	149.0	2710.5	356.2	896.4	1529.3	4.2929
SHZV3	110.0	1680.5	242.8	444.7	1413.2	5.8206
SHBV4	32.4	623.4	0.0	121.4	192.7	0
KVLV5	199.4	3184.9	701.4	1093.6	278.4	0.3969
KLLV6	138.3	2751.2	252.4	753.6	1810.7	7.175
KLLV7	46.9	2341.9	221.9	555.4	122.4	0.6
KLLV8	137.3	2580.4	296.0	879.9	1786.3	6.0349
KLLV9	1801.6	959.2	136.4	680.48	2597.3	19.1
KLLV10	2237.4	2181.0	159.6	1468.54	2783.9	17.4
CERV11	12.6	563.8	20.0	26.3	0.0	0
ZADV12	1063.1	1565.2	96.4	304.4	1257.6	13.0
MERV13	129.9	1821.5	314.7	536.8	645.5	2.0513
MERV14	113.6	1973.3	322.9	655.2	931.5	2.8847
RIEV15	31.1	195.2	36.1	80.6	51.4	1.4233
RIEV16	24.6	493.3	23.5	90.1	91.8	3.8986

DISCUSSIONS AND CONCLUSIONS

The high variation in polyphenolic content between cultivars (Table 4) is due to the grape composition whilst it is assumed that changes between wines of the same cultivar (Table 6) are related to the oenological practices. Moreover, wine ageing can modify the phenolic composition (Fulcrand et al., 2006) since these compounds are involved in many chemical reactions during wine maturation and ageing that modify characteristics such as colour, flavour, taste (bitterness and astringency) and antioxidant activity (Pérez-Magariño and Gonzales-SanJosè, 2004).

Wines with more stable and intense colour come from grapes with good phenolic maturity (Mattivi et al., 2002b; Jensen et al., 2008). The results show a similar level of colour intensity (Table 6) between wines from 'Kallmet' and 'Sheshi i Zi' (1.6 ± 0.21) but when Kallmet is mixed with Vlosh, the value increases to 2.7.

Kallmet and Sheshi i Zi produce wines suitable for ageing because they contain more phenolic compounds, especially anthocyanins and tannins with a low degree of polymerisation that are able to be transformed into proanthocyanidins or condensed tannins during storage. For this reason, grapes for wines to be aged for a long time should have a very high ratio between tannins with a low degree of polymerisation and those with a high degree of polymerisation.

These autochthonous cultivars, with great wine potential represent a valuable instrument for improving the local economies. They risk to disappear (genetic erosion), mainly due to the competition with international cultivars.

This description completes and makes more accurate existing ampelographic descriptions found in the Albanian literature.

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THE DETERMINATION OF YIELD TRAITS OF SOME SILAGE MAIZE (*Zea mays L.*) CULTIVARS IN AEGEAN REGION ECOLOGICAL CONDITIONS OF TURKEY

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ABSTRACT

This research was carried out to determine the adaptability cultivars for silage production as main crop. The experiment was conducted at Alasehir-Manisa in western Turkey in 2006 and 2007. The varieties tested are Varenne, C-955, AG-92150, AG-92149, DKC-6022, MF-714, Tietar, AG-92148, Mitic, DKC-6610, DKC-6842, Ada-523, Goldavid, Doge and Vero. Significant differences were detected among the varieties for plant height, number of green leaves per plant, stem diameter, ear ratio, leaf ratio, stem ratio, herbage yield, dry matter content, dry matter yield, crude protein content and crude protein yield traits. Average plant height of maize genotypes varied between 173.6 and 238.3 cm; number of green leaves per plant between 10.8 and 14.1; stem diameter between 2.0 and 2.5 cm; ear ratio between 24.47% and 36.83%; leaf ratio between 22.62% and 29.73%; stem ratio between 38.19% and 50.25%; herbage yield between 39.02 t ha^{-1} and 82.45 t ha^{-1}; dry matter between 34.28% and 53.70%; dry matter yield between 20.95 and 38.54 t ha^{-1}; crude protein content between 8.78% and 12.70%; crude protein yield between 1.99 and 3.97 t ha^{-1}. We concluded that C-955, Goldavid, Mitic and AG-92150 cultivars were superior than other cultivars for herbage and dry matter yield traits, respectively.

Key Words: Maize cultivars, Crude Protein Yield, Dry Matter Yield, Herbage Yield

INTRODUCTION

Maize is the most important silage crop in the world, because it is the most proper crop for ensiling. It produces abundant amount of green herbage and maize silage has high nutritive value and palatability(Kirtok, 1998; Akdeniz, et.al.,2004; Erdal et al.,2009; Oner et al.,2011).

Traditional ruminant livestock production in Turkey is based predominantly on animals grazing natural pastures with low nutritive value especially during dry seasons. The nutritive value of the naturel pastures varies according to season. Fodder deficiency exceeds in the colder hilly tracts of the country and much more in the dry land areas where agriculture totally depends on seasonal rainfall. Fodder defiency adversely affects milk, milk products, and meat avaibility in Turkey(Avcioglu,1983; Saglamtimur et al.,1990; Soya et al.,1997; Orak and Iptas, 1999; Keskin et.al.2005; Kusaksiz and Kusaksiz, 2005; Yolcu and Tan, 2008; Bulut et.al., 2008).The existing fodder resources are too limited to provide even only half of the maintenance ration for the existing livestock population(Avcioglu,1983; Saglamtimur et al., 1990; Soya et al., 1997; Geren et al., 2008). The strategy for the enhancement of livestock production in the country should be therefore primarily focused on the increasing forage and fodder productivity both quantitatively and qualitatively through introduction of high yielding races in areas where they can relatively perform better under existing climatic conditions. The Aegean region has promising important potential for livestock production. To meet the increasing needs for feed in the region, the best adapted maize cultivars should be selected both as main and second crop. The most important component providing high yield is that to use the best adapted cultivars in any region. Cultivars may show highly different yield performances depending on soil and climatic conditions from one region to another, so the best adaptable cultivars should be determined for any region. Additionaly, one should remember that cultivars of different origin may provide higher yield then the domestic cultivars (Saruhan et al. 2007). The objective of this study was to evaluate the herbage yield potential and some yield components of different new maize (*Zea mays L.*) cultivars under irrigated conditions of Manisa.

MATERIALS AND METHODS

This study was conducted at Alaşehir Vocational College fields in 2006 and 2007. The physical and chemical properties of the surface soil (0-20 cm) are as follows: Texture was sandy clay, pH was 7.8, organic matter content was 1.40 % and P, K, and Ca contents in the upper 20 cm. of soil were 0.21 ppm, 120 ppm. and 8173 ppm., respectively. The experiment was designed in a Randomized-Complete-Block Design with three replications. The trial was run at the same field for two years. Each plot consisted of six

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rows, 8 m long, and 0.65 m apart. The seeds were planted 0.20 m apart in the rows. The total area of each plot was 31.2 m^2 and the harvest area of each plot was 15.6 m^2. Sowing dates were 5 May 2006 and 5 May 2007. Hybrid maize cultivars, Varenne, C-955, AG-92150, AG-92149, DKC-6022, MF-714, Tietar, AG-92148, Mitic, DKC-6610, DKC-6842, Ada-523, Goldavid, Doge and Vero were used as the crop material in the experiment. The full dose of nitrogen (100 kg N ha^{-1}), phosphate (100 kg P_2O_5 ha^{-1}) and potassium (100 kg. K_2SO_4 ha^{-1}) were applied at sowing. Additional dose of nitrogen (100 kg N ha^{-1}) was applied at the stage when the crops were 40-50 cm. Four irrigations were applied each year and weeds were controlled by hoeing. The maize crops were harvested 90 days after sowing. Plant height, number of green leaves per plant and stem diameter traits were measured on ten randomly selected plants in each plot.

Dry matter: DM contents of plants were determined by drying the samples at 105 °C for 24 hours (Geren, 2000).

Herbage yield (t ha^{-1}) : The plants harvested from the soil level were immediately measured and weighed.

Dry matter yield (t ha^{-1}) was calculated by multiplying herbage yield and dry matter percentage.

Crude protein content: Whole plant nitrogen content was analyzed using a micro-Kjeldahl method. Protein content was calculated from the N % content in whole plant multiplied by a conversion factor of 6.25.

Crude protein yield (t ha^{-1}) was calculated by multiplying dry matter yield and crude protein percentage.

All data were analyzed applying the analysis of variance procedures using the MSTAC software package program (Freed et al.,1989). The comparison of the genotype means was made using the Duncan test (Steel and Torrie, 1980).

RESULTS

Variance analysis showed that cultivars were statistically and significantly different for all traits ($P<0.01$). Cultivar x Year interaction effect was found none significant for plant height, number of green leaves per plant, stem diameter,ear ratio, leaf ratio, stem ratio, herbage yield, dry matter yield, crude protein content and crude protein yield ($P<0.05$). Cultivar x Year interaction effect was found to be significant for dry matter content (Table 1 and 2).

Ear ratio, Leaf ratio and Stem ratio (%): The combined analysis of variance for 2 years for ear ratio, leaf ratio and stem ratio gave significant F values (Table 1). Cultivar AG-92149 had highest ear ratio 36.83%, while lowest ear ratio 24.47% was recorded in cultivar AG-92148. Similar result was also reported by (Avcioglu et al.2001). Cultivar Vero had highest leaf ratio 29.73%, while lowest leaf ratio 22.62% was recorded in cultivar DKC-6022. Highest stem ratio value 50.25% was found in cultivar AG-92148 and lowest value was recorded in cultivar DKC-6842 as 38.19%. Similar results have been recorded by (Geren,2000; Yılmaz et al.2003).

Herbage yield (t ha^{-1}): Herbage yield was significantly being effected by various cultivars in 2006 ($P<0.05$). However, highly significant $P<0.01$ difference were detected among cultivars for herbage yield (t ha^{-1}) in 2007 (Table 2). Highest herbage yield (82.45 t ha^{-1}) was recorded in cultivar C-955 (Table 2). This variation may be due to the different genetic capacity of the genotypes (Allard, 1999). Similar results were recorded by (Iptas,1993; Konak, 1994; Bilgen et al.1996; Akdemir et al.1997; Degirmenci, 2000; Budak and Soya 2003; Oz et al. 2009; Kusaksiz and Kaya, 2010).

Dry matter content (%): Dry matter contents (%) were significantly different in various cultivars in 2006 and 2007. Year and Cultivar x Year interaction effect were found to be significant ($P<0.05$) for dry matter content. Highest dry matter value 54.26% was found in cultivar DKC-6842 which is followed by cultivar Tietar 50.76%. Lowest value was recorded in cultivar AG-92148 as 33.14% in 2006.

Dry matter yield (t ha^{-1}): Dry matter yield (t ha^{-1}) was significantly different among the maize cultivars in 2006 and 2007. Highest yield 38.54 t ha^{-1} was recorded in cultivar Mitic which is followed by cultivar AG-92150 with 35.48 t ha^{-1} dry matter yield. Lowest dry matter yield 20.95 t ha^{-1} was recorded in cultivar

DKC-6842. Similar yield values were reported by (Konak, 1994, Akdemir et al.1997; Geren, 2000; Yılmaz and Saglamtimur, 1996; Yılmaz et al. 2003).

Crude protein content (%): Crude protein content was significantly different among maize cultivars in 2006 and 2007 (Table 2). Cultivar Doge had highest crude protein content(12.70 %), while lowest crude protein content(8.78 %) was recorded in cultivar MF-714 (Table 2). Similar result was also reported by Degirmenci(2000); Ahmad et al.(2012).

Crude protein yield (t ha^{-1}) : Crude protein yield was significantly different among the maize cultivars in 2006 and 2007. Highest yield 3.97 t ha^{-1} was recorded in cultivar Doge which is followed by cultivar Mitic with 3.81 t ha^{-1} crude protein yield. Lowest crude protein yield 1.99 t ha^{-1} was recorded in cultivar DKC-6842.Similar yield value was reported by(Degirmenci, 2000).

Table 1. Means of the traits measured in maize cultivars

Maize Cultivars	Plant height (cm)	Number of green leaf per plant	Stem diameter (cm)	Ear ratio (%)	Leaf ratio (%)	Stem ratio (%)
Varenne	202.8 abc	12.6 cde	2.49 a	26.64 bcd	23.94 abc	49.30 ab
C-955	238.3 a	14.1 a	2.45 a	27.54 bcd	26.76 abc	45.69 abcd
AG-92150	205.5 abc	12.3 de	2.24 ab	32.34 abc	27.38 abc	40.27 cd
AG-92149	217.4 ab	12.5 cde	2.10 ab	36.83 a	22.88 c	40.27 bcd
DKC-6022	220.1 ab	12.7 bcde	2.41 ab	31.93 abcd	22.62 c	45.44 abcd
MF-714	215.1 ab	12.4 cde	2.32 ab	24.87 cd	27.77 abc	47.35 abc
Tietar	186.4 bc	13.5 abcd	2.43 a	30.00 abcd	26.01 abc	43.97 abcd
AG-92148	231.9 a	13.9 abc	2.50 a	24.47 d	25.26 abc	50.25 a
Mitic	218.9 ab	12.7 bcde	2.25 ab	29.38 abcd	24.00 abc	46.61 abcd
DKC-6610	221.9 ab	12.8 abcde	2.26 ab	33.52 ab	23.31 bc	43.16 abcd
DKC-6842	173.6 c	10.8 f	2.00 b	32.81 ab	28.99 ab	38.19 d
Ada-523	234.2 a	13.9 ab	2.38 ab	28.82 abcd	27.51 abc	43.66 abcd
Goldavid	230.4 a	13.9 ab	2.26 ab	29.78 abcd	24.82 abc	45.39 abcd
Doge	202.4 abc	13.5 abcd	2.41 ab	26.67 bcd	29.38 a	43.94 abcd
Vero	190.3 bc	12.7 cde	2.49 a	31.42 abcd	29.73 a	38.84 cd
MEAN	212.6	12.9	2.33	29.80	26.04	44.16
F Values	6.62 **	14.70**	3.15 **	4.26 **	4.41 **	4.36 **

**, **, indicates significance at 0.05 and 0.01, respectively, NS indicates not significant*
Means followed by different letter(s) are significantly different at the 5% or 1% level of probability

Table 2. Means of the traits measured in maize cultivars

Maize Cultivars	Herbage yield (t ha^{-1})	Dry matter content (%) 2006	2007	Dry matter yield (t ha^{-1})	Crude protein content (%)	Crude protein yield (t ha^{-1})
Varenne	74.41 ab	44.15 e	44.71 cde	33.05 abc	10.61 cd	3.51 abc
C-955	82.45 a	38.17 g	40.64 fg	32.54 abc	9.10 hı	2.96 abcde
AG-92150	76.20 ab	46.39 d	46.77 bc	35.48 ab	9.80 defgh	3.46 abc
AG-92149	57.08 bc	50.54 b	50.41 ab	28.83 abcd	10.41 cde	3.02 abcde
DKC-6022	69.67 ab	46.31 d	47.12 bc	32.55 abc	9.16 ghı	3.00 abcde
MF-714	59.31 abc	41.97 f	42.21 def	24.96 bcd	8.78 ı	2.19 de
Tietar	66.81 ab	50.76 ab	50.44 ab	33.77 abc	9.92 defg	3.34 abc
AG-92148	71.00 ab	33.14 ı	35.42 h	24.26 cd	10.18 def	2.48 cde
Mitic	79.76 ab	48.39 c	48.17 abc	38.54 a	9.88 defg	3.81 a
DKC-6610	73.35 ab	35.82 h	38.05 gh	27.11 abcd	9.75 efgh	2.64 bcde
DKC-6842	39.02 c	54.26 a	53.14 a	20.95 d	9.56 fgh	1.99 e
Ada-523	75.90 ab	44.19 e	45.23 cd	33.94 abc	9.05 hı	3.05 abcde
Goldavid	80.45 ab	39.04 g	40.79 efg	32.07 abc	11.27 bc	3.61 ab
Doge	64.05 ab	49.26 bc	48.43 abc	31.26 abcd	12.70 a	3.97 a
Vero	67.37 ab	36.05 h	37.92 gh	24.88 bcd	12.56 ab	3.12 abcd
MEAN	69.12	43.90	44.63	30.28	10.18	3.08
F Values	5.62 **			5.33 **	60.73 **	6.82 **

**, **, indicates significance at 0.05 and 0.01, respectively, NS indicates not significant*
Means followed by different letter(s) are significantly different at the 5% or 1% level of probability

CONCLUSION

Based on the results of the experiment, it was concluded that significant differences of various traits were found among the maize cultivars tested. Tansi (1987) stated that in selecting the cultivar for silage maize production, three characteristics of the plant, namely, herbage yield, maturation period and dry matter content in harvest should be considered. It should be emphasized that herbage yield is one of the important characteristic in order to compare the agronomical performances of crops. It is a quantitative trait affected by the correlated traits such as number of the plants per area, genotype, maturation period, harvest date and avaible technology. Alessi and Power (1974); Esser and Entrup (1980) revealed that herbage yield is a characteristic that closely related to enviromental conditions

There are special total temperature requirements for the favorable growing and maturing cycle for species and cultivars of the crops. For maize, these values are between 2370-3000 °C (Boguslawski, 1981). Hence, in the regions where the average temperature is quite high, the crops reach to earlier harvest stage by completing the total temperature requirements in a shorter period. In late spring in mediterranean environments, the increasing air and soil temperatures meet the requirements of the early maturing cultivars and the crops complete their growing cycle by pollen shedding. Consequently, the vegetative growth ceases automatically and the herbage yield decreases considerably. For the mid-late cultivars, vegetative period is longer than the earlier cultivars. Therefore, the vegetative period of mid-late cultivars prolong and herbage yield increases. Our results obtained in the study are not in accordiance with the findings of some other researchers (Avcioglu et al.2001; Korkut et al.,2009). These results might be due to the ecological differences among the research areas.

To come to the conclusion, maize cultivars of C-955, Goldavid, Mitic and AG-92150 were found to be recommendable under irrigated growing conditions of Manisa.

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GENETIC RELATIONSHIP AMONG AUTOCHTHONOUS GRAPEVINE CULTIVARS IN BOSNIA AND HERZEGOVINA

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ABSTRACT

Grapevine growing area of Bosnia and Herzegovina is limited by surface, but there are a great number of autochthonous varieties. A small number of them have a greater commercial significance, while most of them are grown at a small scale. However, their genetic inter-relationships are presently unknown. The aim of this study was to genotype 26 accessions of native grapevine varieties from Bosnia and Herzegovina. This should put more light on the level of genetic diversity among the studied accessions, as well as determination of possible synonyms and homonyms. Genetic profile of each variety was produced with SSR markers at nine loci. On the basis of obtained results coefficient of genetic similarity was computed. The mean number of alleles per locus was 7.33 and observed heterozygosity over all loci was 0.77. Five clusters of identical genotypes were found. Synonyms and homonyms were also found within the analyzed accessions. The coefficient of genetic similarity shows that there is a significant level of genetic distance and diversity among the tested varieties. This fact suggests that the grapevine varieties from Bosnia and Herzegovina may have different genetic and geographical origins.

Key Words*:* Autochthonous varieties, Grapevine, Genetic relationship, SSR

INTRODUCTION

Grapevine growing area of Bosnia and Herzegovina is mostly located in Herzegovina, its southern Mediterranean region. Grapevine is major agricultural crop of Herzegovina, with long history and tradition of cultivation. Most cultivated varieties are autochthonous ones - created by natural and artificial selection and adapted to local climate conditions. Despite the long tradition of farming there is no detailed description of the autochthonous varieties of Herzegovina. There is only a partial description of some of the most important commercial varieties (Bulić, 1949, Vuksanović, 1977, Mirošević and Turković, 2004). There are some assumptions about the synonyms and homonyms within the Herzegovinian varieties referred in these works.

Characterization and identification of grapevine genetic resources can be done using ampelography, and more recently molecular methods. Although the ampelographic methods are fast and very reliable, they are significantly influenced by environmental factors, as well as subjective approach and experience of ampelographer (Dettweiler *et al.*, 2000). Therefore, in recent times, molecular markers have been increasingly used for a reliable identification of varieties, and the most often used are microsatellites (SSR) markers (Maletić *et al.*, 2008). Molecular markers are based on DNA polymorphism and are very good tool for the identification and determination of inter-varietal variability.

Using modern molecular methods it is possible to create genetic profiles of the analyzed material and in this way to precisely identify genotype of each variety. Genetic analysis of Herzegovinian varieties was not published so far, except for some clones of Žilavka variety (Tomić, 2009). In this work genetic analysis of 26 grapevine accessions from Herzegovina, consisting mostly? of known local cultivars was performed using SSR markers. The aim of this study was to determine the genetic profile of each accession and thus to assess their genetic diversity. In the future, this data will be used to compare their genetic profiles with cultivars from neighboring winegrowing areas as well as with other European varieties, in order to determine the relationship of autochthonous varieties of Bosnia and Herzegovina with entire European grapevine germplasm.

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MATERIALS AND METHODS

Tentative autochthonous grapevine varieties from Herzegovina were used as a material for this study. They were previously determined in the field, collected and propagated into *ex situ* collection "Višići" near Čapljina. In order to obtain their genetic profiles, 26 accessions were sampled from this germplasm repository. Genetic profiles of the sampled accessions were generated by microsatellite markers at nine loci in accordance with the genotyping recommendation of the European consortium GrapeGen06 (https://www1.montpellier.inra.fr/grapegen06/). Freeze-dried samples of single vine leaves were used for DNA extraction using a Macherey-Nagel NucleoSpin Plant II kit. Nine microsatellite loci were analyzed: VVS2 (Thomas and Scott, 1993); VVMD5, VVMD7, VVMD25, VVMD27, VVMD28, VVMD32 (Bowers et al., 1999), VrZAG62 and VrZAG79 (Sefc *et al.* 1999). Fluorescently labeled primers, according to the procedure Vilanova *et al.* (2009), were used. Fragments were electrophoretically separated using a capillary sequencer "ABI3130 Genetic Analyzer". GeneMapper 4.0 program was employed for the fragment size analysis, using "2nd Order Least Square" algorithm. Molecular statistical parameters were calculated using NTSYS-PC 2.1. program (Rohlf, 1993).

Detected microsatellite profiles were searched for identical genotypes (synonyms). Non redundant set of genotypes (without synonyms and duplicates) was used to analyze allele frequency, expected and observed heterozygosity as well as polymorphism information content (PIC). They were calculated using The Excel Microsatellite Toolkit (Park, 2001), which was also used to detect identical genotypes. The cluster analysis was performed in order to test grouping of accessions across their origin. Genetic distance matrix was computed by the NTSYSpc version 2.10 software, based on the DICE coefficient. The distance matrix was then processed using the UPGMA algorithm which was then visualized as dendrogram by the same software.

RESULTS AND DISCUSSION

Dendrogram analysis (Figure 1) shows that among the tested varieties, there are five clusters of identical genotypes (synonyms). They are: Toboluša - Dobrogostina, Žilavka - Žilavka old - and Žilavka yellow, Mala blatina - Plavka, Pošip white - Prošip white and Pošip red - Prošip red, respectively. For some accessions, it was expected that they share the same genotype. Žilavka, Žilavka stara (old) and Žilavka žuta (yellow), even though we assumed some of them might by homonyms, proved to be different morphotypes of the same variety. They were collected from different locations, and differences in visual properties might be the result of environmental influence. Some authors have reported about different genotypes of Žilavka but, according to genetic analyses, it seems they have same original genotype. Pošip and Prošip even having different (but similar) names and being collected at different locations showed to be identical in their SSR profile.

Toboluša and Dobrogostina had also identical genotypes. The name Toboluša is used in the northern part of Herzegovina, and Dobrogostina is the name used in southern part of the area. Earlier, there were some suggestions that they represent the same variety, which is proved by this study (Figure 1). The varieties Mala (small) Blatina and Plavka were not expected to be identical. Nobody knows why people call this variety Blatina small although it has nothing to do with the true variety Blatina: neither morphologically, nor technologically.

Two homonyms were found within analyzed materials. The first one is Blatina and Blatina stara (old). First, it was assumed that they represent two morphotypes of the same variety. But after genetic identification it was found that Blatina old is quite different from regular Blatina. The second case of homonymy is Toboluša 1 and Toboluša 2. Sample Toboluša 2 was taken in Jablanica, about 20 km far from the place where Toboluša 1 was taken. Farmers do not differentiate them. Considering its genetic distance to all other samples (GS=0,185), it is supposed that Toboluša 2 might be a seedling: hybrid between Vitis vinifera and Vitis sylvestris or some wild Vitis species, respectively (Figure 1).

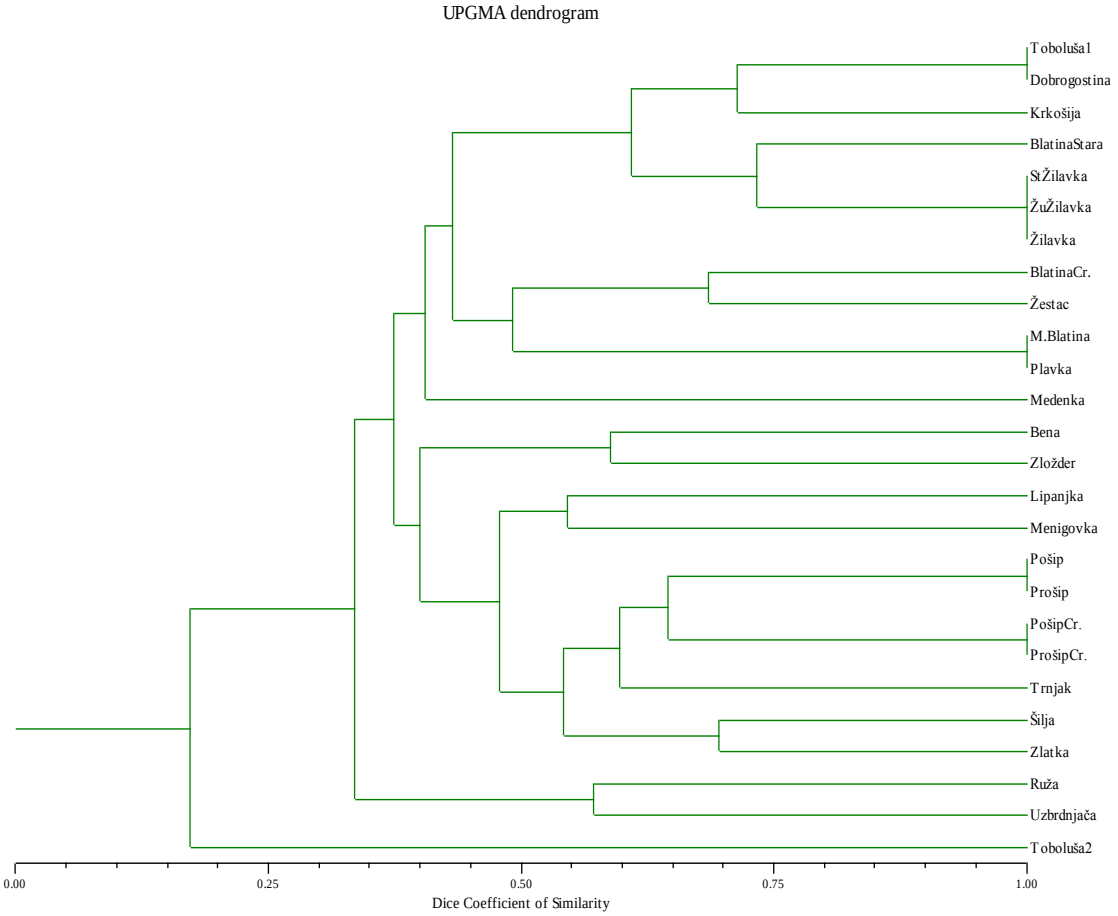

Figure 1. Dendrogram of analysed genotypes

All analyzed genotypes, according to the genetic similarity (represented by the given Dice coefficient), can be classified into five clusters. Varieties within a cluster are genetically closer than those ones among clusters. As the dendrogram shows, white and red varieties appear in the same cluster, which means that they share the common ancestors.

The average coefficient of genetic similarity derived from the similarity matrix amounts to 0.403; which is rather low, and it shows a great genetic diversity comparing other studies that suggests different origin for these varieties. Another proof of different origin is the range of coefficient of similarity between varieties. It varies from very low, 0.065 to rather high, 0.733. Such a wide range means that the analyzed materials originate from different sources. The composition of the Herzegovinian grapevine germplasm might be the result of several factors. The first one is the development of autochthonous varieties through the domestication and natural selection during the centuries of cultivation. The second factor affecting diversity might be the neighboring Dalmatia, an important winegrowing area. Some varieties might be transferred in the past from Dalmatia and adapted to the local conditions of Herzegovina. Third source of diversity might be the introduction of foreign varieties during the long period of Turkish rule and presence in this region. Some of these varieties have adapted to environmental conditions of Herzegovina and gained some useful properties. They might have been grown and intercrossed with domestic germplasm and assumed as local varieties. The names of some varieties (not included in current set) remind the Turkish language (Rezakija, Nadiđar). Finally, some varieties could be the result of introduction from other areas during the 20th century. All those sources resulted in the today's mixture of varieties in Bosnia and Herzegovina.

Number of alleles per locus for all the varieties ranged from 5 to 10, in average of 7.3 (Table 1). Some of the distinctive alleles were present in more genotypes while some others appeared only at one genotype. Values of polymorphism information content (PIC), presented in Table 1, ranged from 0.53 for locus VVMD 7 to 0.82 for the locus VrZAG79, proving them as good markers. The average PIC value

amounted to 0.71. The expected average heterozygosity was 0.76 and the observed heterozygosity was almost the same – 0.77. Basically, it can be concluded that the values of heterozygosity and polymorphism found in this study were at the similar level comparing the grapevine varieties observed in other similar studies (De Mattia et al., 2007, Tomić, 2009, Cipriani et al., 2010), but of much higher sample size.

Table 1. PIC value for 20 nonredundant genoytpes from Herzegovina

	No.of samples	No. of alleles	Expected heterozygosity	PIC values	Observed heterozygosity
VVS2	**20**	**6**	**0.74**	**0.68**	**0.85**
VVMD5	**20**	**9**	**0.83**	**0.79**	**0.80**
VVMD7	**20**	**8**	**0.57**	**0.53**	**0.60**
VVMD25	**20**	**5**	**0.71**	**0.65**	**0.80**
VVMD27	**20**	**6**	**0.77**	**0.72**	**0.75**
VVMD28	**20**	**8**	**0.86**	**0.82**	**0.85**
VVMD32	**20**	**7**	**0.82**	**0.77**	**0.75**
VrZAG62	**20**	**7**	**0.66**	**0.62**	**0.75**
VrZAG79	**20**	**10**	**0.84**	**0.80**	**0.75**
Mean	**20**	**7.33**	**0.76**	**0.71**	**0.77**

CONCLUSIONS

Based on results presented above following conclusions can be drawn:

Among 26 analyzed accessions 20 different genotypes, as well as five identical clusters were found.

The results of this study show rather large genetic diversity in spite of relatively small number of analyzed genotypes and limited growing region. It would be necessary to merge the results of this research with equivalent marker data for neighboring countries and other European growing areas in order to investigate wider genetic relationships and contribution of Bosnia and Herzegovina germplasm to general Vitis germplasm.

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A SURVEY OF STORAGE PESTS PARASITOIDS (HYMENOPTERA) IN IRAN

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ABSTRACT

Agricultural stored products threaten by several storage insect pests with about 6-10% reduction in Iran. These storage pests mostly belong to Coleoptera and Lepidoptera that be attacked by several species of natural enemies especially hymenopterous parasitoids. This survey was carried out to identify the species of Hymenoptera associated with storage pests. Ten parasitic wasps belong to three superfamilies Bethyloidea (two species on small beetles), Chalcidoidea (six species on coleopterous pests) and Ichneumonoidea (two species on lepidopterous pests) were listed for Iranian fauna. These parasitoids are as follow: Two bethylids species *Cephalonomia tarsalis* (Ashmead) and *Laelius anthrenivorus* Trani; two braconids *Bracon hebetor* Say and *Bracon brevicornis* (Wesmael); six pteromalids species *Anisopteromalus calandrae* (Howard), *Dinarmus vagabundus* (Timberlake), *Lariophagus distinguendus* (Förster), *Pteromalus* sp., *Theocolax elegans* (Westwood), *T. formiciformis* Westwood. Within these parasitoids, *A. calandrae* is a well known cosmopolitan parasitoid of Anobiidae and Bruchidae (Coleoptera) associated with stored products in Iran that is widely distributed. Biological associations for the Iranian species are presented, and geographical distribution and biological data are summarised.

Key Words: Insects, biological control, stored products, natural enemy

INTRODUCTION

Agricultural products attack by different groups of pests that cause a huge drop off it. These pests destruction may be happened in different stages of plant phenology. One of important groups are post harvesting pests that may infests products in storage condition. This group mostly belongs to the coleopterous and lepidopterous orders. Based on available literatures this damage may be reaches about 6 to 10% (Bagheri-Zenouz, 1986; Maroof, 2002). Stored products commodities are vulnerable to infestation by many species of arthropods and insects cause great losses in stored grain and milled cereal products. The activity of stored-product pests may be associated with weight losses and presence of allergens or toxinogenic fungi in the infested stored products.

Contact insecticides and fumigants are the primary ways used for controlling these pests. However, the chemical control of these pests has many limitations because of pesticide residues that can occur in stored edible products. On the other hand, high mammalian toxicity of Phosphine (Willers, 1999), and a pending ban of Methyl bromide, therefore studies on possibilities of biological control of these pests are of great need to develop an integrated pest management approach.

The use of biocontrol agents to control of pests is well established in agricultural and horticultural ecosystems but in post-harvest condition is limited. Due to many reasons especially its compatibility with other IPM methods, this technique gradually occupied stored product IPM (Haines, 1974, 1984; Schöller and Flinn, 2000; Flinn and Hagstrum, 2001; Eliopoulos *et al.*, 2002).

Insect pests of stored products are attacked by a variety of natural enemies especially hymenopterous parasitoids that are natural components of storage ecosystems. The use of predators and parasitoids for biological control of stored product pests has been studied by many authors (Waterston, 1921; Haines, 1991; Anonymous, 1995; Johnson *et al.*, 2000; Flinn and Hagstrum, 2001; Fursov, 2002), and an overview is given by Schöller and Flinn (2000). During the last 100 years more than 1000 publications have dealt with biocontrol agents of storage pests (Schöller, 1998; Eliopoulos *et al.*, 2002). To date, 58 species of predators and parasitoids of 79 stored-product pests have been studied experimentally (Schöller, 1998).

In Europe, however, only few of these species are available on a commercial level such as *Trichogramma evanescens* Westwood, *Bracon hebetor* (Say) and *Lariophagus distinguendus* Förster that are mass-produced in Germany (Adler, 2004).

Esmaili *et al.* (1994), Eslami (1998), Habibpour *et al.* (2002), Assemi and Shojai (2004), Kazemi *et al.* (2004) have reported some parasitoids on stored product pests in Iran. But in order to develop biological

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control methods sufficient knowledge must be gained on biotic regulators of stored product insect populations. Therefore, this research aimed to identify parasitic wasps of stored products in Iran and support some biological and geographical data.

MATERIALS AND METHODS

The survey was conducted during 2008 to 2012 on a wide range of products stored in varying quantities and different types of storage facilities. It was also belong to low to high quantities in different storages conditions such as farm store, flourmills, household, warehouse and silos. Samplings were made from different stored products such as grains, flour, legumes, dried fruits from different localities in Iran. Insects were originally collected from storage areas in East-Azarbaijan, Kermanshah, Kurdistan, Qazvin, Mazandaran, North-Khorasan and Sistan-Baluchestan provinces.

Infested samples of different localities were conserved separately in a plastic container of 2 litter. Rearing was made at 25±2°C and %70±10 RH. The containers were examined daily to separate emerged parasitoids.

Identification of reared Hymenoptera were done using Bouček and Rasplus (1991), Graham (1969), Terayama (2003) and Tobias (1995). Previously reported species were included in this list.

RESULTS AND DISCUSSION

In this study eight parasitic wasps were identified from three hymenopterous superfamilies: Bethyloidea, Chalcidoidea and Ichneumonoidea (Table 1). Most of them includes to second superfamily that attacks coleopterous storage pests. The family Pteromalidae include 60% of identified species (Figure 1).

Table 1- Parasitoids of storage pests in Iran.

Superfamily	Family	Species
Bethyloidea	Bethylidae	*Cephalonomia tarsalis* (Ashmead)
		Laelius anthrenivorus Trani
Chalcidoidea	Pteromalidae	*Anisopteromalus calandrae* (Howard)
		Dinarmus vagabundus (Timberlake)
		Lariophagus distinguendus (Förster)
		Pteromalus sp.
		Theocolax elegans (Westwood)
		Theocolax formiciformis Westwood
Ichneumonoidea	Braconidae	*Bracon brevicornis* (Wesmael)
		Bracon hebetor Say

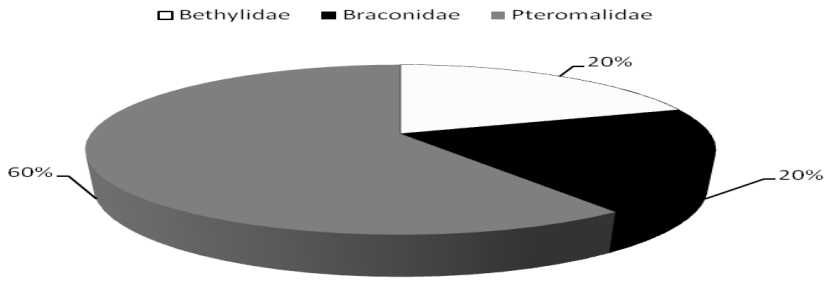

Figure 1- Composition of storage pests parasitoids (Hymenoptera) in Iran.

I- Family Bethylidae

The family Bethylidae, belonging to Bethyloidea and known as a group of primitive aculeate Hymenoptera, is widely distributed from the tropics to the subarctic regions of the world (Terayama, 2003). Most species are external parasites of lepidopterous and coleopterous larvae.

Two species of this genus was reared on stored products pests in Iran.

1- *Cephalonomia tarsalis* (Ashmead)

Material examined: East-Azarbaijan, Marand, 1.i.2010, ex *Oryzophilus surinamensis* on rice, H. Lotfalizadeh leg., 4 ♂♂. North-Khorasan province, Esfarayen, ii.2011, ex *Callosobruchus maculatus,* M. Lal-Haghi leg. 1 ♀ & 4 ♂♂.

***Cephalonomia tarsalis* can parasitize either larvae or pupae of the sawtoothed grain beetle, *O. surinamensis*; but the larvae are more commonly attacked. Although this species reportedly uses several different stored product beetle hosts (Powell, 1938).**

***Cephalonomia* is a genus of parasitoids of the larvae and pupae of small cryptic beetles that feed upon stored products, bark and fungi. This can be distinguished by following characters: Antenna with 12 segments; notauli absent; radial vein absent, median vein almost with the same width from anterior to posterior end, not broaden at the mid-length, or median vein obscure, anal vein obscure to absent.**

2- *Laelius anthrenivorus* Trani

This species was reported from Iran (Habibpour *et al.*, 2002), France and Italy (Vikberg and Koponen, 2005) as parasitoid of the family Dermestidae (Coleoptera). It can be distinguished by yellowish red femora; lacking notauli; infumate fore wing apically (Vikberg and Koponen, 2005).

The genus *Laelius* Ashmead, 1893, is represented worldwide by 30 species, 20 of them recorded from the Palaearctic region, six from the Nearctic region, two from Afrotropical region and two from the Oriental region (Barbosa and Azevedo, 2010).

II- Family Braconidae

Generally braconids are solitary endoparasitoids that attack young host larval instars and leave their host before it reaches maturity. The genus *Bracon* Fabricius, which is one of the largest genera in the subfamily Braconinae, has about 800 species world widely and of those 300 species are Palaearctic species (Tobias, 1995). It is a difficult genus of the Hymenoptera need a modern revision. Two species of this family have been found in Iran as parasitoids of lepidopterous storage pests.

3- *Bracon brevicornis* (Wesmael)

This species is closely related to another common species, *Bracon hebetor*, from which it can be identified by the following characters: Antenna of female with 15-18 segments, slightly longer than length of head and mesosoma combined; antennal segments of male 22-27. Setae of vertex more adpressed, mostly not reaching above upper level of posterior ocellus; vein 3-SR of fore wing 1.2-1.8 times vein r.

This species was reported by Habibpour *et al.* (2002) from Iran.

4- *Bracon hebetor* Say

Material examined: East-Azarbaijan, Marand, ex *Ephestia kuehniella,* H. Lotfalizadeh leg., 3♀♀ & 2 ♂♂.

***Bracon* (*Habrobracon*) *hebetor* is a common ectoparasitoid reported on 72 host species. The first report of this species from Iran dates back to 1973 as a parasitoid of Indian meal moth (Lep.: Pyralidae) (Bagheri-Zenouz, 1973). *Bracon hebetor* is widely distributed in the Australasian, Palaearctic, Ethiopian, Nearctic, Neotropical, Oriental and Oceanic regions (Yu *et al.*, 2005).**

It can be identified by the following characters: Antenna of female with 13-14 segments, shorter than length of head and mesosoma combined or of equal length; antennal segments of male 20-23. Setae of vertex erect, reaching above upper level of posterior ocellus; vein 3-SR of fore wing 0.9-1.2 times vein r,

rarely up to 1.4 times.

III- Family Pteromalidae

The family Pteromalidae with 618 genera is one of the largest families among parasitic Hymenoptera of the superfamily Chalcidoidea. It includes important natural enemies of many harmful insects widely distributed in major insect orders such as Coleoptera, Diptera, Lepidoptera, Hymenoptera and Homoptera. This family is one of well known parasitic group in Iran with more than 80 species (Lotfalizadeh and Gharali, 2008). It belongs most of storage pests parasitoids (six species).

Table 2 shows parasitic wasps of this family attack wide range of hosts of the coleopterous families Anobiidae, Bostrychidae, Bruchidae, Dryophthoridae, Silvanidae, Tenebrionidae and lepidopterous family Gelechiidae.

5- *Anisopteromalus calandrae* (Howard)

Material examined: Kermanshah province, Kanghavar, viii.2009, ex *Callosobruchus maculatus,* M. Kahrarian leg. 5 ♀♀ & 4 ♂♂. Qazvin province, vii.2009, ex *Bruchus piosrum,* A. Zarnegar leg., 8 ♀♀ & 3 ♂♂. North-Khorasan province, Esfarayen, ii.2011, ex *Callosobruchus maculatus,* M. Lal-Haghi leg. 10 ♀♀ & 9 ♂♂. Mazandaran province, Babolsar, vi.2011, ex *Lasioderma serricorne,* N. Vakhideh, 7♀♀ & 7 ♂♂. Sistan-Baluchestan province, Sarbaz, vii.2009, ex *Callosobruchus maculatus,* N. Khiabani leg. 5 ♀♀ & 4 ♂♂

***Anisopteromalus calandrae,* as parasitoid of *Callosobruchus maculatus* F. (Col.: Bruchidae), is a well-known cosmopolitan parasite of various beetles in stored grains pests (Bouèek and Rasplus, 1994). This common species has a wide distribution and reported from all arctics.**

6- *Dinarmus vagabundus* (Timberlake)

This species parasitizes three bruchids in Iran (Eslami, 1998). Some of important morphological characters are as follow: Head and mesosoma black without metallic reflection, head finely and closely reticulate, anterior margin of clypeus weakly emarginate, scape reaching median ocellus, pedicel as long as F1, forewing without marginal fringe, post marginal vein as long as stigmal vein.

7- *Lariophagus distinguendus* (Förster)

Material examined: East-Azarbaijan province, Tabriz, 30.i.2010, ex *Tribolium* sp., 10♀♀ & 4 ♂♂. Same locality, ix.2008, *Sitophilus granarius,* H. Lotfalizadeh leg., 5♀♀ & 2 ♂♂. Mazandaran province, Babolsar, vi.2011, ex *Oryzophilus surinamensis,* N. Vakhideh, 10♀♀ & 7 ♂♂. Qazvin province, ix.2008, ex *Bruchus piosrum,* N. Jalilvand, 6♀♀ & 2 ♂♂.

This is common species is widely distributed world widely. It parasitises various beetle species of the families Bruchidae, Dryophthoridae, Silvanidae and Tenebrionidae. It can be separated by combination of following characters: having two spurs, convex thorax, swollen lower face, emarginate clypeal margin.

Reppchen *et al.* (2001) believe *L. distinguendus* is a promising candidate for the biological control of *Sitophilus granarius* and other stored-product pest beetles. It is a generalist, solitary ectoparasitoid of larvae and pupae of at least 11 beetle species that develop mostly inside grains and seeds including the granary weevil *S. granarius,* one of the economically most important pests of stored grain. Based on the literatures this polyphagous species shows distinct preferences for older hosts in general and fertilized eggs are laid in host larvae older than 15 days. During parasitism, the female of *L. distinguendus* lays one egg beside the host into the grain. The female parasitoid is able to discriminate between healthy grains and grains infested by its host. Its commercial products are available for the biological control of stored product pests, especially of the granary weevil in some countries such as Germany. This potential natural enemy is able to significantly suppress the population growth of stored-product pest weevils and reduces 79-94% of *S. granarius* during a period of seven months. It is widely distributed in all of arctics (except Afrotropical region) (Noyes, 2012).

8- *Pteromalus* sp.

In the family Pteromalidae, the genus *Pteromalus* includes 502 species that have not a reliable identification key. The indetimined species was reported by Habibpour *et al.* (2002).

9- *Theocolax elegans* (Westwood)

Material examined: East-Azarbaijan province, Tabriz, 30.i.2010, ex *Oryzophilus surinamensis*, M. Balavar leg., 10♀♀. Mazandaran province, Babolsar, ex *Lasioderma serricorne*, N. Vakhideh, 10♀♀ & 7 ♂♂.

The genus *Theocolax* Westwood belongs to subfamily Cerocephalinae and has eight described species in the World (Noyes, 2012). *Theocolax elegans* is a cosmopolitan parasitoid of stored products and it was reported from south-west of Iran (Khuzestan province) (Habibpour *et al.*, 2002; Lotfalizadeh and Gharali, 2008). It was applied for biological control of pest species of families Anobiidae, Bostrichidae, Chrysomelidae, Curculionidae and Gelechiidae (Graham, 1969).

10- *Theocolax formiciformis* Westwood

This species has been reported by Assemi and Shojai (2004) from Mazandaran province as parasitoid of rice weevil (*Sitophilus oryzae*). *Theocolax formiciformis* is from the subfamily Cerocephalinae and known from Australia, Europe (Belgium, Czeck Repablic, Germany, Netherland, Poland, Russia, Sweden, UK) and Caucasus (Noyes, 2012).

CONCLUSION

Within reared parasitic wasps on storage pests in Iran, there are some different species comparing with previously reported hosts (see Table 2).

Table 2- Parasitoids of storage pests and their hosts in Iran and reported.

Parasitoids	Hosts in Iran	Known hosts
Anisopteromalus calandrae	Bruchidae *Bruchus piosrum* *Callosobruchus maculatus* Anobiidae *Lasioderma serricorne*	Anobiidae *Anobium* sp. *Catorama herbarium* *Lasioderma serricorne* *Stegobium paniceum* Bostrychidae *Rhizopertha dominica* Bruchidae *Acanthoscelides obtectus* *Bruchus chinensis* *B. obscurus* *B. pisorum* *B. quadrimaculatus* *B. rufimanus* *Callosobruchus analis* *C. chinensis* *C. maculatus* *C. phaseoli* *C. quadrimaculatus* *Zabrotes subfasciatus* Silvanidae *Oryzaephilus surinamensis* Tenebrionidae *Tribolium castaneum*
Bracon brevicornis	Pyralidae *Ephestia kuehniella*	Pyralidae *Ephestia kuehniella* *Galleria mellonella*

Bracon hebetor	**Pyralidae** ***Plodia interpunctella*** ***Ephestia kuehniella***	**Pyralidae** ***Ephestia elutella*** ***E. kuehniella*** ***Plodia interpunctella*** ***Galleria mellonella*** **Gelechiidae** ***Phthorimaea operculella*** **Tineidae** ***Tineola bisselliella***
Cephalonomia tarsalis	**Bruchidae** ***Callosobruchus maculatus*** **Silvanidae** ***Oryzophilus surinamensis***	
Dinarmus vagabundus	**Bruchidae** ***Callosobruchus maculatus*** ***C. chinensis*** ***C. analis***	**Bruchidae** ***Bruchus chinensis*** ***B. quadrimaculatus*** ***Callosobruchus analis*** ***C. chinensis*** ***C. maculatus***
Laelius anthrenivorus	**Dermestidae** ***Anthrenus* spp.**	**Dermestidae** ***Anihrenus muscorum*** ***A. verbasci***
Lariophagus distinguendus	**Bruchidae** ***Bruchus piosrum*** **Dryophthoridae** ***Sitophilus granarius*** **Silvanidae** ***Oryzophilus surinamensis*** **Tenebrionidae** ***Tribolium* sp.**	**Anobiidae** ***Lasioderma serricorne*** ***Stegobium paniceum*** **Bostrychidae** ***Rhizopertha dominica*** **Bruchidae** ***Bruchus brachialis*** ***Callosobruchus chinensis*** ***C. maculatus***
***Pteromalus* sp.**	**Bruchidae**	**Bruchidae** ***Bruchus brachialis*** ***Bruchus chinensis*** ***Bruchus lentis*** ***Callosobruchus maculatus***

Theocolax elegans	**Anobiidae** ***Lasioderma serricorne*** **Silvanidae** ***Oryzophilus surinamensis***	**Anobiidae** ***Lasioderma serricorne*** ***Stegobium paniceum*** **Bostrychidae** ***Rhizopertha dominica*** **Bruchidae** ***Acanthoscelides obtectus*** ***Bruchus quadrimaculatus*** ***Callosobruchus analis***
Theocolax formiciformis	**Dryophthoridae** ***Sitophilus oryzae***	**Anobiidae** ***Anobium domesticum*** ***A. punctatum*** ***A. striatum*** **Dryophthoridae** ***Calandra granaria***

Within these parasitoids, *A. calandrae* is a well known cosmopolitan parasitoid of Bruchidae (Coleoptera) associated with stored products in Iran that is widely distributed. This species were found in Kermanshah (Kangavar), Qzvin, North-Khorasan (Esfarayen), Mazandaran (Babolsar) and Sistan-Baluchestan (Sarbaz) provinces.

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AGRICULTURAL AND ENVIRONMENTAL CONCERNS ON AMBROSE IN BOSNIA AND HERZEGOVINA WITH PARTICULAR EMPHASIS ON THE SITUATION IN UNA-SANA CANTON

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ABSTRACT

Ambrose is an invasive weed species and causes on the one hand a serious problems that affects agriculture in different agroecosistems. On the other hand as a biological aeropolutant ragweed pollen, increasing number of health status of human population being one of the indicators of the quality of living. It could be stated that allergy is also one of the serious modern time environmental problems as it has a serious impact on the health of human population. Monitoring of ragweed pollen is a very important segment of the general monitoring of the environment. This monitoring study started in 2008 in Una-Sana Canton. Bearing in mind the above mentioned basic objective of this study was that the sensory representations of the dynamics of pollen given weed species during the for a period of four years.

Key Words: Ambrose, agricultural problems, ecological problem, monitoring

INTRODUCTION

Pollen grain of the *Ambrosia* genus, among others, is considered to be one of the major allergens to the modern humanbeing. One of the most significant species of this genus is American short ragweed (*Ambrosia artemisiifolia*) also known as: ambrosia, bitterweed, etc. It is considered a very problematic weed. In addition to the production of considerable amounts of pollen, it also belongs into the group of invasive weeds which replace native species and cause considerable damages to ecosystems (agricultural and urban). It is also highly plastic plant well adapted to unfavorable conditions, which makes it a dominant weed. It has high morphological variability, survival capacity and further reproduction under the conditions of strongest competition with other weeds. Ambrosia is a heliophil and thermophil species, a short day plant. It is an annual herbaceous plant whose vegetation period lasts 150-170 days. In our region ambrosia appears in mid April, begins to flower in late July and continues to flower until the first frosts.

An increasingly growing number of the world's population shows more or less pronounced reactions to pollen of various plants. One of every five inhabitants is allergic to plant pollen. Pollen grains cause allergic reactions in human population (bronchitis, conjunctivitis, dermatitis, hay fever). Share of allergic reaction to grass pollen amounts to about 20%, to tree pollen about 30%, while in case of ragweed pollen it amounts to as much as 50%. During the flowering phase, ragweed produces a large amount of pollen grains that are very tiny and with great aerodynamic properties. One plant can have a daily production of up to 2.5 billion pollen grains, which means that 250 pollen grains in 10,000 m^3 of air (Laaidi *et al.*, 2003).

In the European region, ragweed is most represented in Hungary, Croatia and partly in France; however, it is rapidly invading the areas of northern Italy, Switzerland, Austria, Czech, Slovakia, Bulgaria, Bosnia and Herzegovina, Serbia and Romania, Ucraine and European part of Russia, while in Bulgaria and Turkey it was registered only in 1995 (Makovcova *et al.*, 1998; Dahl *et al.*, 1999; Rybnicek *et al.*, *2000;* Laaidi *et al.*, 2003; Makra *et al.*, 2004; Peternel *et al.*, 2005; Byfield and Baytop, 1998). Spreading rate of ragweed averages 6-20 km per year, while major focal points of infestation in Europe concentrates in Bosnia and Herzegovina, Croatia, Serbia and Hungary (Trkulja *et al.*, 2010).

Ragweed is also present in the area of Una-Sana Canton where it spreads rapidly. In addition to normal measures for controlling ragweed, some legal steps were also undertaken. Citizens of the U-S Canton who own or use agricultural or construction land, pursuant to the F BiH Government's Decision on measures for preventing the spread and destroying ragweed are obliged to control and destroy ambrosia. First measuring of the concentration of ragweed pollen in the area of U-S Canton was started in Bihać in 2008.

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Ragweed as a serious problem in agricultural production

With regard to ruderal habitats, the highest abundance of this species is identified along the roads, railroads, construction sites, waste disposal sites, while in agricultural habitats it is most represented in wide-row crops as well as stubbles, though its presence is evident in almost all crops and plantations. It shows no preference for any specific type of soil, which proves it huge capacity for adaptation.

Due to its abundance ragweed causes severe damages to the production of soy-bean, maize, true cereals, medicinal plants, clover, as well as fruit plantations. In the area of Dubica during 2003, it destroyed soya crop on a total area of 20 ha and a plantation of peppermint on 4 ha, while in Kostajnica it destroyed chamomile on 5 ha (Mataruga, 2006). The same author states that ragweed can form an enormous number of plants per square meter – as many as – 4112 plants which was recorded in 2006. To summarize, according to Trkulja *et al.* (2010) damages to agriculture caused by ragweed are as follows: it mechanically kill (suffocate) crops; reduces yields of cultivated plants; causes deterioration of quality in cultivated crops; reduces quantity of water in soil; consumes and takes large quantities of nutrients from the soil; reduces soil temperature; makes soil cultivation more difficult; complicates implementation of various agrotechnical practices; increases the cost of agricultural production; indirectly conduces to the incidence of plant diseases; shortens the life cycle of some perennial crops; reduces the market value of soil infested by ragweed, etc.

Ragweed as a serious environmental problem for the human population

In many places around the world, common ragweed *(Ambrosia artemisiifolia)* poses a serious environmental issue to the allergic members of the human population. This invasive allergenic species releases huge quantities of pollen, where each plant can produce several million of pollen grains annually (Comtois, 1998; Jäger, 1998, 2000*).* Pollen grains of common ragweed *(Ambrosia artemisiifolia)* are considered a serious biological pollutant (aeroallergen) responsible for allergy conditions, in humans manifested as rhinitis, rhinoconjunctivitis and bronchial asthma (Dechamp and Meon, 2003; Gioulekas *et al.*, 2004; Trkulja *et al.*, 2010). Common ragweed as allergen assisted by favorable wind circulation being the abiotic environmental factor can spread through the environment at the speed reaching up to 300 km/h (Comtois, 1998; Deen *et al.*, 1998; Genton *et al.*, 2005) traveling distances from 10 to 100 kilometers. Unlike wind, heavy downpours drastically reduce concentration of airborne ragweed pollen (Makra *et al.*, 2004). Aeropollutants such as $S0_2$, $N0_2$ and CO_2 along with UV radiation induce an increased production of pollen grains of this aeroallergen.

Researches conducted by Wayne *et al.*, (2002) showed that a future increase of $C0_2$ level from 350 to 700 mmol/mol may result in the increase of ragweed pollen production by 60-90%. Additionally, researches by Ziska *et al.*, (2003) pertaining to the cities with specific climate being the heat and CO_2 emitters confirm the existence of temperature (1,8-2°C) and CO_2 gradients (30-31%) between rural and urban areas, indicating that those gradients have influence on increased growth rate, flowering and production of biomass and pollen in ragweed.

When viewed from the ecological aspect, health status of human population being one of the indicators of the quality of living, it could be stated that allergy is also one of the serious modern time environmental problems as it has a serious impact on it. One can predict with a certainty that due to global warming and air pollution the production of ragweed pollen will be twice as big, hence the number of people suffering from allergies is expected to be increasingly growing. Bearing in mind the above stated issues related to the agricultural and environmental aspects on global level, as well as the fact that *Ambrosia artemisiifolia* remains widely spread in the area of Una-Sana Canton, the primary objective of this paper was to make an analysis of the annual seasonal dynamics of common ragweed in this area, i.e. to analyze the monitoring of aeroallergenic ragweed pollen in the period 2008 – 2011. An additional objective was to point out the significance of this type of monitoring.

MATERIAL AND METHODS

Ragweed pollen sampling methodology as defined by the International Aerobiological Association – IAA was used. The Concentration of pollen was measured by standard Hirst's method (1952) using a specialized instrument. Sampling of aeroallergenic ragweed pollen was performed during the pollination

in the period of 2008 - 2011. Equipment used for research included a Hirst type pollen trap (sampler) - Burkard (Image 1.), placed in the town of Bihać, 15 meters above the ground, at the locality of „Borići". (Burkard Manufacturing Co., Uxbridge, Middlesex, UK). Pollen sampler operates as a pump that is calibrated to intake 10 liters of air per minute, i.e. 14.4 m^3 of air per day (10 liters x 60 min x 24 h = 14.4 m^3). Air is sucked in through an orifice that is always facing oncoming wind. During the passage of air through the orifice of pollen trap, pollen grains get fixated (glued) onto a strip whose size is 672 mm^2 (Image 2.) or a subject glass coated with silicon gel, whose movement rate is 2 mm/h.

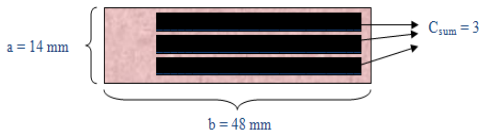

Image 1. Burkard type pollen sampler in Bihać *Image 2.) Layout of strip within pollen trap*

Counting and visual identification of ragweed pollen was performed using a light microscope at magnification of x400. After having established the count of pollen grains, relevant mathematical formulas were used to calculate the concentration of airborne pollen grains (pollen in m3 of air – p/m3).

For determining the concentration the following parameters were taken into account:

r – diameter of the microscope field, that is r = 0,5 mm;

Pt – area of strip (total area)

Csum – number of strips that are observed (three strips)

Po – area of the microscope field (observed area)

CF – correlation factor; CF = 9,3

$$P_{observed} = r * b * c_{sum} \qquad CF = \frac{P_t}{P_o}$$

X – concentration of airborne pollen grains (p/m^3)

$$X = \frac{CF * pollen\ grein}{14{,}4m^3}$$

The results obtained were interpreted by means of the so called „pollen traffic-light" scale (color-based rating scale) with a relevant percentage of individuals that are likely to develop allergy symptoms. (Table 1). Allergenic plants are classified into three types: trees, grasses and weeds. This classification is taken over from the American Academy of Allergy, Asthma and Immunology (AAAAI) and Pollen Rating Scale (PRS) - Forsyth County Environmental Affairs Department.

Table 1. Criteria for rating the concentration of airborne pollen

Level of pollen (color)	Count of pollen grains /m^3 of air			Occurrence of allergic reaction symptoms
	Trees	Grasses	Weeds	
Absent (white)	0	0	0	No symptoms
Low (green)	1-15	1-5	1-10	Only in extremely sensitive persons
Moderate (yellow)	16-90	6-20	11-50	In 50% of sensitive persons
High (red)	91-1500	21-200	51-500	In almost all allergic persons
Very high (purple)	> 1500	> 200	> 500	In all allergic persons

RESULTS

Results of monitoring the aeroallergenic ragweed pollen in the period from 2008 to 2011 in the area of the town of Bihać in the Una-Sana Canton are depicted in figure 1 thru. They show the seasonal dynamics, i.e. the beginning, course and ending of the pollination.

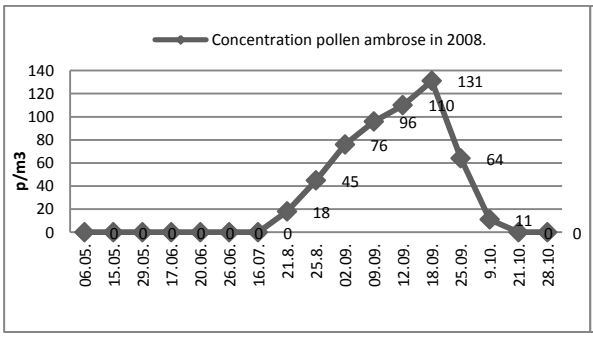

Figure 1. Concentration of ragweed pollen in 2008

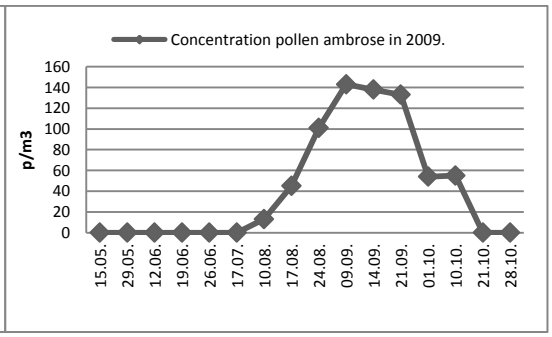

Figure 2. Concentration of ragweed pollen in 2009

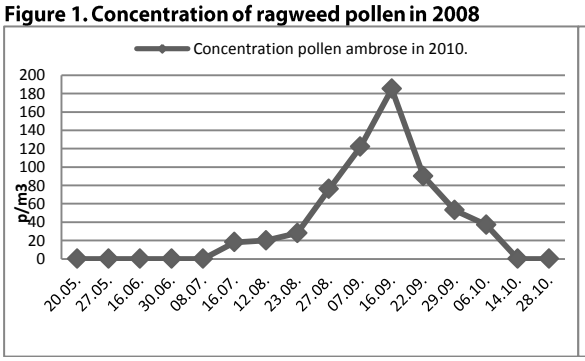

Figure 3. Concentration of ragweed pollen in 2010

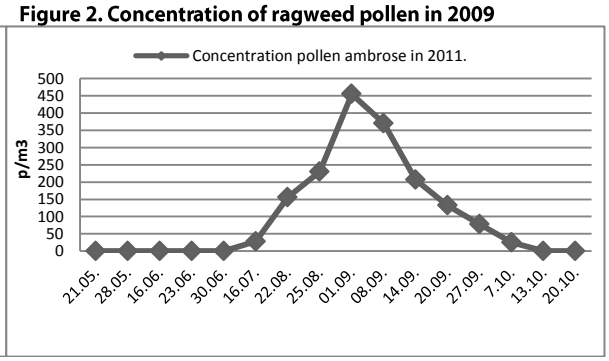

Figure 4. Concentration of ragweed pollen in 2011

Presence of ragweed pollen grains in the course of a four-year monitoring was recorded in the second half of July, August, September and first half of October. In other months no presence of ragweed pollen was recorded. High to very high concentration during the observed period were registered in the first half of September, from 130 grains/m³ (2008) to 450 grains/m³ (2011). At annual level, the maximal concentration of ragweed pollen grains was recorded in 2011 (455 p/m³), and the minimal was recorded in 2008 (131 p/m³) (Figure 5). Percentage share of various types of airborne pollen in the area of U-S Canton, i.e. town of Bihać, in the past two years is presented in Figure 6.

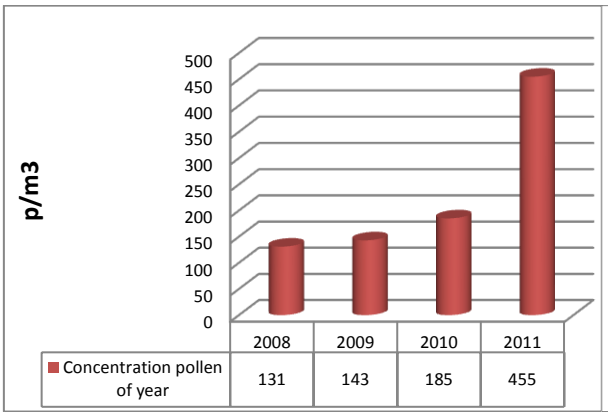

Figure 5. Concentration of ragweed pollen at annual level in the town of Bihać, U-S Canton

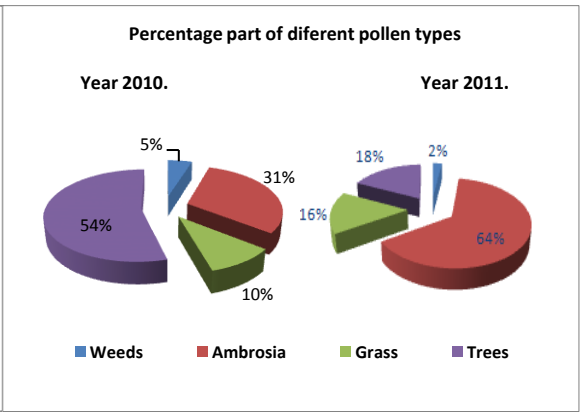

Figure 6. Percentage share of various types of pollen in the town of Bihać, U-S Canton

DISCUSSION AND CONCLUSION

During the study conducted for a period of four years, ragweed pollen grains were registered from the second half of July (moderate concentrations), throughout August (moderate to high) and September (very high concentrations), which corresponds with BiH climatic conditions during the ragweed flowering season.

In the area of U-S Canton high concentrations of pollen were recorded in late August and early September during the entire course of studied period, which proves that the ragweed pollen is most widely spread when the climatic conditions in our region are most favorable (high temperatures, low relative humidity, high atmospheric pressure).

In the area of U-S Canton, the year 2011 was characterized by drought and high temperatures, which helped ragweed pollen to spread in the environment, hence the records on highest concentrations in the four year monitoring period. Based on the monitoring and results of the ragweed pollen measurement that were obtained, a direct correlation can be established between the level of ragweed pollen and the suitability of abiotic environmental factors (climate).

Quality of living, among other things, depends on spreading of ragweed in the environment, as the number of people stricken by allergy condition in the U-S Canton constantly grows. Percentage of the ragweed share in the overall presence of different types of weed ranges between 30 and 60%.

Monitoring of ragweed pollen of importance since the impact of the pollens is significant socially, ecologically and medically for people who are sensitive to this type of allergen.

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PROPERTIES OF TWO SELECTED VINEYARD PEACH TYPES DESIGNED FOR FRESH CONSUMPTION

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ABSTRACT

This paper aims to show the results of the important properties of the two selected types of vineyard peach (XIX/4 and XIX/15) whose fruits are designed for the fresh consumption. Both types possess a round fruit shape, intermediate degree of skin pubescence and belong to a freestone peach type. In terms of other morphological properties (skin ground colour, skin blush colour, flesh colour and presence of redness around the stone) the studied types differ from each other. The XIX/15 type averagely ripened on 14th August and was characterised by a higher yield (65.8 kg/tree) in comparison with the XIX/4 type, which ripened on 29th August and achieved a yield of 36.5 kg/tree. The XIX/15 type had a greater average length, width, thickness and fruit weight (56.2 mm; 55.8 mm; 55.3 mm; 102.5 g) in comparison with the XIX/4 type (48.5 mm; 51.6 mm; 51.1 mm; 77.2 g). Regarding the chemical properties of the fruit there were no significant differences between the investigated types. The XIX/15 type showed significantly better appearance, taste and aroma, regarding the organoleptic assessment of the fruit, which resulted in a better total mark (29) in comparison with the XIX/4 type, which was given a total mark (27). Both selected types can be recommended for general production on the basis of their properties and can be recognized as new cultivars for the fresh consumption.

Key Words: Vineyard peach, selection, yield, fruit quality

INTRODUCTION

The population of vineyard peach in Serbia is very rich and polymorph. The seed from of a vineyard peach is used to produce generative rootstocks and fruits are used fresh or as a raw material for processing. A significant part of vineyard peach population has being destroyed due to expansion of cities and development of agriculture. Therefore, researching, collecting, storing and examination of the types of vineyard peach from the natural population is one of the important tasks in preserving the germplasm and creating new cultivars and rootstocks of peach.

Although the work on the selection of vineyard peach in Serbia is very intensive (Mišić et al., 1987, 1990; Vujanić-Varga et al., 1988, 1994; Paunović et al., 1992; Todorović et al., 1995; Papić et al., 1997; Milutinović et al., 2000; Zec, et al., 2000; Gašić et al., 2001; Rakonjac et al., 2005; Nikolić et al., 2005), there are no recognized cultivars and distinguished vineyard peach trees of different purposes.

A selection of vineyard peach types at the Faculty of Agriculture, University of Belgrade has been done for a long period in three directions. The first direction included isolating the types for the production of generative rootstocks (Rakonjac et al., 2005), the second comprised isolating the types for fresh consumption and the third included isolating the types for various kinds of processing (Nikolić et al., 2005). Within each of these directions, after an individual positive selection, a large number of genotypes, which are constantly examined, were collected.

In this study, two vineyard peach types chosen for fresh consumption (or market) were evaluated to their some fruit quality traits.

MATERIAL AND METHODS

As a researching material, two types of vineyard peach (XIX/4 and XIX/15) were used, whose fruits are designed for fresh consumption. These types were planted in the Experimental Station Radmilovac of the Faculty of Agriculture, University of Belgrade, after them selecting from the different regions of Serbia. The plantation was established in 1993, on a space 4 x 4 m. During the researching period, standard agro-technical measures applied in the plantation.

In the period from 2006 to 2008, major morphological, agro-biological and technological properties of thise types were studied. Fruit shape, skin pubescence, skin ground colour, skin blush, stone adherence

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and flesh colour were determined on the basis of descriptors for peach (Bellini et al., 1984). Presence of the redness around the stone was visually determined by the grade from 1 to 3 (1-absent, 2-in trace, 3-highly).

The ripening time was determined when the fruits reach the best quality for the consumption. The yield was established by measuring the mass of all fruits from the tree. Fruit length, fruit width, fruit thickness, fruit and stone weight were measured based on 30 samples collected during the full ripeness. Randman, the share of flesh weight in the total fruit weight was determined by calculation.

Soluble solids content was determined by the manual refractometer and the total and invert sugar content was determined by the Somogyi-Nelson's Method (Somogyi, 1952). The total acid content was determined by titration with 0.1N NaOH.

Organoleptic evaluation of the investigated fruit types was shown on the scale from 1 to 10 based on the evaluation of 3 tasters.

RESULTS AND DISCUSSION

The results in Table 1 show that all the examined types were different in four out of seven examined morphological fruit traits, while there are no determined differences for the other three traits between the examined types.

Table 1. Morphological, agro-biological and technological properties of vineyard peach types

Property	Type XIX/4	Type XIX/15
Fruit shape	rounded	rounded
Skin pubescence	intermediate	intermediate
Skin ground colour	yellow	cream
Skin blush	partly red	medium red
Stone adherence	freestone	freestone
Flesh colour	yellow	white-cream
Redness around stone	highly	in trace
Ripening time	29.08.	14.08.
Yield (kg/tree)	36.5	65.8
Fruit length (mm)	48.5	56.2
Fruit width (mm)	51.6	55.8
Fruit thickness (mm)	51.1	55.3
Fruit weight (g)	77.2	102.5
Stone weight (g)	5.83	6.27
Randman (%)	92.45	93.88
Soluble solid (%)	13.98	14.31
Total sugar (%)	8.26	8.39
Invert sugar (%)	3.54	3.80
Total acid (%)	0.57	0.52
Appearance	9	10
Taste	9	10
Aroma	9	9
Total organoleptic mark	27	29

Both types have a round fruit shape and intermediate skin pubescence. Skin ground colour of the XIX/4 type is yellow and XIX/15 type is cream colour. Regarding the additional skin blush type XIX/4 has partially present redness and type XIX/15 medium redness presence (Figure 1). Quantified, 70% (XIX/4 type) to 95% (XIX/15 type) of the fruit surface is colored with dark red stripes over an orange yellow

background. Both types belong to freestone peach type. The type XIX/4 has a yellow flesh colour and the type XIX/15 white-cream colour. Redness presence around the stone at XIX/4 is highly visible, while it at XIX/15 is in traces.

The type XIX/15 had an average ripening time on 14th August and had a bigger yield (65.8 kg/tree) from the type XIX/4, which ripened on 29th August and had 36.5 kg/tree yield. The type XIX/15 had an average bigger length, width, thickness and fruit weight (56.2 mm; 55.8 mm; 55.3 mm; 102.5 g respectively) from the type XIX/4 (48.5 mm; 51.6 mm; 51.1 mm; 77.2 g). The stone weight and randman were also bigger at the XIX/15 type (6.27 g; 93.88%) than at XIX/4 type (5.83 g; 92.45%). As it can be seen, both types had a satisfying randman (over 92%), which makes them suitable for fresh consumption.

Figure 1. Fruits XIX/4 type (left) and XIX/15 type (right).

Beside the above mentioned traits, it should be taken care during the selection of vineyard peach to the chemical content of the fruit. It can be seen from the Table 1 that regarding the chemical traits of the fruit (soluble solids, total sugar, invert sugar and total acid) there were no significant differences between the examined types. Soluble solids content was from 13.98% (type XIX/4) to 14.31% (type XIX/15). Total and invert sugar content was bigger at XIX/15 type (8.39%; 3.80%) than at XIX/4 type (8.26%; 3.54%). On the other hand, total acid content was bigger at XIX/4 type (0.57%) than at XIX/15 type (0.52%).

Vineyard peach fruits are characterized by the specific taste and aroma, which makes them unique within peach germplasm. In order to better define fruit quality, besides determining soluble solids content, sugar and acid, it is important to grade organoleptic fruit traits. Data in the Table 1 show that XIX/15 type had considerably better appearance, taste and aroma, which resulted in a higher total grade (29) regarding organoleptic evaluation than XIX/4 type, which had a total mark of (27).

Suitability of vineyard peach types for fresh consumption was studied by other authors. Vujanić-Varga et al. (1988) say that during the selection of trees for fresh consumption except for health condition and buoyancy, special care should be taken as regards largeness of fruit, a good randman, attractive appearance and characteristic taste and aroma. Studying the population of vineyard peach in Fruška Gora, Vujanić-Varga and Ognjanov (1990) isolated 14 types whose fruit are capable for fresh consumption and which are characterized by vigour to medium vigour tree, high yield and fruit weight between 66 g and 92 g. Milutinović et al. (1994), based on the weight, fruit appearance and favourable randman, isolated three selections of vineyard peach suitable for fresh consumption and Todorović et al. (1995) isolated four selections of vineyard peach, with combined traits, capable for fresh consumption and processing.

CONCLUSION

These studied types of vineyard peach (XIX/4 and XIX/15), designed for fresh consumption showed a lot of similarities, as well as certain differences regarding the examined traits.

As regards yield and major pomological traits, XIX/15 type is the best, although the XIX/4 type does not lag far behind concerning the stated aims of selection.

Both chosen types, based on their traits, can be recommended for mass production and eventual recognition as new fresh consumption cultivars.

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A REVIEW ON ASTER YELLOWS PHYTOPLASMA OF VEGETABLES

Nilay ÖZDEMİR[1]

ABSTRACT

The aster yellows phytoplasma (formerly a mycoplasma like organism or MLO), is a single-celled prokaryotic microorganism, lacking a cell wall, capable of inciting disease in over 300 plant species. Aster yellows phytoplasmas which are pathogenic to cabbage, carrot, onion, celery, lettuce, strawberry etc., are non-culturable prokaryotes of the Mollicutes. The disease spread throughout the regions and caused severe losses of yield. It is vectored by the aster leafhopper (*Macrosteles quadrilineatus*). Aster yellows symptoms include proliferation, alteration of tissue pigments (red, orange, yellow, and purple), phyllody, and reduced palatability in food crops. Once a plant is infected, there is no curative treatment. Symptoms of aster yellows often mimic other diseases or chemical damage making identification difficult. This anthology contains aster yellows phytoplasma diseases on vegetables, symptoms and struggle methods.

Key Words: Aster yellows phytoplasma, Vegetables, Symptoms, Struggle Methods

INTRODUCTION

Aster yellows is a disease caused by a mycoplasma-like organism which attacks a wide range of plants. Symptoms are variable and can include phyllody, virescence, chlorosis, stunting, and sterility of flowers. Plants may be stunted or with numerous secondary shoots. Foliage is yellow and seeds are usually sterile. Plants have an upright habit of growth. Affected leaves are somewhat narrower than healthy leaves. Old leaves may develop a slightly reddish, brownish, or purplish tinge in the late stages. The main branches will be shortened. Flower parts may develop into leafy structures. Aster yellows affects over 300 different species that represent more than 40 families of plants. The aster leafhopper vector, *Macrosteles quadrilineatus*, moves the aster yellows phytoplasma from plant to plant. There are a range of characteristic symptoms which vary with the phytoplasma strain, timing of infection, plant species, temperature, age, and/or size of the plant. They include vein clearing until the entire leaf becomes chlorotic, stunting, deformation, virescence (greening of flowers), phyllody (development of leaf-like flower petals), reddening of foliage, reduced root system, and sterility. Aster yellows do not typically kill perennial host plants. Aster yellows phytoplasmas are prokaryotes lacking a cell wall and responsible for numerous plant diseases all over the world (McCoy *et al.*, 1989). Detection and identification of phytoplasmas were for a long time based on their biological characteristics and related diseases because it has not been possible to isolate and study the phytoplasmas in pure culture (Lee *et al.*, 2000). PCR-RFLP and sequence analysis of the PCR-amplified 16S rRNA gene, the ribosomal protein gene and the elongation factor TU (*tuf* gene) have become essential tools for the molecular identification, characterization and classification of phytoplasmas. This kind of analysis provides at least a provisional classification scheme for phytoplasmas (Lee *et al.*, 1998; Jomantiene *et al.*, 2002). Based on 16S rDNA RFLP patterns, 15 main phytoplasma groups (putative species) and at least 40 subgroups have been described (Lee *et al.*, 1998; Montano *et al.*, 2001) that largely match phytoplasma subclades delineated by phylogenetic analysis of full-length or nearly full-length sequences of 16SrDNA (Lee *et al.*, 1998; Marcone *et al.*, 2000). The occurrence of two ribosomal gene sets in the phytoplasma genome has been demonstrated (Seemüller et.al., 1994; Oshima *et al.*, 2004), and small differences have been found between the sequences and RFLP patterns, which have been taken into account in some cases for classification at the subgroup level (Lee *et al.*, 1993; Liefting *et al.*,1996; Marcone *et al.*, 2000). The 16SrI aster yellows phytoplasma group, widely distributed and with more than 100 isolates studied, has been separated into at least six well-defined subgroups according to RFLP patterns and nucleotide sequence of the 16S rDNA (Jomantiene *et al.*, 1998; Lee *et al.*, 1998).

DISEASE CYCLE

The Aster yellows disease is caused by the aster yellows phytoplasma (AYP) which is a phloem-limited, procaryotic organism and is vectored by the aster leafhopper, *Macrosteles quadrilineatus*, a phloem-

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feeding insect of the order Hemiptera. The vector leafhopper feeds on the phloem of aster yellows infected plants by inserting their straw-like mouthpart, a stylet, into the cell and extracting it. Once the phytoplasma is acquired, an incubation period follows in which it multiplies within the leafhopper and then moves to the salivary glands. At this point, the phytoplasma can be transmitted to a new host through the saliva as the leafhopper feeds. Within 8–24 hours after inoculation, the phytoplasma moves out of the leaf into the host plant phloem. Cells adjacent to the phloem enlarge and die while surviving cells begin to divide, but soon die too. Infected plants usually show symptoms after 8–9 days at 25 °C and 18 days at 20 °C, with no symptoms developing at 10 °C (Agrios, 2005).

HOSTS AND SYMPTOMS OF ASTER YELLOWS ON VEGETABLES

Aster yellows affect a long list of plant species including native plants, ornamentals, weeds, and cultured crops. Many horticultural crops such as cabbage, carrot, onion, celery, lettuce, strawberry etc., are affected with the latter suffering from the greatest losses.

Cabbage

The diseased cabbages show shorter and thicker leaves and a long thick shoot. The leaves grow outward from the apex, not forming a cabbage head. Infection occurring after the formation of the cabbage head results in early flowering. Polymerase chain reaction (PCR) using the P1/P7 universal phytoplasma primer pair showed the cabbage to be infected with phytoplasmas (Fodor et.al., 1999) (Fig 1).

Figure 1. Aster Yellows Symptoms On Cabbage

Lettuce

In lettuce, the head leaves fail to fully develop and they have pink to tan spots. Infected plants may fail to head. It is characterized by a yellowing and curling of the youngest leaves. At heading time, heart leaves remain dwarfed and curled and heads remain soft. The mycoplasma overwinters in many perennial weeds and is spread to lettuce by leafhoppers during their feeding activities (Jiang and Chen, 1987) (Fig 2).

Figure 2. Aster Yellows Symptoms on Lettuce

Carrot

In carrots, the tops become yellow, stunted, and bunchy. Many small rootlets are on the carrot. The first symptom of aster yellows is yellowing of the foliage ,followed by excessive growth and bunching of shoots. Older leaves become twisted and may fall off. Leaves later have a bronzed appearance. Roots are misshapen, and are of poor quality with a proliferation of adventitious roots. This organism is

transmitted by leafhoppers. weeds in and surrounding the crop can serve as a reservoir for this pathogen. The disease usually occurs sporadically with little economic loss (Agrios, 2005) (Fig 3).

Figure 3. Aster Yellows Symptoms on Carrot

Potato

Small, purple, terminal leaves and auxiliary tubers develop on potato plants. Potato plants exhibit symptoms of yellowing or purpling of apical leaves, with the top leaves rolling inward and aerial tubers formation (Cheng et.al., 2011) (Fig. 4).

Figure 4. Aster Yellows Symptoms on Potato

Onion and Garlic

Onion leaves are twisted, yellow, more numerous and dwarfed. Symptoms include a yellowing of the leaves and reduced leaf size which leads to reduced plant size and lower yields. In the diseased garlic plants, symptoms included formation of elongated hollow stems terminating in proliferated, silky, round heads. At maturity (end of the season), each head was discolored with greenish brown edges and contained no seeds. The infected green onion plants were stunted. The leaves showed severe yellowing and the bulbs were reduced in size. Healthy plants showed vigorous growth, produced large bulbs and were free from the above-mentioned symptoms (Khadhair et.al., 2002, Oshima et.al., 2001) (Fig 5).

Figure 5. Aster Yellows Symptoms on Onion

Celery

Infected plants are characteristicaly light green or yellow in colour and show elongated, twisted, and intertwined leaves. The first symptom of the disease is a yellowing of the veins of the youngest leaves. Usually the yellowing is followed by an elongation and upright growth of the leaves. Diseased plants are often taller than adjacent healthy plants. As the disease progresses the plants become yellow and dwarfed. The petioles lose the upright position, become brittle and frequently crack. This often results in secondary disease organisms invading the plant and causing a heart lot. In some plants aster yellows virus causes a severe stunting of the leaves which results in an open flattened dwarfed plant (Freitag et.al., 1959) (Fig 6).

Figure 6. Aster Yellows Symptoms On Celery Leaves

Strawberry

Green foliaceous growth (phylloidy) may be produced from the achenes and the petals may be virescent. These symptoms may appear on one or several fruit per plant in a field, then not develop on subsequent fruit. Older leaves on severely infected plants may develop a red to purple discoloration and young leaves may be small with short petioles. A stunting of the plant often occurs with the older leafs turning purple-reddish in color and the newly emerging leaves are small with bright yellow margins. Ultimately the stunted plant will wilt and die. Although some small normal shaped fruit may be produced, the characteristic symptom is a type of phylloidy where a few fruit are produced with receptacles that resemble broccoli florets. A proliferation of branch crowns are produced along with numerous small leaves with spindly petioles. These plants are typically stunted and have a dense bush-like appearance, although infected plants may occasionally attain normal size. (Andersen et.al., 1998) (Fig 7).

Figure 7. Aster Yellows Symptoms on Strawberry

CONTROL MEASURES OF ASTER YELLOWS PHYTOPLASMAS

Aster yellows is difficult to control because of the number and diversity of plants attacked and because of the lifelong infectiousness of a very efficient insect vector.

1. Where possible, eradicate all susceptible overwintering hosts in and around crop and ornamental plantings and destroy infected plants as soon as they appear.

2. Do not plant a susceptible crop next to a yellows-infected crop.

3. Spray susceptible plants with an insecticide suggested to control the aster leafhopper. Spraying before removing infected crop plants is important.

4. Weed hosts growing near crops in fields, fence rows, ditch banks, and roadways should be destroyed or should be sprayed early and repeatedly with insecticide to help prevent the spread of disease from these reservoirs.

5. Fast-growing crops such as lettuce or valuable crops such as asters and chrysanthemums should be grown under a cloth screen (22 threads to the inch) or wire screening (18 threads to the inch).

6. In small plantings, placing aluminum foil strips as a mulch between the rows is thought to increase control because leafhoppers are disoriented by bright light from below.

7. In small plantings, removing the first infected plants may slow the spread of the disease.

8. There are no resistant or immune crop varieties available up to now.

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LUCAS – LAND USE/LAND COVER AREA FRAME STATISTICAL SURVEY – IMPORTANCE AND DEVELOPMENT IN BOSNIA AND HERZEGOVINA

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ABSTRACT

At a European level the statistical series arising from GIS LUCAS work aims to provide comparable and harmonized statistical information on land cover and land use in the EU to meet the data needs of the Commission, the European Environmental Agency (EEA) and others, by setting up an integrated system for land cover/use statistics in Europe. In preparation for future policy orientation including EU Common Agriculture Policy (CAP) 2014-2020, the European Commission has been intensifying the specification and development of environmental and agri-environmental indicators. Although not originally organized for this purpose the GIS LUCAS methodology and system is now recognized as a key element in helping sectors prepare and manage the environmental and agri-environmental data collection using synoptic analysis and field visits. GIS LUCAS is becoming a multi-functional platform and not one just limited to the original LUCAS and frame sampling concept on land use and crop areas and production.

In this paper the concept of LUCAS system is presented as well as its importance in defining and assessing the EU CAP. When it comes to activities in Bosnia and Herzegovina, the methodological approach based on LUCAS (Project BiH AIS) is presented. This approach is used for the preparation of following data: Agriculture Land Cover data, Total Agriculture Area, Total area under specific crops and Total production of main crops and yield. Results are shown for pilot municipalities. The importance of developing of such system in Bosnia and Herzegovina in the context of EU accession is discussed.

Key Words: (Geographic Information System) GIS, LUCAS, land cover and land use, Common Agricultural Policy (CAP), accession to the European Union.

INTRODUCTION

Land cover and land use are of high importance in the definition and evaluation of common agricultural and environment policies.

To support policy formulation, Eurostat launched - in close co-operation with the Directorate General responsible for Agriculture - the pilot project "Land Use/Cover Area Frame Statistical Survey" – LUCAS. LUCAS that was launched as a pilot in 2001 was initially developed to deliver, on a yearly basis, European crop estimates for the European Commission. With time, the survey has become essential in providing policymakers and statisticians alike with increasing amounts of data on different forms of land use and environment in Europe and proved to be a useful tool in the area of environmental monitoring. Eurostat is carrying out the LUCAS survey in the EU member states every three years. The LUCAS 2012 survey covers all 27 EU countries. The field work will be carried out by September 2012 (Eurostat, 2012). The repeating surveys every three years gives an overview of the dynamic of changes and trend in development both in the field of land use/cover changes as well as environmental changes. The results of these surveys are of great importance for efficient planning of the future CAP 2014 - 2020 and environmental policy at the EU level.

However this survey model is very useful not just for small scale surveys on the EU level but it can be efficiently adopted also for bigger scales on the level of separate countries, where the collected data gives more detailed overview of the environmental and agricultural situation for the country, which is the case only in few EU member states (France, Italy, etc.), while the other countries uses different approach such as list-frame and using data from various registers. However it is an important tool for the countries where no accurate data exists or where is no reliable data from the registers and other statistically sound reliable sources.

The overall objectives of the LUCAS project are:

• developing a standard survey methodology in terms of the sampling plan, nomenclature, data collection process and statistical estimators to obtain harmonized and unbiased estimates at EU level of the main land use/cover areas and changes;

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• collecting information on agricultural land cover and land use within an acceptable time-lag and providing estimates of crop areas;

• offering a common sampling base (frame, drawing procedure, scheme) that Member States can use to obtain representative data at national/regional level by increasing the sampling rate while respecting the general LUCAS approach;

• testing the suitability of the survey for collecting data on environment, multi-purpose land use, landscape and sustainable development (Martino, Fritz 2008).

The main statistical variables collected in the LUCAS survey are: Land Cover, Land Use and Landscape indicators.

The LUCAS survey is based on an area-frame sampling scheme. Area frame surveys are common approaches to gather land cover and land use data. In contrast to mapping approaches, (e.g. the CORINE Land Cover project) area frame sampling is a statistical approach (EUROSTAT 2000). Systematic area frame sampling has been chosen as sampling design method because LUCAS should provide multi-purpose information on an annual basis and therefore needs to cover all the territory of the EU Member States (3.240.190 km^2) and not only the agricultural area (Delincé 2000, Avikainen et al. 2001). The two concepts (land cover and land use) are clearly distinguished in the nomenclature of the LUCAS survey. This distinction is particularly worthwhile and allows also the analysis of the interactions between the two (cover and use).

The advantage of LUCAS statistical survey is mainly because it is fast and relatively non expensive, excluding the time consuming and rather complicated methodology preparation phase. Another advantage of these surveys is that the statistical error can be controlled and preset based on actual needs on data quality. The collected sample data can be of higher quality in contrast to full data collection where due to large surveys usually higher error in data accuracy is expected.

LUCAS is fast becoming a multi-purpose platform with land cover and use data as its core activity. Flexible modules dealing with more specific themes, such as soil and biodiversity, would increasingly be integrated into the survey (Kasanko, 2012). In the 2009 and 2012 surveys, a specific soil module has been integrated in order to provide statistics and indicators for the European Soil Data Centre (ESDAC) hosted by the Joint Research Centre (JRC) of the Commission. This could be a starting point for harmonized European monitoring of soil parameters for a whole range of statistical, research and policy purposes (European Commission, 2012). In addition, it provides the statistical information needed for the implementation of indicators to monitor the integration of environmental concerns into the CAP. The survey provides the possibility of monitoring and quantifying changes in land cover, land use and landscape structure over time (JRC, 2002).

Reliable statistical data on agriculture is not available in BiH with most of it being based on subjective estimations using methods suited more to previous farming and administrative structures of the country. There is little comparability between old and new data and there are large gaps in the agriculture time series with the last agriculture census being completed in 1961. The reasons for this lack of reliable data are numerous but include the disruption caused by the war and changing the administrative structure (Počivavšek, 2011).

Some of these data needs can be overcome by conducting a full GIS Area Frame Sample Survey (AFSS) using the methodology produced by the IPA project "Strengthening and Harmonization of the BiH agriculture and rural sectors Information System" (BIH AIS). The technique for the AFSS is similar to that used in LUCAS which was designed for much larger survey to cover all the countries in the EU. The project has used a similar approach with some adaptations to make it more efficient for country level sampling and to get BiH estimates of crop production of the main crops and corresponding areas.

MATERIALS AND METHODS

The methodology applied in BiH is divided into two main parts. The first part is defining a suitable sample using GIS techniques and statistical methods and the second part is a field survey for data collection. It has to be noted that full AFSS approach was implemented in three municipalities: Capljina, Sanski Most and Gradiska. The sample size in pilot areas was only to test the methodology and not to produce statistically sound data. The whole system is designed to be based on WEB GIS application and GIS database where all the data is stored.

First step in the methodological approach is to define area of interest (AOI) in BiH. The AOI represents the main agricultural areas in BiH, which is about 2.64 million hectares in size as is quite close to current statistics from the agricultural yearly reports. The mask for Area of Interest (AOI) was formed to exclude non-agricultural land and thus minimize the number of points which have to be surveyed. With this approach forests and other non-agricultural areas have been excluded resulting in a reduction in the number of points by 50%. The AOI was given a buffer of 50 m into the forest edge, to make sure not to miss any of the agriculture areas on the forest edge because of different quality of data sources and errors of photo interpretation.

Second step related to the sampling was consisted of three phases: defining a master sample on the regular grid of 500 m (reference grid), photo-interpretation of points (stratification) and field sample selection (systematic stratified).

The reference grid – proposed as the multipurpose Pan-European standard – is based on the ETRS89 Lambert Azimuthal Equal Area coordinate reference system with the centre of the projection at the point 52 N, 10 E and false northing: Y0 = 3210000 m, false easting: X0 = 4321000 m (CRS identifier in INSPIRE: ETRS89-LAEA). The grid is designated as Grid_ETRS89-LAEA. In this case it is regular grid a of 500 m distance between each point in ETRS 89 in LAEA projection. The grid consists of 205.157 points equally spread over the whole territory of BiH. The Area of Interest where forests and bare land are excluded consists of 105.943 points over the whole territory of BiH. The photo-interpretation process was done by using Very High Resolution (VHR) satellite imagery (SPOT) of the recent years available for the BiH. The results of photo-interpretation are used for stratification of points into nine different strata. Required strata are arable land, permanent crops and grassland. For the field sub-sample, non-agricultural strata was excluded from the sample. Different sampling rates are applied to the agricultural strata to arrive at the total field sample. It is proposed to include also areas which are agriculture but are not being used for some time and might turn into overgrown if they will not be used in the near future. The main purpose for this is to identify all the potential agricultural areas which can be back in production if using proper agricultural policy. The second phase was stratified systematic sampling. This produced sub sample of points for filed survey. This step should be carried out as a systematic sampling within the required strata. For systematic stratified sampling, the standard error is represented by

$$Std\ err\left(\hat{Z}\right) \cong b\,D\sqrt{\frac{p(1-p)}{n}}$$

where D = the region area (in this case the agricultural area in the AOI), p = the crop proportion, n = number of points in sample. Based on this, it is possible to calculate the accuracy of the area estimates - coefficient of variance (CV).

There were two separate field surveys: land cover or crop survey and yield survey. The qualification of surveyors is of crucial importance for the quality of the results. Surveyors need skills in crop recognition and agriculture in general but also in using the supporting tools (maps, ortho photos, compass or GPS) (Bettio, Delincé at all, 2002).

RESULTS AND DISCUSSION

The reference grid for BiH that was created consists of 205.157 points equally spread over the whole territory of BiH.

Table 1. Number of points in the established reference grid for BiH and pilot municipalities

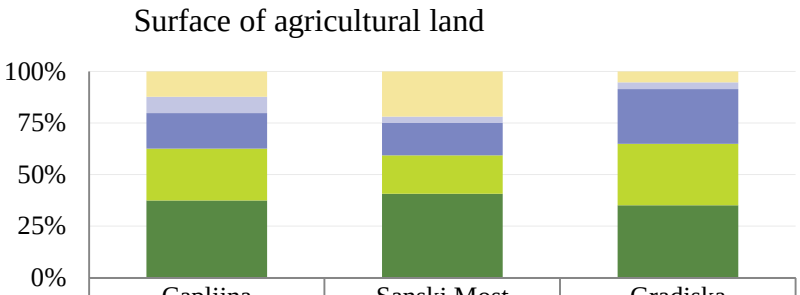
Grid	Number of points	
500 m regular reference grid (whole BiH)	205.157	
500 m AOI (main agricultural and potential agricultural areas)	105.958	
Municipalities	AIO (ha)	Number of points
Capljina	15.509	617
Sanski Most	52.144	2.084
Gradiska	60.452	2.415

Crucial in the sampling surveys is the total number of sampling units selected for observation. The sampling size determines the required precision of the estimated characteristic of the statistical population (Bettio, Delincé at all, 2002). In case of BiH, it is proposed to use a 40% sampling rate for arable land and permanent crops, whereas a 20% sampling rate for grassland should be sufficient. The size of the field sample is in close relation to the size of the total area (whole population), the size of the crops and accuracy to be achieved. The main issue is to reduce the sample size to the minimum required to achieve sufficiently accurate results. But for most of the minor crops it is not possible to get sufficiently accurate results, which is the main disadvantage of the statistical approach. When designing the sample there is a strong impact of available budget that needs to be taken into account, meaning that if more budget available better results can be achieved, having a larger sample which should produce smaller error and include data for phenomenon that is in minority (Počivavšek, 2011).

The experience from the pilot areas showed that too many points were selected from the grassland strata and as such arable land and permanent crops were not representative enough. This led us into decision that grassland should be assigned a smaller percentage and increases the percentage of arable land and permanent crops. Also it needs to be pointed out that many of the grass land were interpreted as arable land due to doubt during photo-interpretation, lack of experience in photo interpretation or low image quality which causes higher percentage of grassland being visited during the field work. However, results from the Pilot field survey show that 57% of points interpreted as arable land or permanent crops were confirmed in the field; a further 23% were found to be grassland in the field (this figure includes temporary uncultivated land) and 14% were woodland or shrubland. Only 26% of points interpreted as grassland were confirmed in the field; 15% were cropland and 54% were woodland or shrubland.

Table 2. CAPI and field survey results

All pilot areas		Field survey results									
		A-Artificial land	B-Cropland	B-Permanent crop	C-Woodland	D-Shrubland	E-Grassland	F-Bareland	G-Water	H-Wetland	TOTAL
CAPI results	A-Artificial land	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%
	B-Cropland	6%	51%	5%	7%	8%	23%	0%	0%	0%	100%
	B-Permanent crop	0%	25%	54%	0%	8%	13%	0%	0%	0%	100%
	C-Woodland	7%	3%	3%	87%	0%	0%	0%	0%	0%	100%
	D-Shrubland	0%	0%	0%	50%	50%	0%	0%	0%	0%	100%
	E-Grassland	3%	13%	2%	29%	26%	26%	1%	0%	0%	100%
	TOTAL	5%	36%	5%	16%	14%	23%	0%	0%	0%	100%



	Capljina	Sanski Most	Gradiska
Grassland	1380	8434	5219
Permanent crops	903	1144	3178
Cropland	1939	6021	25741
Arable land	2842	7166	28919
All agricultural land	4221	15600	34139

Figure 1. Surface of agricultural land

Regarding the standard error, the table below shows that, for example, in Capljina the area of a crop covering 50% of the agricultural area would be estimated with 9% accuracy, for Sanski Most the accuracy would be 4%.

Table 3. Coefficient of variance

Pilot area	Agricultural area (in AOI from CAPI) (ha)	Sample size	Crop area (% of agricultural area)	Coefficient of variance (%)
Capljina	9.700	100	50%	9%
			25%	15%
Sanski Most	36.200	400	50%	4%
			25%	7%
Gradiska	43.200	500	50%	4%
			25%	7%
All 3 pilot areas	89.100	1.000	50%	3%
			25%	5%

CONCLUSIONS

LUCAS is currently the only in-situ land cover and land use collection with a harmonized nomenclature over the whole EU territory. It is not a mapping exercise but is based on statistical calculations. It gives reliable results on area entities (with the currently applied sample density on regional level and higher) (Martino, Fritz 2008).

Area frame surveys are designed for specific purposes and are commonly used in agricultural statistics as known by FAO (1996, 1998), Cotter & Nealon (1987). There are several advantages of area frame sampling. Due to the fact that only parts of the territory are observed, data can be gathered at a very detailed level and results can be extrapolated to larger reference zones. Moreover, execution of area frame sampling is relatively simple. Compared to exhaustive mapping approaches, sample surveys provide rapid results, thus enabling periodic (annual or seasonal) surveys. In addition, accuracy estimates are possible, which judge reliability and efficiency (Bettio, Delincé at all, 2002).

As BiH is concerned, it is crucial to have reliable data for approaching the agricultural funds, for planning the agricultural support schemes, for assisting negotiations for different funds and for designing efficient agricultural policies. Some of these data needs can be overcome by conducting a full GIS sample survey using the methodology produced by the AIS project.

The pilot results showed critical situation in the three municipalities, showing that the actual utilized agricultural areas are different from the official statistics and that lot of potential agricultural areas are being abandoned and overgrown. However, to be able to get proper estimate of utilized agriculture areas and yields for the whole BiH it is urgent to run the survey in whole territory of BiH.

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PHYTOCHEMICALS FROM THE FRUITS *OF Zosima absinthifolia*, AN EDIBLE AND MEDICINAL PLANT

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ABSTRACT

Zosima absinthifolia **(Vent) Link (Apiaceae) is a perrenial herb distributed in Iran, Turkey, Iraq and different countries of Caucasia. The plant fruits are used as food flavoring and as food spice in Turkey and Iran. In the present work, the essential oil of the plant fruits was distillated using a Clevenger type apparatus. The chemical composition of the obtained oil was analyzed by GC-MS. Twenty four compounds were characterized in the oil. The major components of the oil were octyl acetate (87.48%) and octyl octanoate (5.03%). On the other hand, n-hexane extract of the plant fruits, obtained using a soxhlet apparatus, was fractionated by VlC on silica gel starting with 100% n-hex*ane* followed with step gradient of EtOAc–n-hexane mixtures. The fractions 30% EtOAC was purified to yield a known furanocoumarijn, imperatorin, using Preparative TLC. The fraction 40% EtOAC was subjected to preparative TLC to afford two known coumarins, 7-prenyloxy coumarin and aurapten, as well as. The isolated compound structures were elucidated by UV, ^{1}H and ^{13}C NMR data. It can be concluded that fruits of *Zosima absinthifolia* contain various bioactive chemicals that make it potent to have different pharmacological and biological activities.**

Key Words: ***Zosima absinthifolia*** **, aurapten, imperatorin, 7-prenyloxy coumarin**

INTRODUCTION

In the flora of Iran, genus Zosima (Apiaceae) consist of 6 biennial or perennial herbs that distributed in different parts of Iran. *Zosima absinthifolia* (Vent) Link is the well-known species of the genus, that is indigenous to Iran, Turkey, Iraq and different countries of Caucasia, Middle East and Central Asia. The plant has grooved pubescent stems that reach up to 1m in high. This widespread plant have tripinnate leaves, 10-25 rayed umbels, greenish to pale yellow flowers and elliptic to obovate fruits with tumid margin (Davis, 1972). *Zosima absinthifolia,* beside *Heracleum* species, commonly known as Golpar in Iran where crushed fruits of the plant has been used as a food flavoring agent and a food spice. Due to edible potential and nutritional value of the plant fruits, In the present study, we focosed on chemicals of *Zosima absinthifolia* fruits.

MATERIAL AND METHODS

A. Essential oil investigation

Isolation of essential oil

Dried fruits of *Z. absinthifolia* were distilled for 3h using a Clevenger-type apparatus. The obtained essential oil was dried using anhydrous sodium sulfate and then stored at 5◦C until tested.

Essential oil Analysis

GC/MS analysis was carried out on a Thermoquest-Finnigan Trace GC/MS instrument equipped with a DB-5 fused silica column (60 m × 0.25 mm i.d., film thickness 0.25 µm). The oven temperature was raised from 60°C to 250°C at a rate of 4 °C/min and held for 10 min; transfer line temperature was 250°C. Helium was used as the carrier gas at a flow rate of 1.1 ml/min with a split ratio equal to 1/50. The quadrupole mass spectrometer was scanned over the 35-465 amu with an ionizing voltage of 70 eV and an ionization current of 150 µA.

GC-FID analyses of the oil were conducted using a Thermoquest-Finnigan instrument equipped with a DB-5 fused silica column (60 m × 0.25 mm i.d., film thickness 0.25 µm). Nitrogen was used as the carrier gas at the constant flow of 1.1 ml/min, the split ratio same to GC/MS. The oven temperature was raised from 60°C to 250°C at a rate of 4°C/min and held for 10 min. The injector and detector (FID) temperatures were kept at 250°C and 280°C, respectively. Semi-quantitative data was obtained from FID area percentages without the use of correction factors.

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Identification of essential oil components

Retention indices were calculated by using retention times of n-alkanes (C6-C24) that were injected after the oil at the same temperature and conditions. Compounds were identified by comparison of their retention indices (RI) with those reported in the literatures (Adams, 2007) and their mass spectrum with the Wiley library (Wiley 7.0).

B. Isolation and identification of secondary metabolites

Dried and powdered seeds of *Z. absinthifolia* (150 g) were soxhlet extracted successively, with n-hexane, dichloromethane and methanol. Hexane extract (4g) were subjected to VLC fractionation on silica gel starting with 100% n-he*xane* followed with step gradient of EtOAc–n-hexane mixtures (1:99 ; 5: 95 ; 10:99 ; 20:80 ; 40:60 ; 60:40 ; 80:20 ; 100) and finally MeOH . Fractions 30 and 40% EtOAc were purified by preparative silica TLC using $(CH_3)_2CO$ - $CHCl_3$, 3:97 and 4:96 as the mobile phase, respectively. Fraction 30% EtOAC was purified to yield compounds 1 (25.2 mg, R_f 0.64, blue fluorescence). Fraction 40% EtOAC was purified to yield compound 2 (14.3 mg, R_f 0.68, olive fluorescent) and compound 3 (6 mg. R_f 0.75, blue flurescent).

The compounds were identified by comparing their UV, ^1H NMR and ^{13}C NMR data with those of published data. UV spectra were obtained using a Hewlett-packavd 8 435 UV/Vis spectrophotometer in methanol. NMR spectra were recorded in $CDCl_3$ on a DRX-500 Avance instrument 500MHz for ^1H and 125MHz for ^{13}C) using the residual solvent peak (δ 3.31 ppm) as internal standard

RESULTS

By hydrodistillation, the dried fruits of *Z. absinthifolia* yield 2.4% (V/W) of a colorless essential oil with a characteristic odor. The results obtained by GC-MS analysis of the oil are presented in Table1. Twenty-four components were identified in the fruits of *Z. Absinthifolia* essential oil. The main component of the essential oil was octyl acetate (87.48%). The other characteristic compounds were determined as: octyl octanoate (5.03%), 1- octanol (2.37%), hexyl hexanoate (1.52%) and octanoic acid (1.1%) (Table1). The main compounds class of the oil were as: esters (94.93%), alcohols (2.91%) and fatty acids (1.11%).

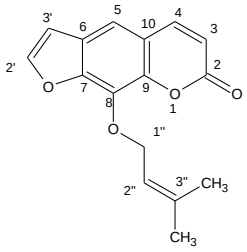
Table1. Chemical composition of the essential oils of fruits of Zosima absinthifolia (Vent) Link.

No	Compounds	%	RI	Rt
1	alpha-pinene	0.07	937	9
2	camphene	0.02	953	9.4
3	hexanoic acid	0.01	968	9.76
4	sabinene	0.01	975	9.94
5	2,3-dehydro-1,8-cineole	0.02	992	10.36
6	octanal	0.61	997	10.49
7	hexyl acetate	0.02	1005	10.7
8	p-cymene	0.04	1024	11.24
9	limonene	0.05	1030	11.39
10	1,8-cineole	0.2	1033	11.49
11	phenyl acetealdehyde	0.01	1040	11.67
12	1-octanol	2.37	1065	12.38
13	octanoice acid	1.1	1182	15.69
14	Z-3-octene-1-ol	0.54	1191	15.94
15	octyl acetate	87.48	1212	16.52
16	bornyl acetate	0.37	1287	18.61
17	octyl propionate	0.07	1294	18.8
18	citronellyl acetate	0.03	1345	20.16
19	octhyl butanoate	0.13	1380	21.11
20	decyl acetate	0.12	1400	21.63
21	octyl 2- methyl butyrate	0.16	1425	22.31
22	beta-caryophyllene	0.02	1430	22.44
23	hexyl hexanoate	1.52	1572	26.1
24	octyl octanoate	5.03	1771	30.8

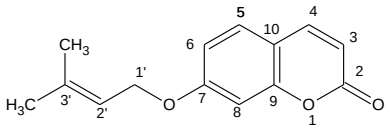
Rt = observed retention time

RI = observed retention indices

Our phytochemical analyses of the n-hexane extract of the seeds of *Z. absinthifolia* afforded a linear furanocoumarin imperatorin (Harkar et al., 1984) and two simple coumarins, 7-prenyloxy coumarin (Bohlmann et al., 1968) and auraptene (Karyone and Matsuno, 1953). The structure of the purified comounds was elucidated by direct comparison of their respective UV, ^{1}H and ^{13}C NMR data with published data (Figure1). The unambiguous assignment of all ^{1}H and ^{13}C NMR signals for these compounds has been presented in Table 2 and Table3, respectively.



(1)



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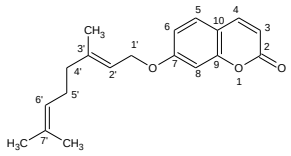

(3)

Figure1. Structures of imperatorin (1), (2) 7-prenyloxy coumarin and auraptene (3).

Table2 ^{1}H NMR data of compounds 1-3 (coupling constant J in Hz in parantheses

	Chemical shift (δ) in ppm		
Position	1	2	3
3	6.28 d (9.4)	6.32 d (9.8)	6.39 d (9.7)
4	7.67 d (9.4)	8.17 d (9.4)	7.80 d (9.7)
5	6.85 S	7.30 d (8.4)	7.66 d (8.3)
6	-	6.86 d (8.4)	7.06 d (8.3)
8	-	7.03 S	7.65 S
1'	-	5.04 brd (6.7)	4.61 brd (6.7,13.3)
2'	6.87 d (2.3)	5.65 t (6.7,13.3)	5.51 t (6.7,13.3)
3'	6.89 d (2.3)	-	-
3'×2Me	-	1.76 s 1.78 s	1.88 s
4'	-		3.80 m
5'	-	-	4.88 m
6'	-	-	5.17 t
7'×2Me	-	-	1.81 s 1.85 s
1"	4.61 brd (6.3)	-	-
2"	5.51 t (6.3,13.6)	-	-
3"' ×2Me	1.80 S 1.85 S	-	-

Table3. ^{13} *C NMR data of compounds*

	Chemical shift (δ) in ppm		
Position	1	2	3
2	160.5	160.9	160.9
3	113.3	113.5	112.9
4	143.9	145.2	144.7
5	113.6	126.2	130.9
6	129.1		114.1
7	161.7	150.4	151.1
8	139.7	94.2	104.7
9	156.2	147.0	155.5
10	119.0	113.2	113.3
1'	-	70.5	65.8
2'	148.5	120.2	120.1
	101.9	139.8	145.5
3'			
3'×2Me	-	25.9 S	18.5 S
		26.9 S	
4'	-	-	39.1
5'	-	-	28.2
6'	-	-	123.2
7'	-	-	131.5
7'×2Me	-	-	18.5 S
			25.9 S
1"	65.8	-	-
2"	112.8	-	-
3"	131.5	-	-
3"×2Me	18.7	-	-
	26.2		

DISCUSSION

The comparison of our results with literature showed some qualitative and quantitative differences in composition of the oil of *Z. absinthifolia* fruits collected from Turkey with our samples. Octyl acetate that was dominant in our samples (87.48%), was found in Turkish samples in low amounts (38.40%). While octyl hexanoate with 31.9% was considered as a characteristic compound in Turkish samples, it was absent in our samples (Baser et al., 2000). The differences can be sufficient to allow the distinction of different chemotypes, are the results of an adaptive process to particular ecological conditions.

It is also interesting to note that oil components class of *Z. absinthifolia* fruits is differ from common essential oils. Terpens that often comprise main portion of essential oils of various plants, were detected in the essential oil in low amount (less than 1%).

A survey of literature showed that imperatorin occur in many genera of family Apiaceae such as *Angelica, Prangos, Heracleum, Peucedanum* and *Glehnia* (Buckingham, 2005). Auraptene was isolated from some genera of Rutaceae like *Citrus* and ocurrance of it within family Apiaceae is restricted to few genera. 7- prenyloxy coumarin as well as occur in some members of Apiaceae such as *Heracleum dissectum, Peucedanum stenocorpum, Seseli linbonatus* and *Angelica ursina* (Buckingham, 2005). To our knowledge, this is the first ^{1}H and ^{13}C NMR reports on occurance of imperatorin, auraptene and 7-prenyloxycoumarin in the genus *Zosima*.

Previous papers reported occurrence of angylon and O- angeloyl in some *Zosima* species such as *Z. korovinii* and *Z. absinthifolia* (Sklyar et al., 1982).

It was mentioned in literature that species of *Zosima* genus are very allied to *Heracleum* species in morphotaxonomical characters (Davis, 1972).

Our finding together with those of Sklyer et al. (1982) demonstrated that there is a considerable similarity between *Zosima* and *Heracleum* species in phytochemical constituents as well as morphological characters (Khetwal and Pathak, 1986; Liu et al., 1998 ; Niu et al., 2002).

CONCLUSION

It can be concluded that fruits of *Zosima absinthifolia* contain various bioactive chemicals that make it potent to have different pharmacological and biological activities.

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EXAMINATION OF MINERALS IN SOME SPICE AND MEDICINAL PLANT SPECIES

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ABSTRACT

There is a tradition of using spices and medicinal plant species in preparing food. Through their nutritional values importance of minerals is emphasized during recent years.In this study, some spice and medicinal plant species in the useable form in which they are commonly found in sales, are examined: cumin seed - *Carum carvi* L., sesame seed - *Sesamum indicum*, ground oregano - *Origanum vulgare* L, dry sage - *Salvia officinalis* L., dry thyme - *Thymus serpyllum* and dry dill, *Anethum graveolens* L., for the presence of: magnesium (Mg), phosphorus (P), potassium (K), manganese (Mn), iron (Fe), copper (Cu) , zinc (Zn) and selenium (Se).

Results show that in all tested samples mostly detected is potassium (K) and the least detected is selenium.

Compared with USDA nutritional values provided (National Nutrient Database for Standard Reference), cumin seed has more phosphorus for 4.79%, manganese for 11.29%, copper for 124% and selenium for 0.03%, and in sesame seeds are more potassium 233.58%. The ground oregano has more magnesium for 11.25% and potassium for 49%, dry thyme has potassium for 42.43% and manganese for 46.71% and selenium for 0.02%. In the dry dill are present all examined minerals in higher values in relation to the prescribed value.

Key Words: Minerals, spice, medicinal plants, values, USDA.

INTRODUCTION

Herbs had a major role in nutrition, households and cosmetics as well as a basic form of medicinal treatment for centuries.

Recently, there is growing interest for the production and collection of medicinal and aromatic plants. It's certainly not a random event at the present time when the man with the gradual development of environmental consciousness wants to return to the nature, to preserve health, protect the nature of various pollutants, and to be protected as the ultimate consumer of such products. In addition to energetic materials (fats and sugars), proteins and vitamins, the organism needs on a daily basis, also mineral substances. Those are in composition of tissue fluid and cells, and also are building blocks which perform the role of biocatalysts, which are conditioned by many vital processes. Minerals that form part of the body are divided into: minerals that are found in large quantities in the body (phosphorus and sulfur) - macro elements and minerals that are found in small quantities in the body - a trace elements.

Minerals are substances needed for building cells and body parts, to build enzymes and hormones, and for the proper performance of the overall matter traffic. Requirements are relatively small for these substances, but without them humans could not live. Regular and sufficient supply of minerals are provided by plant food (vegetables, fruits) as well as medicinal and aromatic plants. By higher quantities of minerals and trace elements, some medicinal plants operate and improve the condition of the body caused by the absence of these substances and thus conditioned by disturbances in metabolism. By preparation of extracts, minerals and trace elements partially pass into solution and thus significantly are involved in healing activity. Some herbs are important sources of minerals.

The mineral content in plants are affected by plant species, and soil type on which the plant grows, geographical origin, used fertilizer in cultivation and some other factors.

As part of our interest, we considered very important and of a priority, to investigate the presence of minerals in herb and medicinal products offered on a market. Even more, because these researches and results available to consumers in B&H are lacking, and through scientific approach and valid results significant guidance in the selection of quality foods would be gained.

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MATERIALS AND METHODS

In this study, spice and medicinal plant species in the usable form in which is commonly found in sales (dry) were examined: Cumin in seed - *Carum carvi L.*, sesame seed - *Sesamum indicum*, ground oregano - *Origanum vulgare L*, dry sage - *Salvia officinalis L.*, dried thyme - *Thymus serpyllum* and dried dill, *Anethum graveolens L.*, for the presence of: magnesium (Mg), phosphorus (P), potassium (K), manganese (Mn), iron (Fe), copper (Cu), zinc (Zn) and selenium (Se).Analyses were performed in laboratories at the Federal Institute for Agriculture in Sarajevo, using the following instruments and equipment:

- Induced coupled plasma with mass spectrometry, ICP-MS 7700, Agilent Technologies
- Microwave oven for digestion, MDS-8, Sineo

Bearing in mind the nature of the analyzed materials, prescribed validated methods by the manufacturer of instruments for sample preparation and reading, were used. The used chemicals were:

- Nitric acid 65% (Suprapur), Merck
- Hydrogen peroxide 30% (Suprapur), Merck
- 30% hydrochloric acid (Suprapur), Merck
- Multi element Calibration Standard 2A, Agilent
- Multi element Calibration Standard 4, Agilent
- ICP-MS Internal Standard Mix, Agilent
- Ultra-pure water.

Sample preparation was performed in a microwave oven for digestion. Microwave sample preparation technology is widely used in modern laboratories worldwide, due to their high speed, high efficiency, with the necessary characteristics related to protection of the environment, etc. Without using this technology, sample preparation is the "bottleneck" of analysis.

Microwave digestion involves rapid heating by direct absorption of microwave energy. This technology applies the closed digestion vessels to achieve high temperature and high pressure. It is possible to achieve high values of the reaction and improve the decomposition of the sample, which represents the ideal effect of digestion.

The presence of elements in samples is read on the ICP-MS (induced coupled plasma mass spectrometry). The development of modern analytical instruments, ICP-MS, ICP-AES has significantly improved the speed and accuracy of detection.

The results obtained in these trials are shown as detected content expressed in mg/100 g dry matter and compared with USDA provided nutritional values (National Nutrient Database for Standard Reference).

RESULTS AND DISCUSSION

The tendencies of the world legislation are based on the improvement of informing consumers about the nutritional properties of products. Consumers need information about recommended servings (serving size), the energy value (calories), as well as chemical composition and quantity of certain nutritive substances in the product such as proteins, carbohydrates, and fat contents of some micronutrients (minerals).

Minerals are inorganic substances. Occurs naturally in soil and water, and hence falls into the plant organism. Many minerals are essential substances, ie substances which belong to the human (and animal) organism must be entered by the food or drink from outside. Entered by the food and drinks arrive into the human body in much larger amounts than vitamins. Some of them belong to the group of heavy metals whose presence in food is limited to the content that pose no threat to human health.

According to current knowledge, the ability of the accumulation of minerals differs in certain plant species, and the highest affinity for these elements show vegetables. Most intensively accumulation in plants achieve: zinc, boron, molybdenum, cobalt, to a lesser extent manganese, iron, aluminum, and the least copper, lead and chromium. The elements that are intensively trans- located are: manganese, cadmium, boron, molybdenum and selenium, medium are: nickel, cobalt, copper, and slowly are: chromium, lead and mercury.

There are many literature data about medicinal and aromatic plants which are covered by the tests in this paper (Cumin in seed - *Carum carvi L.*, sesame seed - *Sesamum indicum*, ground oregano - *Origanum vulgare L*, dry sage - *Salvia officinalis L.*, dried thyme - *Thymus serpyllum* and dried dill, *Anethum graveolens L.*), but such studies are rare in B&H related to listed plant species and the presence of: magnesium (Mg), phosphorus (P), potassium (K), manganese (Mn), iron (Fe), copper (Cu), zinc (Zn) and selenium (Se), in quantitative terms.

This can be regarded as a consequence of the status of medicinal and spice plants and sorting products from these raw materials into teas, spices or herbal remedies that are produced in the pharmaceutical industry. These products have been stressed out as the value of beverage or their medicinal properties.

The most common sources of information about the contents of individual minerals are related to the general indication of their greater or lesser presence in certain plant species (Turner, 2009) and usually emphasize their use value.

Cumin is used as a spice and medicinal plant species. They are used as whole or ground seeds in cooking and for the elimination of some health problems. Regarding the nutritional composition, specifically are highlighted contents of calcium, manganese, phosphorus, potassium and sodium. Cumin seeds have always been used to treat various indications in traditional treatments in many areas of the world (Johri, 2011).

Sesame contains three very important elements, magnesium, calcium and copper. In only 50g of sesame is enough of these minerals to satisfy daily needs. Some research of content elements provide information on the quantities of potassium (851.35 ± 3.44 mg/100 g) Who has the most, and then in descending order of phosphorus (647.25 ± 3.52 mg/100 g), magnesium (579.53 ± 0.42 mg/100 g), calcium (415.38 ± 3.14 mg/100 g) and sodium (122.50 ± 4.21 mg/100 g) (Nzikou, 2010).

Oregano is the dried plant that is grown successfully because of natural populations are rare and unavailable (it's growing on high areas and mountain regions). The oregano is most frequently cited figure of considerable amounts of vitamin C in fresh plant (60 mg / kg) (Grlić, 1986). Lticeanu et.al. (2008) suggests that the oregano leaves, contain the highest content of: K (1970.35 mg/100 g FW), Ca (562.36 mg/100 FW) and Ba (129.68 mg/100 g FW), while Mg, Al and Na are in traces.

Sage contains the most of vitamin A, potassium, calcium, iron and manganese. They are used as fresh and dried leaves and flowers. According to the European Medicines Agency (2009) sage leaves are collected in Gdansk in Poland are very rich in iron (885 ppm) and magnesium (4.1 g / kg), potassium (14.9 g / kg) and calcium (10.1 g / kg).

Thyme is a spice herb with penetrating aroma and strong flavor. It is an excellent source of minerals, iron, manganese and calcium, and vitamin K and dietary fiber. Research of *Thymus serpyllum* in Jordan (Abu Darwish, 2009). Have resulted in indicators of content of copper (7.66 ppm), manganese (44.0 ppm) and iron (756.17 ppm).

As part of our research, the results of detection of minerals in the analyzed products of spices and medicinal plant species indicate the presence of elements in significant quantities (Table 1). There are differences depending on the individual plant species and quantity of elements expressed in mg/100 g of plant material.

Most magnesium is found in a sample of Sage (395.13 mg/100 g) and least in sesame seed (145.34 mg/100g).

Table 1. Readings results of elements in parts of the spice and medicinal plant species in mg/100g

Elements	Cumin in seed	Sesame in seed	Oregano-ground	Sage -dried	Thyme-dried	Dill -dried
Magnesium (Mg)	263.00	145.34	387.34	395.13	198.48	366.43
Phosphorus (P)	522.91	0.29	249.51	82.77	106.68	259.45
Potassium (K)	1.559.29	233.58	2.269.04	796.11	1.159.42	2.048.59
Manganese (Mn)	3.67	0.84	4.98	1.74	11.59	5.14
Iron (Fe)	9.62	3.04	72.86	9.51	44.07	14.08
Copper (Cu)	1.24	0.91	0.86	0.64	0.37	0.89
Zinc (Zn)	3.18	2.97	2.17	3.18	2.76	3.44
Selenium (Se)	0.003	0.02	0.02	0.01	0.02	0.01

Phosphorus content was lowest in the sesame seeds and is 0.29 mg/100 g, while most of this mineral is contained in Cumin seed (522.91 mg/100g).

Potassium-rich are all tested product samples of spice and medicinal plant species, as indicated by high values detected. This is the least contained in the sesame seed (233.58 mg/100g), followed by dry sage (796.11 mg/100 g) and thyme (1159.42 mg/100 g), cumin seeds (1559.29 mg/100g) and a maximum in dried dill (2048.59 mg/100 g) and ground oregano (2269.04 mg/100 g).

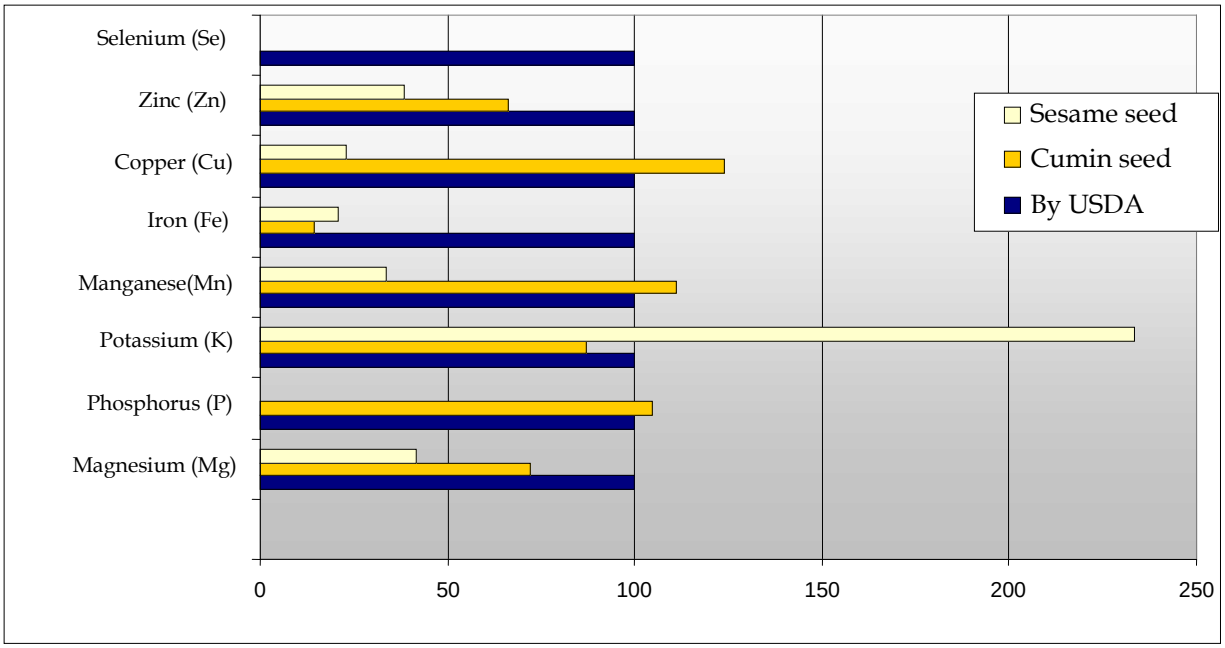
Manganese is the highest in thyme sample (11.59 mg/100g), iron in grind oregano (72.86 mg/100 g), copper in the cumin seeds (1.21 mg/100 g), and zinc in the dry dill (3.44 mg/100 g).

Selenium is present in minimum quantities in relation to all other studied elements, and the detected values are ranging from 0.003 mg/100 g in the cumin seeds to 0.02 mg/100 g as determined in sesame seeds, oregano, and thyme.

With the aim to put the results in some of the prescribed framework (our legislation does not include similar guidance), information about the content of certain trace elements by type of spices and herbs seem to be acceptable (which is made with USDA provided nutritional values (National Nutrient Database for standard Reference, Release 16 July 2003). These data included all examined plant species, except for sage which could not be calculated in percentages compared with the USDA.

Comparing the values of detected elements in the analyzed samples with USDA standards for individual plant species, obtained data are expressed in percentages of greater or lesser presence.

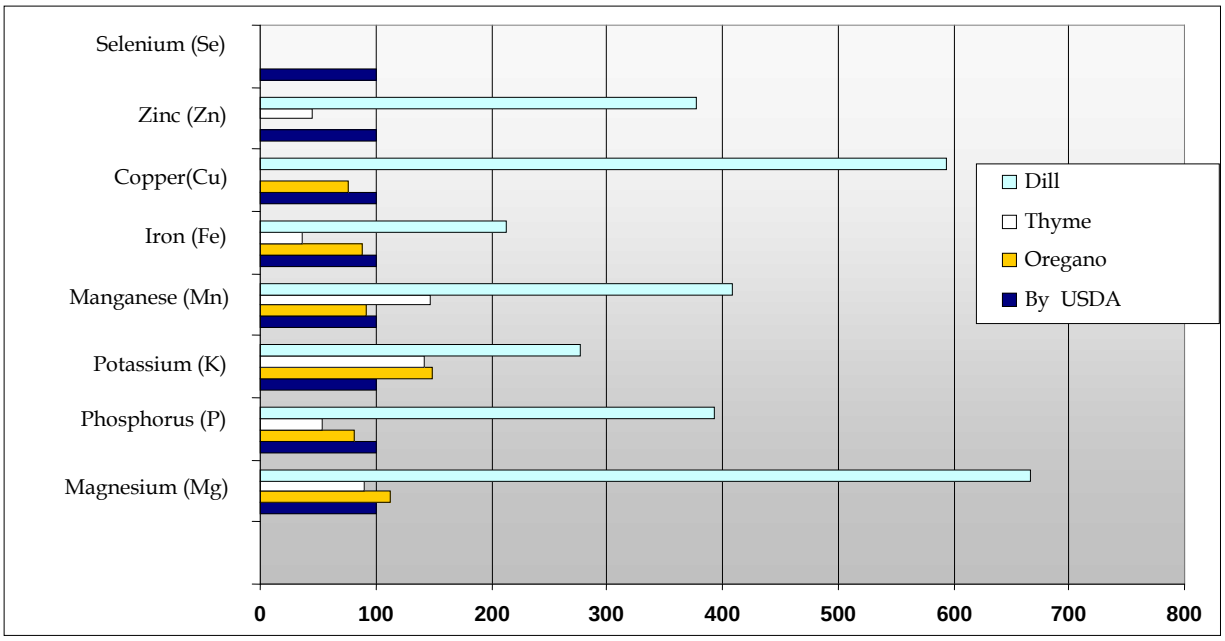
If you look at the results of the presence of certain minerals in the sesame seeds and cumin, and compare it with the prescribed quantities by the USDA, it can be seen that in some analyzed samples are marked differences. In relation to the prescribed content for trustworthy plant species by the USDA, the amount of selenium detected in samples of cumin seeds are 0.003%, and in sesame seeds 0.35% (Chart 1). In the analyzed sesame seeds there is less zinc, copper, iron, manganese and magnesium, especially phosphorus (only 0.05%), while the detected amounts of potassium are even higher (233.58%) than prescribed by USDA.



Graph 1: The values of minerals in the sesame and cumin seeds in comparison with the USDA standards

The quantities of copper, manganese and phosphorus detected in samples of cumin seeds are larger than prescribed, except selenium and zinc are lower (containing 66.25% compared to the USDA), iron (14.49%) and potassium (87.21%).

Minor amounts of selenium were detected in samples of dill (0.01%), thyme (0.02%) and oregano (0.44%), zinc in oregano (0.10%), and copper in thyme (graph 2).Except for selenium content, only in dill samples were detected higher amounts of all other minerals in relation to the prescribed amount and in significantly larger proportions: Magnesium 666.24%, phosphorus 393.11%, potassium, 277.59%, manganese 407.94%, iron 213.67%, copper 593.33% and zinc 378.02%.



Graph 2: The values of minerals in dry dill, thyme and oregano compared with the USDA

In the analyzed samples of thyme, copper (0.37%) is not detected in significant amounts, while the highest amount was of manganese (146.71% compared with the USDA standards) and potassium (142.43%).

With a low content of selenium, in samples of oregano zinc was the least (0.10%), the highest was potassium (149.0%). With potassium, in oregano was detected magnesium (111.95%) in the major content than the standard.

Although the performed examinations, significant information about the contents of trace elements in some medicinal and aromatic plant species was obtained, it would be necessary to examine the possible influence of external factors as well as the contents of elements in the form in which are consumed as foods.

CONCLUSIONS

The obtained research data of content of magnesium (Mg), phosphorus (P), potassium (K), manganese (Mn), iron (Fe), copper (Cu), zinc (Zn) and selenium (Se) in the cumin seeds - *Carum carvi L.,* sesame seed - *Sesamum indicum,* ground oregano - *Origanum vulgare L,* dry sage - *Salvia officinalis L.,* thyme - *Thymus serpyllum* and dill- *Anethum graveolens L,* indicate that the analyzed samples:

- **Contain the most potassium, with a minimum of minerals in the sample of sesame seed (233.58 mg/100g), followed by dry sage (796.11 mg/100 g) and thyme (1159.42 mg/100 g), cumin seed (1559.29 mg/100 g), and highest in the dry dill (2048.59 mg/100 g) and ground oregano (2269.04 mg/100 g).**
- **Most of magnesium is found in a sample of Sage (395.13 mg/100 g) and least in sesame seed (145.34 mg/100g).**
- **Phosphorus content was lowest in the sesame seeds and was 0.29 mg/100 g, while most of this mineral is contained in cumin seed (522.91 mg/100g).**
- **Manganese is the highest in thyme (11.59 mg/100g), iron in grind oregano (72.86 mg/100 g), copper in the cumin seeds (1.24 mg/100 g), and zinc in the dry dill (3.44 mg/100 g).**
- **Selenium is present in minor quantities in relation to all other studied elements, and the detected values ranging from 0.003 mg/100 g of cumin seeds to 0.02 mg/100 g as determined in sesame, oregano and thyme.**

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INVESTIGATING BARRIERS TO LAND CONSOLIDATION IN ARDABIL COUNTY OF IRAN

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ABSTRACT

Land and the size of it, is one of the most important factors of production in agriculture. In farming systems with small operation units due to the lack of effective use of technology and modern facilities, the size is the limiting factor in to agricultural productivity and production efficiency which will not be able to meet the sufficient food requirement of the society. One of the main obstacles of agricultural development of Ardabil county is thatagricultural lands are scattered and small. This leads to increasing of costs, reducing of efficiency and wasting of agricultural inputs. The aim of this descriptive- survey study is to investigating and prioritizing barriers to the integration of agricultural land operation systems in two selected rural areas of Ardabil county, namely Barugh and Garjan (N= 500) usingAnalytica Hierarchical Process (AHP) and expert choice software.A sample of 250 landowners was selected for data gathering. Results showed that social and structural factors were the main barriers to implementation of land consolidation project, cultural and economic factors were placed the next priorities.

Key Words: Land consolidation, fragmentation, parcels, AHP, Ardabil.

INTRODUCTION

Since land reform of 1960's,the smallness and fragmentation has been the main feature of agriculturallandsin Iran. This feature is one of the structural problems for agricultural development.According to(Shirzad, 1996), low productivity, high production costs, inefficient use of farm machineries, conflicts among farmers, declining social solidarity in rural areas and thereby, rural poverty and migrations asunderdevelopment indicators all are related to fragmentation of property parcels. In order to solve this problem land consolidationprograms have recommended by specialists, decision makers and agricultural development authorities.

Land consolidation is a planned readjustment and rearrangement of land parcels and their ownership which applied to form larger and more rational land holdings. It does not meanthe simple reallocation of parcels to remove effects of fragmentation. According to (Lambert, 1963), land consolidation had already been concluded in Western Europe. In reality, it has been associated with broader social and economic reforms from the time of its earliest applications in Western Europe. For example, the first consolidation initiatives of Denmark in the 1750's were part of a profound social reform to free people from obligations to noble landlords by establishing privately-owned family farms. The consolidation of fragmented holdings did result in improved agricultural productivity but this was not the only objective of these reforms(FAO, 2002). The present type of landconsolidation process was adopted in Europe in the late 19th century and early20th century (Vitiikainen, 2004).

The objectives of land consolidation vary in different countries. However, the primary objective for land consolidation is the improvement of fragmented property division and the enhancement of land use and sustainable development although it may also include tendencies towards enhancing various regionaldevelopment projects(Vitiikainen, 2004). In Iran, land consolidation has defined as a type of land reform which aims to replace small and fragmented parcels of landholdings to give each farmer one relatively large plot of land rather than scattered, small parcels of land (Turkamani, et al, 1998). Furthermore,these projects includeprovisions such as irrigation and drainage infrastructure to improve water management, construction of rural roads, land leveling, soil improvement measures.

As consolidation is entirely voluntary, all participants must agree fully with the proposed project. Due to the lack of appropriate and explicit legislation to provide a legal basis for the projects,voluntary consolidations tend to be smallin Iran and take place semi- voluntary and sporadic. However, the government can play a significant role in accelerating land consolidation projects by financial and technical support, training and encouraging target farmers(Amini, 2007).

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A number of conditions should be in place before a land consolidation project can be undertaken. Stakeholders should be willing to participate actively in the decision-making process of a project. The process should be demand-driven and a project site must be identified where local citizens and community authorities are interested in land consolidation (FAO, 2002). This study aimed to identify and prioritize problems of land consolidation project in Ardabil region using farmers' viewpoints to find feasible solutions.

Factors affecting the distribution of agricultural lands

Different factors affect scattering of agricultural lands units. These factors are divided into four main groups, namely: Cultural, Economical,Social,and Structural factors.

1) Cultural Factors:

- Adherence to traditional beliefs of farmers to maintain the existing structure, opposition to the plan beneficiary or lack of informing as one of the inhibiting factors in the integration plan is studied.
- Literacy level: Knowledge and understanding of the benefits of the project plan is one of the factors in the recognition and acceptance.

2) Economic factors:

- High costs of the land consolidation project.
- Lack of government financial supports for implementing the consolidation projects(Norouzian, 1998).

3) Social factors:

- Level of trust between farmers and the government;
- Fear of losing ownership.

4) Structural and administrative factors:

- Differences in lands' fertility and values;
- Laws and legislations, including inheritance and dedication laws, and state legislations (Taghavi, 1998).

Result of (Garcia, 2007) in Spain showed that consolidation projects are important steps to improve labor efficiency and agricultural productivity. Farmers' awareness about the socio-economic results of consolidation programs, transfer of useful information by extension agents and supporting programs of the government are important factors in the adoption of projects.

(Vitikainen, 2004), in Europe showed that size of fragments and reduce ofparcels number are the most plausible reason for profitability of consolidationproject in an area. The result also show that the extreme differences in soil fertility and access to roads and water resources, are main problems associated with replacement of parcels and consolidation.

The results of (Gergievsk, 2005) indicated that, dispersal of land parcels is one of the main barriers to agricultural development in Macedonia andestablishment of rural cooperatives and government technical supports are facilitating factors in the implementation of Land consolidationproject.

(Backman, 2002) argued that rural development in Sweden has been the result of land consolidation. Farmers' education and awareness, geographical conditions of the lands, the number of parcels and training programs were the most important factors in the acceptance of projects by farmers.

MATERIAL AND METHODS

Methods in this study include the following steps:

1. Literature review, to gather Information related to background of the study and review of available documents related to land consolidation project in administrative and research centers especially Jihad-Agriculture organization and production cooperative of Barouqvillage.

2. Fieldsurvey, and data collection (after a pilot study) using a researchers made questionnaire during several sessions with farmers and visits of the study area (Garjan and Barouq villages). A sample of 250 land owners were randomly selected from the population (N= 500) for data collection.

3. Since the purpose of this study is to identifying and prioritizing the main barriers of implementationof land consolidation project, AHP technique,as a method of decision making in complex environments, was used for data analysis.

In this paper, the hierarchical tree structure of the decision is as follows: the first level consists of the main purpose, to prioritize the factors inhibiting the development and implementation of land integration project. The second level contains the main criteria affecting consolidation project including rules, ownership, education level, costs, trust, fertility, lack of funds and believes. The final level includes important choices from of classification criteria of second level consisting social, cultural, economic and technical issues. El Saati introduced this method first time in Iraq.

RESULTS AND CONCLUSION

To carry out this study, factors affecting important variables identified in land consolidation project which included traditional beliefs, trust, literacy, ownership, law, high cost of implementation, lack of funds and the differences were in the fertility of lands. Adherence to traditional beliefs and education level were major variables influencing the cultural factor. The impact of education level and traditional beliefs on cultural factor placed on critical level of significance. This result indicate that underdevelopment in agriculture is result of low technical knowledge and traditional culture of farm operators which in turn results in non adoption of new technologies and practices. Social factors, mainly related to variables, including ownership and trust to each other and farmers' trust to the government. Regarding ownership,there were two major factors affecting the non adoption of consolidation project. These factors are change in location of property after consolidation project and change in the acreage of property which may have unfavorable social consequences after implementation of the project. Structural factors include the structural laws, such as inheritance and endowment and etc. differences in land structure is related to land quality and fertility or landvalue. Economic factor in this study includes the high implementation cost and lack of project funds is allocated by the government that plays a decisive role in rural development projects that could take place.

A) Comparison of criteria with respect to the purpose

The first stage criteria as a paired comparison study relative to purpose of the study (prioritizing preventing factors of land integration operation) are compared. Figure 1 shows that the paired comparison of criteria with respect to this research purpose is as follows.

Pair-wise comparison of the criteria in relation with the purpose of the study (prioritization of inhibiting factors of land consolidation) conducted in the first stage (Figure 1).

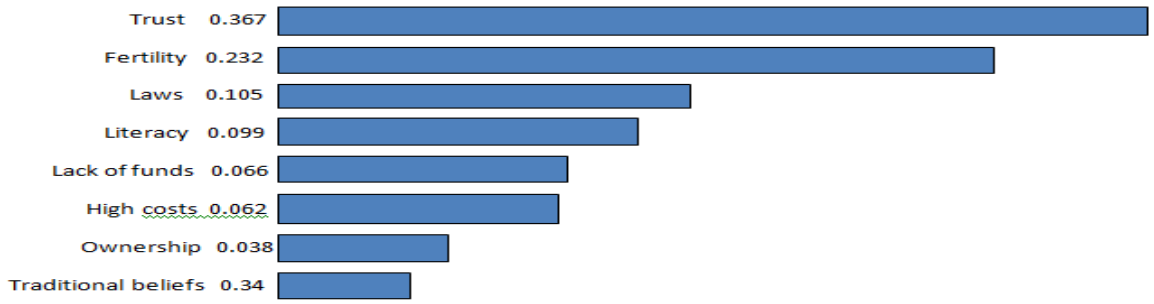

Figure1: Pairwise comparison of the criteria in relation with the purpose of the study

As the figure shows, the measure of trust with ratio of 0.367 and the measure of traditional beliefs with ratio of 0.34 were placed in the highest and lowest priorities, respectively. The concluded Inconsistency rate equal to 0.07 implies that criteria had acceptable consistency with the purpose of the study.

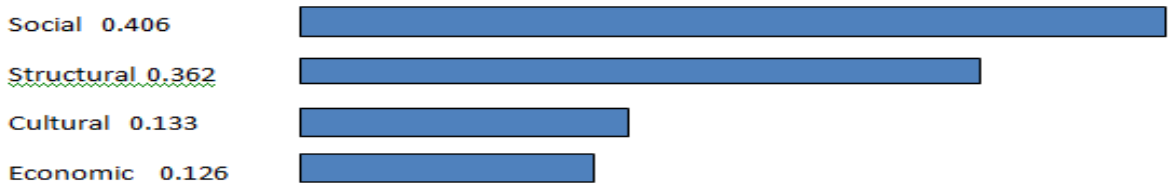

Figure 2: results of combining the choices

B) combining

Based on the results of combining the choices and measures (Figure 2) with reference to the purpose of the study itcan be concludedthat amongst the existing barriers to land consolidation, social factor with ratio of 0.406was the most important inhibitor. In contrast, economic factor with ratio of 0.126 was the least important barrier of land consolidation. Finally,it can be said that the preventing factors of land consolidation could be listed in this order: social, structural, cultural and economic.

According to the results of the study, the most important barriers of land consolidation are social issues which resulted from the fear of loss of the ownership right and distrust of each other and government programs. Thus promoting the extension education programs and presenting thetangible benefits of joint cultivation in line with trust building between farmers and government agents can solve the problem to some extent.

Since the difference in the land fertility is one of the main barriers of land consolidation, thus providing a feasible model according to the guidelines and conditions can be an appropriate action plan to eliminate existing problems in the rejection of the project.

Mass media, especially radio and television program can play an important role in informing farmers about the benefits of land consolidation and facilitate the adoption of the project.

Enacting explicit legislation for land consolidation as well as prevention of land fragmentation could help the agricultural development.

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ALLELOPATHIC POTENTIAL OF COMMON (*Fagopyrum esculentum Moench*) AND TARTARY (*Fagopyrum tataricum L.*) BUCKWHEAT FOR WEED CONTROL IN CEREALS

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ABSTRACT

Allelopathy is the direct or indirect, positive or negative effect of one plant to another through chemical exudates or allelochemicals. Both the Common and the Tartary buckwheat posses allelopathic potential, which can be used for weed control especially in agricultural systems that rely on biological control. On the other hand, the Common and the Tartary buckwheat grow in crop rotation, so the question is there are inhibitory effects on the crops that follow in rotation. Our goal was to investigate the effects of the Common and the Tartary buckwheat on germination of weed seeds (redroot pigweed, yellow foxtail, hoary cress, and field bindweed) and germination of crop seeds (wheat, barley, oats, and carrot). The extract has been made in three concentrations, seeds germinated in Petri dishes in a germination chamber, and after 7-15 days the number, length, and weight of seedlings were recorded. Statistically, the Common buckwheat significantly inhibited the number of germinated seeds in redroot pigweed and hoary cress in all three concentrations. The Tartary buckwheat inhibited the number of redroot pigweed and hoary cress seedlings too, but had no effect on yellow foxtail and field bindweed. The Common buckwheat diminished the number of carrot seedlings, while the Tartary buckwheat showed a negative effect on seed germination of wheat and oats.

Key Words: Allelochemicals, crop rotation, weed control

INTRODUCTION

The buckwheat (*Fagopyrum* sp.) is a crop with strong allelopathic potential. Recently, beside the Common buckwheat (*Fagopyrum esculentum* Moench), science has shown great interest in Tartary buckwheat (*Fagopyrum tataricum* L). Among all buckwheat specieses, *Fagopyrum tataricum* L. is characterized with a high content of rutin which can be 50-130 times higher than content in *Fagopyrum esculentum* Moench. The rutin is proven to have antibacterial as well as the antioxidative properties (Iqbal *et al.*, 2007). Iqbal *et al.* (2005) indicate rutin as allelochemical to be responsible for allelopathic properties of Tartary buckwheat. This is one of main reasons for increased usage of Tartary buckwheat as cover or forage crop. Kalinova and Dadakova (2006) allegate that rutin content in Tartary buckwheat stem and flowers is significantlly higher then one in Common buckwheat. Studies have shown that common buckwheat, thanks to allelochemicals, significantly reduces mass of certain weed species: *Tlaspy arvense, Cirsium arvense* and *Plantago lanceolata*a (Kalinova, 2006). The root lenght of ryegrass, mustard and lettuce was significantly reduced when they seeds coogerminated with the buckwheat (Kalinova, 2004). Scientists reported succesfull control of *Cirsium arvense, Sonchus oleraceus, Euphorbia esula, Centaurea repen,* and *Lepidium latifolium* using *Fagopyrum sp.* (Marshall and Pomeranz, 1982). Recent studies were mostly focused on allelophatic action of the Common buckwheat on weeds. However, Tartary buckwheat is more in focus in past few years, so the objective of this research was to examine allelophatic influences of Common nad Tartary buckwheat on following weeds: redroot pigweed (*Amaranthus retroflexus* L.), field bindweed (*Convolvulus arvensis* L.), yellow foxtail (*Setaria glauca* L.) and hoary cress (*Cardaria draba* L). Besides, buckwheat can influence the crops that will follow it in the crop rotation, so another objective was to determine allelophatic influence of both, Common and Tartary buckwheat on following crops: common wheat (*Triticum aestivum* L.), barley (*Hordeum vulgare* L.*),* oat (*Avena sativa L.*) and carrot (*Daucus carota* L).

MATERIAL AND METHODS

Slovenian variety of Common buckwheat (cultivar Darja) and Tatary buckwheat (accession from Luxemburg) were sown on experimental field in 2010. In the flowering stage leaves from buckwheat

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plants (separately Common and Tatary buckwheat) were collected, bring to laboratory, dried at 40°C for 72 hours, and store up making extract.

10 grams of dry buckwheat were chopped and soaked in distilled water (300 ml) for 24 hours. After that the soaked materials were filtered (High *et al.*, 2005). The extract was diluted to 50 and 25% concentrations. 6 milliliters of extract were applied on a filter paper in each Petri-dish (diameter 9 cm), in four replications. Control variant was treated by distilled water. In each Petri-dish 30 germinable seeds were put. Petri dishes were put in germination chamber on 22^{0}C (12 hours dark/12 hours light). After 7-15 days (7 days for crops, 15 days for weeds) the number, length and weight of seedlings were evaluated. These data were obtained as the average of four replications.

The influence of the aqueous extract of leaves of mentioned buckwheats (Common and Tatary) on germination of weed seeds: *Amaranthus retroflexus, Convolvulus arvensis, Setaria glauca, Cardaria draba,* and crop seeds: *Triticum aestivum* (cv. Srpanjka), *Hordeum vulgare* (cv. Favorit), *Avena sativa* (cv. Kupa), *Daucus carota* (cv. Nantes) was investigated in the laboratory. The data collected was analyzed statistically using Fisher's analysis of variance. Least significant difference test was applied at 5 and 1% probability level to compare treatment means.

RESULTS AND DISCUSSION

In the laboratory studies, water extracts of leaves of Common and Tatary buckwheat were investigated. In the next tables the results of the investigation can be seen.

The effect of aqueous extract of buckwheats on weeds

Table 1. The influence of the extracts of Fagopyrum esculentum on weed seeds germination and weed characteristics (Convolvulus arvensis and Amaranthus retroflexus)

Extract concentration, %	*C. arvensis* germinated seeds			*A. retroflexus* germinated seeds		
	number	lenght, cm	weight, g	number	lenght, cm	weight, g
100	5.5	7.6 **	0.32	7.3**	5.4	0.02
50	5.3	11.4	0.41	10.3**	6.1	0.07
25	6.0	10.5	0.44	12.5*	6.4	0.08
Control	5.0	12.4	0.31	17.0	4.9	0.08
p>0.05 p> 0.01	ns	3.24 4.55	ns	3.63 5.09	1.21 1.70	ns

Table 2. The influence of the extracts of Fagopyrum esculentum on weed seeds germination and weed characteristics (Setaria glauca and Cardaria draba)

Extract concentration, %	S. glauca germinated seeds			C. draba germinated seeds		
	number	lenght, cm	weight, g	number	lenght, cm	weight, g
100	7.5	4.1**	0.09	24.0**	4.80	0.28**
50	9.0	5.6	0.13	39.5**	4.7	0.49**
25	7.0	5.9	0.12	34.5**	5.4	0.55
Control	6.8	6.7	0.13	58.0	5.1	0.65
p>0.05 p> 0.01	ns	1,36 1,91	ns	9,43 13,23	ns	0.15 0.21

F. esculentum had no effect on the number and weight of C. arvensis and S. glauca seedlings, while the 100% concentration significantly reduced the length of both mentioned weeds (Tables 1 and 2). However, F. esculentum reduced the number of germinated seeds of A. retroflexus and C. draba at all three concentrations studied. The length of theese two weeds was not affected, and a reduction of the C. draba mass was noticed in 100 and 50% concentration (Table 1 and 2). Šarić et al. (1992) allegated redeuced lenght of C. draba seedlings for 39%. Đikić et al. (2008) showed that water extract of buckwheat cultivars in flowering stage suppressed root and shoot growth and germination of Rumex crispus, Galium molugo, and Abutilon theophrasti, while the influence on sprout number of Galium aparine was lower.

Table 3. The influence of the extracts of Fagopyrum tataricum on weed seeds germination and weed characteristics (Convolvulus arvensis and Amaranthus retroflexus)

Extract concentration, %	C. arvensis germinated seeds			A. retroflexus germinated seeds		
	number	lenght, cm	weight, g	number	lenght, cm	weight, g
100	13.0	9.0**	0.91**	10.0**	7.2	0.06
50	14.2	10.2**	1.12*	8.8**	7.7	0.05*
25	14.5	8.5**	1.09*	9.5**	7.4	0.06
Control	13.5	16.3	1.49	20,0	6.1	0.12
p>0.05	ns	2,54	0.28	3.92	ns	0.06
p> 0.01		3,56	0.40	5.50		0.08

F. tataricum extract had no effect on the number of C. arvensis seedlings, but it reduced its length and weight in all three concentrations (Table 3). Number of A. retroflexus seedlings in investigated samples was significantly reduced under the influence of F. tataricum extract, as well with the Common one, so we can say that both Fagopyrum species reduce redroot pigweed.

Table 4. The influence of the extracts of Fagopyrum tataricum on weed seeds germination and weed characteristics (Setaria glauca and Cardaria draba)

Extract concentration, %	S. glauca germinated seeds			C. draba germinated seeds		
	number	lenght, cm	weight, g	number	lenght, cm	weight, g
100	2.5*	6.6	0.06	5.0**	3.10*	0.77
50	5.7	7.4	0.14	8.7**	3.98	0.11
25	7.5	7.1	0.18	12.7**	4.88	0.18
Control	5.5	6.6	0.12	20.7	4.52	0.32
p>0.05	2.59	ns	0.07	4.71	1.34	0.31
p> 0.01	3.63		0.10	6.61	1.88	0.43

F. tataricum extract exerted a certain suppression on the number of C. draba seedlings (Table 4), as we had with the F. esculentum, and even here we can conclude that both act to reduce number of germinated seeds of C. draba.

The effect of aqueous extract of buckwheats on crops

Testing the effect of buckwheat on crops was done because the studied crops often follow buckwheat in the crop rotation so we tried to determine whether buckwheat has inhibitory or stimulatory effect on these.

Table 5. The influence of the extracts of Fagopyrum esculentum on crop seeds germination and seedling characteristics (Srpanjka and Favorit)

Extract concentration, %	Srpanjka germinated seeds			Favorit germinated seeds		
	number	lenght, cm	weight, g	number	lenght, cm	weight, g
100	29.2	6.6	4.1	28.0	8.2**	5.4
50	29.0	7.2	4.3	31.2**	9.1**	5.6*
25	28.0	7.8*	4.3	30.8**	9.9*	6.2**
Control	28.0	7.1	4.4	26.2	10.7	4.5
p>0.05	1.25	0.60	0.73	1.87	0.73	0.96
p> 0.01	1.76	0.84	1.03	2.63	1.02	1.35

The F. esculentum extract, except of stimulation of seedling length in 25% concentration, had no effect on Srpanjka (Table 5). However, the effect on Favorit was statistically proven in the way of stimulation in weight and number of seedlings, which means that the Favorit in the crop rotation after the buckwheat should be sawn more. Golisz et al. (2002) also reported that buckwheat has shown negative effect on the couch grass and mustard, while the influence on wheat was not noticed. Belz and Hurle (2004) reported that the root of wheat is very susceptible to allelochemicals and that the length of the root is the key parameter to verify the strength of allelopathic action.

Table 6. The influence of the extracts of Fagopyrum esculentum on crop seeds germination and seedlings characteristics (Kupa and Nantes)

Extract concentration, %	Kupa germinated seeds			Nantes germinated seeds		
	number	lenght, cm	weight, g	number	lenght, cm	weight, g
100	31.0**	6.8**	3.9	18.2**	4.1*	0.10
50	31.5**	8.9	4.9	22.8**	4.7	0.16
25	26.5	9.2	4.1	28.0*	5.1	0.21
Control	26.8	8.7	4.2	26.5	5.5	0.24
p>0.05	1.23	1.24	1.03	1.92	1.05	0.18
p> 0.01	1.72	1.73	1.45	2.69	1.47	0.26

Stimulation of Kupa seedlings occurs under the influence of F. esculentum extracts. Effect on the number of germinated seeds was simulative while the length of seedlings in 100% concentration decreased (Table 6). In the Nantes the inhibition was noticed in 100 and 50% concentration, and stimulation of seedlings occurred in 25% concentration. An et al. (1998) reported that it often happens that the higher concentration of active matter acts inhibitory while smaller one acts stimulatory, what was actually the case in this situation. This was also confirmed by Narwal et al. (2005) who say that buckwheat sown together with oats leads to an increase in yield of oats.

Table 7. The influence of the extracts of Fagopyrum tataricum on crop seeds germination and seedling characteristics (Srpanjka and Favorit)

Extract concentration, %	Srpanjka germinated seeds			Favorit germinated seeds		
	number	lenght, cm	weight, g	number	lenght, cm	weight, g
100	30.0	11.9**	3.9	33.0**	14.9	6.2
50	28.5	10.6	3.8	30.0	13.8**	6.5
25	25.8**	10.7	4.6**	27.0*	15.6	5.9*
Control	28.8	9.2	3.2	29.0	15.0	6.8
p>0.05	1.52	1.65	0.79	1.71	0.70	0.74
p> 0.01	2.13	2.31	1.10	2.40	0.98	1.03

F. tataricum manifested inhibition on Srpanjka at 25% concentration, but the length (100% concentration) and weight (25% concentration) were stimulated. Favorit was also inhibited in 25% concentration, but it was stimulated in 100% concentration. Inhibition was registered on the length as well as on the weight of Favorit seedlings (Table 7).

Table 8. The influence of the extracts of Fagopyrum tataricum on crop seeds germination and seedlings characteristics (Kupa and Nantes)

Extract concentration, %	Kupa germinated seeds			Nantes germinated seeds		
	number	length, cm	weight, g	number	length, cm	weight, g
100	30.0*	10.4	4.0*	25.8**	4.4**	0.14
50	27.5**	11.7*	3.2	27.5**	6.9*	0.14
25	26.8**	11.5*	3.9	26.8**	6.9*	0.15
Control	31.8	10.8	3.1	25.0	6.0	0.14
p>0.05	1.67	0.71	0.95	0.51	0.74	0.11
p> 0.01	2.34	1.00	1.33	0.72	1.04	0.15

***F. tataricum* extract inhibited the number of Kupa seedlings, but it stimulated their length and weight (Table 8). Unlike the *F. esculentum, F. tataricum* has a stimulating effect on germination of Nantes at all three concentrations.**

According to Golisz *et al.* (2002), during buckwheat growth, buckwheat is effective in suppressing many weeds, including *Agropyron repens.* Weed biomass during buckwheat growth has been reduced by 75% (Iqbal *et al.*, 2003; Tominaga and Uezu, 1995) and 86% (Creamer and Baldwin, 2000). Such reductions in weed biomass help prevent establishment of perennial weeds, as well as reduce the risk of seed production by summer annuals. Because buckwheat germinates quickly, it produces a dense canopy quickly, shading the soil and acting as a good competitor against weeds. On the other hand its allelopathic ability to suppress certain weeds increases its activity in the way of reducing the number, height and weight of weeds.

CONCLUSION

The results presented in this paper support the fact that the both, Common and Tartary buckwheat have allelopathic potential and therefore should be grown as crops that reduce germination and growth of weeds. It is also very important to pay attention which crops should follow the buckwheat in crop rotation. In order to utilize stimulatory effect Favorit can be sown after *F. esculentum,* and Nantes after *F. tataricum.*

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THE EFFECTS OF CONVERSION FROM CONVENTIONAL TO ECOLOGICAL GROWING AND VINE SITE ON YIELD AND QUALITY OF RHINE RIESLING VARIETY (*V. vinifera* L.) IN SERBIA

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ABSTRACT

This paper shows the results of conversion from conventional to ecological growing of Riesling variety at the Experimental field 'Radmilovac' which is in the property of the Faculty of Agriculture in Belgrade. At the experimental vineyard, conventional production with standard cultivation technology was applied in 2008 and it was used as control in the analysis, while in 2009 and 2010 ecological production was applied. The following properties were examined: yield (kg/vine), number of bunches per vine, bunch weight (g), sugar content in the must (%) and total acid content in the must (g/l). In 2008 average yield were found as 2.00, 1.90 and 1.80 kg/vine in 2008, 2009 and 2010 years respectively. Their are not differences between them as statistically. Larger number of bunches per vine was recorded in 2008 (24.20 bunches) in comparison to 2009 (23.76 bunches) and 2010 (21.50 bunches). Average bunch weight in 2008 was 140.00 g, while in 2009 it was 137.80 g and 130.00 g in 2010. The results are presented by maps obtained in GIS framework by IDW method.

Key Words: Conventional production, Ecological production, Riesling, IDW

INTRODUCTION

Most developed grape growing countries have increasing demand for grape products without pesticide residues or other harmful substances. This supports the development of specific production types such as organic production (ecological, biological). In Serbia, ecological grape production has been recently introduced (Korać et al., 2009). In Serbia the first experience of application of ecological preparations against downy mildew and powdery mildew dates back to 1994 (Robotić et al., 1995). Some experiments in vine growing and grape production, with particular attention paid to the ecological aspect (soil tillage, mulch, microbiological fertilizers, biological preparations against downy mildew and powdery mildew), were also performed on small-scale fields in the mid 80s and 90s of the last century (Lović and Sivčev, 1986; Sivčev, 1989; Sivčev et al., 2003; Sivčev et al., 2005; Sivčev et al., 2006). By careful selection of varieties and application of adequate agrotechnics, ecological production can be economical and consumers can be provided with qualitative and healthy grapes, wine and other products (Korać, 2008). Choice of a variety is influenced by two key factors: an economic indicator-market perspective and characteristics of a variety. Traditional varieties have advantage over the newly created ones. However, new preparations and improved computerized forecast models contribute to the efficient protection against diseases and pests (Sivčev et al., 2010). Growing *Vitis vinifera* varieties in conditions of ecological production has become more popular in recent years, and in spite of the risks because of their susceptibility to fungal diseases its cultivation is possible. Viticulture and enology are among the many application areas in which modern technologies, software tools and visualization methodologies are making a difference in achieving improvements in grape crop, both in quantity and quality, and thus in producing premium wine (Shanmuganathan et al., 2011.). Monitoring of different parameters in viticulture can be achieved by GPS and GIS technology (Ennahli and Kadir, 2006; Arno et al., 2009; Green, 2012; Green and Szymanowski, 2012). Global Positioning Systems (GPS) have become essential in many day to day activities in the vineyard. More sophisticated mapping solutions are also rapidly becoming available and maps collected in the field can be input to desktop Geographical Information Systems (GIS) software. This paper shows the comparison of some important economic-technological properties of Riesling variety in the stage of conversion from conventional to ecological growing.

MATERIAL AND METHODS

The research was conducted in vineyard at the experimental field „Radmilovac" which is in the property of the Faculty of Agriculture in Belgrade. The region is characterized by temperate continental climate. Mean annual temperature is 11.8°C, and it increased by 1°C in the period from 1961-2001, which is in accordance with the forecast change (Vuković et al., 2009). Average rainfall in the grapevine

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vegetation period is 401.7 mm which falls into the "sub-humid category". At „Radmilovac" locality, during the conversion period (ecological grape growing), the total amount of precipitation varied considerably and it was 521.5 mm in 2009, and 912.2 mm in 2010. Annual mean air temperature in 2009 was 13.4°C. Slightly colder was the year of 2010 when annual mean air temperature was 13.0°C. Total amount of precipitation in 2009 was 854.6 mm, and in 2010 it was 710.6 mm (Sivčev et al., 2012). Riesling variety was planted on Kober 5 BB rootstock at the distance of 3 x 1 m in single Guyot training system. Vineyard was 15 years old. The total area of the experimental field was 0.58 ha. During the year of 2008, conventional production was carried out with standard technology of cultivation, and it was used as control in the analysis. Grape growing according to the principles of ecological viticulture was carried out in 2009 and 2010. The grapevine protection was achieved by copper and sulfur based fungicides, which are on the list of allowed substances for plant protection in ecological production in Serbia, and insecticide with the active piretrine based substance listed in the EU. The following properties were examined: yield (kg/vine), number of bunches per vine, bunch weight (g), sugar content in the must (%) and total acid content in the must (g/l). All parameters were tested on 50 grapevines. Grape yield per vine was determined by measuring the mass of all clusters per vine. Sugar content in grape juice was measured by Oechsle scale, and total acid content was measured by titration method with n/4 NaOH. The measured data were statistically analyzed using the variance analysis. Spatial analysis of vine properties is presented through maps created in GIS framework by applying inverse distance weight (IDW) method.

RESULTS

Results of grapevine properties are presented in tables (Table 1-4) and graphs (Figure 1-3). Some economic-technical properties of Riesling variety is given in Table 1. Conventional production was applied in 2008 and conversion from conventional to ecological production in 2009 and 2010. In 2008 the average yield were found as 2.00 kg/vine, average number of bunches per vine was 24.20 and bunch weight was 140 g. In 2009 and 2010 the average yield were found as 1.90 and 1.80 kg/vine. In 2009 number of bunches per vine found as 23.76, and in 2010 determined average number of bunches per vine was 21.50. Bunch weight in 2009 it was 137.80 g, while lower average weight of 130.00 g was measured in 2010 (Table 1).

Variance analysis of Riesling variety for the tested years did not show significant difference in the yield of grapes (Table 2).

Table 1. Some economic-technical properties of Riesling variety

Year	Yield (kg/vine)	Number of bunches/vine	Bunch weight (g)
2008	2.00	24.20	140.00
2009	1.90	23.76	137.80
2010	1.80	21.50	130.00

Table 2. Variance analysis of Riesling variety yield (kg/vine) for the tested years

Source of variation	df	Sum of Squares	Mean Square	F
Repetitions	4	4.3540	1.0885	2.072
Treatments	2	0.0652	0.0326	0.062
Error	8	4.2034	0.5254	
Total	14	8.6226		

LSD between the treatments
0.05 sig. = 1.0572 0.01 sig. = 1.538
LSD for one treatment
0.05 sig. = 0.7475 0.01 sig. = 1.0876

Table 3. Variance analysis of number of bunches per vine of Riesling variety for the tested years

Source of variation	df	Sum of Squares	Mean Square	F
Repetitions	4	693.1092	173.2773	38.607**
Treatments	2	21.0849	10.5424	2.349
Error	8	35.9060	4.4883	
Total	14	750.1001		

LSD between the treatments
0.05 sig. = 3.0898 0.01 sig. = 4.4953
LSD for one treatment
0.05 sig. = 2.1848 0.01 sig. = 3.1787

Variance analysis showed statistically significant differences in the number of bunches per vine and in the bunch weight for the tested years (Table 3 and 4).

Table 4. Variance analysis of Riesling variety bunch weight (g) for the tested years

Source of variation	df	Sum of Squares	Mean Square	F
Repetitions	4	2098.9375	524.734	31.835**
Treatments	2	276.1375	138.0688	8.377*
Error	8	131.8621	16.4828	
Total	14	2506.9375		

LSD between the treatments
0.05 sig. = 5.9211 0.01 sig. = 8.6147
LSD for one treatment
0.05 sig. = 4.1869 0.01 sig. = 6.0915

Grape yield greatly depends on the cultivar/clone, climate factors, relief, exposure, temperatures, light conditions, physical and mineral soil properties. Riesling yield (kg/vine) in 2008 was classified into 8 classes (Figure 1). The first class comprised yields lower than 1 kg/vine, while the eighth class comprised yields of 4-4.5 kg/vine. Number of bunches per vine were distinguished into 9 classes (Figure 1). The first class comprised grapes with 0-5 bunches per vine, while the tenth class comprised grapes with 40-45 bunches per vine (Figure 1). In 2009 and 2010, Riesling yield was classified into 9 classes, number of bunches per vine was classified into 10 classes (Figure 2 and 3).

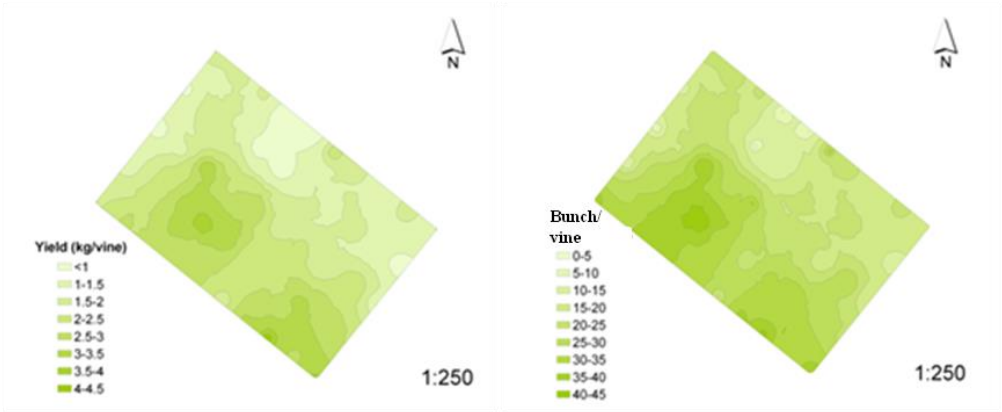

Figure 1. Yield per vine (kg) (left) and number of bunches per vine (right) in 2008

Figure 2. Yield per vine (kg) (left) and number of bunches per vine (right) in 2009

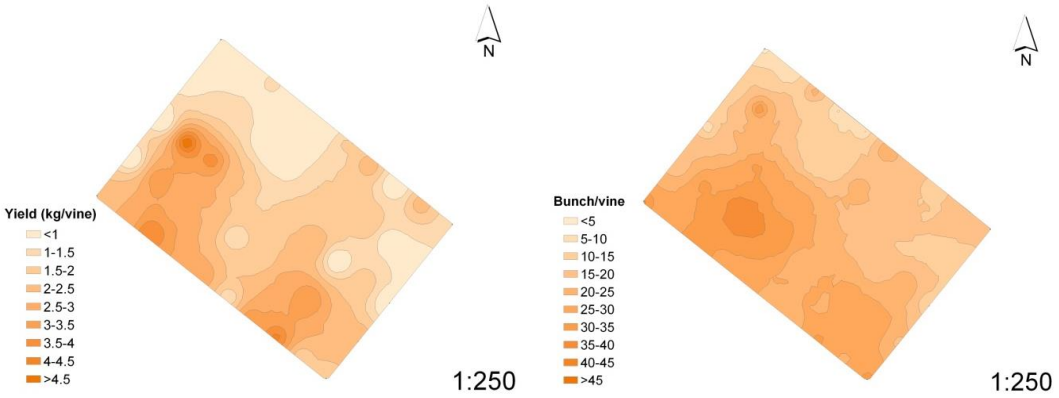

Figure 3. Yield per vine (kg) (left) and number of bunches per vine (right) in 2010

In 2008, Riesling grape variety was harvested in the technologically mature phase when it was 100 % healthy based on sanitary conditions. Sugar content in must was 21.00% and the titrable acid as wine acid was 7.20 g/l. During the conversion period sugar content ranged from 21.50% (in 2009) to 22.50 (in 2010), and in 2009 the determined acid content was 7.50 g/l, and in 2010 it was 6.20 g/l.

CONCLUSION

By constant control of production, which aims at environmental protection, ecological viticulture ensures quality, preservation of environment and people's health. Ecological grape growing is basic requirement for the achievement of balance between ecology, economics, and grape and wine quality. Main principles of ecological viticulture are: right choice of variety and rootstocks adjusted to the climatic conditions, soil tillage, applied agrotechnics, weed, disease and pest control in order to produce high quality grapes as raw material for wine production. Variety properties and its market perspectives are key factors of selection of a variety that is to be grown in the conditions of ecological production. Under agro ecological conditions in 2009 and 2010, at the experimental field „Radmilovac", the growing of Riesling variety which was converted from conventional to ecological production gave similar results to those from 2008 when standard agro technical measures were applied. Variance analysis did not show statistically significant differences in the yield of grapes tested during the research years but showed statistically significant differences in the number of bunches per vine and in the bunch weight.

Maps created in GIS framework by inverse distance weight (IDW) method is used in this study to present characteristics of vine yield (kg/vine) and number of bunches per vine. A dense rectangular grid of 50 sampling sites was designed in order to analyze vine characteristics in the vineyard and to create maps. Based on the results of the study it can be concluded that conventional and ecological production of Riesling variety showed no major deviation in its production – technological properties.

ACKNOWLEDGEMENTS

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OIL AND TRIACYLGLYCEROLS COMPOSITION OF SOYBEAN LINES

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ABSTRACT

The composition of the triacylglycerols is a characteristic of plant species and has nutritional, biochemical and technological importance. Influence of year on oil content in grain and triacylglycerols composition of oil from soybean lines (*Glycine max* (L) Merrill) was investigated. The study was conducted in eastern Croatia and involved three sets of soybean genotypes depending of maturity group: 00, 0 and I over three consecutive years (2002-2004) on an anthropogenic hypogley hydro meliorated soil. Oil content in grain was determined by near infrared transmittance spectroscopy. Triacylglycerols (TAG) were analyzed by reversed phase high performance liquid chromatography with refractive index detector and identified by comparing their retention time to standards.

The results showed that oil content varied significantly among soybean lines within and between years. The main TAG components were trilinolein, dilinoleolein, dilinoleopalmitin, linoleodiolein, linoleoleopalmitin, linolenodilinolein and triolein and their content were 84.28 % in 2002, 83.75% in 2003 and 84.49% in 2004 year. Other minor TAG were linolenolinoleopalmitin, linoleodipalmitin, linoleoleostearin, dioleopalmitin, dioleostearin, dilinolenolinolein and dipalmitolein. A significant difference of triacylglycerol composition was noticed among soybean lines whereas larger one was noticed among the investigated years. In field selection, choosing lines with good quality traits can improve the nutritional and functional quality of the soybean oil.

Key Words: Soybean lines, soybean oil, triacylglycerols

INTRODUCTION

Soybean *Glycine max* (L) Merrill is the most widely grown source of oil for food and non-food application. Seed of current soybean cultivars in Croatia contains approximately 40% protein and 21% oil on a dry weight basis and breeding program is aimed at continuously development of new better soybean lines that have had high and stable grain yield and satisfactory grain composition (Sudaric et al., 2006; 2007). Soybean oil is complex mixture containing a wide range of compounds. The most important group of compounds is represented by triacylglycerols (TAG), which are in chemical terms trihydric alcohols esterifies with fatty acids (FA). The molecular composition of TAG mixture is typically very complex due to a combination of a variety of fatty acids, differing in their chain-length, degree of unsaturation and distribution between the *sn*-1, *sn*-2 and *sn*-3 positions of the glycerol backbone. Palmitic (P), stearic (S), oleic (O), linoleic (L) and linolenic Ln) acids are dominant acids in soybean oil and they can form different TAG species (Sudar et al., 1997). The glyceride structure of plant oils is quite specific; saturated FA are concentrated almost entirely in the primary positions (*sn*-1 and *sn*-3), while the *sn*-2 position of TAG of seed oils is greatly enriched in polyunsaturated FA, and monoenoic acids are relatively evenly distributed (Buchgraber et al., 2004). Extensive information about environmental effects on fatty acids content can be found in literature, but data about TAG composition in soybean oil are limited (Hou et al., 2006; Schnebly and Fehr, 1993).

The objective of this study was to evaluate the influence of year on quantity of oil in grain from soybean lines in the frame 00, 0 and I maturity groups and to determine triacylglycerols composition in these lines.

MATERIALS AND METHODS

The study was conducted in eastern Croatia at the experimental field of the Agricultural Institute Osijek and involved soybean genotypes over 2002, 2003 and 2004 years on an anthropogenic hypogley hydro meliorated soil (pH 6-6.5; humus 2.2%; 27.4 mg K_2O 100 g^{-1} of soil; 18.4 mg P_2O_5 100 g^{-1} of soil). Field trials were designed as a randomized complete block design with 3 replications on basic plot of 10m^2. After harvesting, only the elite breeding lines with the best agronomic traits were taken for analysis. The total number of investigated genotypes, depending of maturity group (MG) was 16, as

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follows: 3 genotypes (MG 00), 5 genotypes (MG 0) and 8 genotypes (MG I). Oil content was determined from the grain sample by nondestructive near infrared transmittance spectroscopy (NIT) on Infratec 1241 Grain Analyzer (Foss Tecator) and expressed in a percentage of dry matter of grain. Soybeans were ground and lipid was extracted according to Folch et al. (1957) with chloroform/methanol (2:1). Solvent was removed by rotary evaporation, and lipid extract was used for TAG determination. Triacylglycerols were analyzed by using a Perkin-Elmer High-Performance Liquid Chromatography system series 200 equipped with isocratic pump, refractive index detector and Total Chrom software. The separation was performed on two serial connected PE Pecosphere C18 columns (83 x 4.6). The mobile phase was acetone/acetonitrile at a ratio of 70:30 (vol/vol). Oil samples (5%) were dissolved in HPLC-grade acetone and 20 μL aliquots were injected onto the column and eluted at a flow rate of 2.5 mL/min. Due to use of two coupled C18 columns, the total analysis time is less than 15 minutes. TAG from extract were identified by comparing their retention time to standards. The relative concentrations of particular TAG in the analyzed soybean oils were estimated on the basis of relative peak areas measured with RI detection. All measures were provided in three replicate. Statistical analyses of data were conducted by statistical-graphic system "Statistica" version 7.0 (Stat Soft software).

RESULTS AND DISCUSSION

The 2002, 2003 and 2004 weather conditions at the test site were different (Figure 1). Growing season 2002 and 2004 were favorable as regard of precipitate and air temperature. In contrast, 2003 was characterized by a water deficit and hotter temperatures. Drought stress was main weather characteristics of the growing season 2003 (Josipovic et al., 2006).

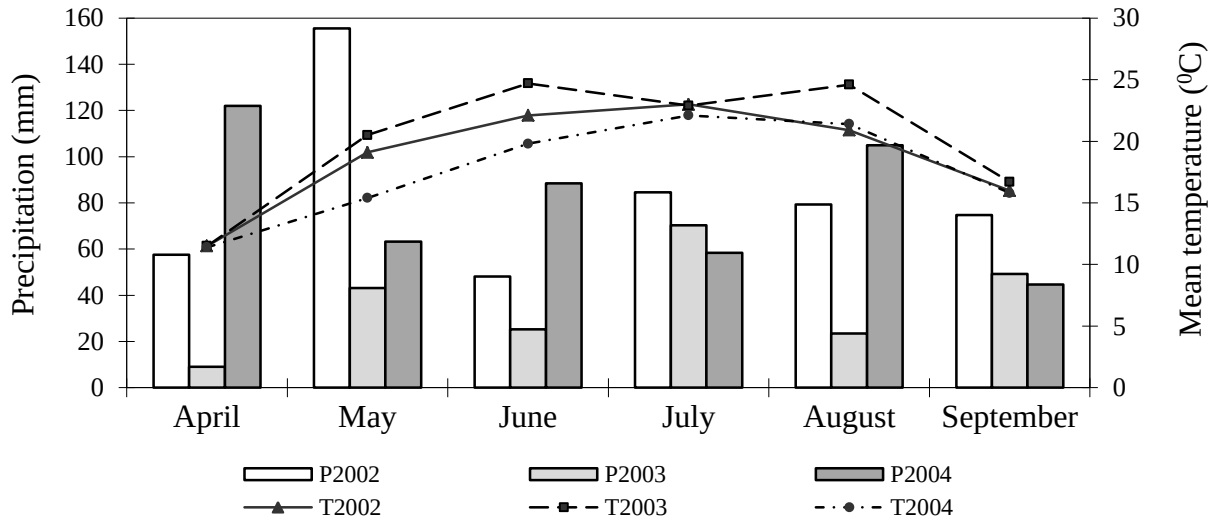

Figure 1. Precipitation and mean temperature during soybean growing season in three consecutive years (2002-2004).

The results of oil content in grain indicated that soybean lines contained different oil content which was ranged for three years from 21.87 to 23.51 % (Figure 2). The oil content varied significantly among soybean lines within and between years. In 2003, genotypes had higher oil content relative to 2002 and 2004. Into elite breeding lines of 0 MG group oil content was significantly higher than in other two MG. Oil content is quantitative trait whose variability is conditioned by genetic difference between cultivars and many environmental factors including temperature, year, planting data, location, drought stress, irrigation and soil type (Velasco and Fernandez-Martinez, 2002; Sprecht et al., 2001). Our results indicated that the line, when grown in different years, varies significantly in oil content. The results indicated that year influenced on oil content in investigated soybean lines.

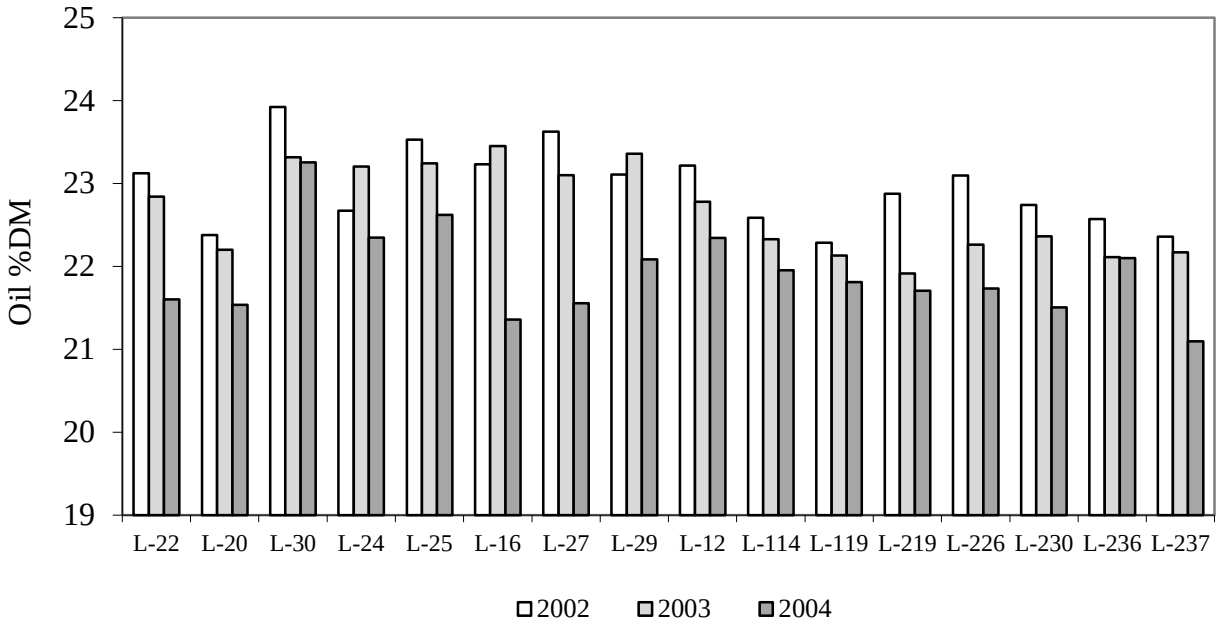

Figure 2. Oil content in grain of soybean lines in three years

An RP-HPLC chromatogram of triacylglycerol of oil of soybean line is shown in Figure 3. The chromatogram shows a clear separation of TAG components within run time (15 min) of method. The standard notation of TAG employs the initial of fatty acid names, arranged in the order of their position on the glycerol backbone.

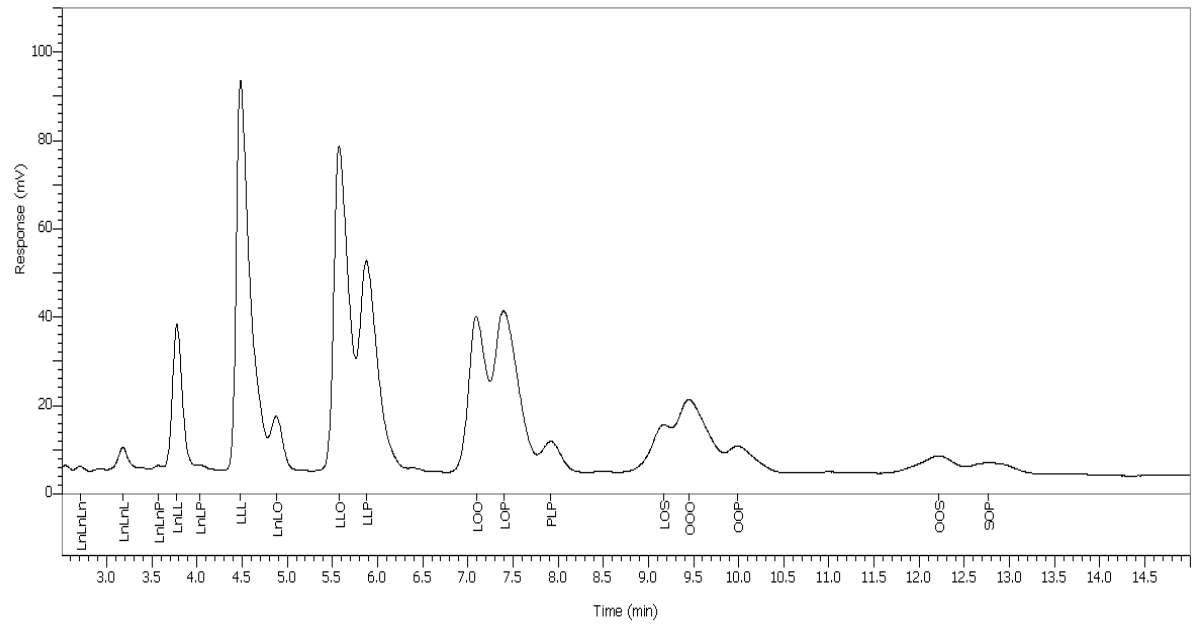

Figure 3. RP-HPLC chromatogram of TAG of oil of soybean line L-20

Chromatogram of every injected sample showed 17 individual triacylglycerol peaks and their concentrations were calculated from peak area.

Table 1. Main TAG composition (area %) of oil of soybean lines in three years (Ln-linolenic acid, L-linoleic acid, O-oleic acid, S-stearic acid, P-palmitic acid).

	Area % in 2002						
Soybean lines	LnLL	LLL	LLO	LLP	LOO	LOP	OOO
L-22	7.86	22.69	16.55	15.44	7.47	11.25	4.75
L-20	7.13	20.28	17.37	12.46	10.06	10.98	6.17
L-30	7.23	20.20	15.30	15.55	7.58	12.11	5.85
L-24	7.75	20.98	15.31	15.33	6.78	11.03	4.97
L-25	8.26	21.85	16.73	14.29	8.33	10.85	4.94
L-16	7.38	20.92	16.04	14.18	8.59	10.93	5.67
L-27	8.52	21.91	15.81	14.43	7.78	10.77	5.16
L-29	8.92	22.03	15.78	14.82	7.11	11.25	5.04
L-12	8.04	20.86	16.46	14.06	8.85	11.18	5.46
L-114	8.82	21.18	15.86	15.15	7.37	11.66	4.99
L-119	8.15	19.73	15.29	14.88	7.50	11.62	5.61
L-219	8.72	20.30	15.02	15.64	6.68	11.84	5.22
L-226	8.85	20.37	15.65	14.70	7.26	11.55	5.12
L-230	8.72	19.57	15.32	14.69	7.73	11.37	5.37
L-236	9.25	21.64	15.78	15.25	7.05	11.27	4.68
L-237	8.96	21.22	15.84	15.22	7.01	11.63	5.06
	Area % in 2003						
Soybean lines	LnLL	LLL	LLO	LLP	LOO	LOP	OOO
L-22	6.65	20.31	16.08	15.05	8.34	12.15	6.20
L-20	7.07	20.36	17.34	13.16	9.97	11.71	6.41
L-30	5.52	17.18	15.79	12.23	10.72	12.05	8.08
L-24	6.56	20.73	16.63	13.52	8.64	12.01	6.53
L-25	6.17	18.93	16.90	12.52	10.48	11.66	7.03
L-16	5.46	19.50	17.56	12.35	10.90	12.00	7.24
L-27	6.99	21.04	16.06	13.68	8.59	11.90	6.59
L-29	7.09	19.94	16.10	13.64	8.81	11.94	6.56
L-12	6.56	18.83	17.07	13.39	10.24	12.33	6.85
L-114	7.05	17.80	15.57	13.80	8.89	12.57	7.09
L-119	6.90	17.39	15.45	13.76	8.74	12.71	7.36
L-219	7.16	19.52	15.44	14.07	7.82	12.28	6.17
L-226	6.78	18.82	15.98	14.11	8.59	12.53	6.62
L-230	6.32	18.47	16.22	13.81	8.91	12.72	6.98
L-236	7.13	19.30	16.04	14.53	8.49	12.26	6.22
L-237	7.05	19.29	15.71	14.39	8.27	11.65	6.31
	Area % in 2004						
Soybean lines	LnLL	LLL	LLO	LLP	LOO	LOP	OOO
L-22	7.47	22.23	16.54	14.43	8.09	11.37	4.95
L-20	8.28	22.29	16.76	13.11	8.28	10.45	5.24
L-30	6.81	20.42	15.93	14.99	8.19	12.28	6.08
L-24	7.21	22.16	16.66	13.80	8.03	11.54	5.91
L-25	7.79	22.19	17.18	13.99	8.78	11.04	5.29
L-16	5.89	20.55	17.71	12.21	10.75	11.35	6.67
L-27	7.37	21.05	16.40	13.38	8.60	11.58	6.34
L-29	7.29	20.73	16.52	13.36	8.71	11.56	6.45
L-12	8.36	20.35	16.78	13.51	8.69	11.50	5.80
L-114	7.44	20.06	16.37	13.85	7.63	12.10	6.41
L-119	7.65	20.00	16.16	13.95	7.78	12.38	6.29
L-219	8.27	20.18	15.34	14.62	6.75	12.11	5.83
L-226	7.87	20.86	16.17	14.18	7.25	12.15	5.80
L-230	8.17	20.50	15.95	13.98	7.30	12.03	5.91
L-236	7.71	20.11	16.24	13.54	7.77	11.36	5.80
L-237	8.34	21.40	16.34	13.84	7.51	11.65	5.67

The HPLC data showed that the main TAG (> 5% peak area) in oils from soybean lines were trilinolein (LLL), dilinoleolein (LLO), dilinoleopalmitin (LLP), linoleodiolein (LOO), linoleoleopalmitin (LOP) linolenodilinolein (LnLL) and triolein (OOO) and they were represented in average 84% of total TAG (Table 1). Other minor TAG (< 5% peak area) were linolenolinoleopalmitin (LnLP), linoleodipalmitin (PLP), linoleoleostearin (LOS), dioleopalmitin (OOP), dioleostearin (OOS), dilinolenolinolein (LnLnL), dipalmitolein (POP). TAG represented less than 1% were trilinolenin (LnLnLn), dilinolenopalmitin (LnLnP) and stearooleopalmitin (SOP). These results are in agreement with results of other authors who studied distribution of fatty acids in TAG from soybean oil (Sudar et al., 2003; Yoshida et al., 2006; Ros et al., 2011).

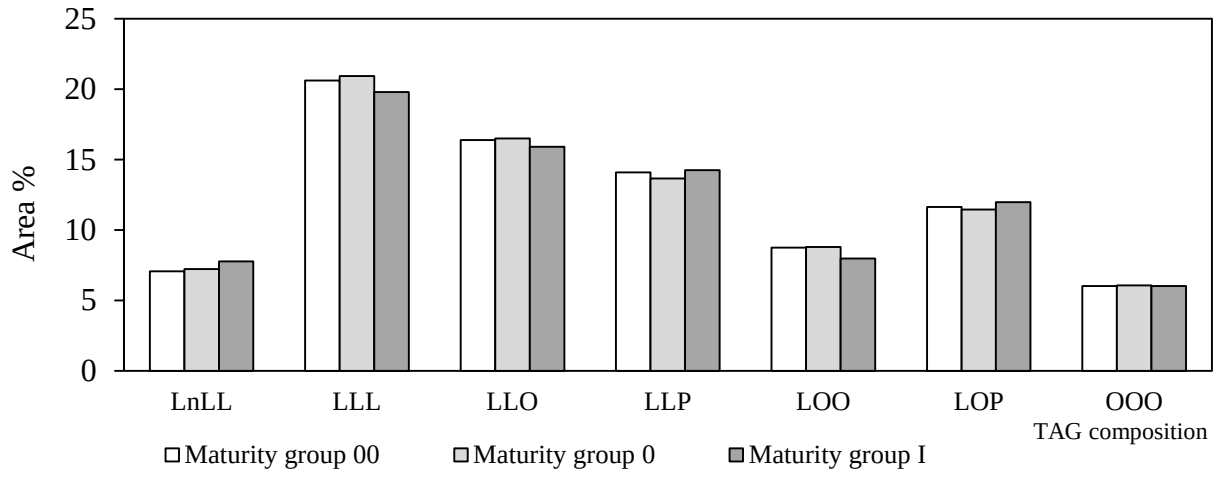

Figure 4. Mean value of TAG composition of oil of soybean lines for 00, 0 and I maturity group

Main triacylglycerols composition of oil of soybean lines for three maturity group is showen in Figure 4. Among 00, 0 and I maturity group concentration was statistically signifincantly different ($p<0.05$) for all main TAG than OOO. A one-way ANOVA showed significant difference between genotypes for: PLnL, LLO, LOO and PLP. Significant differences between years were found for all main TAG. In 2002 and 2004 LnLL, LLL, LLP were higher compared to 2003 but TAG levels containing oleic acid, LOO, LOP, LOS, OOO, OOP were higher in 2003. In 2002 and 2004 when growing seasons were favorable as regard of precipitate and air temperature, TAG containing linoleic and linolenic acid were increased but in 2003 when drought stress was main weather characteristics of the growing season TAG with oleic acid were increased. These results indicated that the differences in relative concentration of TAG were likely due to the different weather condition in investigated years. Results showed that genotype and weather conditions during the year were significantly influenced on the concentrations of individual triacylglycerols of soybean oil.

CONCLUSIONS

The obtained results indicated that investigated soybean lines had widely range of individual TAG and that year influenced on their relative amount. The main TAG components were trilinolein, dilinoleolein, dilinoleopalmitin, linoleodiolein, linoleoleopalmitin, linolenodilinolein and triolein and their content were 84.28 % in 2002, 83.75% in 2003 and 84.49% in 2004 year. The soybean lines and years included in this study indicated that these results may be useful for the development of soybean genotypes with better quality. Field selection of lines with good quality traits can improve the nutritional and functional quality of the soybean oil.

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VALORISATION OF GREENERY´S TYPOLOGY OF LANDSCAPE ARCHITECTURE FROM OTTOMAN PERIOD IN BOSNIA AND HERZEGOVINA

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ABSTRACT

The development of greenery, as the ambient component, in Bosnia and Herzegovina began in the period of Turkish domination. Different categories of greenery were created in this period, and they represent a connection between the original landscape components of space, tradition and influences that appear with arrival of Turks. Landscape objects from this period express main characteristics of oriental – Arabic garden style combined with traditional heritage of autochthonous population, and represent from the historical point of view, very important component which is necessary to be correctly interpreted in scientific papers from landscape architecture. By analysing various sources of literature, it can clearly be seen that different types of objects of landscape architecture got developed in this period, as those that belong to public greenery, as well as those which are consisting part of religious and residential buildings. Major carriers of greenery composition, landscape architecture objects, are based upon autochthonous plant species that accomplish relation with surrounded vegetation. The present attitude as the part of historical development of landscape architecture in Bosnia and Herzegovina, that recognizes the existence of greenery within the house as private area only, cannot be accepted; therefore the aim of this paper is to point on existence and values of different types of buildings of landscape architecture in the area of Bosnia and Herzegovina.

Key Words: Greenery types, valorisation, Turkish period, Bosnia and Herzegovina

INTRODUCTION

Basic biological thesis and esthetical laws are demanding harmonious relation between natural and anthropogenic areas which are easy spotted inside of specific urban complex that got developed in the area of Bosnia and Herzegovina during the period of Turkish domination. Existing towns, as well the new ones, are getting characteristics of Turkish – eastern architecture with high minarets, characteristic bridges, regulated beds of streams and rivers with greenery planted around, which can also be found within the complex. As the result of this, the urban complex was created, and has clearly divided working part - čaršija[2] and intimate residential area - mahale[3]. Greenery as urban factor, prevail within the whole city area, and it can be seen from all around, from yards, mezaristan, mosque yards, river banks with alleys, and as the most important component of this greenery, it is its connection with surrounding nature, which is its ecological adjustment. Minarets, within this town greenery, appear as architectonic verticals that define city space between some streets (mahala). Mahala had also its territorial organization with developed micro neighbourhood in which each family had its house, while the house was consisting of residential facility with Bosnian flower yard and garden. Original garden style was created in such ambience. Analysing literature and performing field visits across Bosnia and Herzegovina, it was possible to record different types of landscape architecture that belong to public greenery, as well as those which are part of residential complex – objects of private character. Main carriers of greenery composition are autochthonous varieties which are emphasising harmonious relation between green areas and natural surroundings.

MATERIAL AND METHODS

Basic methodical approach in this paper was analyses of collected field and literature information. Field research comprehended available authentic areas in Sarajevo, Mostar, Stolac, Travnik and Čapljina, with different types of green areas that originate from the Turkish domination period. Recording of existing plant and architectonic elements as well as analyses of composition was conducted at mosque

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[2] Čaršija – (tur. čaršy), square with shops, shoping quarter
[3] Mahala – (tur. mahalle) narrow town stret

yards, private houses, locations which are on the list of cultural-historic monuments of Bosnia and Herzegovina. Analyses of composition included: (Drljević, 1985; Vujković, 2003):

1. - tall greenery
   - low greenery
2. - interior (architectonic elements)
   - views (towards outside, interior views)
   - composition connection

Some literature sources that may provide information on origination of objects of historical greenery, its concept and changes that happened during the past times were recorded and consulted (Alomar, 1973; Šćitaroci, 1992). Sources comprehended: documentation of competent institutions, written archival records, expert literature, literature works, memories of owners, graphics, photographs, postcards, paintings, present situation as the most important source and similar.

RESULTS

Origination of typical Bosnian style was generated by unchangeable outside factors. These factors comprehend natural landscape with all its elements and urban concept within which the green areas were created. Extremely beautiful garden creations were created within architectonic buildings with different purposes. Ambient atmosphere and beauty of greenery shaped in traditional garden style was unsurpassed so far. Analysing these green areas, the conclusion may be drawn that they satisfy functional criteria that modern landscape architecture put before the objects of greenery. Historical changes had strong influence on development of landscape architecture in the area of Bosnia and Herzegovina, and several periods may be extracted:

- period of domination of oriental – Islamic elements in garden (period of Turkish domination)
- appearance of European influences with arrival of Austro- Hungarian administration
- period between two world wars
- modern period

Green areas that were created in the period of domination of oriental – Islamic elements in garden were classified in different categories that may differ in the accordance to: their location, size of the area, composition of main and secondary elements. Analysing collected information, the greeneries that originated from this period, were classified into the following categories (Temim, 2009):

- public green areas (excursion sites – green ring around the square-čaršija, alleys)
- greenery within religious buildings (mosque yards, musala and mezaristan)
- greenery within residential blocks (yards and gardens)

1. Public green areas

Public green areas were excursion sites, green ring around the square - čaršija and alleys. Many towns, originated from the period of Turkish domination, had one or more sites that were used as excursion sites. Naturally attractive areas, that Bosnia and Herzegovina is rich with, were chosen for excursion sites. Those areas were chosen because of their forests, rivers, geographical, floristic, fauna and the other natural phenomena. The sites that were usually selected for excursion sites were fulfilling the criteria of modern landscape architecture of green areas used for this purposes. They were fulfilling need for spending some time in the surrounding which is different than in permanent place of residence, they had different biological, visual and micro climate characteristics, and chosen locations were in town's vicinity.

Specific greenery objects were alleys formed from cherries (*Prunus avium* L.). Besides cherries, walnuts (*Juglans regia* L.) and mulberries (*Morus sp.*) were planted by paths because of their shade and fruits as well. Individual trees of oak (*Quercus sessiliflora* Salisb.), English yew (*Taxus baccata* L.) and the

other trees were planted in village yards, while nettle trees (*Celtis australis* L.) were mostly planted in the area of Herzegovina, since it is extremely long-lived tree, over 1000 years.

Green ring around the square - čaršija, during that period, had priory ambient function, it decreased breakthrough of noise, dust and unpleasant scents from the square – čaršija into residential areas – mahalas. Green ring was mostly created from wild trees and bushes that were regularly maintained, so it was not an obstacle to the commercial activities that čaršija was used for.

2. Green areas within religious objects

2.1. Musala

Musala or namazgâh is praying area under open sky, and it is located in the towns of Bosnia and Herzegovina. These spaces could be classified into two basic groups:

- **Bajram musala that were used for praying of inhabitants from the town or its villages for both Bajrams**
- **česma musale (cesme musallalari) that were assign for praying of bigger or smaller groups that were visiting town**

Musala was used, besides for praying, for the other purposes too, such as farewell for people going for Hadz, rain praying, or just gathering place for town inhabitants without religious character, reading of declarations and conversations of erudite people. The other group of musalas, got the name after česma – water tabs that were usually built as the part of the object, and they have been used for religious washing (abdest) before the praying. The town could have one musala only, and many towns in Bosnia and Herzegovina had musalas: Konjic, Mostar, Sarajevo, Čajniče, Banja Luka, Višegrad, Zvornik, Foča etc. There were certain conditions that had to be fulfilled by the area chosen for musala built. At first of all, they would be attractive location which comprehended the beauty of space, as well as its size. In the towns, where it was not possible to have naturally beautiful location chosen for musala, its landscape would be modified by planting of different trees and grass. Musala had white walls around (height 1,5 - 2 m) with a gate and simple or decorated portal. They were not interesting monuments in architectonic sense. Their beauty was connected to their attractive location, its maintenance and refining with greenery, therefore their significance as greenery objects was bigger. The grass was soft, and the trees that were planted in geometrical order were plane (*Platanus sp.*), linden (*Tilia sp.*), aspen (*Populus sp.*), willow (*Salix sp.*), spruce (*Picea abies* L.), cypress (*Cupressus sempervirens* L.), laurel (*Laurus nobilis* L.) and the other trees, and their task was to insure the shade necessary for praying.

2.2. Mosque yards and mezaristans

Mosque yards were enriched with trees and all the other types of ornamental plants. It was shaped in the accordance to the same principals and it contained same typical garden elements that were present in avlijas as well. The ornamental plants that were emphasised, were the ones with tall crown that tended towards sky, such as selvije[4] (*Cupressus sempervirens var. pyramidalis* L.), poplars (*Populus nigra* L.) as the symbols of eternity. There were also the other tree types, the ones with vertical trunk, proper crown and leaves of interesting shapes and colours: linden (*Tilia* sp.), nettle trees (*Celtis australis* L.), medlar (*Mespilus japonica* Thunb.), bushy types of roses (*Rosa sp.*), box-trees (*Buxus sempervirens* L.), pomegranate (*Punica granatum* L.), jasmine (*Jasminum officinale* L.), sweet mock orange (*Philadelphus coronaries* L.), barberry (*Berberis vulgaris* L.) etc., and flowers such as hyacinths (*Hyacinthus orientalis* L.), carnation (*Dianthus caryophyllus* L.) and the other flower types that could insure the presence of colour and scent within the mosque complex. Through the analyses of collected data, it may be seen that selection of present types of ornamental trees was a consequence of old Slav heritage and Islamic influences. Therefore, within the mosque yards, next to sadrvan, which is typical Islamic element, tree of silver linden (*Tilia tomentosa* Moench Syn. *T. argentea* Desf.) may be seen which was traditionally dedicated by Old Slavs to their gods.

[4] Selvija – (tur. selvi, servi), cypress

Water has a double function, aesthetic as the element with the strongest effect inside of the garden, but useful function as well, used for washing before entry in the mosque for praying. Water is always running, imaging Heaven Rivers in this way.

Mosque yard was surrounded with high white walls, with distinguished entering gate. Physical barrier around religious object and its isolation from the outside world, was emphasised with an aim of achievement of ambience that could provide undisturbed praying. The yard smelled of silence and serenity which is in compliance with object purpose, with a lot of colours and scents.

Mezaristans were greenery objects that were dominated with wild flora with autochthonous trees, bushes and herbaceous plants. Anthropogenic influence was including, at the beginning, only regular maintenance and cleaning of overgrown to avoid careless look. Tradition of planting of box-tree (*Buxus sempervirens* L.) and rose (*Rosa sp.*), in these spaces, appeared later. Traditional way of mezaristan forming and modern naturalistic approach of graveyards solution is similar in the whole world. Naturalistic approach is based upon extraction of natural forest complexes and turn into graveyards. The existing, adult trees would be rarefied, lower levels removed and paths made.

Picture 1. House and traditional Bosnian garden in Mostar (cultural and historical monument)

2.3. Green areas as the part of residential object (Bosnian flower garden)

Three different garden spaces may be isolated within the residential complex. These spaces differ from each other in their function and space composition: avlija (or big avlija) big house garden with the role of economy yard with stables, therefore it had no garden significance at all, Bosnian flower garden was the part of female part of the house and the part of the special significance for garden art of Bosnia and Herzegovina, and finally, the garden which would represent horticultural[5] designed space.

2.3.1. Plants elements in avlija

Decorative plants. During inventory of decorative plants in ambient space of avlijas and gardens, special attention was put on those that are really rare today, and those are old rosa varieties, medlar, old varieties of apple etc. Genesis of autochthonous decorative flora is result of influence of different factors, especially to the spontaneous introduction, and introduction of wild herbs. Special attention is put on flowers, in the autochthonous garden style, which were basic garden element. Thanks to professionally formed garden spaces, through using of different architectonic elements, spontaneously pointed on humidity preservation, different types of bushes, annuals and rarely trees (fruit trees) were successfully grown inside of these gardens. Important plant element was clipped greenery; dominant type was box-tree. (*Buxus sempervirens* L.).

Pergola. This extremely decorative architectonic – plant garden element had multifunctional role: esthetical, usable and functional.

[5] Space reserved for production of vegetables and fruits, and decorative plants partly.

2.3.2. Architectonic avlija elements

Elements with water. Water cult is specially emphasised, it is present in different motives, but it is always in running form. Apart of its esthetical role and refining of space with discreet water noise, water was also moisturizing garden air and easing summer heats.

Cobblestones. The entire avlija space, which was not planned to be planted with ornamental plants, was paved with cobblestones using river stones. Building of cobblestones, regardless to that was it supposed to be done in the accordance with pattern or not, was always implied placing of chosen material on flat ground surface. Spaces between stones have often been used for planting of succulents.

Wall. High whitewashed walls had a function of fence for the intimacy of family life and fulfilment of religious customs. The walls were made out of hewed stone, regularly white washed in order to absorbs as less as possible of sun beams, while in functional sense they were increasing of air humidity and creation of shade in garden space. As well as cobblestones, avlija walls were also overgrown with autochthonous succulents.

Flower beds. They were used for flower cultivation in permanent position and they represented original basic element of Bosnian flower garden. They were raised in comparison to the level of avlija, which was representing communication path. They had regular shape either of rectangle, circle, triangle, round and hexagon, depending on its position in avlija. Rectangle beds were positioned along the garden or house walls, while round and hexagon beds had central garden place. Beds were spaces fenced with white washed walls of different size, from 10 to 60 cm, even higher sometimes, filled with soil. Thanks to white colour of walls, they were less heated, and bigger soil depth was providing longer humidity preservation. Besides of that, the plants were planted quite close to each other, taking care on their height.

CONCLUSION

Through analyses of collected data, the conclusion was drawn that greenery objects originated from the period of Turkish domination in Bosnia and Herzegovina, may be classified into the following types:

- **public green areas (excursion sites – green ring around the square-carsija, alleys)**
- **greenery within religious buildings (mosque yards, musala and mezaristan)**
- **greenery within residential (yards and gardens)**

Analysing certain greenery types, it may be concluded that they have been shaped in original way, and that Bosnian flower garden is especially emphasised, representing monument of cultural-historical heritage of landscape architecture. Balance in space was achieved with harmonious combination of intensive flower colours, adjustments of height of flowers and with light – darkness relationship. The present plants included: trees, mostly fruit trees, bushes, creeping plants, season flowers and annuals, pot plants, medicinal and aromatic herbs.

Typical architectonic elements that were present in different greenery types were: high white walls, specially shaped flower beds, water elements, cobblestones and pergola as architectonic - plant element. Such type of garden was easy to be maintained, the use of chemicals was decreased, it was adjusted to the surrounding space and its purpose, it was functional and it created connection between anthropogenic and natural landscape.

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THE IMPORTANCE OF PLANT NUTRIENT ELEMENTS IN MEDICINAL AND AROMATIC PLANT PRODUCTION

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ABSTRACT

With the increasing negative effects of chemical substances on human health in the recent years, natural substances have become more preferred in all stages of life, and it has also increased the demand for medicinal and aromatic plants. The importance of these plants which have a considerable place in global trade is increasing day by day. Medicinal and aromatic plants utilized in public medicine for centuries are mainly used in food and cosmetic industries as well as in ration preparation for animal feed. These plants can be used in crop rotation systems in agricultural applications. Despite all these benefits, there is limited number of medicinal and aromatic plants produced in Turkey, and they are collected from nature, which is quite worrying for their sustainability. Most of medicinal and aromatic plants are endemic in Turkey, and that indicates the importance of the situation. For this reason, many studies have been implemented about the production of medicinal and aromatic plants at universities of Turkey and their production conditions are investigated. Within the scope of these studies, fertilization experiments have been increased in the recent years and explicit knowledge was acquired in this matter. In the studies, fertilization is found important for medicinal and aromatic plants active ingredients of which are utilized. Fertilization improves many agronomic and quality parameters of plants. For instance, in a study, nitrogen applied in increasing amounts was observed to boost green herb yield and essential oil content of garden sage (*Salvia officinalis* L.). Furthermore, in another study investigating the effect of nitrogen and phosphor application on yield and quality of fennel (*Foeniculum vılgare* Mill.), it was reported that nitrogen and phosphor increase the seed yield.

Key Words: Medical and aromatic plant, fertilization, nitrogen, essential oil

INTRODUCTION

Plants in culture should be provided with the necessary nutrient substances they need in order for them to grow in healthy, productive and quality way. After nutrient elements in soil are determined with soil analysis, the plants in production should be supplemented with adequate amount of nutrient elements considering their needs. Plants should take adequate amounts of all nutrient elements during vegetation period. Otherwise, yield and quality deteriorate according to nutrient element deficient in plant. In fact, higher values were determined in arid conditions than in ground conditions in a study investigating yield and quality of rosemary plant (*Rosmarinus officinalis* L.), which is an indication of this situation (Kırpık, 2005).

Fertilization is the process of providing soil with all the necessary plant nutrient elements. The number of elements necessary for plant growth is reported as 17. These are C, H, O, N, P, K, Ca, Mg, S, Fe, Mn, B, Zn, Cu, Mo, Cl and Na. The initial ten of them are called macro element, and the rest of them are micro element. Macro and micro expressions are not related to function of elements but to intake amounts. These are absolutely necessary for plant life. In addition, these elements make important contributions to soil and sustain it. Nutrient elements given to soil are transformed into usable forms for plants by physical and chemical reactions through fertilization. Therefore, nutrient element concentrations in soil constantly change (Ceylan, 1994). Quality is an important criterion beside yield in the production of medicinal and aromatic plants. In other words, drug herb yield of these plants as well as effective factor and compound are required to be at maximum level. The number studies on this matter are inincrease every day.

Medicinal and aromatic plants are known to be used by 80% of global population for their medicinal therapeutic effects as estimated by World Health Organization (WHO) (Anonymous, 2008). Many of these plants synthesize substances that are useful to the maintenance of health in humans and other animals. Many of these plants include aromatic substances, most of which are phenols or their derivatives suc as

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tannins. Others contain alkaloids, glycosides, saponins and many secondary metabolites. Many of the herbs and spices used by humans to season food yield useful madicinal compounds (Naguib, 2007).

In fact, these plants are known to grow wildly and naturally. Unfortunately, many of these plants are threatened by the hazard of extinction. The Center of Biological Diversity reports that about 15,000 medicinal plants across the globe are at risk from habitat destruction, overharvesting, and big business (Sheldon, 2009; Barbara, 2010; Naguib, 2007).

Some Macro Nutrient Elements And Their Effects On Medicinal And Aromatic Plants

Fertilizer

Fertilizers are soil amendments applied to promote plant growth; the main nutrients present in fertilizer are nitrogen, phosphorus and potassium (macronutrients) and other nutrients (micronutrients and trace elements) are added in smaller amounts. Inorganic fertilizers vary in appearance depending on the process of manufacture.

Researches on fertilization

In the production of medical and aromatic plants, generally the nitrogen, phosphor and potassium fertilizers are used. Nitrogen, phosphor and potassium the basic needs of many culture plants and most commonly used, are also quite important for medicinal and aromatic plants.

Nitrogen, an important source of basic nutrient for plants, is essential constituent of living organisms. It constitutes an important part of plant dry matter. Nitrogen need of plants is generally high in vegetative development period (Kacar and Katkat, 2010). Plants take nitrogen as NH_4^+, NO_3^- and elemental nitrogen in their bodies. This is closely related to environment pH. NH_4^+ intake is high in neutral or close to neutral pH, and it gradually decreases in acidity direction of pH. However, NO_3^- is taken more in acid pH levels (Kacar and Katkat, 2010). Old leaves of plant turn yellow in the deficiency of nitrogen element and dark color in its surplus. Plants remain green in the excess amount of nitrogen element, and ripening is delayed, harvest time is extended, and plants catch disease more easily because vegetative growth increases and generative growth decreases. In general, nitrogen application to medicinal and aromatic plants is made twice a year as ammonium sulphate and ammonium nitrate. For instance, due to nutrient element deficiency in thymus plant, similar results are obtained to those of other plants, and plant leaves remain small, yield decreases and especially standardization cannot be provided in oil contents (Esetlili and Çakıcı, 2010). Nitrogen is a substance that affects the vegetative parts of plant. Therefore, it is especially important for plants from which herb and drug leaf are obtained (Ceylan, 1995). In a study investigating the effects of different nitrogen doses on yield and yield properties of melissa (*Melissa officinalis* L.), 0 kg/da, 4 kg/da, 8 kg/da and 12 kg/da of nitrogen applications were made and the highest contents of fresh herb, drug herb, essential oil were obtained with 12 kg/da N application (Katar, 2004). In another study investigating the effects of nitrogen fertilization on medicinal sage (*Salvia officinalis* L.), it was determined that medicinal sage gives positive responses to nitrogenous fertilization (İpek, 2007). In a different study with applications of gradually increasing doses of nitrogen and sulphur, it was reported that nitrogen increased green herb yield and essential oil content but it did not affect drug herb yield and plant height (Koç, 2006). In a study investigating the effects of different doses of nitrogen (0, 30, 60 and 90 kg/da) and phosphor applications on fennel plant (*Foeniculum vulgare* Mill.) under ecological conditions, and the highest fruit yield was obtained with 90 kg/da nitrogen dose in the first year and with 60 kg/da in the second year (Tunçtürk, 2011). In another studies investigating the effects of different nitrogen doses on some important properties of *Datura stramonium* L. in Samsum conditions, it was concluded that 15 kg/da nitrogen dose should be used for high fresh drug herb yields, while 20 kg/da nitrogen dose should be used for the highest fruit yield (Esendal et. all., 2000). Halva and Puukka (1987) reported application of NPK 40–16–68 kg/ha as optimum asic fertilization. In addition basil received a benefit from the N-top dressing 80 g/ha. Due to the cold weather, the fresh yields were quite low. According to Hornok (1992) the Hungarian fertilization advice includes three applications of fertilizers: basic fertilization in the autumn N=40–60 kg/ha, P=60–80 kg/ha and K=120–140 kg/ha are recommended. Start of the fertilization in the spring at

the time of soil preparation with N=40–60 kg/ha and P=18–20 kg/ha. Foliar N-fertilization is applied after the foliage cuttings, in doses of 60–70 kg/ha.

Phosphor has an important place in plant growth and development. It assumes a significant role in facilitating plant nutrition intake and development, cellular formation, synthesis of oil and special proteins, respiration and photosynthesis. Phosphor takes places in nucleoproteins, phosphatides, ferments, vitamins, hormones and many other compounds in plant stem (Ceylan, 1994). It is plant nutrient element that plays role in creation of genetic structure of plants and flowering. Plants take phosphor in the form of primary orthophosphate ion $H2PO4^-$ and secondary orthophosphate ion HPO_4^{2-}. Plants generally take $H_2PO_4^-$ ion more in acid reactive soils and HPO_4^{2-} ion more in alkaline reactive soils. Contrary to nitrate and sulphate anions, they cannot be degraded and they preserve their oxidized form. Plants receive most of the phosphor they need from soil solution and a little bit directly from solid phase of soil. Decreasing phosphor in soil solution is immediately restored by solid phase of soil. There is a constant balance between soil solution and solid phase of solid for phosphor just like for other plant nutrient elements (Kacar, 2005). Plants receive phosphor at the beginning of vegetation period. Phosphor deficiency reveals itself with purple and copper colors in old leaves. Phosphor deficiency becomes evident in young leaves in the advanced stage. Phosphorus fertilizers are not only important for healthy root development, but they are also effective in rapid ripening. For this reason, it is also important for flower, fruit and seed drogs (Ceylan, 1995). In a study mentioned above in terms of nitrogen doses, which investigated the effects of different nitrogen and phosphor doses on yield and quality of fennel plant (*Foeniculum vulgare* Mill.) under ecological conditions, it was observed that phosphor application created significant increases in number of umbel and fruit yield (Tunçtürk, 2011).

Potassium is a nutrient element found organic matters of plant like protein, oil, glucose etc., needed by plants and kept in all plant organs. As it takes role in plant growth, development and substance exchange, it exists more in young plant organs. It accumulates mostly in leaf, stem and roots in plant and less in seed. It easily passes through membranes; therefore, potassium has an extraordinary mobility in plants (Kacar and Katkat, 2010). Its quantity decreases towards the end of vegetation, and it is transferred from old tissues and organs to young tissues and organs (Ceylan, 1994). In addition, potassium is an element that has very important physiological and biochemical functions (Kacar and Katkat, 2010). It takes role in N metabolism. In the absence of potassium, metabolism does not function and amino acid –like accumulations occur. Plants receive potassium from their environment in K^+ ion form. Potassium intake is higher than other nutrient elements except for nitrogen. Plants take K^+ mostly from soil solution. There is constant balance between soil mineral, soil solution and plant roots in terms of K^+ (Kacar and Katkat, 2010). Plants need potassium for a good yield and realizing normal growth. The effects of potassium on functions, production and quality in culture plants have been proved by studies from various countries (Kaçar, 2005). Yield decreases in potassium deficiency. The rate of this decrease could sometimes reach 50% level. Quality also deteriorates. The leaves lose their gleam. It reveals itself as signs chlorosis among old leaf veins. Roots stop extending, and fruits shrink and get misshaped. In medicinal and aromatic plants, potash fertilizer is especially used for plants yielding radix drogs, but plants drug herb yield also need it abundantly (Ceylan, 1995). Anaç et al. (2007) investigated in their study the effects of potassium fertlizers on oil quality of some medicinal and aromatic plants and determined that oil contents of leaves increased by 2.22-2.44 % with K fertilization (Anaç et al., 2007). In another study carried out on the effects of different doses of potassium on yield and leaf nutrient matter content of anise, six different doses of potassium were applied. As a result of the study, yield increased in parallel to the increasing doses of potassium and the highest yield was obtained with 2.4 g K_2O/plot dose (Yağmur, 2009).

CONCLUSION

As medicinal and aromatic plants considered in culture plants are affected by environmental conditions, they gain characters according to soil structure and nutrient element content in soil where they are grown. Plant nutrient elements in soil structure are effective on yield and quality. Plant nutrient elements increase yield and quality, and they also positively affect the human nutrition. In addition, these mineral matters effective on growth and development directly or indirectly affect the quality of product, as well. Commercial quality of the product is also affected by surplus or deficiency of these elements, and active ingredient quantity and composition undergo changes.

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THE LEVELS OF COPPER, ZINC, IRON AND MANGANESE IN SERUM OF SHEEP IN DEPENDENCE OF THE PHYSIOLOGICAL STAGES

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ABSTRACT

The purpose of study was to investigate the copper, zinc, iron and manganese levels in serum of sheep depending on physiological stages of animals. Twenty, autochthonic average three year old pramenka sheep – type dubska, in this investigation were included. Blood samples from ewes were collected three times according to different physiological stages (lactation, dry and pregnancy). The serum levels of copper, zinc, iron and manganese were measured by using Atomic Absorption Spectrometry (VARIAN AA 240FS). The average serum level of iron was significantly different in lactation ($p<0.05$) than in dry stages. The average levels of copper and zinc in serum of ewes were higher in lactation ($p<0,001$) than in dry stages and early pregnancy. For serum manganese, there were no significant difference between lactation and dry stages of ewes, but there was a high significance between lactation and pregnancy, as well as pregnancy and dry stages ($p<0.001$). It can be concluded that all investigated elements had lower average values in serum in stage of dry.

Key Words: Copper, zinc, sheep, physiological stages

INTRODUCTION

Trace elements have an important role on growth, reproduction and productivity of domestic animals (Erman Or et al., 2010). Copper, iron, zinc and manganese are essential trace elements. The essential nature of trace elements is widely accepted. The indispensable feature of the most prominent of these trace elements rests on their role as functional or structural components of crucial metaloenzymes and metalloproteins (Kargin et al., 2004). These trace elements are generally included in enzymes molecules, for example copper in cytochrome oxidase, alkaline phosphatase, in DNA and RNA polymerase and dehydrogenase, manganese in pyruvate carboxilase, zinc in lactate dehydrogenase, carbon anhydrase and iron in catalase and metaloproteins (haemoglobin and myoglobin). The nutrition and health status of ruminants needs attention, particularly with regard to reproduction and productivity. Deficiency of minerals may result in decreased productivity, lower immunity, and compromised health and affect reproductive performance (Antunović et al., 2002). The aim of this study was to determine the levels of copper, zinc, iron and manganese in serum of ewes and to find out possible differences between content of these trace elements according to different physiological stages of ewes.

MATERIAL AND METHODS

The study was carried out on 20 pramenka sheep (n=20) type dubska in area Vlasic Mountain. During the study, the animals were at natural pastures and grassing. The ewes were given fresh water and salt (ad libitum).The ewes were in average 3 years old, healthy and in good physical condition. In the study sheep were properly marked with ear tags and the same ewes were followed in all three physiological stages, from April (lactation), July (dry) and October (early pregnancy). The blood was collected from the jugular vein into sterile vacuum tube and serum was separated by centrifugation at 3000 rpm (10 min) and frozen at -20°C and stored until analysis. For determination of investigations of elements, the serum was diluted 5 times in a solution of 0.1M HCl and concentrations of Cu, Zn, Fe and Mn were measured by using atomic absorption spectrophotometer (VARIAN AA 240FS). The obtained data was analysed statistically using analysis of variance (ANOVA) and statistical differences between means by LSD test were estimated.

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RESULTS

The individual values of investigated elements in the serum of sheep are presented graphically (Figure 1-3).

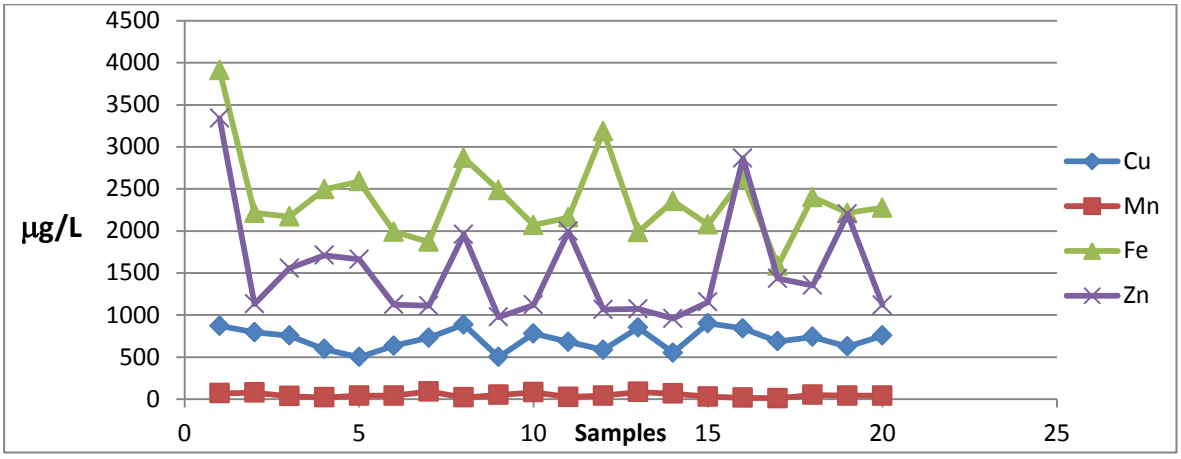

Figure 1. The levels of elements in serum of sheep in stages of lactation

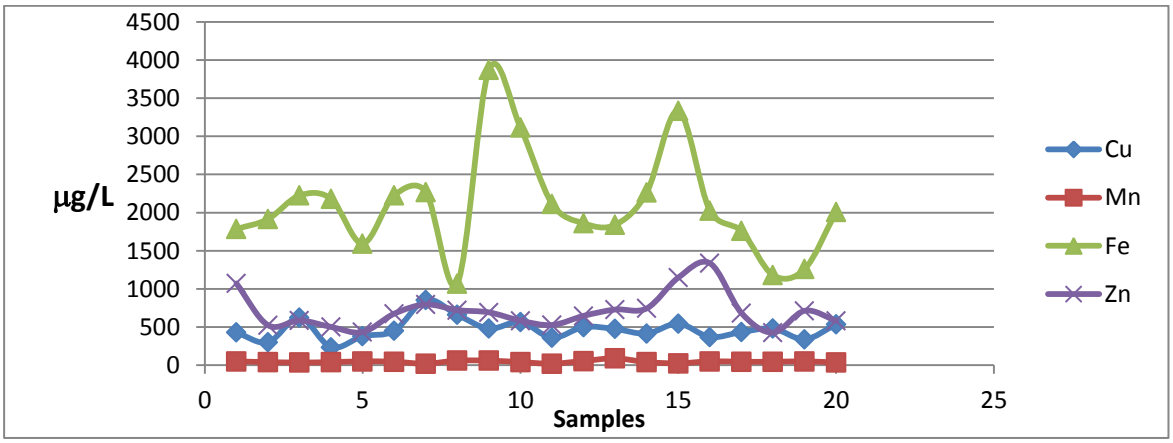

Figure 2. The levels of elements in serum of sheep in stages of dry

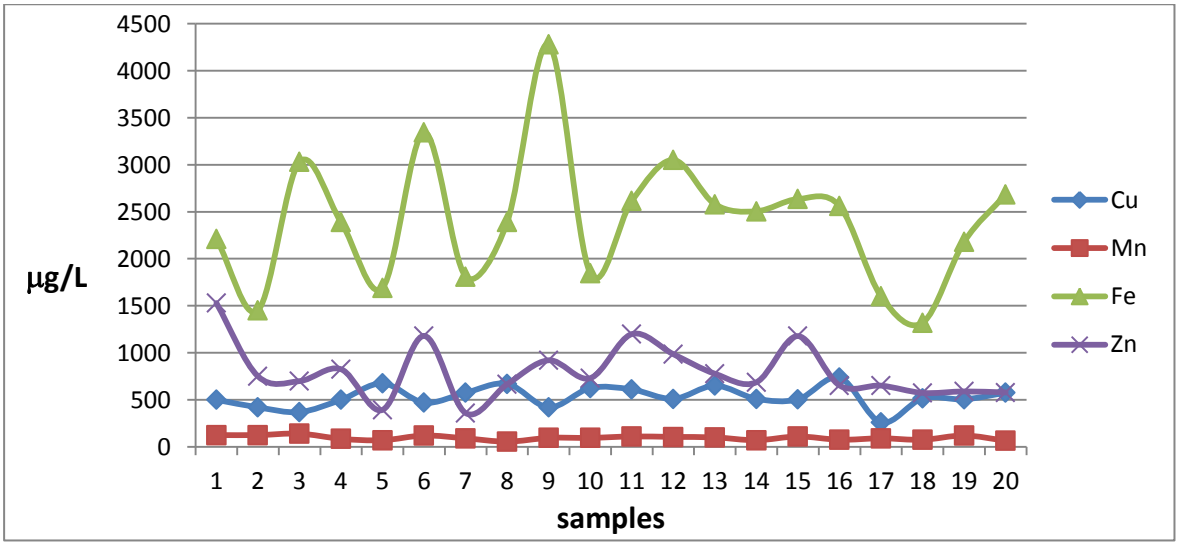

Figure 3. The levels of elements in serum of sheep in stages of pregnancy

The average content of investigated elements in serum of sheep in lactation, dry and pregnancy are presented below (table 1).

Table1. The concentrations of investigated elements in blood serum of sheep (average ±st.dev)

Physiological stages	Cu μg/L	Mn μg/L	Fe μg/L	Zn μg/L
Lactation	712.8±126.3[a]	46.13±24.26[b]	2377±508.2	1545±650.3[a]
Dry	471.8±138.7[b]	44.75±15.6[b]	2095±689.7	706.4±234.8[b]
Pregnancy	530±114[b]	96±23.32[a]	2409±705.3	796±292.4[b]
F test	*	*	n.s.	*
$LSD_{0,05}$	80,16	13,54	-	274,10
$LSD_{0,001}$	138,67	23,42	-	474,193

**- significant ; n.s. – non significant*

The average concentrations of Cu in serum of pramenka sheep, type dubska in stage of lactation are 712.8±126.3 μg/L. It is in range with reference value for copper in serum of sheep (580-1600 μg/L) which given by Kaneko et al., (1997). Lower values for Cu than referenced values, were in dry and early pregnancy. The concentration of Cu during lactation was significantly higher (p<0,001) when compared with values in dry stages. There was a significant difference in Cu concentration between dry and pregnancy (p<0,05). Comparing the levels of Cu in lactation and pregnancy, in pregnancy values were significantly lower (p<0.001) than in lactation.

The average concentrations of Fe in serum of pramenka sheep in stage of lactation were 2337±508.2, in dry (2095±689.7), and 2409±705.3 μg/L for pregnancy. According to Kaneko et al., (1997) the normal values for iron in serum of sheep are from 1660 to 2220 μg/L. Serum analysis of Fe content of pramenka sheep in lactation showed higher values (p<0.05) than in dry, and comparing values between lactation, early pregnancy and dry and pregnancy there were not any significant differences.

The serum level of Zn was higher in lactation (p<0.001) than in dry. There were not statistically differences between content Zn in dry according to pregnancy level this elements, but in lactation contents this parameter was significantly higher (p<0.001) than pregnancy.

The comparing Mn level in lactation and dry showed no statistical difference. The serum manganese concentrations were significantly higher in pregnancy (p<0.001) than in lactation and dry.

DISCUSSION

In the present study, the concentrations of analysed trace elements (Cu, Fe, Zn and Mn) were obtained according to different physiological stages of animals. Zinc and copper are the most important essential minerals necessary for the normal functioning of animals reproduction functions (Kendall et al., 2000; Yildiz and Balikci, 2004). Copper has an important role in haemoglobin shaping and body growth. Symptoms like failure in metabolic functions like immune function, increase in mortality rate, debility, depigmentation, walking disorders, demyelinization in nerve tissues, low osteoblastic activity, and los of weight caused by the failure of oxidation in tissue and diarrhea are reported (Sharma et al., 2005). The copper metabolism is influenced by genetics, and significant difference exists among breeds of sheep in concentrations of Cu in plasma and liver (Woolliams et al., 1985).

There are numerous studies on the effects of different phases of the reproduction cycle on biochemical parameters in domestic animal species. In sheep and goats they were carried out, among others, in relation to oestrus cycle, pregnancy and lactation (Krajničáková et al. 1993).

In this study Cu values in serum from pramenka sheep in lactation were 712.8±126.3 μg/L. It is in range with reference values by Kaneko et al., (1997) for normal values for copper in serum of sheep. Asimovic et al., (2006) were found that average contents for Cu was 820.82±210.75 for pramenka and for cross-bred values was lower 538.49±212.11 μg/L.

The highest daily nutrient requirements for ewes occur during lactation. Concentrate feeds will often be included in the lactation diets to meet these high requirements. An exception to this may be when ewes go directly to pasture with their lambs.

Factors other than Cu intake affect the concentrations of Cu in plasma. Copper in serum was higher at oestrus than at d 21 in nulliparous heifers (Small et al., 1997). The normal ranges of plasma and serum copper are wide and vary between species. The norms for serum copper are 571.5-952.5μg/L for ruminants (Underwood and Suttle, 1999). Serum copper levels between 190.5 and 571.5μg/L represent marginal deficiency, and levels below 190.5μg/L represent functional deficiency (Radostits et al., 2007).

Zinc is an essential mineral for healthy skin, reproduction, bone and cartilage growth, carbohydrate, lipid and protein metabolism, enzyme and immune system. It has a vital role for DNA synthesis. Plasma zinc is a good and early reflection of the zinc status. Early studies have reported that delay in growth, testicular atrophy, hyperkeratosis, anorexia and immune response is affected seriously by zinc deficiency (Burnet, 1982). Plasma zinc level significantly increases in haemolytic blood or in blood contamination during collection, storage or processing (Al-Busadah, 2003). The increase in serum level Zn during lactation could be associated with changes in serum albumin level which was reported to be higher during lactation (Abdelatif et al., 2009).

Many researchers reported that the levels of serum Zn in sheep should be between 800 and 1200μg/L (Ozan, 1985). In our study we obtained the average Zn content: 706.4 (in dry stages), 796 (in pregnancy) and 1545 μg/L in stage of lactation. The levels of Zn were consistent with the previous findings Asimovic et al., (2006). They found that content of Zn in serum of healthy sheep were 1439.92 for pramenka and for cross-breed (1076.01 μg/L).

The serum levels in our study for Fe were in normal range as values by Kaneko et al., (1997) in stage of dry and values in lactation and pregnancy were higher than reference values.

Ruminants are often exposed to high iron intakes through ingestion of water, soil and feedstuffs that are high in iron. A number of studies indicate that addition of 250-1200 mg of iron (from ferrous carbonate/kg of diet) greatly reduces of status cooper in sheep (Prabowo et al., 1988).

Examined Mn content in serum of pramenka sheep in dry stages was lower than in lactation and pregnancy. The results of the present study indicate that Mn might have played some role in the normal oestrus process. Some researchers were founded that level manganese in whole blood in ruminants are: <20 (deficient), from 20-70 (marginal) and >70mg/L are normal.

Manganese has a role in steroid synthesis (Keen and Zidenberg-cheer 1990). In ruminants plasma Mn values were generally lower than 100μg/L (Lamand, 1987; Al-Busadah, 2003).

Manganese deficiency in ruminants is associated with impaired reproductive function, skeletal abnormalities in calves, and less than optimal productivity (Graham, 1991; Puls, 1994). Cystic ovaries, silent heat, reduced conception rates, and abortions are reported reproductive effects.

CONCLUSION

The data obtained from this study showed that profile of investigated elements were affected by physiological stages. The results obtained on this basis indicate that all investigated elements had lower values in stages of dry, than in lactation and pregnancy. This may be due to increased dynamic activity and preparation sheep for reproduction.

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WHOLE-FARM PHOSPHORUS BALANCE ON SMALL DAIRY FARMS IN CENTRAL BOSNIA REGION

Senada ČENGIĆ-DŽOMBA[1] Edina HODŽIĆ[2]

ABSTRACT

Phosphorus is a mineral required for bone growth and many other important bodily functions but fed in excess of an animal's requirement phosphorus is excreted mostly in the feces. In such circumstances, phosphorus is accumulated in soil and thereby contaminates the surface water, which negatively affects the environment. At livestock farms phosphorus arrive as purchased products (fertilizer, animal feed and purchased animals). Within the boundaries of the farm, phosphorus recycles between the livestock and crop components. Finally, phosphorus exit a livestock operation unit preferably as managed outputs (milk, animals, crops and manure) sold off farm. Difference between the inputs and the managed outputs represents a phosphorus balance that can be an indicator of environmentally sustainable production. Phosphorus (im)balance consider only amount of the nutrient that cross the border of the farm. One year study was conducted on five small dairy farm in order to determine whole farm phosphorus balance as difference between total phosphorus inputs (fertilizer, animal feed) and outputs (milk, animals and manure). The inputs to outputs phosphorus ratio ranged from 1,66 : 1 to more than 7:1 indicating that at least four farms are in large phosphorus imbalance representing potentially environmental high risk units.

Key Words: Phosphorus, dairy farms, environment, balance

INTRODUCTION

Phosphorus represents one of essential nutrients for all life forms (essential to plant growth and development, optimum animal performance, bone development and many other important biological functions. Mismanaged P can become environmental contaminants - phosphorus accumulates in large quantities in the soil and transported from agricultural lands to surface waters can promote eutrophication. Eutrophication refers to an abnormally high growth of algae, with declining levels of natural oxygen what can cause changes in fish population and, in extremely cases, fish death. Livestock systems must maintain a balance between the nutrients arriving on farm as purchased feed and fertilizer and nutrients leaving farm as managed products (animal products, animals, crop or manure). Livestock operations that have achieved a balance represent a potentially sustainable production system. Contrary, imbalance of nutrients is the difference between the inputs on farm and the outputs. Any excess of P arriving on farm results in a higher concentration of these nutrients on farm and environmental loses.

P balance or input/output ratio near 1 :1 could be consider as ideal but in the most farms practice phosphorus balance is far worse. Dairy farm with a large imbalance (1.5:1 and greater) would expect steadily increasing soil P levels. According to Koelsch and Lesoing (1999) neither farm no size or ratio of animals to land explain variation of observed phosphorus balance. Feed program and manure export practices were more significant indicator of P balance variation. Commercial fertilizer can be a common source of P inputs on dairy farm especially those with large cropping programs. Purchased animals are potential source of P inputs and purchased animal feeds are often the most significant source of the P inputs. The primary route of P excretion is fecal (Morse et al. 1992). Properly formulated ration that precisely meets the cow's requirements for milk production, maintenance, and gestation will minimize excessive P excretion in the manure and urine. According to Klausner and Goyette (1993) large percentage of the P that is brought onto the several dairy farms in New York farm each year remains on the farm and accumulates over years.

In Bosnia and Herzegovina none study regarding whole animal farm phosphorus balance conducted yet. Taking into account considerable number of cattle (dairy and meat) kept under different farm

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operant condition knowledge of phosphorus flow in farms could be basic step for improvement of P management at the farm.

MATERIALS AND METHODS

One year study was conducted on five small dairy farms in central Bosnia region. Producers were interviewed face to face to collect information needed for determine whole farm's phosphorus balance for each farm. P balance was estimated as difference between total phosphorus inputs (fertilizer, animal feed) and outputs (milk, animals and manure).

Questions referred to producers included the number, breed and category of livestock, land size, total production of forage and crops on the farm, purchased and sold feed, diet composition, the quantity of purchased fertilizer, the amount of manure produced and sold, manure storage method, purchased and sold animals and animal's products (meat and milk). All data (information, questions) were related to the period of one year.

Feed samples (single diet ingredients) were collected and analyzed to determine P, crude protein, crude fiber, ether extract, ADF and NDF content and intake. Feed samples were taken randomly from several different points of the lot on each farm. Subsequently the samples are then mixed to a single blend to produce a collective sample, which again is divided into several representative laboratory samples for crude nutrient analysis. The feed sample is initially dried at 105 °C for 3 hours. The weight loss of the sample is determined and the crude water fraction is calculated. Ashing the sample at 550 °C for 4 hours all organic compounds are removed. Calculating the weight loss of the feed sample from the dry matter to crude ash content mathematically determined the organic matter fraction. The nitrogen content of the feed was the basis for calculating the crude protein (CP) content of the feed (Kjeldahl method). Multiplying the nitrogen content in % obtained via Kjeldahl analysis with 6.25 gives an approximate protein content of the sample. Fats and lipids are extracted continuously with ether, after evaporation of the solvent the residue remaining is the ether extract (EE) fraction. Crude fiber (CF) was determined as the fraction, which is not soluble in a defined concentration of alkalis and acids. Nitrogen-free extractives (NFE) fraction again was calculated by subtracting CP, EE and CF from organic matter.

ADF and NDF content was determined by the Van Soest method. Neutral detergent fiber fraction (NDF) was obtained by digesting (boiling) the feed sample in neutral detergent solution The residue after digestion in a solution with acid detergent is called the acid detergent fiber (ADF). Energy content of forage feedstuffs and diets was calculated on the basis of crude nutrient and ADF content (www.foragetesting.org): (i) NEL, Mcal/lb = 1,0876-(0,0127ADF) for grasses and mixed forage, (ii) NEL, Mcal/lb = 1,044-(0,0119ADF) for legumes, (iii) NEL, Mcal/lb = 1,044-(0,0124ADF) for corn silage, (iv) NEL, Mcal/lb = 0,9265-(0,00793ADF) for grain, and (v) NEL, Mcal/lb = 0,866-(0,007ADF) for complete feed.

Animal nutrient requirements were calculated according to the NRC (1989) scheme for dairy cattle. Milk samples were taken in spring and autumn. Samples were mixed to produce a three collective sample for each farm. Samples were frozen and stored for later analysis of phosphorus content. P content in feed and milk was determined ICP-MS spectroscopy with the prior addition of nitric acid and hydrogen peroxide and digestion of the sample.

Literature data (LPES) was used for phosphorus content in meat and manure. Phosphorus content in mineral fertilizers used from product declaration.

Annual whole-farm phosphorus balance was calculated as difference between total phosphorus inputs (animals, fertilizer, feed) and total phosphorus outputs (animals, fertilizer, milk, crop, feed). This balance is interested only in the nutrients that cross the border of the farm. It is not concerned with nutrients recycled within the farm.

RESULTS AND DISCUSSION

Herd size of farms involved in the study ranged from 8 to 23 dairy cows, with heifers, calves and bulls. Holstein and Simmental breeds were dominant with the exception of one farm with Brown swiss breed

The annual milk production on the farm 1 was 48000 kg, farm 2 - 169200 kg, farm 3 - 85000 kg, farm 4 - 69000 kg and farm 5 – 54000 kg. Annual milk production amounted 6700 (farm 1), 4900 (farm 4), 6100 (farms 2, 3 and 5), kg of milk/cow.

Whole-farm P balance expressed as kg of P per year and P input/output/ratio is shown in Table 1.

Table1. Average whole-farm P balance per farm

Variable	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5
P inputs, kg					
Imported feed	86,25	382,44	168,49	27,64	84,44
Imported animals	0	0	0	0	0
Imported fertilizer	390	165	225	581,25	270
Total inputs	476,25	547,44	393,49	609,19	354,44
P outputs, kg					
Animals	15,33	48,18	30,66	21,90	17,52
Milk	56,61	131,49	85,77	60,45	64,13
Feed	0	0	0	0	0
Fertilizer/Manure	162,5	0	0	0	131,25
Total outputs	234,44	179,67	116,43	82,35	212,90
Inputs - outputs	241,81	367,77	277,05	526,83	141,54
Inputs/outputs : 1	2,03	3,05	3,38	7,40	1,66
output /Input, %	49,22	32,82	29,59	13,52	60,07

Inputs/outputs P ratio ranged from 1,66:1 (F5) to 7,40:1 (F4). P arrived on the investigated dairy farms mostly in the form of purchased feed and fertilizer. The greatest input of phosphorus to the four farms, except farm 2, was purchased by fertilizer.

Since the farmers owned their own land, most of the necessary feedstuffs have been produced at the farms. This primarily relates to the forage (green mass, hay, silage) and part of concentrate feed (grain). No one of the farmer used phosphorus as a supplement.

The largest output of phosphorus from the farms was achieved through the sale of milk. Sales of calves have also affected the output. Only two farmers (F1 and F5) have been sold their manure, what is positively reflected on the balance of phosphorus.

The main reason for this balance of phosphorus is inadequate structure of daily rations for dairy cows as well as for other animals at the farms. Feed used in animal nutrition were low quality, and energy/protein ratio in the diets also was not properly balanced. A direct consequence of inappropriate balanced diets was low milk production what caused low total phosphorus outputs via milk at almost all investigated farms.

Table 2. Phosphorus efficiency and some parameters of dairy cows' diets quality (all values were expressed as daily average per cow)

	Farms				
	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5
Milk yield, kg/day	22	20	20	16	20
P intake, g/day	43,55	68,14	50,175	32,63	51,7
Energy intake, NEL, MJ/day	111,53	116,9	91,79	97,29	119,39
Crude protein intake, g/day	2245	2169	2471	1869	2069
P in milk, g/day	23,54	21	21,40	15,36	22,92
P efficiency*	0,54	0,31	0,43	0,47	0,44

*estimated as relative difference between P in milk and consumed P

The results in Table 2 show that the amount of P in the daily rations did not exceed NRC (1989) recommendations, except at farm 2. Phosphorus efficiency in milk production at investigated farms was variable ranged from 0,31 at farm 2 to 0,54 at farm 1. According to Spears et al (2003) increasing conversion of feed phosphorus to product (milk and meat) phosphorus is an important way to help reduce whole farm phosphorus balance.

Taking into account relatively uniform structure of diets in all farms, variability of phosphorus efficiency in milk production can be explained as consequence of:

(i) inadequate phosphorus intake. Adequate amount of phosphorus in dairy cows rations is important for health and performance. According to NRC (1989) diets containing 0,45% P meets cows' requirements. Efficiency of absorption of phosphorus declines as intake of phosphorus increases (Challa et al. 1989). Phosphorus efficiency was the best at the farm on which was the lowest daily consumed P, while the worst was on the farm 2 in which the cows consumed phosphorus 30% above recommendation, and

(ii) inappropriate balanced ration. Diets at farm 1 had almost optimal energy/protein ratio caused the best P efficiency in milk production because of all consumed energy and protein utilized for milk synthesis. Energy/protein ratio at other farms (energy deficit at farm 3 and protein deficit at other farms) could not meet demand for milk synthesis in amount in quantity which could be adequate for consumed phosphorus. Therefore, managed P outputs (via milk) were lower what was caused poorer whole farm phosphorus balance.

Phosphorus is the most expensive single nutrient in dairy cow nutrition if it is supplemented as inorganic P. Precision cow feeding would save the cost of milk production but also improve whole farm phosphorus balance (Van Horn et al. 1996) with positive effects on the environment. P in feed is largest and the most important input of phosphorus making from 47% to 74% of total P inputs depending on farm capacity (LPES). Taking into account LPES recommendation all farms except farm 5 are out of phosphorus balance what is particularly pronounced at farm 4. Comparing whole farm P balance between farms in intensive end extensive milk production Giustini et al. (2007) found similar result of phosphorus efficiency (40,78%) at extensive farms.

CONCLUSION

Precision nutrition and feeding practice according to recommendation, maximizing feed intake, testing all feed ingredients, soil test and proper soil fertilization will minimize phosphorus excretion in the environment. Some obtained results indicate high environmental risk and require urgent action to improvement of whole farm phosphorus balance.

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THE EFFECT OF VEGETABLE AND ANIMAL FATS ON THE QUALITY OF ADIPOSE TISSUE AND MEAT OF BROILERS

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ABSTRACT

Within these studies, we monitored the effect of added vegetable oil (sunflower oil) and animal fat (lard), in the chicken nutrition, on the chemical composition of meat and melted fat. In the experimental trial, Cobb 500 chicks were raised for 42 days. The total number of female chickens was 120, divided into two groups. Each group had a total of 60 pieces of chicken that were fed with food of identical nutritional composition. Different types of fat were added to the food. The percentage of fat in the mixtures for broilers was 3% per treatment. Chemical analyses were done on melted fat (abdominal fat), white meat (breast without skin) and red meat (drumstick without skin). There was statistically significant difference ($p<0.001$) between groups in the contents of grease in red meat of samples. Sunflower oil with regard to lard in chicken diet gives statistically very high significant difference ($p<0.001$) in the content of proteins of white meat. The protein value in white meat of chickens whose food was greased with sunflower oil was 25,60 %, while the protein value in white meat of chickens whose food was greased with lard was 22,39 %. In the melted fat, in both ways of nutrition, was found a higher presence of Cd whose value was 0,07 mg/kg. The amount of Pb in red and white meat was increased in both food treatments, which is the influence of the diet containing traces of heavy metals. Determination of quality for rendered chicken fat showed that there was statistically significant difference ($p<0.001$) between groups in peroxide number depending on the applied treatment of nutrition. Greater value of peroxide number was observed in the fat of the chicken that were fed with the diet that was greased with sunflower oil. It iwas determined that there was statistically significant difference ($p<0.001$) between the groups in free fatty acids. Free fatty acids had greater value in the grease of chickens that were fed with the diet in which sunflower oil was added.

Key Words: Lard, sunflower oil, meat, compound

INTRODUCTION

The success of broiler production depends on nutrition. Analyzing the impact of food containing soybean oil and tallow in fattening chickens Wongsuthavas et.al. (2007) found that the food has impact on the amount of water and fats in the chicken bodies. Food enriched with copper can cause stimulation or reduce activity of some enzymes and influence the structure of tracylglycerols in subcutaneous adipose tissue of animals (Gurr, 2009). Crespo and Esteve-Garcia (2002) in different experiments obtained significant results when it comes to food for fattening effect on abdominal fat deposition in broilers. It was shown that broilers fed with sunflower and linseed oil (added 6-10%) have better value for feed efficiency, regardless oft he amount of added oil.

Azain (2004) showed that the choice of fat for greasing food can directly affect the composition of fat and meat.The primary goal of our research was to make the evaluation of impact of the type and quality of the fats used to grease food for towelling chickens on quality and chemical parameters of lipids in melted fat, red and white meat of chickens aged to 42 days. A part of these studies was the impact of used sunflower oil and lard, which have a decisive impact on the chemical composition of melted fat, red and white chicken meat. The content of toxic metals like contaminants of food are also determined.

MATERIAL AND METHODS

In the experimental trial, Cobb 500 chicks were raised for 42 days. Chickens were fed with diet including sunflower oil and lard. The procedures were made on melted fats taken from different parts of chicken body and from red and white chicken meat, are divided into two groups. The total number of chickens was 120, divided in two groups (of 60). From each group individual samples were taken for chemical analysis. Both of the groups contained Cobb 500 chicks fed with greased food in whose composition sunflower oil was added (sample:FSO-melted fat, RSO – red meat and WSO - white meat) and lard (sample: FL-melted fat, RL-red meat and WL-white meat). Chickens were kept in fattening for 42 days

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and divided into two periods. In the first period from 1-16 days, chickens were fed with starting (starter) mixture, and in the second period from 17-42 days closing (finisher) mixture. The percentage of fat in mixtures for broilers per treatment was 3%. After the age of 42 days, chickens were starved for 12 hours and then they were slaughtered. After processing the bodies adipose tissue was separately melted in the usual way (heating in the pot) in appropriate laboratory conditions. The samples were analysed in the laboratory of Biotechnical Faculty.

Analytical methods

Determination of water content in the samples was done by the reference method (EN ISO 662:2000). Determination of fat content was done by method (HRN ISO 1443: 1999). Determination of protein content was done by method (HRN ISO 937: 1999). Toxic metals (Cd, Cu, Pb) were determined by atomin absorption spectrophotometry „Analitycal Methods" FP-3 Analysis of Meat and Meat Products (2000), UV spectrum, „Perkin Elmer" AAnalyst-800. The results are expressed in mg/kg. Reading the results of the AAS was carried out on a flame technique. The peroxide number was determined by method (EN ISO 3960:2010), free fatty acids by method (EN ISO 660:2009). Statistical processing of data obtained on the basis of average values, standard deviation, variability coeficient and the t-test for all parametres was done by using the PC software package Microsoft Excel 2003.

RESULTS

The average values of chemical parameters in analysed samples are shown in Table 1.

Table 1. Average values of the chemical composition of chicken fat and meat according the treatmaents

Analysed parameter (n = 60)	Samples					
Water (%)	FL	FSO	RL	RSO	WL	WSO
$\overline{X}$	0.37	0.24	76.15	73.15	72.38	76.21
SD	0.24	0.16	1.179	0.970	1.180	1.993
Sx	0.04	0.03	0.215	0.177	0.215	0.364
X min	0.10	0.10	73.76	71.36	70.30	70.10
X max	0.93	0.74	77.90	75.92	74.90	78.94
Statistically significant differences (T- test)	t=2.48*		t=10.771***		t= 9.04***	
Fats / Mast(%)	FL	FSO	RL	RSO	WL	WSO
$\overline{X}$	98.33	98.74	3.97	3.27	2.58	2.48
SD	1.15	0.71	0.836	0.792	0.904	0.443
Sx	0.21	0.13	0.153	0.145	0.165	0.081
X min	94.90	97.25	2.32	1.97	1.14	1.95
X max	99.74	99.84	5.19	5.24	4.22	3.22
Statistically significant differences (T- test)	t =1.652 N.S		t=3.359**		t =0.551 N.S	
Proteins/ Proteini (%)	FL	FSO	RL	RSO	WL	WSO
$\overline{X}$	---	---	17.12	17.55	22.39	25.61
SD	---	---	1.55	1.43	0.99	1.68
Sx	---	---	0.28	0.26	0.18	0.31
X min			14.08	15.06	19.99	22.14
X max	--	--	19.36	19.74	24.17	27.90
Statistically significant differences (T- test)	---		t = 1.102 N.S		t=8.994***	

** There wos a significant difference (p<0.05) ** Produced highly significant difference (p<0.01)*
**** Very high significant difference (p<0.001) NS- Not exist significant difference (p>0.05)*

According to the results in Table 1, the significantly higher ($p<0.05$) content of water (0.37 %) was in the samples of fat of chickens fed with lard, compared to the fat of chickens in whose food sunflower oil (0.24 %) was added to. Pesti et.al., (2001) the content of water in fats of chickens fed with food with added lard was from 0.20 to 0.67 %. According to the Wongsuthavas i et.al. (2007), the content of water in fat of chickens whose feed soybean oil was added to, was 4.5 %, and in chickens fed with fat, it was 4.9 % which is significantly higher according to our results. Water content in samples of white meat was significantly higher ($p<0.001$) in samples whose food was with sunflower oil (76.21 %) than in samples whose food was greased with lard (72.38 %). According to research of Ivanković et.al.,(2004) the water content ranged from 74.43 % to 75.63 % for red meat. In samples of red meat whose food was greased with lard and sunflower oil, the content of water was 76.15 % and 73.15 % respectively. The content of fats in melted fat showed no significant diherence between treatments. In samples of fats of the chickens fed with sunflower oil and lard were 98.74 % and 98.33 %. It was determined that there is no significant difference ($P>0.05$) between aritmetic mediums of the fats obtained by melting the fat content of adipose tissue. The value are compared with our results. The fat content is higher in red than in white meat. In samples of red meat whose food was greased with lard and sunflower oil, the fat content was 3.97 % and 3.27 %. A statistically high significant difference was determined ($P<0.01$). Lessiow (2006) states that the total content of fats in muscle tissue of broilers at the age of 6 weeks for breast area is 1.58 %, for drumstick and thighs 6.65 %. The proteins in melted fat were not determined, so it can be concluded that they are not present or can not be verified.

In the red meat of the chickens fed with food greased with lard and sunflower oil, the content of proteins was 17.12 % and 17.55 %. The difference between treatments was not statistically significant ($P>0.05$). In sample of white meat whose food was greased with lard and sunflower oil, the content of proteins was 22.39 % and 25.60 %. It was determined that the content of protein in white meat was statistically very significant ($P<0.001$). Alvarado and Owens (2006) state the protein content of 19.14 % in the drumsticks and thighs area, and in the breast area 22.80 %. The values are compared with our results. The results of toxic metals are showed in Figure 1.

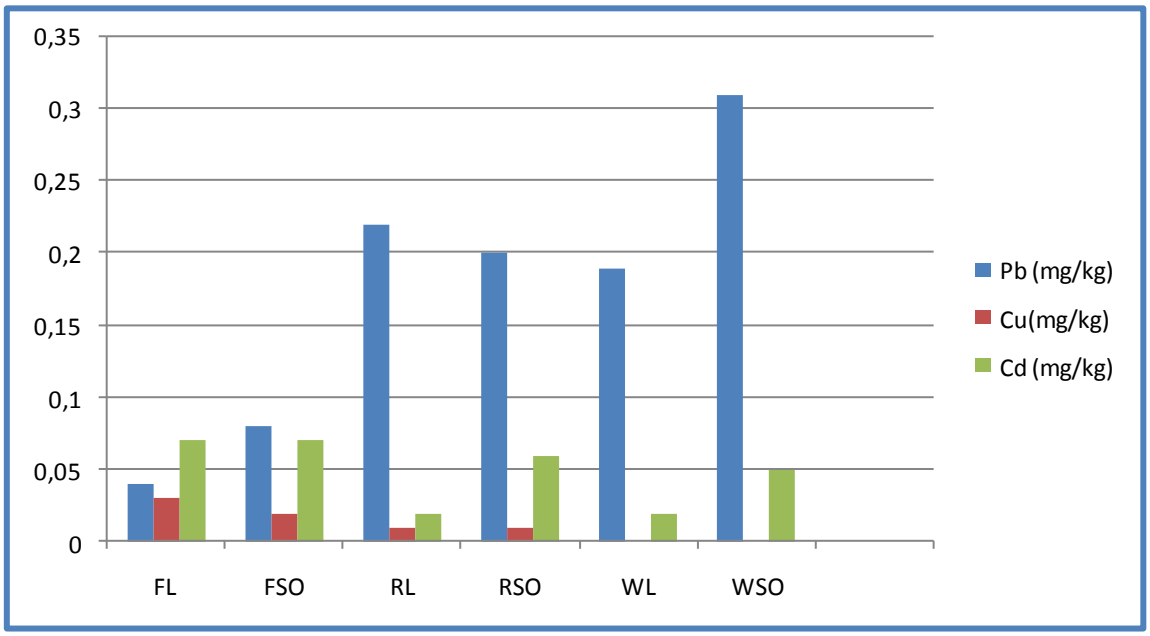

Figure 1. Average values of toxic metals in rendered chicken fat

Content of lead (Pb) in sample of fat of the chickens fed with lard was 0.04 mg/kg and in sample whose food was greased with sunflower oil 0.08 % mg/kg. At red meat whose food was greased with lard and sunflower oil, they were 0.22 mg/kg and 0.20 mg/kg. At white meat whose food was greased with lard the value was 0.19 mg/kg and in the sample whose food was greased with sunflower oil 0.31 mg/kg. The amount of cooper (Cu) in melted fat of samples of chickens in whose food lard was added was 0.03 mg/kg and in samples of the fat of chickens fed with sunflower oil was 0.02 %. In samples of red meat in both

nutrition treatments values of 0.01 mg/kg were found, while in white meat the presence of cooper (Cu) wasn't detected. In melted fat of chickens the value of cadmium (Cd) was determined in the samples of both nutrition treatments, 0.07 mg/kg. In samples of red meat containing cadmium (Cd) in food greased with lard and sunflower oil they were 0.02 mg/kg and 0.06 mg/kg. White meat had 0.02 mg/kg (Cd) in a sample in which lard was added and in the sample where sunflower oil was added there was 0.05 mg/kg. Toxicity is expressed by acting on biological tissue, and manifested by disorder of vital functions in the organisms of living beings .Maximum levels for certain contaminants in food allowed values of lead for fats is 0.01 mg/kg, Cd 0.050 mg/kg and copper 0.40 mg/kg (Čorbo,2000).

Table 2. Average values of peroxide number and free fatty acids in melted fat

Analysed parameters of melted fat n = 60	Samples		Statistically significant differences (T- test)
Peroxide number (mmolO_2/kg)	FSO	FL	t= 5.81***
$\overline{X}$	0.76	3.2	
SD	0.06	0.7	
Sx	0.01	0.1	
X min	0.68	2.2	
Xmax	0.89	4.4	
Analysed parameters of melted fat n = 60	**Samples**		**Statistically significant differences (T- test)**
Free fatty acids (% oleic acid)	FSO	FL	t = 8.76***
$\overline{X}$	0.76	0.5	
SD	0.06	0.1	
Sx	0.01	0.0	
X min	0.68	0.3	
Xmax	0.89	0.7	

Statistically very high significant difference (P<0.001) in peroxide number in melted fat between different nutrition treatments. The fat of chickens in which food lard and sunflower oils was added. The values were 3.27 mmolO2/kg and 4.16 mmolO2/kg. Piette et al. (2001) determined the value of peroxide number from 3.3 mmolO2/kg to 5.1 mmolO2/kg in chicken fats. Our results are consisted to the literature data as well as with the (EN ISSO 3960:2010) which allows the value to 5 mmolO2/kg. In samples of chicken fats whose food was greased with lard and sunflower oil, the content of free fatty acid in both treatments was 0.54 % and 0.76 %. In samples of chicken fats whose feed was greased with lard and sunflower oil, the content of free fatty acid in both treatments was 0.54 % and 0.76 % respectively.. It was determined that there is statistically significant difference (p<0.001) between values of free fatty acids in melted chicken fat in different nutrition treatments. Based on the studies (Piette et.al., 2001) which were performed on subcutaneous adipose tissue from the chicken breast, it was found that by increasing the temperature, the content of free fatty acids was also increased. That is how at the temperature of 105°C the value of free fatty acids was 0.81 %. According to the Regulation (Sl.list RH/Official Gazette of Republic of Croatia, 55/99), the content of free fatty acids for chicken fat should not go beyond 0.75 %.

CONCLUSION

The application of different feeding treatments affected the content of water in chicken melted fat (abdominal fat). The statistical analysis showed that there is statistically significant difference (p<0.005). In samples of red (drumstick without skin) and white meat (breast without skin) is a statistically highly significant difference (p<0.001). The content of water was higher in white meat of chickens whose food was greased with sunflower oil comparing to the meat sample of chickens fed by lard greased food. The applied treatments had no significant effects on fat content in chicken melted fat which was proved by statistical analysis (p>0.05). In chickens fed with food in which lard was added, the fat content in samples of red meat was higher comparing to the white meat . Between the feed treatments it was determined statistically highly significant difference (p<0.01) in fat content of red meat, because the fat content is

higher in the samples of lard greased food, while in white meat no statistically significant differences (p>0.05) were determined. There is a higher content of proteins in white meat than in the red meat. Among samples of white meat and red meat depending on food treatment, there were no statistically significant differences (p>0.05) observed. Only at white meat of chickens whose food was greased with sunflower oil, there was statistically highly significant difference (p<0.001) observed due to the higher content of proteins. The application of sunflower oil and lard in the diet of chickens, affected fat and meat quality parametres. The added sunflower oil resulted in meat with higher content of proteins and lower content of fat because of unsaturated fatty acids in its structure. In samples of melted fat (abdominal fat) of both feed treatments, the presence of Pb and Cu was not identified in unallowed quantities. In white and red meat, the content of Pb is increased in both food treatments which is primarily the result of food in which traces of heavy metals may be found in as well as in fats that the food was greased with. The peroxide number of melted fat of sunflower oil treatment was higher than in the lard treatment. Statistically highly significant difference (p<0.001) was observed. Also, the applied treatments had significant effect on free fatty acids in samples of chicken melted fat in sunflower oil treatment, where statistically high significant difference (p<0.001) was observed.

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PHENOTYPIC AND GENETIC VARIABILITY OF DAIRY TRAITS OF BLACK AND WHITE COWS

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ABSTRACT

Application of certain selection methods and procedures is qualified by the degree of heritability and genetic correlations among observed traits. Since the large number of the genes influences dairy traits of cattle, it is necessary to analyze different conditions and factors that influence milk production of cows. This is very important because expression of genes linked with dairy traits partly, sometimes mainly, depends on the environmental conditions.

In order to analyze phenotypic and genetic variability of dairy traits, sample is consisted of 2955 first calving Black Paid cows. Daughters of 18 pure Holstein bull-sires originated from 7 farms of Agricultural Cooperation Belgrade were used. Average milk yield in the first standard lactation accounted 6194 kg, milk fat content was 3.85%, milk fat yield 238 kg, and yield of fat corrected milk 6047 kg.

Variation of observed traits in the first standard lactation mainly was under influenced of farm, year and season (P<0.01). The influence of genotype was significant (P<0.01) for all yield traits, while non-significant (P>0.05) was for duration of lactation.

Heritabilities for the duration of lactation and average milk yield in the first standard lactation, milk fat content, milk fat yield, and yield of fat corrected milk were 0.04, 0.176, 0.022, 0.169, and 0.175, respectively.

Key Words*:* Phenotypic variability, heritability, dairy traits, black and white cattle

INTRODUCTION

Milk yield, milk fat content and protein yield and content, are among the economically most important characteristics of milk production. Listed traits are quantitative and they vary due to effects of factors influencing their expression. The first group of factors are hereditary – the genotype. Individuals within one herd differ in their genes, which originate from their parents. Milk production characteristics of cows vary under the influence of sires (Petrović et al., 1998; Stojić, 1997; Chaauman and Hayes, 1991; Schutz et al. 1990). In addition to the genotype which is the most important constant effect, there are also other constant, environmental factors (Stojić et al., 1993; Trifunović, 1993; Novaković, 2001) influencing milk yield, such as: age at calving, lactation duration, days open, year and season of calving, level of milk production on the farm, rearing technology. Due to various conditions and the effect of environmental factors, it is very difficult to establish the actual and absolute genetic impact on each genotype, and the impact of environmental factors. The introduction of up to date and improved technological solutions in milk production results in decreased variation of environmental factors. Optimal rearing conditions and nutrition enable more complete expression of additive effects of genes, thus improving the efficacy of selection of reared animals, which is in fact the terminal goal of all breeders of domestic animals (Djedović, 2000).

In addition, linear methods used today to evaluate breeding value enable the use of more informations which are indispensable for objective evaluation and ranking of investigated animals.

The goal of this paper is to asses phenotypic and genetic variability of milk production traits of black pied cows in the region of Belgrade, and to establish the possibility to apply parameters obtained in future selection work to upgrade this population, all aimed at a more secure increase of milk production.

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MATERIALS AND METHODS

Phenotypic and genetic variability of milk production traits were investigated on a sample of 2955 standard lactations of first calving black pied heifers, with an average of 51.8% HF genes in their genotype. First calvers originated from a total of 18 sires, and produced on seven farms of "PK Beograd", during a period of four years.

Following milk production traits were analyzed in a standard lactation: lactation duration, milk yield, milk fat content, milk fat yield and yield of 4% FCM.

Sources of phenotypic variability and heritability of milk production traits in the 1st lactation were determined using the following mixed model (LSMLMW), Harvey (1990). Coefficients of heritability of investigated traits were calculated from components of variance of sires.

Models 1 and 2:

$$Y_{ijklm} = \mu + O_i + F_j + G_k + S_l + e_{ijklm}$$

$$Y_{ijklm} = \mu + O_i + F_j + G_k + S_l + b_1(x_1-x_1) + b_2(x_2-x_2) + e_{ijklm}$$

where:

Y_{ijklm} = expression of milk yield trait of m^{th} cow, daughter of i^{th} sire which produced on j^{th} farm, and was born in k^{th} year in l^{th} season

μ = general average of the population with equal number of repetitions by classes; O_i = random effect of i^{th} sire (except in Model 2, where this is a fixed effect); F_j = fixed effect of j^{th} farm; G_k = fixed effect of k^{th} year of calving; S_l = fixed effect of l^{th} calving season; b_1 = linear regression effect of age at calving; b_2 = linear regression effect of duration of days open; e_{ijklm} = other undetermined effects

RESULTS AND DISCUSSION

Mean values and variability (standard deviation, mean error and correlation coefficient) of investigated traits of milk production in the 1st standard lactation, obtained by standard data analyses are presented in Table 1.

Table 1. Mean, standard deviation, mean error and correlation coefficient of milk production traits

Traits	$\bar{X}$	SD	$S\bar{x}$	CV(%)
	n=2955			
HF genes, %	51.81	12.92	0.24	24.94
Lactation, days	322.03	49.15	0.90	15.26
Milk yield, kg	6194.66	1354.77	24.92	21.87
Milk fat content, %	3.85	0.19	0.004	4.99
Milk fat yield, kg	237.95	51.58	0.95	21.67
Yield of 4% FCM, kg	6047.20	1307.09	24.05	21.61

In the 1st lactation of 322 days average duration, first calvers produced an average of 6194.66 ± 1354.77 of milk, and 237.95 ± 51.58 kg of milk fat yield. Milk fat content was 3.85%, while the yield of 4% FCM was 6047.20 ± 1307.09 kg.

Analysis of variance (Table 2) showed that the effect of sires was statistically highly significant ($P<0.01$), for all investigated traits, except for milk fat content, where this effect was statistically significant ($P<0.05$).

Table 2. Overall mean (μ) of least squares and their errors (SE) for milk production traits in the 1st standard lactation and F-test for investigated effects

			F-test for investigated effects					
Traits	**μ**	**SE**	**Sire**	**Farm**	**Year of calving**	**Season of calving**	**Calving age**	**Days open**
				n = 2955				
df_1			17	6	3	3	1	1
df_2			2923	2923	2923	2923	2923	2923
Lactation, days	323.19	0.71	2.403**	163.090**	0.814 NS	8.014**	0.546 NS	34651.082**
Milk yield, kg	5934.2	91.39	7.459**	45.021**	3.684 *	10.910**	36.399**	124.052**
Milk fat content, %	3.81	0.01	1.783*	112.012**	15.136**	5.127**	0.062 NS	23.833**
Milk fat yield, kg	225.88	3.36	7.164**	57.688**	8.701**	8.374**	39.409**	97.556**
Yield of 4% FCM, kg	5761.8	86.86	7.415**	51.069**	6.385**	9.731**	38.996**	110.553**

*NS; non-significant, * P<0.05; **P<0.01*

The contribution to sires to total variation of milk yield was 7.46%, while their contribution to total variation of milk fat content was lower and amounted to 1.78%. The established highly significant contribution of sires to milk production traits of their daughters indicates the importance of their contribution to genetic upgrading of milk production, as well as the importance of selection procedures which are undertaken with the goal to rear and select the best bulls for breeding.

The effect of fixed factors of farm, year and season of calving on investigated traits of milk production, is also statistically highly significant (P<0.01), except for the effect of year of calving on lactation duration, when this factor was not statistically significant (P>0.05).

Results of phenotipic variability of milk production traits from our investigation were in agreement with values established by Stanojević et. al. 2012, Djedović 2000, Trifunović 1990, Stojić 1997. Considerably lower values for traits of milk yield and milk fat yield were established by Allbuquerque et al. 1995, Makarov 1994, Brotherstone, 1994, Petrović 1993, Moore et al. 1991, Lazarević et al. 1988 and Camacho and Deaton 1984. Higher values for milk and milk fat yield were established by Domyan, 1992, Hageman et al. 1991 and Weller and Folman, 1990.

Milk production traits, especially milk yield, vary under the influence of sires, which is in agreement with investigations by Stojić 1997 and 1993, Latinović et al. 1990 and Lazarević et al. 1998. Our results showing highly significant effects of farm, year and season of calving of cows on milk production traits and are similar to results reported by Latinović 1990. and Sonja Jovanovac 1989.

Table 3 presents results for heritability of milk production traits calculated from the relationship between additive genetic and total phenotipic variability.

Results obtained for heritability of milk production traits indicate significant potentials to influence genetic potential of cows by selection, and therefore also to increase milk and milk fat yield. Established lower values for heritability of milk production traits, as compared to other authors, can be explained by the mode of selection in the studied population, which is characterized by using positively tested sires with small mutual differences pertaining to milk and milk fat yield.

Table 3. Heritability (h^2), heritability error (S_h^2) and additive genetic variance (σ^2_a) for milk production traits in the 1st lactation

Traits	h^2	S_h^2	σ^2_a
Lactation, days	0.040	0.021	1.00
Milk yield, kg	0.176	0.062	4.61
Milk fat content, %	0.022	0.016	0.56
Milk fat yield, kg	0.169	0.060	4.40
4% FCM yield, kg	0.175	0.062	4.58

Heritability coefficients for milk production traits established in our investigation mainly agree with investigations carried out by other domestic authors. For example, Stanojević et. al. 2012, Djedović 2000 and Nikolić 1997, published results similar to ours, while Hung et al. 2008, Carlen et al. 2004, Petrović et al. 1998, Stojić 1997 and Allbuqurque et al. 1995, reported higher results for heritability of above mentioned traits.

The differences for heritability of milk production traits, by authors, are most probably due to the size and structure of samples, and not to actual heritability within the investigated population. For this reason, it is very important to use larger numbers of animals, originating from more various sires to investigate heritability, which results in a decrease of the share of variability resulting from environmental factors, and an increase in the share of variability caused by the genotype of animals, in the total variability, all leading to a more accurate assessment of heritability.

CONCLUSION

Average milk yield in the first standard lactation accounted 6194 kg, milk fat content was 3.85%, milk fat yield 238 kg, and yield of fat corrected milk 6047 kg. Heritability of the investigated traits had values from 0.022 (milk fat content) to 0.176 (milk yield).

Results obtained for phenotypic and genetic variability of black pied first calvers, permit the conclusion that existing variability provides sufficient room for further improvement of production capacities of cows by using already known methods of selection and breeding. A more accurate assesment of hereditary variance will considerably contribute to a more reliable evaluation of breeding values of cows, as well as to creating future procedures for genetic upgrading of milk production.

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SHEEP AND GOAT PRODUCTION IN ALBANIA

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ABSTRACT

Small ruminants provide about 13% of total milk production and 30 % of total meat production in Albania. Meanwhile, 47% of sheep and 55% of goat flocks are managed in hilly and mountainous regions of Albania. In these regions accounting for about 60% of Albanian territory, nearly 40% of the human population dwells, out of which 70% inhabit poor rural areas. The small ruminant farming is one of the main production activities in these regions of Albania. Sheep produce about 55% of total milk quantity and goats produce about 45%. Small ruminants produce nearly 48% of the meat production. Nonetheless, in these regions 36% of livestock markets, 27% of milk processing units, 29% of meat processing units, 44% of wool knitting units and 14% of refrigeration units are functioning. The production system is extensive. Animal feeding is mostly based on the utilization of pastoral reserve of the environment. The cultivated pasture feeds provide 5-10% of requirements. The concentrated feed (mainly maize and/or bran) is used at the amount of 100-150 g/day, only for one month before and after weaning. Barns for shelter are built of makeshift materials.

Key Words: Albania, small ruminants, production system, meat production

INTRODUCTION

Albania is located in south east of Europe with a total area of 28,000 km^2 out of which 24% consists of agricultural land, 36% of forest, 16% meadow and pastures and 24% of unproductive land, urban land, inland waterways, etc. (Fig. 1).

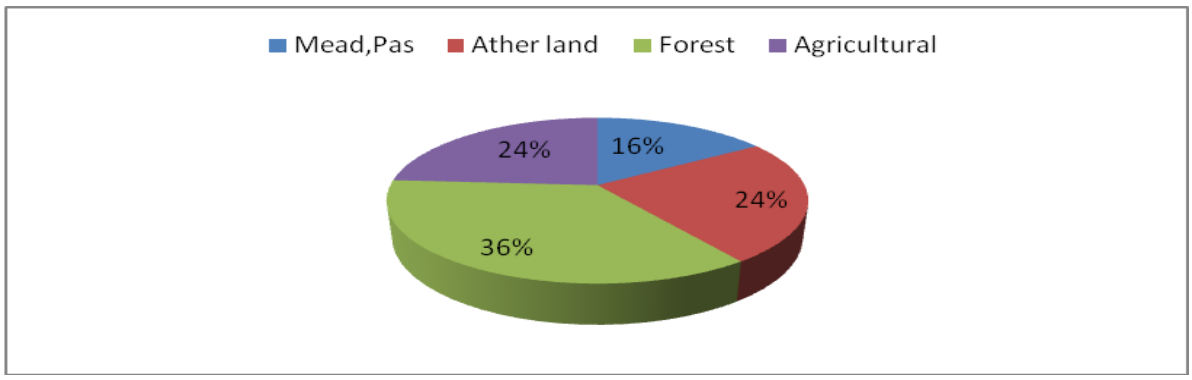

Figure 1. The structure of land in 2010

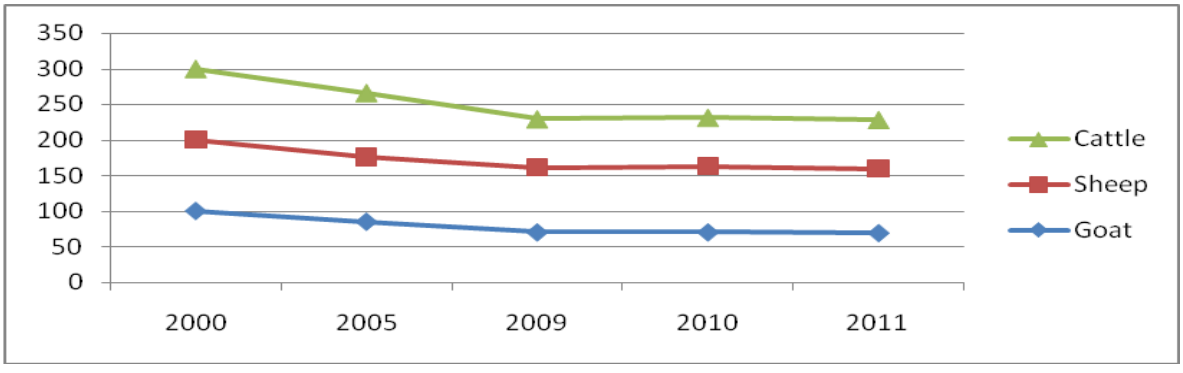

Figure 2. Number livestock in % to 2000

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The number of livestock has changed until 2000 and from 2000-2011 the number has remained unchanged (Fig. 2).

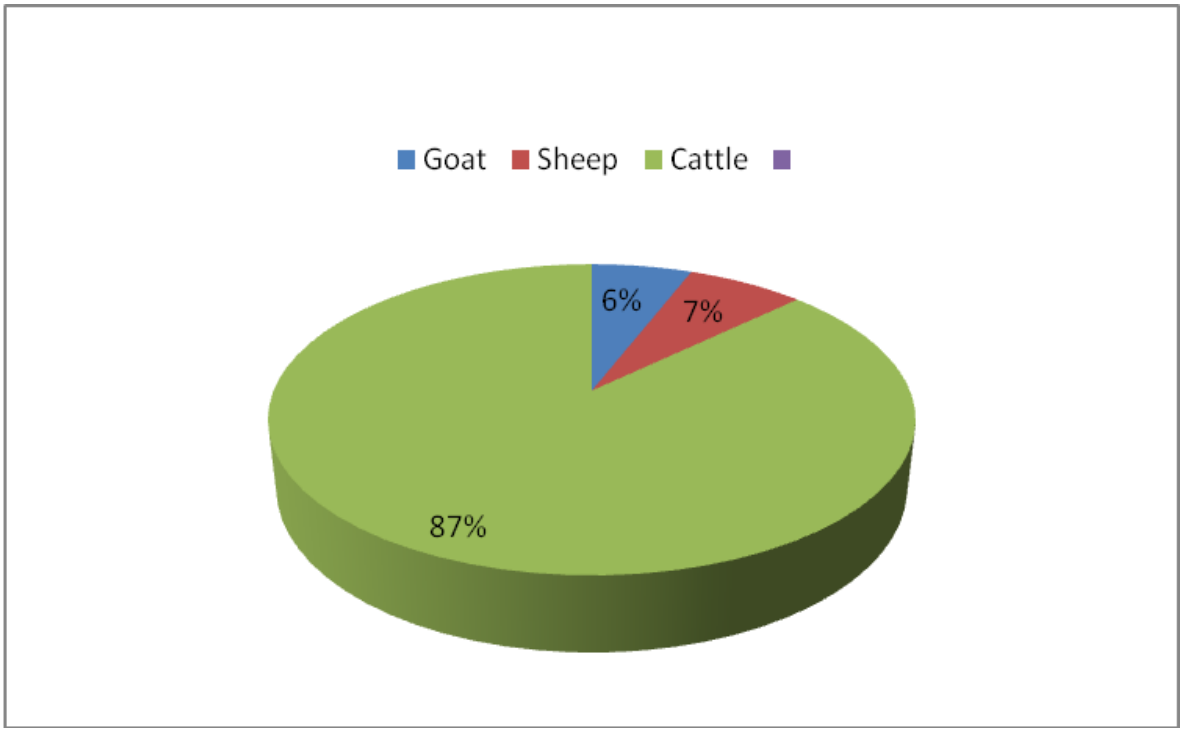

Figure 3. Milk production in 2010

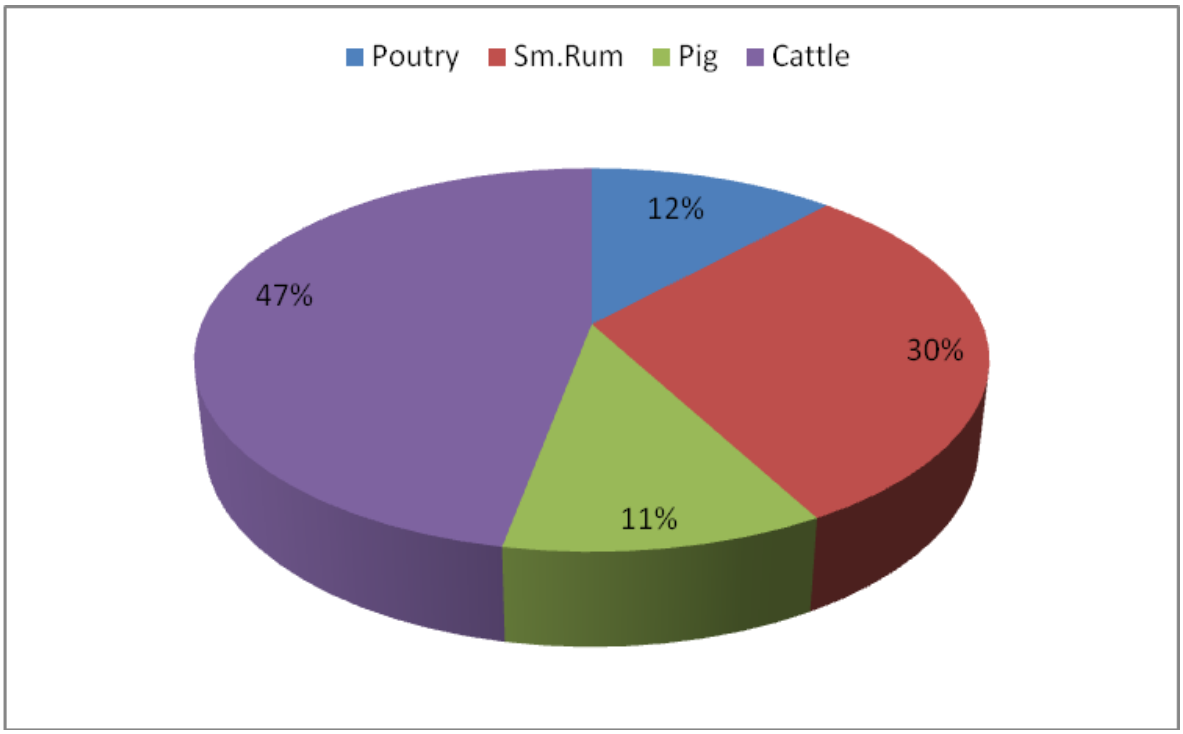

Figure 4. Meat production in 2010

The agricultural production constitute about 65% of the gross domestic product (GDP). The livestock production accounts about 47%, the field crop 45% and the fruit trees up to 8% of total agricultural production. Agricultural land is 393,000 ha (about 56%), 86% of Albanian forest's fund (1026 thousands ha) out of which 45.5% consists of high forest, 30% of coppice and 25% of shrubs, lies in hill and mountainous regions of Albania. In these regions accounting for about 60% of Albanian territory, nearly 40% of human population dwells, out of which 70% in poor rural areas. The small ruminant farming is one of their main production activities. There are managed 47% of sheep and 55% of goat flocks. Sheep produce about 50.2% of total milk quantity and goats produce about 55%. Small ruminants produce nearly 48% of meat production. Nonetheless, 36% of livestock markets, 27% of milk processing units, 29% of meat processing units, 44% of woof knitting unit and 14% of refrigeration units are functioning only there. The figures mentioned above demonstrate clearly the insufficient investments of infrastructure because of the low economic and social level. This situation is not only consequence of politics of old communism system. The lack of clear strategy for the macro and micro economic development of these regions during the last 10 years of politic and economic transition period, the population and youth emigration towards the western regions and abroad have effected negatively too. In hill and mountain regions the presence of supported politics and projects for economic and social development are insufficient. There are not determined yet priorities and development strategies according to the main characteristics of these zones. There are only some private initiatives within familiar economy aiming to provide the living necessities on minimal economic and social level. The main resource of inputs for rural area families is the cultivation of 1-1.5 ha of arable land and the management of a mix heard of 1-2 cow's and 10-15 small ruminants. Only 15-20% of small-scale farms keeps 80-1000 small ruminants. The average yearly inputs for person are about 650-700 US $.

Sheep and goats production system

The predominant system in hill and mountain regions of Albania is the extensive one. The management of the animals is that based on traditional. The new technologies are of a little known by the farmers.

The animals have not ear tags and does not exist the structures and needed logistic for their performance control. This work is done only in some small herds and not in systematic ways. The reproducers selection is done by the farmers themselves based on their experience and their empiric intuit.

Animal feeding is mostly based on the utilization of pastoral reserve of environment. The cultivated pasture provide 5-10% of requirements. The concentrated feed (mainly maize and/or wheat bran) is used at the amount of 100-150 g/day, only for one month before and after yeaning.

Barns for sheltering are built of makeshift materials.

The transhumance of animals is carried out as common activity of owners having flocks of no fewer than 100 heads. During March-October period alpine pastures are used. During the winter season the flocks immigrate in western field zones of the country. Their owners have to pay the rent of 120-160 US $/ha. The animals are kept outdoors grazing the fields that will be planted in spring time. The farmers having very few heads do not migrate animals. They use communal pastures and forests. The use of pastoral reserves of spontaneous flora has not been done organized and managed, generating major questions for protecting and developing environment. Recently, this phenomenon is acquiring threatening dimensions because of massive emigration of young people; there are no shepherds, necessary for following and migrating flocks. Keeping animals at the same pasture and grazing them without criterion is ruining these land pastures.

Usually farmers practice only one lambing per year. A second lambing during the same year can be found accidentally.

Lots of work on sheep and goat farms is done by hand. The most labour-consuming process in sheep/goat farming, for example milking, is done manually nowadays.

Is very difficult to manage the present production system. Based on the current production system, thoroughly changed in the last ten years, we are not supplied with any scientific research or detailed description of labour organization at the farm level. In present situation, possible means to improve sheep and goat production system in hill and mountainous regions of Albania are:

(ii) Setting up a parameters of sustainable production in local ecological and market conditions.

(iii) Moulding of new production strategies, according the specifics conditions in different zones of these regions, for an optimal utilize of the farm's resources.

(iv) Development and implementation of pilot-projects with participation of farmers and/or farmers' organizations.

Extension services for the farmers

The structures of this service have been set up at local level. One extension service specialist covers 3-4 communes. He is responsible to transmits necessary knowledge to farmers and/or their community concerning good management of the producing sources of farm, managing animals and reproduction as well as products processing.

This public service in the hill and mountainous regions is in the first steps and a lot of questions regarding various problems have to be answered:

(i) Prior to starting an extension program, the farmer's practice must be well known. It is also useful to evaluate their knowledge and to better understand their attitude towards the problems they have to face.

(ii) The training requests are huge and the information requirements are often elementary.

(iii) The farms should be individually considered because their characteristics are very different.

(iv) The process of build up of farmers' Association is very important as a best way to have been the project of integrated rural development. Actually, real possibilities of extension service structures, in hill and mountainous regions in Albania are much fewer than need are. Lack of organizing farmers in association and insufficient work of these structure in community indicate deficiency of this service. As it has mentioned above, these regions of Albania have at the same time the lowest economic, social and cultural level as well as suffer major lacks in infrastructure and investments. In this condition, with the aims for the development these regions, the Albanian Government, supported by the International Fund for Agricultural Development (IFAD), has established the Agency for Developing Mountainous Areas (MADA). This Agency will focus primarily on activities related to animal husbandry and upgrading Extension Service. Study and definition of ways for optimal utilization of human potentials and other producing sources such as environment and animal, harmonious development between them, efficient implementation of extensive production system, protection of environment and increase of farm income are objectives of this Agency. Another important objective of this Agency will be the support of the farmers' initiative to create the farmers' and breeding organization as a key factor to achieve sustainability of the sheep and goat production. In achieving the its aims the MADA will cooperate with the different research institute, the local governments and extension service structures also will the other local-NGO and foreign agency. Implementation of different methods and tools of extension will be the main activity of this Agency. Besides the seminars, instructions, one-day field demonstrations, training, leaflets, brochures, etc., the Agency will promote the constitution of pilot-farm group. Though this pilot-farms will be possible to demonstrate the new technology and knowledge. The pilot-farmers themselves play a great role in this extension. In the hill and mountainous regions the pilot-farmers will be also a key factor for demonstrate

practically the way for achieved a compromise between the production objectives and the environmental constraints.

MATERIALS AND METHODS

In this study have been involved 12 prefectures. This study examined, the structure of land, milk and meat production. Sheep and goats production system. Extension services for the farmers. Albania belongs to the subtropical Mediterranean climate and is characterized by mild winters with abundant precipitation and hot, dry summers. The annual mean air temperature has a wide variation over the territory. Absolute minimal temperature recorded -25,8 degrees and the highest 43,9 degrees Celsius. The average annual temperature varies from 17.6 degrees Celsius (Saranda) to about 7 degrees Celsius (Vermoshi). Albania is known as a country with a very high sunshine period. The mean annual precipitation total over the Albania is about 1,485 mm/year. The highest precipitation total (70%) is recorded during the cold months (October-March). The method of zonal estmation was used. This method has its prioritiescompared to otherones under conditions of information infrastructure that exist in our country. The method of zonal estimation was used . For each district, 100 fermers that menaged and marketed 100-150 heads were randomly comprised in study. Alongside direct zonal assessment and contacts with farmers, secondary data received by Office of Statistics (DRBUMK) and MBUMK were used . Data was statistically processed by ANOVA.

CONCLUSION

The small ruminants farming is one of the main production activities in the hill and mountainous regions in Albania.

The present sheep and goat extensive production system in these regions is very difficult to be manage because:

(i) The farmers' and breeding associations are new organizations with insufficient experiences and resources or they do not exist in many of zones in this regions.

(ii) Lack of well-trained people for effective management of sheep and goat production.

At present the possible means to improve production system are:

(i) A careful study of present production system.

(ii) Moulding new strategies and definition of ways for optimal utilization of human and all other producing sources, conservation and development of bio diversity and increase of farm income.

For development and implementation of extension service very important are:

(i) Evaluation of the farmers' knowledge level.

(ii) Developing the methods and tools for extension service according the social, cultural, economic and traditional characteristic in which zone of the hill and mountainous region.

(iii) Support of the activities in community and establish of farmers' and breeding associations.

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STUDY OF GROWTH CURVE VARIATIONS FOR KIDS 0- 6 MONTHS OLD OF ALPINE GOAT BREED IN ALBANIA

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ABSTRACT

Study of growth curve for kids at the age 0-6 months old and influence of non genetic factors on its variation, was carried out by analyze of data for 728 kids managed in two different production systems: (a) semi intensive production system in farms with over 50 goats and (b) small family farms that manage 2-3 goats as "Goat of family". The aim was to evaluate the level of breed's aclimatization in Albania. Gompertz's model was used for modeling growth dynamics curve of kids. Gompertz's model parameters were estimated.each kid. Analyze of variance was carried out according to procedure of General Linear Model (GLM). Results showed that linear model accounts for 58-62% of total variance of growth curve parameters. Non genetic factors affect the variances of these parameters. Production system (P<0.01) is the most important factor that affect on phenotypic variance of growth curve parameters. Sex and mode of birth (P<0.05) are factors that must be taken into account during growth of kids 0-6 months old. Values and variations of growth parameters of Alpine kids farmed under conditions of Albanian production systems show that this breed has positively responded to these conditions.

Key Words: Alpine goat breed, acclimatization, Gompertz's curve of growth, non genetic factors, kids 0-6 months old

INTRODUCTION

Growth dynamics of young generation may be used as one of indicators to evaluate the level of adaptation of this genetic pool under conditions of a production system which is different from its origin place. Growth period of young generation until the puberty age can be divided into three phases: (i) maternal phase- from birth to weaning, (ii) phase of development of bio physiological mechanisms of growth and individual response to environmental conditions-from weaning to 6 months old and (iii) growth phase from the age of 6 months to puberty one. Susceptibility of organism to environmental conditions in these three phases is different. At the first phase, it can be considered mat kid is "protected" by maternal effect. During the second phase the kid should cope with environment conditions and therefore, necessary bio physiological mechanisms should function well in order to have a normal growth dynamics. As a consequence, this phase can be considered as one of phases mat bring more information in relation to the adaptation rate and/or response of breed under conditions of environment, different from its origin place. Already, in spite of bio physiological mechanisms are more developed in order that the animal to be adapted better to environment, study of growth dynamics during the third phase, is important because it can serve to more accurately and completely judge for the rate of response of young organisms to the changed conditions of environment. It can in particular be accomplished by comparing values of growth indicators until puberty age: (i) age at first heat appearance (ii) live weight at the first matching; (iii) conception rate of first matching achieved by individuals placed in environment, different from its origin place, with average values, which are characteristic to breed. The objective of the present paper is to give the information about the level of acclimatization of Alpine goat breed in Albania, based to the study of growth performances of kids during the period age 0- 6 months.

MATERIALS AND METHODS

The live weight data for 728 kids of Alpine breed, of which, 432 kids born in small family farms, which manage no more than 5 goats and 296 kids belonging to private farms that manage flocks of over 50 goats were analyzed. Using the data of weighing, carried out every 15 days period from birth to 6 months old, growth curve was build up, for each kid, according to Gompertz's model:

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y = A exp (-exp (-b(t-c)

where

y = live weight of kid

t = age of kid

k = growth curve asymptote

b, c = adjusted both slop and inflexion pointo

The individual growth curve parameters were analyzed as quantitative traits. A General Linear Model analysis was applied to decompose the total variance and to apply the F statistical significance test. The statistical GML model used with independent variables was as follows:

Yijklm = μ + ai +bj + ck + kl + eijkln

Yijkln = the performance analyzed; curve parameters (a, b, c)

μ = mean of population

a_i = the sex effect (j=1.2 single or twin)

b_j =the mode of birth effect (j=1.2 single or twin)

c_k = the "row of kidding,, effect(k=1.2 the first and the second)

k_l = the "system of management,, effect (l=1,.2-farm withover 50 goats, farm with not more than 5 goat)

e_{ijkln} = the model residuals

RESULTS

For each kid, the Gompertz growth curve parameters were estimated by an iterative procedure with zero as the starting value for all parameters. The number of the iteration is fixed less than 1000 and the convergence criterion was set at 108 (Najari et al. 2007) For each of production systems, which are applied in Albania, Gompertz's model, that describes the dynamics of growth rate of kids for the age 0-6 months old, were estimated as follows:

Farm with over 50 goats:

Y (weight) = 29.8Exp (-Exp (0.6825 - 0.017 age))

Family farms up to 5 goats:

Y (weight) = 31.98Exp (-Exp (0.7307 - 0.019 age))

Referring to the parameters of curves it can be said that asymptotic weight, which is at the same time also as statistical estimation of adult animal weight, is higher to kids that are managed under conditions of small family farms. Age (in days) at which, the curve of growth dynamics of body weight pass through the point of inflexion, for kids reared under the conditions of small family farms is estimated about 38 days and the body weight corresponding to this point is 10.51 kg. Meanwhile, these two indicators for kids raised under conditions of semi-intensive production system in farms with over 50 goats, are respectively: age at inflexion point 9 days higher and body weight at the day of inflexion point 14 % lower. Supported upon indicators, referring to the interpretations of authors given in literature (Ben Hamonde, 1985; Nguyen Tni Mai et al. 2000, Najari, Sg. etc. 2005, 2007) it can be stated mat kids raised under conditions of small family farms perform a growth process that make possible for entering in reproduction of them at optimal age and body weight.

Table 1 shows averages of some indices of growth dynamics to kids from birth to 6 months old raised in different production system.

Table 1. Averages of growth indicators of kids estimated by Gompertz's model in the different production systems

Indicators	Unit	Production system	
		Farm with over 50 goats	Family farm with no more than 5 goats
Live weight at birth	kg	3.11	3.15
Live weight at 6 months old	kg	25.72	28.12
Age at inflexion point	day	47.0	38.0
Weight at inflection point	kg	9.04	10.51
Live weight:			
at 1 month	kg	6.708	7.561
at weaning	kg	13.904	17.64
at 4 months	kg	20.414	24.571
Average daily gain:			
from birth to one month	g	128	155
from birth to weaning	g	154	208
from weaning to 6 months	g	120	112
from birth to 6 months	g	134	152

Referring the information of Table 1, that could interpret as the kids' response in different production systems, it must be formulated the following:

In general, kids of Alpine breed differently respond to different conditions of environment. Nevertheless, based upon the average indicators of live weight during the different growth phases, it can be said that during the growth phase (birth to 6 months) responses of kids do not reach to compromise the behavior of this breed in these production system. This is because of the rule according to which animal growth process is carried out during this period, for each of production systems, is complied with that described by Gompertz's Function. Statistical weight of Gompertz's Model for each of production system is estimated (R2 = O.92.)

To have better results in the growth rate of female kids, which will be maintained for reproduction, especially, under conditions of rearing in private farms with more 50 goats, it is advisable that mothering period be lasted by about 8-12 days

Results of multivariate analysis, carried out according to model (1) are given in Table 2

Table 2. Results of analyze of variance for Gompertz's model parameters: GML (1)

Source of variance	d.f.	Parameters of Gompertz's curve		
		A	b	c
Sex of kid	1	11.4***	4.13*	4.02*
Mode of birth	1	5.21*	3.46*	3.81*
Row of kidding	2	4.13*	2.02^{NS}	1.83^{NS}
Production system	1	12.3***	5.97**	6.09**
Residuals	723	Variance 8.152	Variance 0.023	Variance 0.015

NS Non significant; Significant (p<0,05); **Significat(p<0.01); ***Highly significant(p<0.00l)

It seems that the factors analyzed, affect in the variations of Gompertz's model parameters. The production system (type of management) manifests a high significant effect upon all analyzed traits (p< 0.01). Regarding kid's sex, birth mode and row of kidding which were known with classic

impacts upon the early kid growth, it seems mat they have moderate effects under the Albanian farming conditions. Kid's sex is one of the most important factors ($p< 0.01$; $p<0.05$), which influence in the variation of all three parameters. Mode of birth influence ($p<0.05$) in total variance of three parameters and the row of kidding affect only the total variance of parameter "A" ($p<0.05$), whereas, regarding other two parameters, her effects could considered as a tendency not statistically proved ($p>0.05$),

The effect of production system on growth curve of kids from birth to 6 months old, is graphically shown in Figure 1.

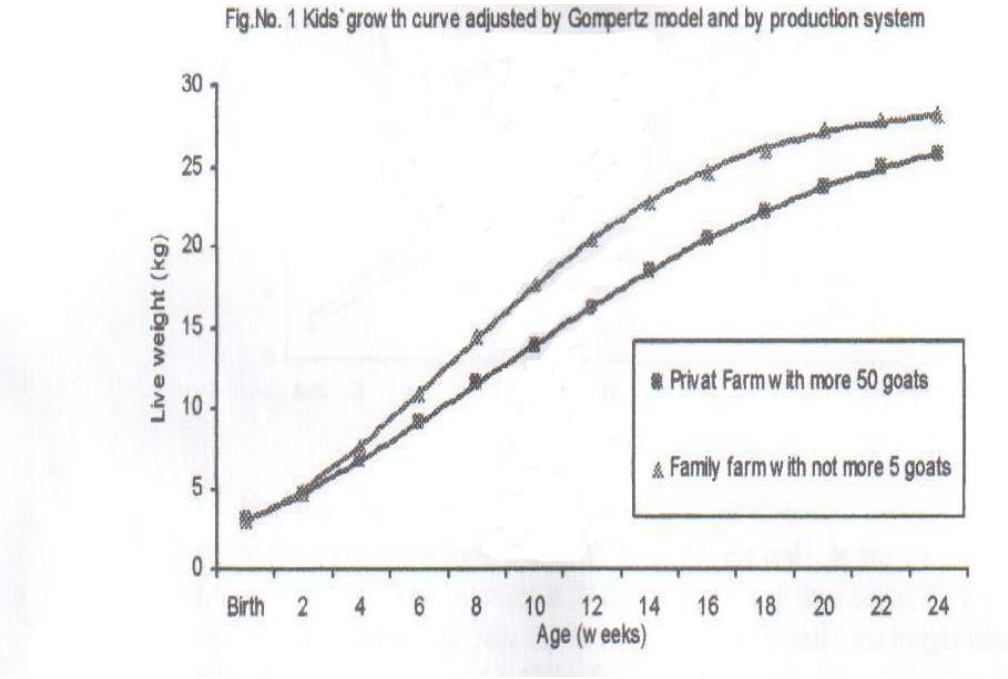

Figure 1. Kids "growth curve adjusted by Gompertz model and by production system

Growth curves show the predicted theoretical character for two production systems. In general, they are similar to curves given in literature in the case of studying growth curves of kids that are managed in different production systems. (Gaddor, A., Najari, Sg., 2007, Barbate, G.F. etj. 1991, Simondon, KB. etj. 1991, Das, M.S. etj. 1996). In the case of kids raised in small farms, tile curve expresses better the theoretical character of physiological growth process. Under the condition of semi-intensive production system applied in farms with more 50 goats, the quantitative indicators of growth dynamics are negatively influenced. Nevertheless this system of production has not brought the essential disorders in physiological growth process. As a consequence, it can be said that factors related to production system, applied in Albanian farms, are administrated in such way that not to create serious problems in the physiological growth process of kids. Figure 2 illustrates the growth curve for male and female kids. Since the birth, differences of kids* weights are remarkable for the two sexes. Birth weight, estimated at 3.2 kg (m) and 2.4 kg (f), respectively explain the superiority of earlier male weights. This male superiority continues during the growth period. According to Gompertz's curves, the male and female asymptotic weights are respectively estimated 31.9 kg (m) and 27.3 kg (f). Similar effects of sex on growth performance are published by different authors (Babato et al. 1991, Anthony et al. 1991, Banda et al. 1993, Barthaee, Leroy, 1996, Alexandre et al. 1997, Oltenacu, et al. 1999, Ounni, M. 2006, Najari et al. 2007, Amour Gaddou et al. 2007).

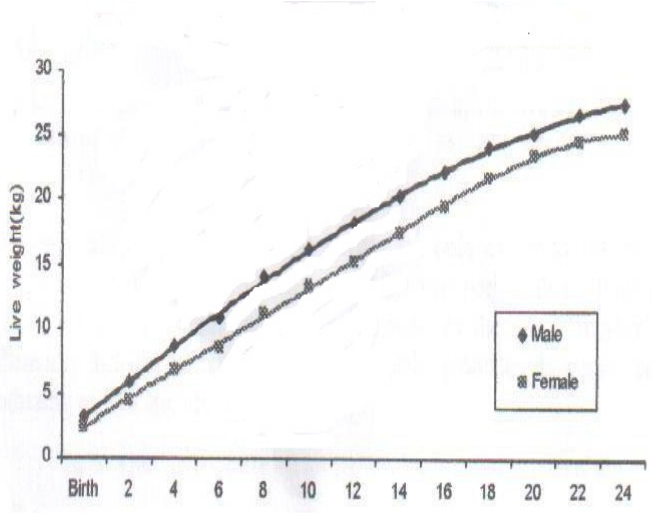

Fig.nr.2.Kids growth curve adjusted by Gompertz model and by kids sex

However, the lower asymptotic weights permit to female to reach more rapidly the same physiologic state with respect to the male. In fact the female kids reach the inflexion point since 39 days of ages, so 6 days before the male kids, the same physiologic state can be represented by the inflexion weight with was, respectively 11.24 and 9.12 kg for male and female kids. According to these results, we can deduct that the female kids of Alpine breed farming in the Albanian system productions, can reach the maturity state rapidly and its can began reproductive process since the first year of age. This can be considered as an argument in favor of their good adaptation in the new Albanian environment.

Row of kidding is a factor, whose effect is only statistically proved in the case of parameter "A" of Gompertz's model. The effect of other two parameters is only shown as a trend. Such result is met in literature. Nevertheless, it needs to be stressed that, most authors, in their studies, confirm effects of this factor. Perhaps, this situation, which is met in this case, it can also be as a consequence of fact that the data are only for kids obtained for two first kidding. As seen, the differences in these curves are only evidenced in the first growth phase, from birth to 3 months old. After that period, this difference is not evidenced anymore. Such that can be explained by the effect "mother*' due to differences that can be in milk quality and intake produced during the period of mothering in the first and the second lactations. Mode of birth is a factor, whose effect on Gompertz's curve parameters is statistically proved. In literature, the effect of this factor is considered as a classic one (Lyatuu et al. 1992, Okello et al. 1993, Gromela et al. 1998, Gaddour et al. 2007). Effects of these factor are in particular visible during the first growth phase, from birth to 12 weeks.

Kids which were born single can be more quickly grown (Alexandre et al. 1997), especially during the period of mothering. This situation is also seen in our case analyzed. Live weight gain obtained by kids born single is about 25-30 % higher compared to twin born ones.

After that period, differences of live weight gain between single born kids and twin born ones are reduced until at age of 6 months, afterwards, according to Gompertz's curves these differences are estimated by about 0.9 kg.

CONCLUSIONS

1. Two systems of management: small farm family with not more 5 goats and semi-intensive production system-farm with more 50 goats, influence indifferent ways on the dynamics of kids' growth for the period from birth to 6 months. Production system of small family farms creates better conditions for anormal growth process and in accordance with standards of breed.

2. Independently on differences evidenced between two systems of management, growth dynamics of kids until at the age of 6 months, shows that the responses of Alpine goats breed evidenced a normal acclimatization process under Albanian farming conditions.

3. The results of study of variations of the main growth indicators carried out by the Alpine kids breed, live weight at the different age, from birth to 6 months old on the one hand, and modeling of their growth curves through Gompertz's model, on the other hand, can served as an argument for their normal adaptation in Albanian

through Gompertz's model, on the other hand, can served as an argument for their normal adaptation in Albanian farming conditions.

4. Variations of Gompertz 's curve parameters brought about by the effect of non genetic factors such as: sex, mode and row of kidding and system of management underline the normal development of physiological process of kids' growth during the first 6 months of life farming under the Albanian condition system.

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FREQUENCY OF AGONISTIC BEHAVIOR WITHIN THE DAIRY GOAT GROUPS DURING FOOD COMPETITION

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ABSTRACT

The aim of this study was, introducing the relation between social hierarchy rank and agonistic behavior frequency during food competition. In this way, 33 pregnant goats which are twenty months age and hornless, are randomly divided into three groups. The processing of goats that are kept in a 5.50 x 5.50 m paddocks, is determined through twenty days. And goats' behaviors during their consumption of alfalfa hay in a 2.5 meter manger have been observed directly or with the help of a camera. The one-hour observation that is twice a day -day and night- continues through nine days. The specific behaviors, such as front butt, flank butt, aggressive biting, threatening and displacement are recorded according to the number of goats. Recorded agonistic interactions used for calculate the linearity of the hierarchy with Landau index (*h*) method and have been evaluated in a model which includes groups, date and period of observation. The correlations between aggressiveness and individual dominance index were made by Spearman's rank correlation. Frequency of observed behaviors found highest in groups which had quasi-linear hierarchy ($P<0.05$) and higher-ranking individuals of a group hierarchy exhibited more aggressive behavior ($P<0.0001$). Aggressive behavior's frequency were affected by individual dominance index in group which has more linear hierarchy structure ($P<0.05$).

Key Words: Turkish Saanen, dominance rank, linearity, food competition, hornless, individual distance

INTRODUCTION

Animals, which are living in groups together, always form a social hierarchy, because forming a social hierarchy minimizes aggressive behavior's frequency and prevents unnecessary energy losses (Karaağaç et al., 2003). A formed social hierarchy is generally beneficial in livestock farming. In ruminant animal groups, structure of social hierarchy is affected by presence of horns, animal's live-weight and age of the animal (Barroso et al., 2000; Cote, 2000; Tölü and Savaş, 2003).

Aggression occurs between animals especially during food competition. Individuals from higher ranks in a dominance order have more advantage in accessing to limited resources compared to the individuals from lower ranks (Andersson et al., 1984; Mosley, 1999; Barroso et al., 2000; Philips and Rind, 2002). After a competition of two individuals, the winner one becomes dominant to another one and so the winner animal getting high ranks in hierarchy (Tölü and Savaş, 2006). Rank structure of social hierarchy was generally stable (linear hierarchy) (Barroso et al., 2000; Cote, 2000) because of animals in this group had individual differences: These differences let animals completely are an "alpha" (dominant to all individuals in a group) or "omega" (subordinate to all individuals in a group) individual in a group. However, in dairy goat's social hierarchy, rank structure was reasonably dynamic (non-linear hierarchy) (Tölü and Savaş, 2006). An individual's rank depends on its success in all the dyads (Chase, 1985). The aim of this study was, introducing the relation between social hierarchy rank and agonistic behavior frequency during food competition.

MATERIAL AND METHODS

Thirty three twenty-month-old, hornless and pregnant female Turkish Saanen goats kept in the Research Centre of the Çanakkale Onsekiz Mart University were assigned at random to three (5.5 x 5.5m) pens (group 1, 2, 3 mean±SD of live-weight=49.2±4.5, 48.4±2.6, 48.5±3.5 kg respectively, 11 goats per group and 2.75 m2 per animal). All animals kept always in their original group. Each pen had a manger (2.5 m) and automatic drinking trough. All of the animals were fed concentrate (0.6 kg/head/day), alfalfa hay (1.35 kg/head/day) and water (ad libitum).

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While animals feeding with roughage, each group recorded with video camera and observed directly at the same time for record all agonistic interactions to measuring the dominance relationships between animals for twenty days. Recorded agonistic interactions used for calculate the strength (linearity) of the hierarchy with Landau index (h) method (Landau, 1951) and the social hierarchy ranks in each group with using Clutton-Brock et al.'s index (CBI) method (Clutton-Brock et al., 1979, 1982). The animals were classified into three categories in each group by CBI: high-ranking animals (4 individuals), medium-ranking animals (4 individuals) and low-ranking animals (3 individuals) to compute the effect of rank class on aggression frequency.

After twenty days, the following agonistic behaviors were recorded directly by continuous sampling method for 9 days during consumption of alfalfa hay in a 2.5 meter manger (1 h observation periods occurred between 08:00-09:00 and 16:00-17:00 per day): "front butting": the goat stops consuming feed, stretches, moves forward rapidly and hits its group mate with its head, "flank butting": the goat hits or shakes its head towards the neighboring group mate without changing its place, "aggressive biting": the goat pulls and bites any place in the body of another goat (especially ears), "threatening": without any interactions with the other goat, the goat drives it away from the resource by threatening through vocalization or some other behaviors (such as by puffing up and particularly by raising dorsal hairs), "displacement": the goat displaces another goat without entering into any aggressive struggle (Tölü, 2009).

Repeated "general linear model" (GLM) was used to test for the effect of observation day, observation period, observed groups and all interactions on aggression frequencies (SAS, 1999). The correlations between aggressiveness and individual dominance index were made by Spearman's rank correlation.

RESULTS AND DISCUSSION

Calculated Landau index values of groups appear in Table 1. The Landau index indicates that group 1 (h=0.536) and group 2 (h=0.454) established a quasi-linear hierarchy (Langbein and Puppe, 2004). Seeing this dynamic structure in social hierarchy of dairy goats confirmed by observations of Tölü and Savaş (2006). However, in group 3 Landau index was found much higher (h=0.909) which means the group 3 had a hierarchy which is too close to linear.

Table 1. The groups' Landau index values, h

	Group 1	Group 2	Group 3
Landau index, h	0.536	0.454	0.909

Table 2 summarizes means of aggression behavior's frequency by groups. In group 2 the means of flank butting (P=0.0011), threatening (P=0.0051) and front butting (P<0.0001) are significantly higher than other two groups. The mean of aggressive biting frequency (P=0.0002) and displacement behavior frequency (P<0.0001) is significantly lower in group 3 than other groups.

Table 2. Mean and Standard Errors (SE) of aggression behavior's frequency by groups

	Group 1		Group 2		Group 3		
Behavior	Mean	SE	Mean	SE	Mean	SE	P
Flank butting	6.36a	0.35	8.40b	0.42	7.62a	0.43	0.0011
Threatening	1.18a	0.11	1.85b	0.16	1.46a	0.13	0.0051
Aggressive biting	10.37a	0.82	9.42a	0.81	7.36b	0.64	0.0002
Front butting	1.86a	0.18	3.63b	0.28	3.18b	0.26	<0.0001
Displacement	4.23a	0.31	4.03a	0.27	2.71b	0.19	<0.0001

Different letters in the same row indicated significance, P ≤ 0.05.

Beilharz and Zeeb (1982) reported that aggression behavior frequencies decrease if the social hierarchy was established. In group 3, social hierarchy was established more stable than other two groups (Table 1) and this may explain why group 3 has lowest aggressive behavior frequency (Table 2).

The mean values of aggressive behavior frequency by rank classes appear in Table 3. High-ranking animals showed all aggressive behaviors which are observed higher significantly than other two rank classes (P<0.0001).

Tölü and Savaş (2007) indicated that the frequency of front butting behavior exhibited higher in high-ranking animals in social hierarchy which is confirmed in Table 3 and authors reported that the frequency of aggressive biting behavior was not affected by social hierarchy rank. However, Table 3 showed that the mean of aggressive biting frequency is higher significantly in high-ranking animals than other two rank classes (P<0.0001). In former studies reported that the front butting behavior exhibited more in high-ranking and horned goats than other aggressive behaviors (Orgeur et al., 1990; Tölü, 2005). This study indicated that high-ranking and hornless goats exhibited more aggressive biting behavior than other aggressive behaviors.

Table 3. Mean and Standard Errors (SE) of aggression behavior's frequency by rank classes

	Low-ranking animals		Medium-ranking animals		High-ranking animals		
Behavior	Mean	SE	Mean	SE	Mean	SE	P
Flank butting	4.31a	0.27	7.16b	0.38	10.12c	0.40	<0.0001
Threatening	0.88a	0.10	1.53b	0.13	1.93c	0.15	<0.0001
Aggressive biting	5.50a	0.51	7.43a	0.70	13.35b	0.84	<0.0001
Front butting	1.75a	0.15	2.90b	0.21	3.74c	0.30	<0.0001
Displacement	2.41a	0.28	3.21b	0.21	5.04c	0.28	<0.0001

Different letters in the same row indicated significance, P ≤ 0.05.

Spearman rank correlations between individual dominance index and aggressive behaviors frequency by groups appear in Table 4. In group 3, we found significantly positive correlation between individual dominance index and flank butting frequency (P=0.0037), threatening frequency (P=0.0467), front butting frequency (P=0.0031), displacement frequency (P=0.0388). There was a positive relationship between front butting frequency and individual dominance index in group 2 (P=0.0208). Even if all animals have same characteristics (hornless, same age, nearly same live-weight), group 3 has a difference from other groups in terms of hierarchy structure (Table 1). Group 3 may has this positive relationship between dominance index and exhibited aggression behavior because of this difference. These results may indicate that linearity of hierarchy increased with the increase in exhibited aggressive behaviors frequency by goat which had higher social rank (Table 1 and Table 4).

Table 4. Spearman rank correlations (rs) between individual dominance index and aggressive behavior frequency by groups

	Group 1		Group 2		Group 3	
Behavior	rs	P	rs	P	rs	P
Flank butting	0.472	0.1420	0.509	0.1097	0.790	0.0037
Threatening	0.390	0.2345	0.354	0.2847	0.609	0.0467
Aggressive biting	-0.209	0.5372	0.354	0.2847	0.354	0.2847
Front butting	0.418	0.2006	0.681	0.0208	0.800	0.0031
Displacement	0.363	0.2716	0.581	0.0604	0.627	0.0388

CONCLUSIONS

Dominant animals have a high-priority access to the food in the barn and the effect of this advantage in the manger which has a limited space is very important. Groups of formed by animals with similar characteristics generally establish non-stable (non-linear) social hierarchies which are increase the

aggressiveness. In contrast aggressiveness reduced in groups which have stable hierarchy structure. In non-stable hierarchies, feeding and of course yield was influenced badly because of animals spend their times with fighting.

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CONTENT OF SOME METALS IN TECHNOLOGY AND WASTE WATER AS INDICATOR OF WATER QUALITY IN THE DAIRY

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ABSTRACT

The metal concentration (Ca, Mg, Fe, Mn, Zn, Cu, Pb, Cd, Ni) in processed and waste water lines in diary plant of middle scale, is discussed, aims at recognizing these elements as indicators of good production techniques and identification of potential improvements in a management practices. The water lines scheme in the plant were used for identification of 6 sampling points (3 +3),which resulted in 72 samples (period January – June). The results have showed that concentrations of the investigated metals in processed and waste waters, except water origin, are very influenced by two effects: process of water conditioning (softening by ion-exchange) and presence of complexing agents (in materials for washing of equipment and sanitation). The concentration of Ca, Mg and Zn in processed and waste waters could reflect good management practice and consequently be used as indicators.

Key Words: Dairy plant, processed and waste water, metals (Ca, Mg, Fe, Mn, Zn, Cu, Pb, Cd, Ni)

INTRODUCTION

In dairy industry all quality indicators are normally related to raw milk quality (butter fat, crude protein, lactose etc.) and hygiene (total bacterial count, somatic cell count etc). These indicators are used for evaluation of production techniques and identification of potential improvements in a management practices, aims at increasing profitability or reducing costs. Very often water quality indicators are not used in the similar way, partly because water is still recognize as something that is on disposal, without any limitation, and partly because relations milk – water were not recognize or not take into consideration as an important producing indicator. An argument in favor is the fact that generally 2% of milk (directly or indirectly) finished in waste water (Munavalli & Saler, 2009).

The paper discusses possibility of some water metal concentrations in the water line in dairy plant as indication of the successful production process.

MATERIAL AND METHODS

The experiment was done in the dairy plant of the middle scale, which needs some 180 m^3 of fresh water/hour. The water of the good quality is transported directly from the well, by pumping. Two reservoirs of capacities 2 x 30 m^3, were installed as reserve for water quantity balancing during the plant operation.

The water parameters that withdraw from requested quality (potable water) is hardness, some 20dH in average (German degree), and occasionally turbidity and iron. For all plant operations the water with hardness of some 10 dH is suitable, which is gained through water softening. Namely, in the tank conditioner half of the needed water quantity is softened to 0, and then mixed with another half that yield desired hardness. The flow of softened and unsoftened water is regulated automatically, but could be changed in accordance to the temporally needs, in the range 5 – 15 dH. The softening mainly rely on the removal of Ca^{2+} and Mg^{2+} by ion-exchange, but also other ions, first of all Fe^{3+}, which could be important for the metals interpretation in the steps that follow. The final stage is water sterilization by UV. After that the water is pushed to the processing area.

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Washing of working area (equipment, sanitation), as important part of Good Manufacture Practices, is also something that have to be taken into consideration when the metal concentration in processed and waste water is in focus. Namely, very often the EDTA (ethylenediaminetetraacetic acid) strong complexing agent is present in cleaning materials that additionally influence some metals concentration, depending of the pH.

Based on scheme of plant water flow, three points in processing water line and three points in the waste water line, are chosen for sampling. The sampling was done in the period January-June, 2010, every second week, in three replicates. Processing water was taken at pipe line from the taps. Waste water samples were composite (plastic barrel for 12 hours). Samplings were followed by temperature and pH measurement, *in situ*. All together, 72 water samples were gathered.

The samples were conserved at -20°C by the end of sampling. After de-icing the analysis of dry matter (filter 45µm,drying at 102-105°C), and metals (Ca, Mg, Zn, Mn, Fe,Cu, Pb, Cd, Ni) were performed by AAS (Varian AAS 25). All standards were Merck-CertiPUR, concentration 1000mg/dm^3. For analysis of Ca and Mg standards and samples contained 5000 ppm of La, added as $La(NO_3)_3$.

All results are statistically treated.

RESULTS

For processed water temperature was in range 21 – 23°C (average 22,3°C, coefficient of variation 4%), pH in range 7,22 – 7,63 (average 7,41, coefficient of variation 5,5%). Waste water temperature ranged much more: 13 – 20°C (average 18,3°C, coefficient of variation 11%), as well as pH: 2,45 – 9,51 (average 4,22, coefficient of variation 0,34%). The dry matter for both water line were very low, less than 10 mg/dm^3.

The concentration of three metals: Fe, Pb and Cd were less than 1 ppm. The results for metals are presented in the Table 1, followed by tables 2., 3., 4., 5., 6., and 7.

Table 1. Total metals in processed and waste water

Element	Range mg/dm^3	Average mg/dm^3	Coefficient of variation,%		Range mg/dm^3	Average mg/dm^3	Coefficient of variation,%
	Processed water				Waste water		
Ca	13,28 - 26,74	17,24	20,4		6,97 – 28,38	15,64	32,7
Mg	2,84 – 6,69	4,96	25,10		3,34 – 8,19	6,22	25,8
Mn	0,603 –0,619	0,608	0,8		0,603 – 0,627	0,614	0,14
Zn	1,138 – 1,210	1,167	2,30		1,150- 1,399	1,237	5,30
Ni	0,899 – 0,911	0,900	1,20		0,899 – 1,348	0,968	1,10
Cu	0,850 – 0,852	0,850	20,4		0,849 – 0,856	0,852	32,6

Table 2. Ca in processed and waste water

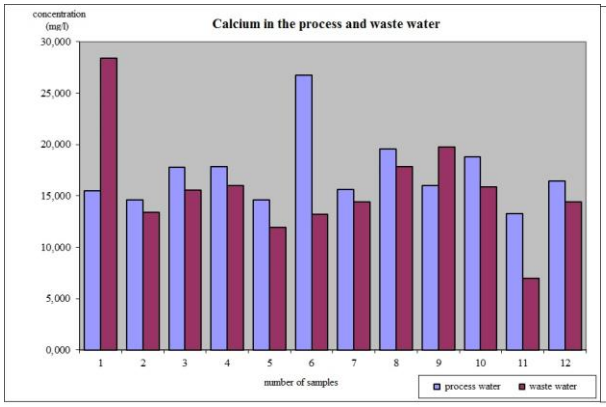


Table 3. Mg in processed and waste water

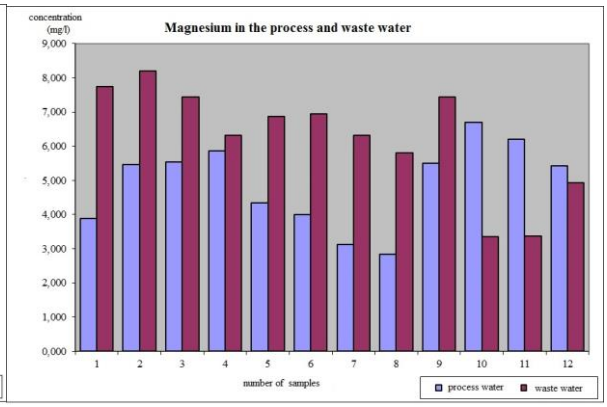


Table 4. Mn in processed and waste water

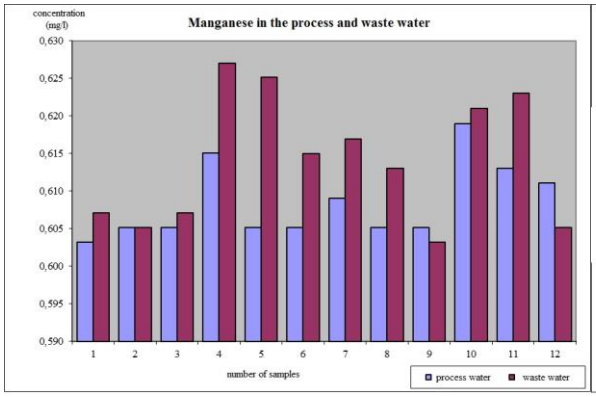


Table 5. Zn in processed and waste water

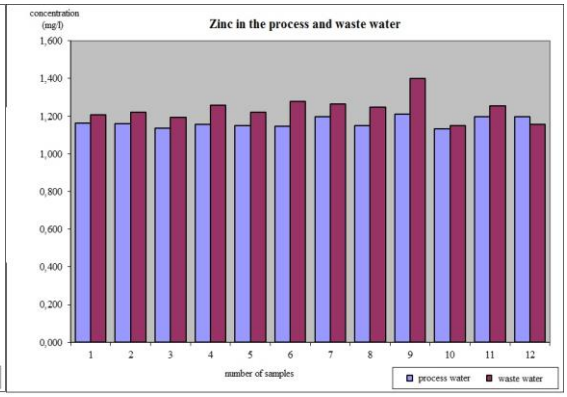


Table 6. Ni in processed and waste water

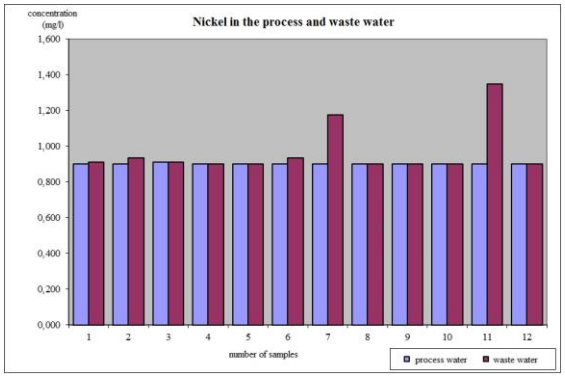
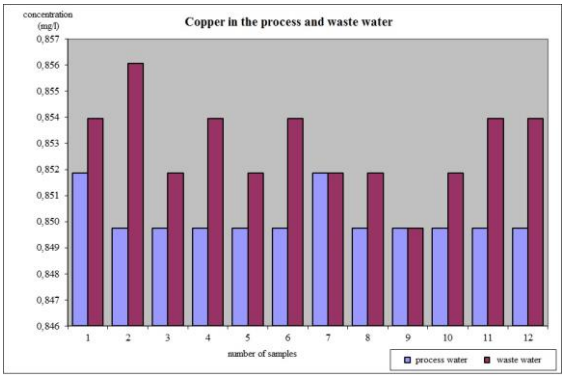


Table 7. Cu in processed and waste water



DISCUSSION AND CONCLUSIONS

In diary industry, concentrations of the investigated metals in processed and waste waters, except water origin, are very influenced by two effects: process of water conditioning (softening by ion-exchange) and presence of complexing agents (in materials for washing of equipment and sanitation). As the results concentrations of three metals: Fe, Pb and Cd (pH in average 7,44) were very low in both, processed and waste water (< 1 ppm; according to Dabrowski (2011) scale of ppt) . Concentration of other analyzed metals varied in the course of investigated period, as well as between the processed and waste water. Very low statistical correlation is established only for Mn (r = 0,48) and Zn (r = 0,49) between processed and waste water.

The levels of concentrations and sequence of metals in processed and waste water during the investigated period suggested that three elements (Ca, Mg and Zn) could have an equally high importance as indicators for evaluation of production techniques and identification of its potential

improvement. Their concentration in processed and waste waters have to be seen as result of ion-exchange process at the beginning (conditioning of waters) and mixing of water and milk (leaking of milk in waste water). In this sense it is important to recognize what does it mean the „normal"relation of these metals between processed and waste water, their usual distribuations. Beside, in spite the differences in concentrations and dynamics, metals sequences retained the same general feature of decreasing order: Ca> Mg >Zn >Ni> Cu> Mn, in both kind of waters, as it is in fresh water and in the milk, assuring levels that could be easily detected in each matrix.

According to Harris (2010) selectivity of ion-exchange resins for cations are: $Fe^{3+} \succ Pb^{2+} \succ Ca^{2+} \succ Ni^{2+} \succ Cd^{2+} \succ Cu^{2+} \succ Zn^{2+} \succ Mg^{2+}$ **. According to this scale ion-exchange resins has bigger effect on Ca^{2+} then on Zn^{2+} and Mg^{2+}. But this effect in our case has been masked and neutralized by mixing of softened and unsoftened water. The results have showed that concentrations of Ca in processed water were higher than in waste one, except in two cases (sampling No.1 and 10). This indicates that, for our situation, normal condition is higher Ca in processed water then in waste one, even leaking of milk in waste water could be present. Situation for Mg is opposite: processed water has less Mg than waste water (except three last sampling: No.10, 11 and 12). Concentration of Zn is always higher in waste then in processed waters, except in sampling No.12. These finding directed us to conclusions that waste water is normally enriched by Mg and Zn from milk leaking. The assessed exceptions indicate poor management of softening processes, present in 1, 10, 11 and 12 sampling periods.**

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CROSSBREEDING EFFECT OF LOCAL BREEDS' EWES WITH AWASSI BREED RAMS

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ABSTRACT

There were carried out studies of the productivity (milk, meat and wool production), those of reproduction (infertility, birth rate, prolificacy or lamb crop), etc. sustainability to diseases, acclimatization skills of purebred Awassi and its crossed progenies of first (F1), second (F2) and third (F3) generation with local sheep breeds. Based on multi-year comparative results of the studies, it is showed that sheep purebred Awassi and its crossbred with local breeds have reflected normal behavior into climatic conditions and sheep breeding systems applied in Albania and indicators of productivity (milk production, meat production), indicators of fertility (infertility, birth rate, prolificacy or lamb crop) are higher than those of local breeds. These results are characteristic of all areas of study, highlands, hilly areas and lowlands. The obtained results in the lowlands showed that productivity and reproduction indicators as far as the acclimatization skills of crossed progenies with Awassi are increased, such as the live weight, production of milk and the dynamics of lamb development, while the crossed progenies of hilly and mountainous areas are higher for the first generations and the advancement of the blood introduction after the second generation observed decline of these indicators and constitutional weakness.

Key Words: Breed, crossbreeding, character, reproduction, acclimatization.

INTRODUCTION

Small ruminants have an important place in livestock products, producing about 20% to 30% milk and meat in Albania (Albania: Strategic Policies for a more competitive agriculture sector. 2007). Large spaces of pastures are favorable to the sheep breeding (Epstein H. 1985). In these conditions, work to improve the genetic capacity of small ruminants, represents the main direction of work, to increase livestock production and incomes of the farmers (Gursoy O. 1992). Sheep and their milk are especially important because the international market needs are constantly increasing and therefore there is no quota for those products, except those of lambs (Albania: Strategic Policies for a more competitive agriculture sector. 2007). This is why the northern states are slowly changing production systems and their direction in terms of milk production (Ploumi K. 1995). In these conditions when the demand for milk and meat are required to support this trend by changing the direction of sheep breeding direction towards the breeds with milk and meat production introducing specialized breeds for milk and meat production. One of these breeds with good indicators of milk production is Awassi breed (Epstein H. 1985, Pollott, E. 1998) that is currently in the Department of Livestock to ATTC Korça, Albania and in some districts of the country. The Local Awassi, a triple-purpose breed for meat, milk, and carpet-wool production, is a low-prolific, hardy breed that is well adapted to the unfavorable conditions, where it is managed under traditionally extensive to semi-extensive conditions. Breeding work with the Awassi has included within-breed selection, crossbreeding, and gene introgression (Dimov, G. 2005). In 1987 were imported from Hungary 50 ewes and 10 rams of the Awassi breed who settled in the Animal Husbandry Research Station of Korça, today Department of Livestock of ATTC, Korça, Albania when began crossing of local sheep breeds in agricultural farms. The aim was to assess the skills and characteristics of acclimatization, genetic purebred capacities of Awassi and its crossbreds, in terms of our goal for the dissemination to the agricultural farms of Albania. Awassi breed have great potentials for the harsh socioeconomic conditions prevailing in the new reclaimed areas depending on free grazing in poor pastures which lead to nutritional deficiencies, poor body condition, low fertility and decreased lamb crop. Have been studied for characteristics of productivity (milk production, meat, wool), reproduction (fertility, fertility, fecundity), resistance towards diseases etc., and those of acclimatization of purebred Awassi and its crossbreds in the first generations (F1), second (F2) and third (F3) with local breeds.

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MATERIAL AND METHODS

The study carried out since 2000 year in parallel at the Department of Livestock and private farms. It was studied in the Department of Livestock the behavior of the breed to housing conditions, semi-intensive and extensive breeding systems in order to determine its capabilities in terms of acclimatization behavior in Albania and to develop technological packages for its pure breeding and crossbred's capacities. The study was done by the method of groups: study group (crossbreeding ewes selected according to generations, F1, F2, and F3) and control group (native existing type ewes).

There were carried out studies:

- Indicators of milk production,

- Indicators of development dynamics of lambs,

- Indicators of reproduction,

- Indicators of behavior in the new environmental conditions, resistance to disease, etc..

The data were processed statistically by determining the average, standard deviation, the average error and the authenticity of change between groups, Student's t-distribution (KUME, 2007).

RESULTS AND DISCUSSION

A) In the Livestock Husbandry Department

Analysis show that the live weight indicator between groups of first [F1] and second [F2] and second [F2] and third [F3] groups have no statistically significant differences (tD<2.3) and (P >0.05), while between the first [F1], the second [F2], the third [F3] and the native ones of this indicator is verified statistically significant differences (td>4) and (P< 0.05). Differences between the third group with that of the first and the second ones have been higher for milk production respectively 57 and 29.5 percent. While the differences between the third and native ewes group have been 2.2 time higher.

Table 1. Ewes' performance of livestock husbandry department

Crossbred	Heads number	Fertility (Birth rate) %	Prolificacy (Lamb crop) %	Live weight M± m	Milk Production Average	Morbidity %
(Native xAwassi) [F1]	100	90	120	44 ±3,7	70	1.5
[F1] x Awassi [F2]	55	90	125	46 ±4.2	85	1.8
[F2] x Awassi [F3]	37	92	135	47 ±4.4	110	2.2
Native	100	89	107	40±3.2	50	1.2

The achieved results are concerned with the breed impact because the external factors in all the groups of study and control have been the same. Compare with the control group (type of local sheep), fertility (birth rate), prolificacy (lamb crop), for several years resulted higher in study group for the first 4% and 15% for the second, as far as the live weight respectively resulted 60% and 10% higher in the study groups compere with native ewes group.

Table 2. The dynamics of lambs' development of the livestock husbandry department

Crossbred generation	Live weight at birth (kg)		Live weight at the end of suckling (kg)		Suckling days	Average daily gain, Suckling period, g/head/day	
Sex of lambs	Male	Female	Male	Female	Both, Male& Female	Male	Female
(Native x Awassi) [F1]	3.5 ±0.25	3.4 ±0.15	12 ± 1.5	11 ± 1.2	60	141	126
[F1] x Awassi [F2]	3.6 ± 0.3	3.4± 0.25	12.5± 2	12 ± 2	60	148	143
[F2] x Awassi [F3]	3.66±0.4	3.45±0.3	12.6± 2.5	12.2± 2.5	60	149	142
Native	3.2 ±0.15	3.0±0.25	11.0±1.15	10.0±0.25	60	130	116

Introducing Awassi blood sheep breed there has been a positive impact on precocity indicators. The data (Table 2) show that the average of male lambs' weight at birth and the end of suckling period are respectively 12% and 11% higher in crossbred groups with Awasi, while for females it is respectively 13% and 15% higher. Indicators of lamb's precocity of Awasi crossbreds are higher since the first generation and continue to the second and third ones. Differences of those weights between first, second and third generations are not statistically significant (tD<2.3) and (P >0.05), whereas for the three generations (F1, F2, F3) with the native type of country sheep, differences are evident and statistically significant; in each case (tD>4 and (P<0.05). Lambs morbidity resulted: F1 1.5%, F2 1.8%, F3 2.2%. The rate of the control group was 1.2%.

A) In the private farms

The number of crossbred sheep (F1, F2, F3) with Awassi is about 7000 individuals in Korça, Devolli, Pogradeci, Kolonja, Fieri, Lushnja, Elbasani, etc., and there are about 30 farms that are motivated and implement in contractual way the development of this breed. Results of 2008-2009 year in assisted farms are issued through the surveys that were conducted in 10% of the farms leaders' number of different population. Results of research conducted at the private farms showed a trend of genetic capacity improvement indicators from first to the third generation similar with those of the Livestock Husbandry Department of ATTC Korça. Live weight, fertility (birth rate), and especially prolificacy (lamb crop) and milk production have been increased (Table 3). Morbidity of ewe has been 2.0%, 2.2%, and 2.5%, respectively to F1, F2, and F3.

Table 3. The indicators of ewes' performance in private farms

Crossbred generation	Live weight kg	Fertility (Birth rate) %	Prolificacy (Lamb crop) %	Milk production kg/head	Morbidity %
(Native x Awassi) [F1]	44.5	91,2	117.5	60	2
[F1] x Awassi [F2]	45.4	92.	123	70	2.2
[F2] x Awassi [F3]	45.1	92.	134	90	2.5
Native	40.0	89.0	107	54	

Precocity indicators as the lambs' weights at birth and birth-end of suckling period in flocks of private farms are higher compared to its existing type of sheep. The increase (%) is as far as the same to those of the sheep in the study groups of the Livestock Department of ATTC Korça (Table 4).

Table 4. The dynamics of lambs' development in the private farms

Crossbred generation	Live weight at birth (kg)		Live weight at the end of suckling (kg)		Suckling days	Average daily gain, Suckling period, g/head/day	
Sex of lambs	Male	Female	Male	Female	Both, Male& Female	Male	Female
(Native x Awassi) [F1]	3.4	3.3	11.5	10.8	60	135	125
[F1] x Awassi [F2]	3.6	3.4	12.3	11.5	60	145	135
[F2] x Awassi [F3]	3.6	3.4	12.3	12	60	145	143
Native	2.9	2.8	10.2	9.5	60	121	111

CONCLUSIONS

1- Results obtained for some years at the Livestock Department of ATTC Korça, as well as those of the 2008-2009 years of the private farms, show that the crossbreds of Awasi breed are well adapted to climatic conditions and breeding systems that are implemented in Albania. These results are positive for all study areas, hills and plains. The lowest results were obtained in the hilly area; this is not of the genetic breed factor but of the external factors (nutrition, housing, etc.),

2- Awassi crossbred sheep had significantly (P<0.01) higher total milk production than native sheep,

3- Awassi crossbred sheep had significantly bigger fertility (F1 120%, F2 125%, F3 135%) than Native ewes.

4- Results achieved in terms of the current level of nutrition and environmental conditions makes possible to continue to introduce the full improved breed blood, while the hilly area would be sufficient until the second generation or third. We suggest this action.

5- To implement the improvement scheme designed is quite necessary to make the change of rams every two years through their acquisition at the Livestock Department of ATTC Korça and assisted farmers by the Department.

6- The improving work will continue using Awassi breed in areas where it is regionalized without damaging the genetic fund of indigenous breeds' populations of Albania.

7- The received results should be taken into account when use these breeds for genetic improvement of domestic sheep populations for dairy production.

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CAKING PROPERTIES OF AGGLOMERATED INSTANT COFFEE POWDERS AS RELATED TO MOISTURE CONTENT AND STORAGE TIME

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ABSTRACT

Coffee is one of the most important commodities nowadays, consumed by millions of people around the world on daily basis. Although functional properties of coffee are well investigated, an insight to its physical properties is of great importance to coffee handling and processing industry, as well as the scientist dealing with food powder particles interaction and properties. One of the most popular coffee beverages, instant coffee is characterized by its good instant properties as a result of the agglomeration process. However, the agglomerate stability is also an important factor which influences physical properties during storage. This study aims to identify moisture content, bulk density, particle size distribution and caking properties (determined by powder rheometer method) of agglomerated instant coffee powder during 4 months of storage. Results showed an increase in moisture content and bulk density of powders, with a slight decrease in cake height ratios and cake strength values. Statistical analysis exhibited an interdependence of all five cake height ratio values and cake strength, indicating that the samples with rising cake height ratio also showed higher cake strength. Furthermore, bulk density values were significantly ($p<0.05$) influenced by moisture content of the sample. Results obtained by this study indicate a change in physical properties of the agglomerated instant coffee samples during the storage time. These changes (e.g. rising moisture content and bulk density) should be taken into account during storage, in order to keep the final product acceptable and appealing for the final consumer.

Key Words: Agglomerated instant coffee, caking, physical properties, storage

INTRODUCTION

Coffee is a major commodity in the world economy today, second only to petroleum (Vignoli et al., 2012). Two of the most widely spread coffee species include Coffea canephora and Coffea arabica, whose distribution and presence in different countries depend mostly on the preferences of the consumers. Coffee is available on the market as coffee beans (rarely), roasted ground coffee, instant coffee and in the form of numerous coffee based beverages (e.g. cappuccino, "3 in 1" or "2 in 1" instant mixtures). Considering the fast lifestyle lead by most of the world's population today, the market for instant coffee is rising, since its preparation requires only mixing the powder with water or milk. Instant coffee is characterized as a water soluble coffee extract (Narodne novine/Official Gazette of the Republic of Croatia 172/04) which can be sold as granulated, instant or agglomerated powder. It is a well-known fact that instantizing and agglomeration improves the reconstitution and the flow properties of powders (Benković et al., 2011; Vissotto et al., 2010). Improved wettability, dispersability, solubility and better flow properties (e.g. cohesion and caking) are some of the properties improved by agglomeration. Coffee agglomerates are a porous structure whose physical properties differ to those of ground coffee beans, and whose stability during storage is highly dependant on the storage conditions (e.g. temperature or moisture) (Saragoni et al., 2007). Furthermore, agglomerates are considered to be structures which are not susceptible to caking. However, changes in agglomerate shapes and sizes, bulk density and moisture content could lead to changes in caking susceptibility during storage.

The aim of this research was to get an insight in changes occurring during the 4 months storage period of agglomerated instant coffee, with an idea to simulate the storage condition prevailing in households after package opening. Changes in particle size, bulk density and moisture content were monitored and correlated to caking properties of the agglomerates during storage.

MATERIAL AND METHODS

Materials

Agglomerated instant coffee samples were supplied by Franck, Croatia. The samples were packed in a tin can and stored at room conditions (18-20 °C, 45-50% relative humidity) for 4 months. Two parallel

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samples were used to make the measurements. Each month of storage the sample was unpacked and particle size distribution, bulk density, moisture content and caking properties were determined.

Particle size

Particle size distribution was determined by a laser diffraction method, using Malvern Mastersizer 2000 instrument equipped with Scirocco dry dispersion unit (Malvern Instruments, Worchestershire, United Kingdom). Laser obscuration was kept at the level of 2 – 6%, feed pressure at 1 bar and feed rate of 60%, to ensure a uniform flow of particles through the measuring cell. All the measurements were done in triplicate.

Bulk density

Poured bulk density was determined based on the method by Haugaard Sorensen et al (1978). The powder was poured freely into a container, weight of the powder in the container was recorded and bulk density was calculated by dividing the mass of the sample with the volume of the powder in the container. All measurements were done in triplicate.

Moisture content

Moisture content of the samples was determined by drying at 105 °C for 3 hours in an oven dryer. The samples were weighed on an analytical balance (Sartorius, Germany) prior to drying and after drying. The difference in weight before and after drying was recorded as the mass of the water contained in the sample (Benković and Bauman, 2012). Measurements were done in triplicate.

Environmental scanning electron microscopy (ESEM)

Agglomerated instant coffee was scanned using ESEM technique. Philips XL30 ESEM (Philips, The Netherlands) with a resolution 3.0 nm at 30 kV and a GSE detector was used to make the scans. ESEM scans a sample with a high-energy beam of electrons in a raster scan pattern. Micrographs were taken at an accelerating voltage of 25 kV, with no coating of the samples prior to scanning.

Caking properties

Caking test was performed by a rheometric method using a Powder Flow Analyser coupled with TA.HD.Plus Texture Analyser (Stable Micro Systems, Godalming, UK). A fixed sample volume (160 mL) was placed in the vertical cylinder vessel and mounted on the base of the instrument. The instrument operation was controlled by TE 32 software (Stable Micro Systems, v.5.0.6). The test began with 2 conditioning cycles to remove any filling stress and to ensure the uniformity of the sample in the cylinder. During caking test, the blade levelled the top of the powder column and measured the height of the column, after which it moved down through the column at a tip speed 20 mms-1 and compacted the powder to a force of 750 g. When the blade reached the required force it sliced up through the powder at 10 mms-1 and repeated the compaction cycle four more times. At the beginning of every cycle the blade measured the height of the column and the height of the powder cake was recorded when the target force was reached. The fifth time the target force was reached the blade cut through the formed powder cake at the bottom of the vessel and measured the force required to perform the task. This force was recorded as the cake strength and represented the work required to cut the cake (gmm). Cake height ratio (current cycle cake height divided by initial column height) was recorded to give information about the settlement and compaction of the powder column.

Statistical analysis of experimental data was conducted using StatSoft Statistica v.10 software (Tulsa, USA) in terms of basic statistics/correlation matrices.

Results and discussion

Particle size distribution results are shown in Table 1.

Table 1. Particle size distribution parameters during storage period of 4 months

Storage time [months]	d (0.1) [µm]	d (0.5) [µm]	d (0.9) [µm]	D [3,2] [µm]	D [4,3] [µm]	Span
1	27.72±0.20	150.24±6.63	577.24±43.28	57.55±0.90	229.63±13.47	3.67±0.13
2	22.00±0.65	118.25±4.24	421.12±8.44	47.00±1.96	179.12±8.50	3.47±0.09
3	24.62±0.29	154.41±2.65	618.08±9.08	57.95±0.69	241.56±3.41	3.84±0.02
4	38.75±0.06	194.80±2.13	615.50±1.95	85.04±0.26	264.95±1.66	2.96±0.02

As shown in Table 1, there were differences in all particle size distribution parameters during 4 months of storage, indicating a change in agglomerate structure. For example, d(0.5) value decrease was visible during 2nd month of storage, while an increase in 3rd and 4th month of storage was detected for the same sample. This could have occurred as a result of uneven distribution of particle sizes in the sample or as a result of particle shape approximation. Namely, laser diffraction particle sizing method approximates all particles with spheres, which leads to measuring errors if the particles are not indeed spherical, as was the case with agglomerated instant coffee used in this study. Furthermore, agglomerates could have been broken down during the circulation through the measuring unit of the instrument, which could have caused discrepancies in the particle size results.

Moisture content and bulk density results are shown in Figures 1a and 1b.

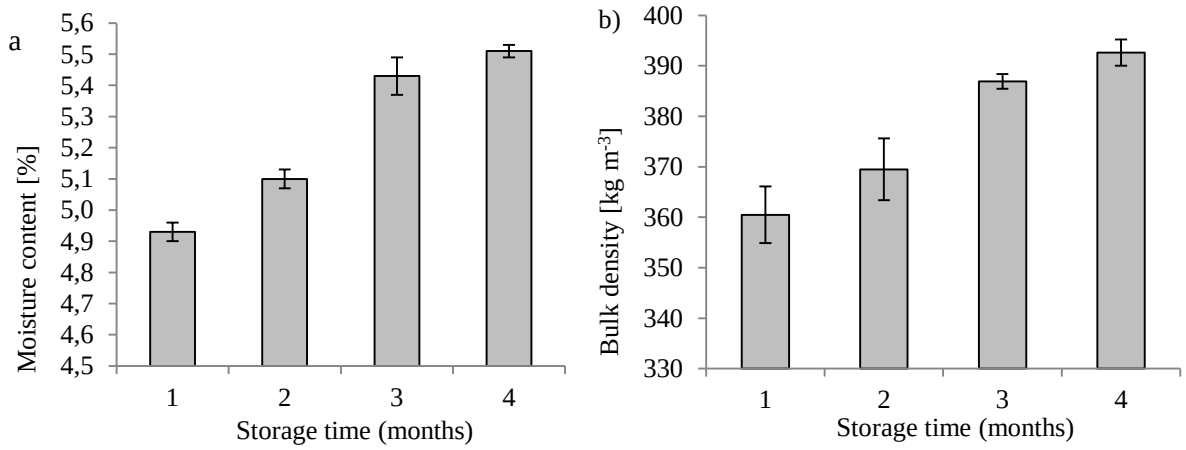

Figure 1. Moisture content (a) and bulk density (b) during 4 months of storage

A consecutive rise in the moisture content was detected during storage at room temperature. According to the Croatian regulations for moisture content of coffee products, instant coffee moisture content level should be kept under 5%. Instant coffee sample used in this study proved to be very hygroscopic and the moisture content exceeded 5% after 2 months of storage (Fig.1a), which made it unacceptable for market placement according to Croatian regulations (Narodne novine/Official Gazette of the Republic of Croatia 127/04). A rise in bulk density values was also detected during 4 months of storage, as shown in Fig.1b. Visual inspection of the sample stored in tin cans revealed a drop in the volume of the powder and a rise in the headspace volume, which was confirmed by the bulk density measurements. Furthermore, statistical analysis showed a significant ($p<0.05$) correlation between bulk density and moisture content – higher moisture content contributed to a rise in bulk density values ($R=0.99$, $p=0.001$).

Caking is a deleterious phenomenon in which particles of an amorphous powder are progressively deformed until they stick to each other (Saragoni et al., 2007). Caking properties of agglomerated instant coffee were evaluated rheometrically and the results were presented as cycle number = f(cake height ratio) (Figure 2a) and cake strength during 4 months of storage (Figure 2b).

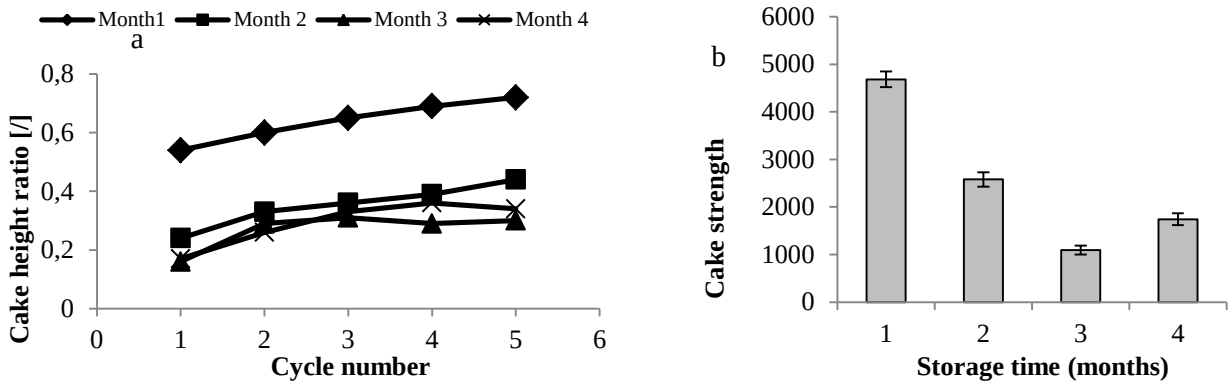

Figure 2. Caking profiles (a) and cake strength (b) of agglomerated instant coffee during 4 months of storage

It is visible from Fig. 2a that agglomerated instant coffee showed a slight rise in cake height ratio throughout all 4 months of storage. A rising cake height ratio indicated that the powder is susceptible to caking, but this susceptibility cannot be considered significant, since the changes in cake height ratio between 1st and 5th caking cycle are relatively small (ranging from 0.14 for month 3 to 0.2 for month 2).

Changes are also visible in cake height ratios in dependence on storage time. A drop in cake height ratios was detected with an increase of storage time, making the powder less susceptible to caking. These results were also confirmed by the consecutive drop in cake strength values shown in Fig. 2b, with an exception of the 4th month of storage, where a slight rise was recorded. These results can be explained by changes in particle sizes and shapes during storage. Namely, since these agglomerates have a very porous structure, they were very easy to break, which lead to changes in particle sizes and consequently to changes in caking properties.

In order to confirm the thesis about agglomerate breakage, ESEM micrograph of the sample was taken, which exhibited a clear image of broken agglomerate structures (Figure 3).

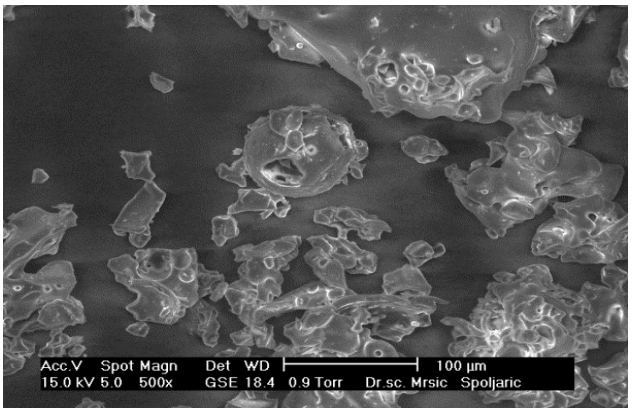

Figure 3. ESEM micrograph of agglomerated instant coffee

Statistical analysis revealed a strong correlation between cake height ratio values for all 5 caking cycles. Furthermore, higher cake height ratio also meant a higher cake strength value, which indicated that higher cake height ratio sample also formed a cake which required a higher force to break it down or disperse.

CONCLUSIONS

Results obtained by this study indicate a change in physical properties of the agglomerated instant coffee samples during the storage time. Moisture content and bulk density values of agglomerated instant coffee rise with storage time. Cake height ratios show a decrease with storage time, making the instant coffee less susceptible to caking, with less force required to cut the cake. These changes should be taken into account during storage, in order to keep the final product acceptable and appealing for the consumer.

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THE QUALITY OF EXTRA VIRGIN OLIVE OIL OBTAINED FROM OBLICA VARIETY

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ABSTRACT

Olive oil is widely used fruit oil especially in the Mediterranean region. Its flavor as well as its specific chemical composition including high content of monounsaturated fatty acids makes it attractive for the use in cooking. Consumers increasingly understand the importance of olive oil quality and stability as well as the nutritional benefits of monounsaturated oil with naturally low levels of saturated fatty acids. Oblica olive variety is the most common olive variety in Bosnia and Herzegovina. The fatty acid profile is important in determining olive oil quality and stability. In this research the samples of extra virgin olive oil, from two different regions, were analyzed by determination of fatty acid composition, peroxide value and free fatty acids content. There was not found statistically significant difference in fatty acids composition, peroxide and free fatty acids content between the samples of extra virgin olive oil from Neum and Ljubuski region. There was not found statistically significant difference in peroxide and free fatty acids content between the samples of extra virgin olive oil from both different region ($p<0.05$). There was no statistically significant difference in the air temperature and precipitation between investigated areas ($p<0.05$).

Key Words: Oblica, oil, fatty acid, stability

INTRODUCTION

Considering its numerous nutritive values, the olive represents the basis of the so-called Mediterranean nutrition, which has often been identified with the term „healthy nutrition". Consumers increasingly understand the importance of olive oil quality and stability as well as the nutritional benefits of monounsaturated oil with naturally low levels of saturated fatty acids.

The Oblica cultivar has the characteristics suitable for the production of olive oil, and for the production of table olives. The fatty acid profile is important in determining olive oil quality and stability. Oleic acid is considered beneficial and high levels are encouraged. Although oleic acid changed little over the maturity period, linoleic acid was found to increase while palmitic acid decreased. Higher levels of polyunsaturated fatty acids are nutritionally beneficial but reduce oil stability (Kulišić et.al., 2004; Abdalla et.al, 2008).

Extra virgin olive oil contains 98 % to 99 % triglycerides and 1 % to 2 % minor components. In the triglycerides the main fatty acids are represented by monounsaturates (oleic), with a slight amount of saturates (palmitic, stearic) and an adequate presence of polyunsaturates (linoleic and α-linolenic). Fatty acid composition may differ from sample to sample, depending on the zone of production, the latitude, the climate, the variety, and the stage of maturity of the fruit (Viola and Viola, 2009; Boskou, 2006).

The aim of this research was to analyze the fatty acid composition, peroxide value and free fatty acids content in the extra virgin olive oil samples of Oblica variety, taken from two regions of Bosnia and Herzegovina (Ljubuski and Neum).

MATERIALS AND METHODS

Materials

The materials for this the olive varieties Oblica comes from more individual growers in the area Ljubuski and Neum.

Olive fruit harvest was done manually (hand-picking) in the October of 2011. , after full ripeness of fruit (18-25%) oil. Immediately after the harvest, until the time of processing, the fruits were kept 24

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hours in the dark and cold room (10 ^{0}C). Olive fruit processing was carried out by the cold pressing on the hydraulic press (22-26 ^{0}C). After crushing and mashing the fruit with the previous preparation, olive fruit were pressed with hydraulic presses with high pressing in the time period from 30-60 minutes.After being pressed, separated oil was filtered and stored in a dark glass bottle. Processing of fruits has been working in the Republic of Croatia, for lack of a factory for processing and obtaining of olive oil in Bosnia and Herzegovina. Fourteen samples of extra virgin olive oil, made from Oblica variety, from Bosnia and Herzegovina, were used in this research. Olive oil samples for analysis were taken from nearer region of Ljubuski and Neum municipalities. From each region we seven samples of olive oil were taken : Ljubuski region (samples A1-A7) and Neum region (samples B1-B7). Air temperature and precipitation of Ljubuski and Neum region were measured during 2011 year.

Methods

The fatty acids composition in investigated samples of olive oil was determined by standard method. Analysis was done on gas chromatogram GC/MS – 6890 II, with use of instrument Hewlett-Pacard with selective mass detector (MSD) 6890 II: FKKT – UL. Capillary column: SP 2560, 100 mx 0,25 mmID, 0,20 µm; Detector: flame ionization FID, 260 °C; Injector: 260 °C, separation 100:1; Gas carrier: helium, 20 cm^3/sec. Temperature of the Owen was 140 °C (5 minutes) and 240 °C/minute, cooling (DGF, C-VI 10a, 1985).

Peroxide value was determined according to method (ISO 3960:1977).

The content of free fatty acids (represented as percentage of oleic acid) was determined by the standard titration method (ISO 660:1983).

Statistical analysis and comparison of results were done by t-test ($p<0.05$), significance level, using Excel 2007.

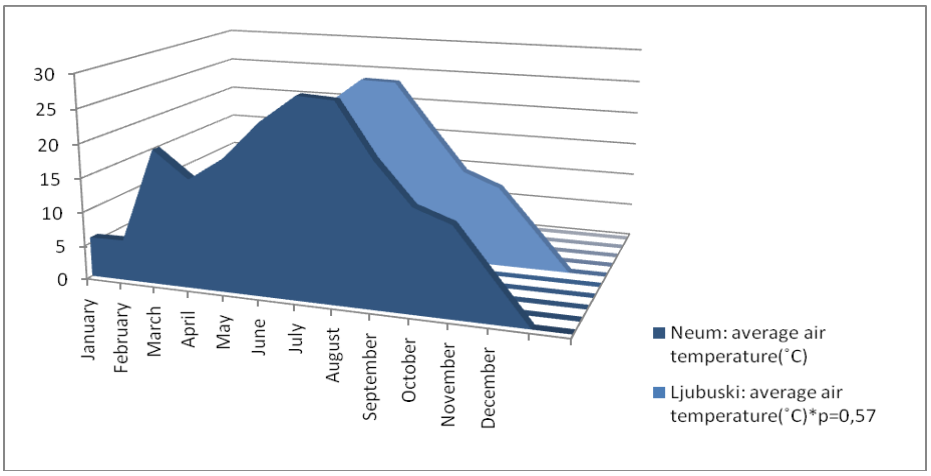
RESULTS AND DISCUSSION

Fatty acid composition in the samples of virgin olive oil, from different region (tab.1), and weather conditions are shown in Figure 1,2.

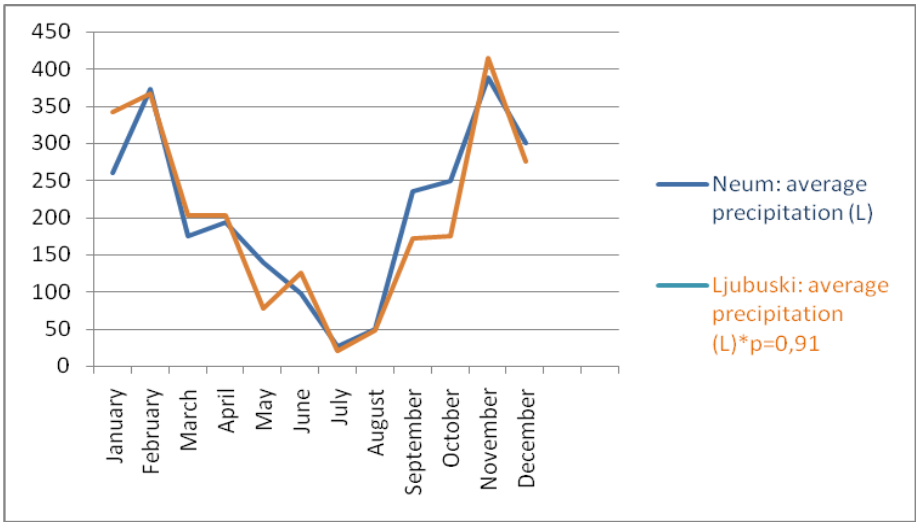
Table 1. Fatty acid composition in the samples of virgin olive oil

Sample	C16:0	C16:1	C18:0	C18:1-n9	C18:2	C18:3
A1	13.63±0.47	0.57 ±0.06	1.73 ±0.06	.30 ±0.26	7.50 ±0.17	0.60 ±0.00
A2	12.33±0.06	0.40 ±0.00	1.90 ±0.00	73.63±0.06	7.83 ±0.60	0.50 ±0.00
A3	13.07±0.10	0.77 ±0.06	1.50 ±0.00	73.43±0.15	7.20 ±0.00	0.60 ±0.00
A4	11.07±0.17	0.57 ±0.06	1.70 ±0.00	75.73±0.23	7.13 ±0.06	0.50 ±0.00
A5	11.50±0.35	0.50 ±0.00	1.73 ±0.06	75.23±0.23	7.90 ±0.00	0.50 ± 0.00
A6	11.53±0.21	0.60 ±0.00	1.50 ±0.00	76.83±0.25	6.23 ±0.06	0.50 ±0.00
A7	11.63±0.11	0.60 ±0.00	1.70 ±0.00	75.77±0.06	6.90 ±000	0.57 ±0.06
T - test*	P = 0.63	P = 0.61	P = 0.38	P = 0.59	P = 0.90	P=0.15
B1	10.08±0.00	0.40 ±0.00	1.73 ±0.06	75.00±0.43	8.43 ±0.15	0.47 ± 0.06
B2	11.02±0.01	0.50 ±0.00	1.80 ±0.00	74.27±0.06	9.17 ±0.06	0.50 ±0.00
B3	10.33±0.21	0.47 ±0.06	1.60 ±0.00	78.53±0.40	5.77 ±0.06	0.50 ±0.00
B4	11.93±0.06	0.70 ±0.00	1.50 ±0.00	76.33±0.40	5.47 ±0.06	0.50 ±0.00
B5	13.73±0.06	0.83 ±0.06	1.47 ±0.11	76.33±0.40	6.73 ±0.06	0.57 ±0.06
B6	10.83±0.06	0.40 ±0.00	1.70 ±0.00	73.43±0.06	9.57 ±0.06	0.50 ±0.00
B7	14.73±0.11	1.10 ±0.00	1.50 ±0.00	73.43±0.06	4.87 ±0.06	0.50 ±0.00

**Statistically significant level at p < 0. 05*



Statistically significant level at p < 0.05
Figure 1. Mean values of air temperature



****Statistically significant level at p < 0.05***
Figure 2. Mean values of precipitation

Among the samples of virgin olive oils, from Ljubuski and Neum region, the highest level of oleic acid was in the sample B3 (78.53 %), while the lowest value was found in the sample A1 (73.30 %). The content of linoleic acid was ranging from 4.87 % (B7) to 9.57 % (B6). The lowest content of linolenic acid had the sample B1 (0.47 %), and the highest had the sample A1 (0.60 %). The content of palmitoleic acid was ranging from 0.40 % (A2, B1, B6) to 0.83 % (B5).

According to Žanetić et al. (2007), the content of oleic acid in the samples of virgin olive oil, derived from Oblica variety, ranged from 70.51 % to 76.58 %, and it means that the content of oleic acid in our samples is slightly higher. Also, according to the same authors, the content of linoleic acid ranged from 7.99 % to 12.71 %, while the content of linolenic acid ranged from 0.53 % to 0.74 %, and those contents are slightly higher in comparison with the contents in our samples.

The most abundant saturated fatty acid was palmitic acid, and its content ranged from 10.08 % (B1) to 14.73 % (B7). The highest content of stearic acid had the sample A2 (1.90 %), while the lowest had the sample B5 (1.47 %).

According to Abdalla et al. (2008), the content of palmitic acid in the samples of virgin olive oils, harvested in November, was around 15.5 %, while the content of stearic acid was around 6.9 %. These results are not in agreement with our results; especially the content of stearic acid in our samples is remarkably lower.

The samples of virgin olive oils, from Ljubuski and Neum region, slightly differ in fatty acid composition, when their mean values are compared. The samples of virgin olive oils, from Ljubuski region, had higher contents of palmitic, stearic, linoleic and linolenic acids in comparison with the samples from Neum region, while higher contents of palmitoleic, and oleic acids had samples from Neum region.

Mean values of air temperature in Ljubuski region was 1.86 % higher in comparison with Neum region, while precipitation in Neum region was 5.45 % higher than in Ljubuski region.

Fatty acids composition was compared statistically, by t-test. The results showed that there is no statistically significant difference ($p<0.05$) among the samples of virgin olive oil from Ljubuski and Neum region, in fatty acid composition. Also, there was not found statistically significant difference between average temperature and precipitation of these two regions.

The mean values of peroxide value and free fatty acid content are shown in table 2.

Table 2. Peroxide value and the content of free fatty acids in the samples of virgin olive oil

Sample	Peroxide value (mmol/kg)	Free fatty acids (% ol.acid)
A1	6.50 ±0.50	0.244 ±0.032
A2	4.00 ±0.50	0.263 ±0.032
A3	3.34 ±2.80	0.263 ±0.032
A4	3.84 ±0.57	0.263 ±0.065
A5	4.67 ±0.57	0.263 ±0.032
A6	2.34 ±0.57	0.227 ±0.056
A7	3.34 ±0.57	0.263 ±0.032
T- test ($p<0.05$)	P = 0.290287	P = 0.105892
B1	2.67 ±0.28	0.207 ±0.032
B2	1.84 ±028	0.263 ±0.032
B3	1.50 ±0.00	0.244 ±0.032
B4	4.17 ±0,57	0.207 ±0.032
B5	2.67 ±0.28	0.150 ±0.032
B6	2.34 ±0.57	0.207 ±0.032
B7	6.50±0.50	0.282 ±0.098

**Statistically significant level at $p < 0.05$*

The peroxide value in the samples of virgin olive oil ranged from15 mmol/kg (B3) to 6.50 mmol/kg (A1, B7). The highest content of free fatty acids among the samples of virgin olive oil had the sample B7 (0.282 %), and the lowest had the sample B5 (0.150 %).

The results of Žanetić and Gugić (2005) showed that peroxide value in the samples of virgin olive oil, obtained from Oblica cultivar, was around 3.8 mmol/kg, and free fatty acids content around 1.79 %. It means that the free fatty acid content in our samples was significantly lower.

According to results Amany et al. (2008), peroxide value in the samples of virgin olive oil was raging from 0.79 to 0.90 mmol/kg, and the content of free fatty acids from 0.10% to 0.14%. Peroxide value in our results is much higher and free fatty acids content is slightly higher.

Peroxide value and free fatty acids content are higher in the samples of virgin olive oil from Ljubuski region in comparison with the samples from Neum region, but there was not found statistically significant difference ($p<0.05$) between these two regions.

CONCLUSION

Oblica olive variety is the most common olive variety in Bosnia and Herzegovina. The quality and stability of olive oil are influenced by its fatty acids composition.

The samples of virgin olive oils from Ljubuski region, had higher contents of palmitic, stearic, linoleic and linolenic acids in comparison with the samples from Neum region, while higher contents of palmitoleic and oleic acids had samples from Neum region. Peroxide value and free fatty acids content were higher in the samples from Ljubuski region.

Statistically, it was not found significant difference between the samples of virgin olive oil from Ljubuski and Neum region in fatty acids composition, peroxide value and free fatty acids content.

It can be concluded that virgin olive oil, obtained from Oblica variety, from Ljubuski and Neum region, has approximately the same fatty acid composition, peroxide value and free fatty acids content.

The results showed t-test found no statistically significant difference at all investigated parameters ($p<0.05$) among samples of virigin olive oil, with both studied areas. There was no significant difference mean value ($p<0.05$) between temperature and precipitation during one year with both areas (Ljubuski and Neum).

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THE INFLUENCE OF BLANCHING AND FREEZING ON THE CONTENT OF PHENOLIC COMPOUNDS, L-ASCORBIC ACID AND NITRITE IN SPINACH

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ABSTRACT

The paper examines the effect of blanching and freezing on the content of total phenol compounds, L-ascorbic acid and nitrites in spinach during the three months period of storage. The experiment was conducted on 50 samples of spinach. Ten control samples were analyzed fresh. Out of the rest 40 samples, 30 samples were boiled at 80°C in duration of 30, 60 and 90 seconds, and the other 10 samples were not processed at all. All of the 40 samples were frozen at -20°C. The analyses on the defined parameters of frozen samples were carried out after one and three months of storage.

It has been affirmed that the processing of spinach significantly changes the content of phenolic compounds, L-ascorbic acid and nitrites in spinach. Our research has found that the content of the examined components is significantly different in terms of statistics ($p<0,001$) with regard to frozen samples without previous blanching. There was no statistically relevant difference between the three different treatments of blanching.

Key Words: Processing, spinach, bioactive components

INTRODUCTION

Spinach (*Spinacea oleracea* L.) is one of the vegetable crops that are commonly used in nutrition in processed form. It is significant in the diet because of its high nutritional value. It is extremely rich in vitamins and especially high in carotene, B-group vitamins and vitamin C. The content of vitamin C (L-ascorbic acid+L-dehydroascorbic acid) ranges from 20-112 mg/100 g of fresh spinach (Lesic *et al.*, 2004). The vitamin C content varies between different cultivars and depends on climatic conditions, agrochemical measures applied during the cultivation, harvesting at maturity and harvest methods (Lee and Kader, 2000).

Spinach leaves are a rich source of phenolic compounds, whose content ranges from 1629-4835 mg equivalents of chlorogenic acid/ kg of fresh weight (Shahidi and Naczk, 2004). Spinach has a greater ability to accumulate nitrate (Lesic *et al.*, 2004). Concentrations of nitrate in spinach can be greater than 1000 mg/kg of fresh weight, which depends on a range of factors including season, light, temperature, growing conditions, fertilizer use, and storage of the crop (Reinik *et al.*, 2008). The concentration of nitrite in fresh vegetables in general, and in spinach, is less than 1 mg/kg and not exceeding 20 mg/kg of fresh weight (Thomson, 2004).

To extend the durability of this high grade vegetable crops, it is preserved by freezing, with or without blanching. Freezing is an effective and excellent way to preserve fresh vegetables and it delays enzyme activity, though it does not stop it. The special heat treatment to inactivate enzymes is known as blanching.

However, during freezing, blanching and frozen storage change of the content of bioactive components usually occur. In addition, spinach is a plant with greater capacity to accumulate nitrate and processing procedures, especially during the processing in the households may bring to their reduction to nitrite, and in that way affect its bioactivity. Nitrites are considered as hazardous for human health. Control of nitrate in vegetable products is systematically implemented in all industrialized countries, because of their potential for reduction in harmful nitrites.

In preliminary research, through personal contacts with the housewives of Bosnian areas, it was found that spinach is one of the predominant vegetables in that area and in the diet used mainly in processed form. Because, it is delicate product with a short shelf life, it is kept frozen, with or without prior

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blanching. Blanching is usually carried out at a temperature 80°C for a period of from 30 to 90 seconds in water.

The aim is to explore changes in the content in total phenolic compounds, L-ascorbic acid and nitrites, that take place under freezing and blanching spinach in households.

MATERIALS AND METHODS

Plant material

Spinach for research, Matador varieties, was grown at the site Podorasac Konjic municipality, B&H. It was cultivated by the practice of individual producers, and sampling was done one month after sowing the spinach. The experiment was conducted in a total of 50 samples. Ten samples were analyzed fresh on the day of sampling. 30 samples were blanched for 30, 60 and 90 seconds, and 10 samples not treated by some method. The temperature and duration of blanching and freezing were selected in accordance with the common practice in households of Bosnian areas. All 40 samples were frozen and stored at -20°C.

Analysis of defined parameters in frozen samples were performed after one and three months storage period.

Chemical analysis

The total phenolic compounds (TP) were determined from ethanol extracts of spinach by the method of Folin-Ciocalteu (Singleton *et al.*, 1999). As a reference standard was used gallic acid (GA). The results are expressed in mgGA/100g dry weight (DW) of spinach.

Determination of L-ascorbic acid (L-AA) in spinach was performed titrimetrically, by the method in which 2,6-dichlorophenolindophenol dye is reduced by ascorbic acid. As extractant was used 4% oxalic acid. The results are expressed in mg/100g DW of spinach (Harris and Olliver, 1942).

Nitrites ($N\text{-}NO_2^-$) are extracted from plant material by hot water, with protein precipitation by adding potassium hexacyanoferrate (II) and zinc acetate and by filtration of precipitate (ISO 6635, 2008). The nitrites were determined spectrophotometrically at 507nm and results are Dexpressed in mg/1000g FW of spinach.

Moisture contents was determinated by air-oven method. The sample was dried to constant weight at 100±5°C and estimated from the weight lost by drying under controlled temperature in an air oven. It is expressed in g per 100 g sample.

Analysis of data

The results of the tree replicates were pooled and expressed as mean±standard deviation. T test were used to test the difference between the applications in terms of content levels.

RESULTS AND DISCUSSION

Informations about the content of total phenolic compounds, L-AA and nitrite in fresh, blanched and frozen samples without blanching spinach are given in Table 1.

The content of total phenolic compounds in fresh spinach samples was 1559±96mg/100gDW, relatively 150±12.3 mg GA/100 g FW. Obtained value of the content of total phenolic compounds were comparable with literature data, which gave Naczk & Shahidi (2004), by which the content of total phenolic compounds range from 162.9 to 483.5 mg equivalents of chlorogenic acid/100 g FW. Bunea *et al.* (2008) obtained values of the content of total phenolic compounds in fresh spinach of 208.8 mg GA/100 g FW. Variations of the content of phenolic compounds in foods of the same or similar nature are the result of many factors, which in addition to genetic, include the area of cultivation and many environmental factors. The time of harvest, post harvest handling, storage, and sample preparation technology during analytical determination and determination methods, are important factors for differences in results of content of phenolic compounds (Oviasogie *et al.*, 2009).

Table 1. The contents of phenolic compounds (TP), L-AA and nitrite in fresh, blanched and frozen spinach samples without blanching

Description of sample	Storage period	Moisture content (g/100g)	TP (mg GA/100 g DW)	L-AA (mg /100 g DW)	$N\text{-}NO_2^-$ (mg /1000 g DW)
		Mean value ± standard deviation	Mean value ± standard deviation	Mean value ± standard deviation	Mean value ± standard deviation
Fresh samples	-	90,3±1,02[1]	1559±96	355±112	14,87±5,58
Samples blanched 30 sec	1 month	89,6±1,25	1159±104*	52,1±36,7*	44,79±19,22*
	3 month	89,9±1,30	1567±280	30,4±22,6*	62,68±14,17*
Samples blanched 60 sec	1 month	89,9±1,42	1174±93*	52,0±29,9*	38,49±16,00*
	3 month	91,2±1,57	1643±227	42,0±16,0*	72,98±27,75*
Samples blanched 90 sec	1 month	89,2±1,10	1091±70*	60,5±25,4*	36,75±15,64*
	3 month	89,9±0,97	1573±131	51,2±15,2*	55,23±12,90*
Frozen samples without blanching	1 month	90,5±1,05	1691±265	14,0±6,3*	80,65±36,96*
	3 month	91,8±1,26	2490±321*	6,3±1,80*	111,53±35,47*

*[1]data are means±standard deviations of ten determinations; *- *- p < 0,001*

Reduction in content of phenolic compounds during blanching could be a consequence of their direct degradation, while the increase during periods of freezing could be explained by chemical changes in the structure of phenol (Misan, 2009). As this is a compounds water-soluble, blanching, by washing, comes to decrease in content of phenolic compounds in spinach. Kalt (2005) noted the decrease in content of phenolic compounds for 20-30% in carrots, spinach and potatoes and some vegetable crops in the cruciferous family after blanching, and longer storage of frozen vegetable crops.

Trend of growth of content of phenolic compounds in blanched samples during the last two months of storage, leads us to the conclusion that the loss of phenolic compounds with blanching could be higher considering that the content of phenolic compounds in blanched samples was not determined immediately after blanching, but a month after storage by freezing. The increase of content of phenolic compounds during the second period of storage in frozen samples without blanching was higher (52%) compared to blanched samples (30%) in the same period. This trend may be an indication that none of the three blanching process was not enough for complete inactivation of the enzyme responsible for changes in the content of phenolic compounds.

There is also some posibillity that choosed method extraction was not appropriate. We think, that when determining polyphenols in fresh samples, extraction has not been a quantitative, so that part of polyphenols remained in the undestroyed cells. Processing operations that followed affected the cell

structure, producing loss of turgor, weakness of cell wall, and some degree of cell separation., thereby facilitating extraction of soluble polyphenols giving higher results.

However, for performing a general conclusion about the effects of blanching and freezing on the content of phenolic compounds in spinach, it would be necessary to know the qualitative character of the changes in blanched and frozen samples and optimize the extraction method.

The L-ascorbic acid in fresh spinach samples ranges from 355±112mg/100gDW, relatively 35±12.7 mg/100 g FW. Larger values of L-ascorbic acid were given by Tosun & Yucecan (2007). As extractant they used 3% metaphosphoric acid and spectrophotometric method of determining and content of L-ascorbic acid in fresh spinach was 97.6±1.79 mg/100 g FW. Values obtained in our experiment were inside average values for the content of vitamin C (L-ascorbic acid+L-dehydroascorbic acid), which ranges from 20-112 mg/100 g fresh weight of spinach (Lesic *et al.*, 2004). Rahman *et al.* (2007) determined the content of total vitamin C in spinach from 21.439 ± 0.153 mg/100 g.

During blanching and freezing of spinach was recorded the biggest loss of L-AA content. It is widely known that L-AA at least stable of all vitamins and that are easily destroyed during processing and storage. Losses of L-AA during blanching mainly are the result of leaching and thermal degradation, and in frozen samples are the result of enzyme activity, oxygen and oxidizing substances.

In our study was found a minimum retention of L-AA in frozen samples of spinach without previous blanching, which may be caused, in addition to enzymatic activity, by the effect of oxygen and oxidizing substances.

Statistically were obtained the same values of L-AA in samples of blanched spinach for 30, 60 and 90 sec in the first and second storage period and were significantly higher than the values obtained in samples of unblanched spinach. In this we can conclude that L-ascorbate oxidase is inactivated with blanching during all three time periods of blanching.

How in our work was not determined activity of enzyme indicator,we will pointed that the conclusions about enzyme activity is primarily conducted from the results of research. In the literature says that the effective inactivation of peroxidase in spinach is achieving by blanching in water at a temperature of 80°C for 60 sec (Gupta *et al.*, 2008). Since that peroxidase is thermo stable enzyme, blanching conditions that lead to its inactivation, supports the the conclusions about enzyme activity in the case of L-ascorbate oxidase, but not about enzymes which are responsible for changes in content of phenolic compounds.

The average content of nitrite of fresh spinach samples was 14,87±5,57 mg/1000gDW, relatively 1.46±0.63 mg/1000 g FW, and is in accordance with published results given by Kenny and Walsh (1975). Tendency of growing of nitrite in blanched and frozen spinach samples during three months storage period by freezing, is in contrast with the published data given by Kmiecik *et al.* (2004). They explored the influence of blanching and freezing to the dill during 12 months of storage. They found that storage by freezing will not affect the changes in content of nitrite in blanched samples and they found small changes in content of nitrite in unblanched samples. The same authors also reported that blanching significantly reduces the content of nitrite in plant species.

Our results showed a significant increase of nitrite during the storage period. There were no significant differences between the three time periods of blanching, but the obtained results in content of nitrite in blanched samples of spinach significantly lower than to samples which were not previously blanched. So, it is possible that the lower values determined in blanched samples of spinach are result of rinsing of nitrate and nitrite into water in which they were blanched. Nitrite in vegetables is formed as a result of bacterial or enzyme (nitrate reductase) actions. Blanching can destroy the enzyme activity and nitrite accumulation is also inhibited under frozen storage, but water used for blanching may contain nitrites and nitrates and lead to an increase of nitrite in the processing products. Storage at room temperature resulted in rapid fall in the nitrate contents and concomitant increases in the nitrite concentrations (Hill, 1996). We believed that a significant increase of nitrite in spinach, no matter way of processing, came during sample preparation, defrosting, and their stabilization to the room temperature.

CONCLUSIONS

On the basis of the presented findings for influence of spinach processing methods to content of bioactive components, we can offer the following basic conclusions:

- **Processing of spinach, blanching in water at a temperature of 80°C for 30, 60 and 90 sec and freezing at -20°C during three months period, significantly changes the content of total phenolic compounds, L-ascorbic acid and nitrite in spinach.**
- **The content of total phenolic compounds showed a tendency to increase during the freezing storage period and blanching resulted in decrease of content of total phenolic compounds in spinach. After three months freezing storage period, the contents of phenolic compounds in blanched samples was practically unchanged in comparison to baseline. But, for performing a general conclusion about the effects of blanching and freezing to the contents of total phenolic compounds in spinach, it would be necessary to know the qualitative character of the changes in blanched and frozen samples.**
- **During the three months of spinach storage at -20°C it was recorded the highest loss of L-ascorbic acid. In our study was found a minimum retention of L-ascorbic acid in frozen spinach samples without previous blanching. Significantly higher values of L-ascorbic acid were obtained in spinach samples blanched for 30, 60 and 90 sec in water at 80°C, but no any statistically significant differences between the three different treatments.**
- **Nitrites showed a tendency to increase during three months period of storage by freezing. There were no significant differences between the three time periods of blanching, but the obtained results about content of nitrite in blanched spinach samples were significantly lower than the samples which were not previously blanched.**

The general conclusion in order to held initial quality of spinach over a long time period as much as possible, it is necessary to keep at a temperature of -20°C and previously process with blanching in water at 80°C for 90 sec. In our study, the best results of keeping the content of defined bioactive components were obtained in that mode of processing.

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DETERMINATION OF HEAVY METALS IN WHEAT STARCH "NIŠESTA" PRODUCED IN THE HOUSEHOLD

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ABSTRACT

The most common dangers are different types of contaminants that can get into the food uncontrolled from environment or may be remnants of treatment that a man uses in various stages of production and processing, packaging, transportation of food.

Analyzing the products in Bosnia and Herzegovina which can be labeled as ingredients with the "geographical name" and the characteristics of traditional products, we considered very important to investigate the presence of heavy metals in wheat starch "nišesta" produced in the household.

The tests in this paper were performed on samples of wheat starch "nišesta" from 4 sites where this type of production remained till today (areas: 1. Bosnian Krajina, 2. Tuzla region, 3. region of Banja Luka and 4. Brčko District Bosnia and Herzegovina) with the control sample (5) industrially produced starch.

Samples of "nišesta" were analyzed for the presence of heavy metals: zinc (Zn), molybdenum (Mo), cobalt (Co), manganese (Mn), iron (Fe), copper (Cu), lead (Pb) and chromium (Cr).

The results indicate that the content of lead and chromium in any homemade sample does not exceed the amounts detected in the control sample. Higher content of cobalt is only present in a sample 1, and iron in samples 1, 3 and 4. All other heavy metals are present in larger quantities in homemade samples. In average for all samples, more manganese is for 679%, copper 878%, zinc 749% and molybdenum for 242%.

Key Words: "Nišesta", wheat starch, household production.

INTRODUCTION

Food safety is a basic requirement based on protecting the health of consumers and it is determine by the legislation. Consumers demand food that is safe and that the products offered on the market excluded all possibility of primary and secondary contamination.

The most common food safety hazards for different types of contaminants which can get into the food uncontrolled are from the environment or by treatment which humans use in various stages of production and processing, packaging, transporting food.

The concept of heavy metals in food, for most consumers, present a potential danger to its' health, because it's not widely recognizable that many of these beneficial ingredients enhance the nutritional value of food.

Heavy metals are classified as essential microelements which include: Cu, Fe, Mn, Zn, Mo, Ni and potentially toxic or non-essential elements which include those metals that are biogenic and act solely as toxic: Cd, Cr, Pb, Hg and As. Of the ten most abundant metals in nature, seven belong to heavy metals, of which six metals are classified as a subgroup of essential trace elements.

Some of the heavy metals are essential for living organisms, may act favorably on the productivity of agriculture, but most of them are often a significant polluter of the environment.

Origin of heavy metals in soil is different. It can be geogenic, when heavy metals in the soil come due from the weathering of source rocks that are formed or their origin in the soil is caused by external factors, mostly caused by humans (anthropogenic and emission).

Most intensively plants accumulate zinc, boron, molybdenum, cobalt, to a lesser extent manganese, iron, aluminum, and the least copper, lead and chromium. The elements that are intensively trans-located are: manganese, cadmium, boron, molybdenum and selenium, highly are nickel, cobalt, copper, and slowly are-chromium, lead and mercury.

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Technology development and technical advances have contributed to the production of enough food, but as a consequence contaminants that are not natural food ingredient appear. The risk of contamination by heavy metals in products may be due toxic substances from the processing of: additives, residues of cleaning, dishes and packaging, hazardous products that may arise during processing (Jašić, Begić 2008.). Such possibilities are significant in the households food processing.

Production and use of starch in the population diet is a tradition in some areas of Bosnia and Herzegovina. It is related to the preparation of wheat starch in a household with the traditional title "nišesta", and such production is retained till today. "Nišesta" is commonly used in the preparation of traditional sweets as their integral part or is used in preparing filo pastry.

Analyzing the products in Bosnia and Herzegovina which can be labeled as food with the "geographical name" and with the characteristics of traditional products, it was considered very important to investigate the presence of heavy metals in wheat starch "nišesta" produced in the household (Hadžić et al. 2012).

Research in the framework of this paper included the analysis of wheat starch "nišesta" from several localities in Bosnia and Herzegovina and the results of heavy metals detected were compared to industrially produced starch, in accordance with legal requirements for such products.

MATERIAL AND METHODS

Analysis were performed on five samples of wheat starch "nišesta", taken from the four production areas (sites) where it is produced in the traditional way at home, and for the necessary comparisons one control sample - an industrial product was included, which is under the same name on the market in Bosnia and Herzegovina. Samples are labeled with numbers from one to five, depending on the area from where they were taken: 1. sample - the Bosnian Krajina (Cazin); 2. sample - near Banja Luka; 3. sample - around Tuzla; 4. sample - the area of Brčko District of Bosnia and Herzegovina and 5. sample - industrial production (Klas d.d. Sarajevo).

The producing technology includes: selection of grains, washing, soaking in water/fermentation, washing, grinding, squeezing, drying and grinding/logs of obtained mass. Significant differences in individual actions occur throughout the duration of fermentation and the frequency of flushing "pickled" grain (Hadžić et al. 2012).

Following heavy metals were determined: Cr, Mn, Fe, Co, Cu, Zn, Mo and Pb. Each sample means of 5 individual samples, and obtained values of heavy metals were statistically analyzed with ANOVA test.

Contents of metals were detected by: EN 13805:2002, ITD and EN 15763:2009, ITD methods using the instrument Induced coupled plasma with Mass Spectrometry (ICP-MS 7700x, Agilent Technologies, Japan), with the previous preparation of plant material in a microwave oven for digestion (MDS-8, Sineo,China). Samples of plant materials were destroyed with Nitric acid, 65% Suprapur purity, Hydrogen peroxide, 30% Suprapur purity and Hydrochloric acid, 30% purity Suprapur. The limits of detection are: Cr – 0.99 ppt (ng/kg), Mn – 0.66 ng/kg, Fe – 9.17 ng/kg, Co – 0.14 ng/kg, Cu – 0.41 ng/kg, Zn – 1.02 ng/kg, Mo – 0.12 ng/kg, Pb – 0.16 ng/kg.

Analysis results were processed and presented in forms that are acceptable for this kind of research, and provide enough valid parameters for the type of product being tested. The basis for comparison and evaluation of the obtained data about detected contents is the Regulations about maximum allowable amounts for certain contaminants in food (Službeni glasnik BiH. 2009). Regulation includes maximum allowable quantities of lead (0.4 mg/kg), cadmium (0.05 mg/kg), mercury (0.03 mg/kg) and arsenic (0.5 mg/kg) in cereal products.

RESULTS AND DISCUSSION

Research carried out on five samples of wheat starch "nišesta", taken from the four production areas (sites) where it is produced in the traditional way in the household and compared to a sample of industrially manufactured wheat starch, which is under the same name on the market in Bosnia and Herzegovina, resulted with the unique data. Significant results were also due to the detection of heavy

metals: zinc, molybdenum, cobalt, manganese, iron, copper, lead and chromium, which are of great value in classifying products in the category of acceptable or undesirable for human consumption. Table 1 provides the data of detected quantity of heavy metals in all five samples individually and for each tested metal.

Table 1. Detected amounts of heavy metals in the samples of „nišesta" in mg/kg

Heavy metals	Mean	Std. Deviation	Std. Error
Sample 1			
Cr	,000000	,000000	,000000
Mn	8,002000	,0015811	,0007071
Fe	9,704000	,0012247	,0005477
Co	,010000	,0007071	,0003162
Cu	,837000	,0014142	,0006325
Zn	2,245000	,0007071	,0003162
Mo	,069000	,0007071	,0003162
Pb	,022000	,0012247	,0005477
Sample 2			
Cr	,000000	,000000	,000000
Mn	3,125000	,0031623	,0014142
Fe	3,885000	,0007071	,0003162
Co	,000000	,0000000	,0000000
Cu	,491000	,0010000	,0004472
Zn	1,917000	,0012247	,0005477
Mo	,124000	,0010000	,0004472
Pb	,000000	,0000000	,0000000
Sample 3			
Cr	,008800	,0049699	,0022226
Mn	7,624000	,0015811	,0007071
Fe	12,049000	,0007071	,0003162
Co	,001000	,0007071	,0003162
Cu	1,467000	,0012247	,0005477
Zn	8,533000	,0017321	,0007746
Mo	,145000	,0007071	,0003162
Pb	,000000	,0000000	,0000000
Sample 4			
Cr	,000000	,000000	,000000
Mn	7,592000	,0012247	,0005477
Fe	11,995000	,0012247	,0005477
Co	,001000	,0007071	,0003162
Cu	1,492000	,0012247	,0005477
Zn	8,381000	,0010000	,0004472
Mo	,136000	,0007071	,0003162
Pb	,000000	,0000000	,0000000
Sample 5			
Cr	,000000	,000000	,000000
Mn	,903000	,0015811	,0007071
Fe	4,369000	,0007071	,0003162
Co	,001000	,0007071	,0003162
Cu	,122000	,0012247	,0005477
Zn	,703000	,0007071	,0003162
Mo	,069000	,0007071	,0003162
Pb	,022000	,0012247	,0005477

Chromium is a heavy metal that can be potentially toxic to the human body. In this research analysis, it was detected only in a sample 3 with 0.011 mg/kg.

Regulations about maximum allowable amounts for certain contaminants in food limits only contents of lead (Pb) to a maximum of 0.20 mg/kg of tested metals in the framework of this paper. In this research, lead was detected only in sample No. 1 with 0.022 mg/kg which for 0.002 mg/kg exceeds the content of heavy metals, and this type of food can not have it.

Manganese was detected in all samples in amounts of 0.903 mg/kg in the control sample, up to the highest content in the sample 1 (8.002 mg/kg).

Iron was the highest in the analyzed sample of "nišesta" marked as sample 3 (12.049 mg/kg) and 4 (11.995 mg/kg) and least in sample 2 (3.885 mg/kg).

Amounts of cobalt were detected in relatively small amounts, and its contents are identical in samples 3, 4 and 5. In sample 2 cobalt was not detected and in sample 1 has the highest value (0.010 mg/kg).

The content of zinc is different for each sample, the lowest is in the control sample (0.703 mg/kg), and in sample 3 reaches an amount of 8.533 mg/kg.

Differences in the content of molybdenum among the tested samples were perceptual and were detected with the lowest values in the control sample (0.049 mg/kg). The highest values of this heavy metal was in the sample 3 (0.145 mg/kg).

If the obtained information of the presence of heavy metals (mg/kg) in the investigated samples of "nišesta" look through the highest content for all samples in average, it is evident that most of them have iron (8.3914 mg/kg), followed by manganese (5.2746 mg/kg), zinc (4.3558 mg/kg), copper (0.8818 mg/kg) and molybdenum (0.1046 mg/kg). At least detected the content of lead (0.0044 mg/kg), cobalt (0.0026 mg/kg) and chromium (0.0022 mg/kg).

Control sample is a sample number 5 and it presents industrially produced wheat starch which should represent the food produced according to the prescribed values. Due to the fact that the other samples are produced without legal framework, under the specific indigenous technologies, the assumption is that such a product may have specific characteristics regarding the terms of heavy metals also.

To comprehend the potential differences, detected values of analyzed elements were compared with the same as in the control variant (taken as 100%) (Figure 1). Chromium is present only in the sample 3 which is for 0.011% higher, and lead content in the sample 2 is for 0.022% higher in relation to detected contents in industrially produced wheat starch. And cobalt was detected in relatively low values but in the sample 1 is 1000% higher than in the control samples, and in other household produced "nišesta".

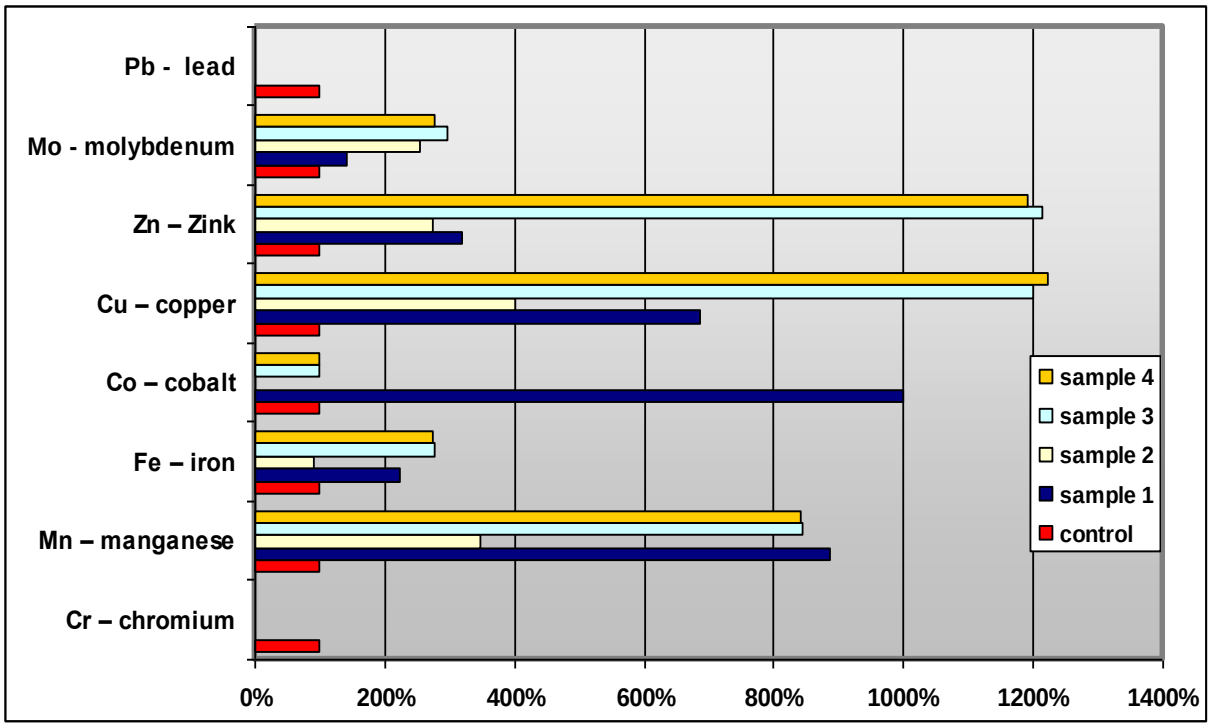

Figure 1. Contents of heavy metals in the tested samples made in households compared to industrially produced „nišesta“

All other heavy metals were detected in larger quantities in samples made in households except iron in the sample 2 (11% less compared to the control). Other samples contain iron from 122% (sample 1) to 176% (sample 3) more.

Manganese was higher in all samples ranging from 246% (sample 2) to 786% (sample 1) in relation to industrial "nišesta", copper ranging from 202% (sample 2) up to 1123% (sample 4), zinc from 173% (sample 2) up to 1113% (sample 3), and molybdenum from 41% (sample 1) to 196% (sample 3).

ANOVA test showed that the differences in the mean values for Mn, Fe, Cu, Zn and Mo among the samples are statistically significant $p<0.0005$. Subsequent Bonferroni test for multiple comparisons showed that this difference is present between each pattern $p<0.0005$. Subsequent Bonferroni test for multiple comparisons showed that the difference in Co and Pb is present between the sample 1 compared with other samples (samples 2,3,4,5) $p<0.0005$, and the gaps between the Cr refers to the pattern in the third than others.

If obtained detected values view as average for all samples made in households in relation to industrially produced "nišesta", it is evident that most of them contain copper (878%), then zinc (749%), manganese (679%), cobalt (300%), molybdenum (242%) and iron (216%) compared to the control (Figure 2).

In the literature, there are no studies about the content of heavy metals in the "nišesta" produced within households, so comparison could be done only related to industrially manufactured wheat starch. For this reason, many questions remain open, and above all the question: which external factors and to what extent they influence the detected levels of heavy metals?

Indicators for such conditionality can be found in some studies regarding the effects of heavy metals in soil and wheat grown on those soils. Similar tests were conducted in France (Baiz, 2009) where it is based on several common soil properties such as pH, organic carbon content and cat ion exchange capacity, determined that the contents of Cd, Cr, Cu, Ni, Pb, Zn, Fe, Mg and Mn in the soil does not reflect their height in wheat grain. It is highlighted especially for the presence of cadmium.

Stefanovic et al. (2008) point out that in addition to containing nutrients (high levels of vitamins, minerals and cellulose fibers) wheat also contains many elements (Cu, Zn, Fe, Ni, Mn) of vital importance to our biological functions, but also hazardous to our health in high concentrations.

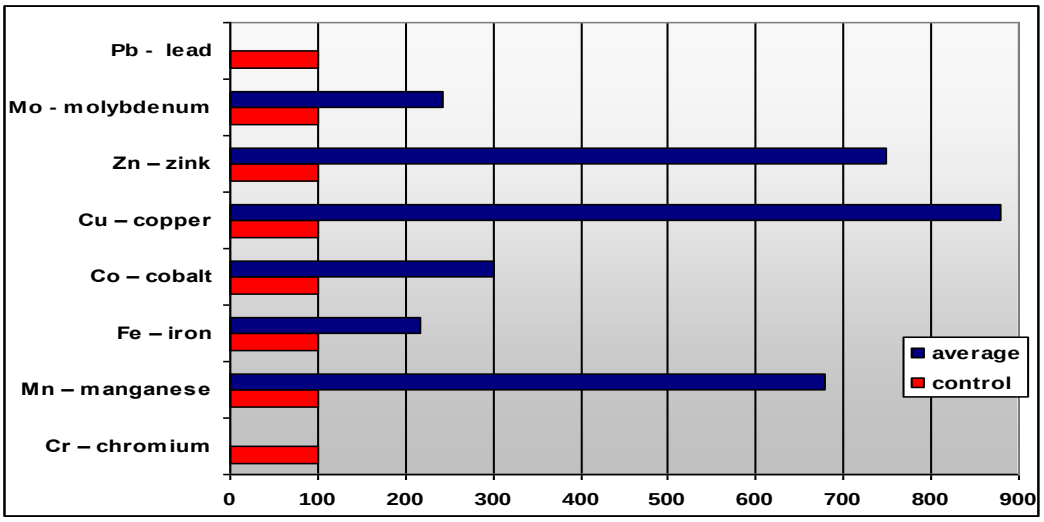

Figure 2. Average of all samples made in households compared to industrially made „nišesta“

There are three groups of minerals which are of interest for the food industry, science and food experts: 1. essential for humans (Cu, Ca, Fe, K and Mg), 2. essential for plants and some animal species, but not for humans (Cd, Ni and others) and 3. toxic or used in therapeutic doses (Al, Ba, Hg) (Jašić. M. and Begić, L. 2008). Examining the impact of wheat varieties on the content of heavy metals in the grain, bran and flour, the same authors report significant differences in undesirable metals content in different varieties of wheat (Tadesse, Z. 2006).

The tested varieties had Fe in amounts of 25.11 - 69.26 mg/kg, Cu from 3.02 -5.48 mg/kg, Zn from 16.01 - 26.43 mg/kg, Pb from 0.33 to 2.46 mg/kg and Cd from 0.01 to 0.21 mg/kg. The results of this study, by the highest content of certain metals for all samples, on average, indicates that the detected concentration of iron (8.3914 mg/kg), zinc (4.3558 mg/kg), copper (0.8818 mg/kg) and lead (0.0044 mg/kg), is much lower than the data obtained by named author's research (Stefanović, Filipović and Jovanović. 2008).

Such results may be due to different content of wheat grain that was used to produce "nišesta", but the question remains whether the contents of some heavy metal are conditioned by contamination of soils on which used material was grown, as well as questions, does its' content decrease or does subsequent contamination occur during processing?

If it is known that cadmium, chromium, lead, mercury, and astatine act solely as toxic, then more detailed studies of these elements must be conducted, as well as to the elements whose activities present of food with better nutritional value.

CONCLUSIONS

Analysis of heavy metals in samples of wheat starch "nišesta" produced in households, resulted in following data:

Chromium was detected only in sample 3 with 0.011 mg/kg.

Lead was detected only in sample 1 with 0.022 mg/kg which for the 0.002 mg/kg is exceeding the content of heavy metals, which may not have these types of foods in traffic.

Manganese was detected in all samples in amounts of 0.903 mg/kg in the control sample, up to the highest content in the sample 1 (8.002 mg/kg).

The iron was the highest in the analyzed samples of "nišesta" marked as sample 3 (12.049 mg/kg) and 4 (11.995 mg/kg) and least in sample 2 (3.885 mg/kg).

The detected amounts of cobalt are in relatively small amounts, and its contents are identical in samples 3, 4 and 5. In the sample 2, cobalt was not detected and in sample 1 has the highest value (0.010 mg/kg).

The content of zinc is different for each sample, the lowest is in the control sample (0.703 mg/kg), and in sample 3 it reaches an amount of 8.533 mg/kg.

Differences in the molybdenum content among analyzed samples are perceptual and are detected with the lowest values in the control sample (0.049 mg/kg). The highest values of this heavy metal is in the sample 3 (0.145 mg/kg).

There are statistically significant differences in the mean values for Mn, Fe, Cu, Zn and Mo between each sample. Such a difference for Co and Pb is present between the sample 1 compared with other samples (samples 2,3,4,5), and gaps between Cr refers to the third pattern in relation to others.

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DETERMINATION OF SACCHARINE CONTENT IN DIFFERENT FOODSTUFFS AND SUPPLEMENTS

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ABSTRACT

Saccharin, (E954) is additive and belongs to group of sweeteners. It is stable during heating, but becomes unpleasant taste. Products in which we can find saccharin as sweetener are: juices, bakery products, jams, preserved fruits, candies and dietetic products.

Primary goal was to determine content of the saccharin in products (n=15), and determine are there any statisticaly significant difference between content of the saccharin in different foodstuffs and food supplements and they are alignment with EU and BiH regulations.

Method for determining content of the saccharin in different foodstuffs and supplements was a spectrophotometry, by use of Nessler's reagent As solvent was used diethyl ether. The solvent is removed and the residue is digested with HCl and made to a known volume. An aliquot is treated with Nessler's reagent and the absorbance of the coloured product is measured at 425 nm. The saccharin content of the sample was got by use of the calibration graph. Results showed that there no statistically significant difference in the content of saccharin in foods and dietary supplements.

Conclusion is that there is no statisticaly significant differences between content of the saccharin in different foodstuffs and food supplements as determined with "t-test" and there is no aberrations according to EU and BiH regulations and results are in rank with available literature sources.

Key Words: Saccharin, products, diethyl ether, spectrophotometry.

INTRODUCTION

Artificial sweeteners are low calorie substances used instead of sucrose to sweeten foods and beverages, are classified in the group of food additives-sweeteners. They are divided into: artificial (non-nutritive sweeteners) and not artificial (nutritive sweeteners). Artificial sweeteners are saccharin, cyclamate, aspartame and thaumatin, and lately joined them; and acesulfame-K, stevioside and glycyrrhizin.

Saccharin is an artificial sweetener (E954), appears in the form of salt: the acid and the sodium and calcium salts. The name saccharin is aptly derived from the Latin word *"saccharum"* which means a sweetener (Mathew, et al.,2006). Saccharin is a white, crystalline, aromatic compound. It is not easily soluble in water, while its salts dissolve easily.

Saccharin is a very bitter in concentrated solution, while very sweet in dilute solution (von Rymon Lipinski 1995). It is not soluble in water, as an artificial sweetener used in its sodium salt. Calcium salts are sometimes used, especially by people restricting their dietary sodium intake (0.67 g / ml of water at room temperature (Nakanishi, et al.,1980b; Prasad,O. & Rai, G. 1986). Saccharin was first synthesized in United States in 1879 by two chemists I. Remsem and C. Fahlberg when they were researching the oxsidation of Toulene Sulfoamide (Mathew, et al.,2006).

An acceptable daily intake (ADI) of 5 mg/kg bw for saccharin (including its sodium, calcium and potassium salts) was established in 1993 by the WHO/FAO Joint Expert Committee on Food Additives (WHO(1978)) and in 1995 by the Scientific Committe for Food of the European Union (Nakanishi, et al., 1980b).

Various methods for the determination of saccharin have been reported in literature, such as gas chromatography, thin layer chromatography, HPLC, infrared spectrophotometry, ultraviolet spectrophotometry, flow injection analysis, precipitation flow injection method, flow-through spectrophotometric sensors (von Rymon Lipinski, G.-W.1995). A comparative analysis of saccharin in

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different food product to evaluate them (from healts view point) was performed by using gravimetric method and U.V. spectrophotometric method (Mathew, et al., 2006). The objective of this study was to determine the content of saccharin in various food products and dietary supplements using the spectrophotometric method.

MATERIALS AND METHODS

In this paper the content of saccharin in different on market available food products was measured quantitively (in tree repetition) with spectrophotometrically Schimadzu UV/VIS 2200 spectrophotometer.

Materials:

- jams (strawberry, cherry and blackcurrant), consumable sugar for diabetics, fruit sugar (sugar free cake preparation for diabetics), pudding powder (chocolate and vanilla flavor), instant lemon beverage, low-calorie sugar free juice (orange and lemon), table sweetener (sweetener for diabetics), nutritional supplements- vitamins and minerals: vitamin C, Magnesium, Calcium and vitamin-mineral supplement (multivitamin in solid form).

Reagents and chemicals

(1) Dietil eter – $C_4H_{10}O$; M = 74.12 g / mol (Semikem)
(2) NH_4Cl (contents min.99.8 %); M = 53.49 g / mol (Kemika)
(3) HCl (contents.min 36 %); M = 36.46 g / mol (Semikem)
(4) Nessler's reagenat 100 ml (Semikem)

Apparatus:

- spektrophotometar, Shimadzu UV/VIS 2200 spektrophotometar

Methods

The content of saccharin in different on market available food products was measured quantitively with spectrophotometrically (A.O.A.C 17th edn, 2000).

Preparation of standard saccharin solution:

- Standard solution of saccharin was obtained by dissolving 0.2921 gm of NH4Cl in 1 litre of ammonia free distilled water (equivalent to 1 gm of saccharin in 1 litre water).

- From the standard solution of saccharin was prepared a series of working solutions with following concentrations: 20, 40, 80, 120, 160 mg/L.

Working solutions were further subjected to reaction with the Nessler's reagent. As a positive result there is a light yellow to the high intensity color developed. After this appraoching to reading the absorbance on the spectrophotometer at 425 nm in order to obtain standard curve. With the help of standard curve performed reading of saccharin concentration in the samples on the sameavelength.

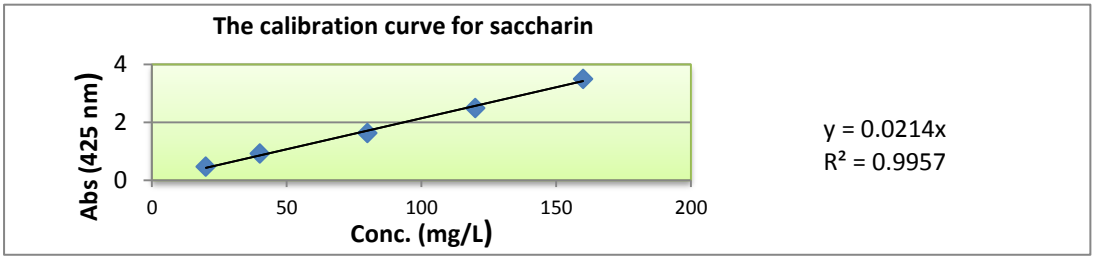

Figure 1. Standard curve for determination of saccharin
Source: Own research

Sample preparation:

Decarbonisation was carried up with the samples conatining CO_2, solid samples were chopped and then dissolved in water and applied to the process of homogenization. Aliquot of this prepared sample is dissolved in a normal vessel and filled with distilled water up to 100 ml. Then is added 2 ml HCl in 50 ml (g) of sample and tansfere into the separating funnel and stir. Then in the separating funnel is added 3x50 ml of diethil ether, agitate and extracted. After that lower organic layer with saccharine is dropped into the conical bottles for evaporation so that solvent can evaporate. To the collected organic extrtact is added 6 ml HCl and 5 ml of distilled water. Then is put into the water bath to evaporate up to 1 ml wich requires a long period of time. The rest is diluted with 50 ml of distilled water. From this solution is taken an 2 ml aliquot, transfere in volumetric bottle, added 1 ml of Nessler's reagent and made a volume. After each precedure and sample preparation determination of saccharin concentration on spectrophotometer at 425 nm was done.

RESULTS

For data on saccharin content was performed basic statistical analysis (average, standard deviation, stanard error). Middle values of saccharin content were tested with t-test and 95% level of statistical significance (acceptable error of 0,5%).

The results of saccharin in tested foodstuffs (descriptive statistics) are shown in Table 1.

Table 1. Descriptive statistics for the coefficient of variation for the content of saccharin in tested foodstruffs:

Tested foodstruffs	Mean mg/100g ∧ mg/100ml	Stand. Deviation	Stand.error	KV %
A1	10.575	0.137	0.079	1.293
B2	12.149	0.099	0.057	0.812
C3	10.270	0.033	0.019	0.323
D4	9.635	0.001	0.001	0.009
E5	0.707	0.012	0.007	1.656
F6	0.770	0.009	0.005	1.179
G7	8.290	0.294	0.170	2.396
H8	8.290	0.238	0.138	1.940
I9	2.070	0.015	0.009	0.727
J10	3.030	0.151	0.087	4.972
K11	1.922	0.055	0.032	2.870
L12	2.290	0.026	0.015	1.137
M13	2.662	0.428	0.247	1.608
N14	5.050	0.007	0.004	0.137
O15	13.714	0.321	0.185	2.339
Average	6.628	0.122	0.070	2.525

Source: Own research

Descriptive statistic table show that the maximum level of saccharin was at foodstuff O15 (13,714 mg/100g) while the lowest value was at foodstuff E5 (0,707 mg/100g). the average value of saccharin in

all samples was 6,628. The highest variability of saccharin test samples has been registered for foodstuff M13 (16,086%) while the relative variability expressed with the lowest coefficient of variability was at foodstuff D4 (0,009%). Generaly it can be concluded that saccharin content in all tested foodstuff, as chemical food propertie, showed variability of 2,53%. According to the t-test ($t_{calculate}$= 2,91986) while ($t_{theoretical}$=4,302653) wich means that $t_{calculate}$ is less than $t_{theoretical}$ on what basis it was established that the zero hypothesis is accepted, alternative is rejected, at the probability of 95% is not statistically significant and should not continue to explore it.

The results can be alignment with the Regulations the EU and BiH, as shown in the following table:

Table 2. Alignment of values obtained in relation to the standards of values of saccharin with max. values allowed by the Rules of BiH and the EU: (www.fsa.gov.ba)

Samples with the names of products	The resulting mean saccharin calculated in mg / kg	Max.allowable values under the law of BiH and the EU, expressed in mg / kg
A1 - Jam strawberry	105.75	200
B2 - Jam blackcurrant	121.49	200
C3 - Jam cherry	102.70	200
D4 - Instant lemon beverage	96.35	80-100
E5 - Low-calorie sugar free juice-lemon	7.070	80-100
F6 - Low-calorie sugar free juice-orange	7.700	80-100
G7 - Pudding powder chocolate	82.90	100
H8 - Pudding powder-vanilla flavor	82.90	100
I9 - Multivitamins, effervescent tablets	20.70	80-100
J10 - Table sweetener	30.30	80-1200
K11- Effervescent tablets Vitamin C	19.22	1200
L12 - Effervescent tablets Ca	22.90	1200
M13 - Effervescent tablets Mg	26.62	1200
N14 - Consumable sugar for diabetics	50.50	80-1200
O15 - Fruit sugar	137.14	80-1200

Source: Own research

DISCUSSION

Based on the table 2 that is comparing chart of average values obtained of saccharin content of foodstuff tested in accordance with BiH Regulations (Regulations on use of sweeteners in food- Officila Gazette No 83/08) and EU Regulations (Food Law No 96/07) on maximum allowed content of the above mentioned can be concluded that none of tested sample (foodstuff) had a higher saccharin content than what is prescribed by law (regulation). On the contrary, all values are significantly lower than the max. allowable value of the saccharin content in the analyzed samples. In spectrophotometric studies of saccharin content at 400 nm by spectrophotometry at 400 nm for the validity of the method is used known amounts of saccharin in various samples, such as icing sugar, fresh apples, oranges and grape juice These researchers have obtained results consistent with established methods, which indicates the accuracy of the proposed method. It can be concluded that the proposed method is simple, rapid, sensitive and reproducible, and can be used for routine measurements (Mathew et al., 2006). Our results show that the values for the samples ranged saccharin (A1 = 10.576 mg / 100 g, B2 = 12.149 mg / 100 g C3 = 10.270 mg/100 g). Masumi Javeed et al., (2001) have determined the content of saccharin in soft drinks, syrups and candies. Gravimetric method, whereby they used acetic acid and lead acetate as the solvent., and the sweets they used chloroform and the solvent content was measured spectroscopically in the UV 235nm. These researchers obtained data: for soft drinks 6.29-13.47mg/100ml; for 4:44 to 5:10 mg/100ml syrup, ice cream from 7.17-17.20mg/100ml; for sweets from 25.32-30.14 mg/100ml. In our research, the content of saccharin in puddings and the G7 H8 (8.29mg/100ml), while for the sample (E5 = 0.707 mg/100 ml and F6 = 0.770 mg / 100 ml). significantly lower saccharin content.

CONCLUSIONS

Starting from the basic goals and tasks of work and on the basis of performed tests for the products tested in the laboratory of the Agricultural and Food Faculty can be made following conclusions:

- **Study found that the highest content of saccaharin had product O15 (137,14mg/kg) while the lowest value had product E5 (7,0707mg/kg).**
- **The content of saccharin in all tested products showed a variability of 2,53%. The highest coefficient of variation was at foodstuff M13 (16,086%) while the lowest value was at foodstuff D4 (0,009%).**
- **The obtained results are in the rang with the available literature dana on the determination of the saccharin content in some nonalcoholic beverages and related food products, using different methods of determination.**
- **Alignment of values obtained of saccharin in tested food products and dietary supplements with EU and BiH Rules and Regulations it can be concluded that the values are in accordance with the Regulations because the obtained values of tested products are below the maximum allowable amount of both Rules.**

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Data from tables own research.

ABILITY OF COOPERATIVES TO UTILIZE IPARD PROGRAM

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ABSTRACT

The IPARD (Instrument of Pre-Accession Rural Development) programs should assist the reconstruction of Bosnia and Herzegovina's (BH) rural economy. Due to many reasons (lack of knowledge, small farm size, poor accessibility of credit lines etc.), most of BH farmers are not able to meet all the mentioned requirements. So, there is a considerable risk that major part of IPARD funds will remain unused and that in turn will slow down the development of BH agribusiness. Active and capable agricultural cooperatives, able to upgrade social capital and attract investments to rural areas, are expected to become the main mechanism to solving this problem. In this context, one very important question for BH agribusiness future development has been raised: to what extent the BiH cooperatives are really able to become the sector's key development agent? Providing answers to this question is the main objective of this paper. In order to do so, some secondary data were used to assess cooperatives' human/social capital, while data obtained from their annual business reports were used to evaluate their business performances. Small and medium scale cooperatives make profit and show better business performance, whereas their initial capital is rather modest and indebtedness very high, which results in a very limited credit rating. This means that their absorption capacity is very low. On the other hand, the large-scale cooperatives are in possession of a significant, but dead capital which has negative impact on their business performance. Though being in possession of assets that could be collateralized, their bad business performance reduces their ability to use IPARD funds. This low capability of cooperatives reduces the overall potential of both the sector and the country to utilize the funds from IPARD program and improve competitiveness which is the main prerequisite for the further efficient development.

Key Words: Cooperative businesses, IPARD utilization, Bosnia and Herzegovina

INTRODUCTION

A previous, though not so extensive research, indicated that low competitiveness of BH economy and its agribusiness is driven by low capability of the companies to build competitiveness based on technical and technological abilities to meet market needs (Silajdžic, 2007, Nikolić et al., 2010, Domazet et al., 2009). Lack of competitiveness is a result of the sector's structural characteristics such as: small and fragmented landholdings, small scale of production, low specialization of production as well as modest technological knowledge, outdated equipment and varieties (inadequate breed composition) and low economic strength. Removal of such structural problems is a time-consuming effort which also requires substantial investments that cannot be funded from local sources. Thus foreign capital needs to be attracted if possible from soft sources like the pre-accession funds such as IPARD program. Therefore, the sector's capability to absorb structural funds, especially from IPARD program, is crucial for the reconstruction of BH rural economy, and without them the agricultural sector's pending restructuring will be very slow and painful. Further sustainable and rapid development of the sector requires not only withdrawal of funds, but also making sure that investments are efficient in generating a balanced development of agriculture, food industry and other supporting industries, especially tourism. Given the fact that BH has always been a net importer of food (Nikolić et al., 2010, Bećirović et al., 2011), and that food industry imports a significant share of raw materials (FAO, 2012 a,b,c) there is a concern that uneven withdrawal of IPARD funds could lead to a further growth of agricultural imports. This concern becomes more realistic if we consider the fact that IPARD does not encourage "small investments", which is also confirmed by the fact that the average project investments included: Croatia 326.572 €, Romania 228.864 €, Latvia 151.558 €, Bulgaria 123.846, Slovakia 86.119 €, Hungary 62.121 €, Slovenia 31.116 € (Nikolić, 2011). In other words, business entities (food industry, tourism) are in every sense more capable of attracting IPARD funds, which could lead to their faster growth and hence to further lagging behind of primary agricultural production. In this case, the additional demand for agricultural produce will be met from imports. This could have a negative impact on market opportunities for BH farmers and thus decrease the growth rate of agricultural output. This possible scenario is not a desirable outcome of the IPARD program implementation.

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The use of IPARD fund implies the preparation of detailed project proposals; provision of demanding documentation which includes business history of the applicant; necessary administrative permits; and, in addition, it also implies applicant's capability to ensure total investment, which will be partly reimbursed by the program. Therefore, the level of IPARD fund utilization will depend on the ability of farmers and other business entities to develop the implementation and pre-finance investment projects (Jakovac et al., 2010), which could be selected for support through the IPARD program. Bearing in mind the dual structure of BiH agriculture, where small farms prevail (Nikolić and Ognjenović, 2009, Bajramović et al., 2008), it is expected that only a very few BiH farmers will manage on their own to meet IPARD requirements due to lack of information, knowledge skills, as well as business' history and accounting reports. Economically weak, non-commercial family farms generally cannot assume the leading role in agricultural development (Franić et al., 2004). So, the farmers cannot do it alone, they need support which can be provided efficiently if they come together and form any kind of civil society organization (CSO) to increase their capability to develop and implement such complex projects. In this respect, agricultural cooperatives, especially in the short run, offer a way to overcome some of the problems that Bosnians have been faced with such as small scale fragmented holdings, lack of production capacity and better access to inputs (Heijman, Moll, and Wals, 2002). It is expected that cooperatives, as community based organizations, network of people and sustainable forms of enterprises able to withstand crisis are more capable to meet the requirements of IPARD programs than individual producers, and therefore could have an important role in ensuring conditions for rapid and efficient development of the sector and rural areas in BiH. Generally speaking, cooperatives facilitate dissemination of information, strengthening of personal and group capacity to cope with life and market challenges, increase networking collaboration, contribute to feeling of trust and reciprocity and belonging giving sense of purpose to the community alongside with decreasing transaction costs and overall efficiency (Beekman et al. 2009, Bateman and Pennarz, 2009, Osterberg, Nilsson 2009. Westley et al. 2011, Nilsson et al. 2012). Therefore cooperatives can support farmers to attract IPARD funds, and thus ensure faster development of agricultural sector and rural economies. So, cooperatives are a key factor of the further and faster agricultural development. The objective of this research is to provide an answer to the critical development question: to what extent the BH cooperatives are able to become the key development agent of the sector? In other words, the research objective is to analyze performance of cooperatives and determine their ability to launch a new investment cycle to induce a faster and more efficient development of BiH rural economy in general and agricultural sector in particular.

MATERIALS AND METHODS

The research assumption is based on results of the pervious research (Millns, 2006) suggesting that only economically viable producer organizations can guarantee adequate support to their members and may have adequate capacity to successfully attract the IPARD funds. In addition, it is assumed that three groups of cooperatives (small, medium and large scale) may have different ability to attract IPARD funds and consequently a different ability to support rapid development of rural economy of BiH.

In order to analyze the capacity of cooperatives to attract investments, two types of data were gathered: (i) secondary data about human resource quality from previous research; (ii) financial data from two main financial records balance sheet and income statement of all registered cooperatives in BH, obtained from official agencies. 2It was difficult to define criteria to group cooperatives according to their size due to following: (i) according to Jevtić (2004), in BH there is no single (common) definition of small and medium-scale enterprises at the state level. At the lower levels of authority - the entities, Brčko District, cantons and municipalities – the provisions on small and medium scale enterprises that vary from one administrative unit to another are applied; (ii) cooperatives base their business on use of part-time workers services, which are not officially recorded, thus the number of employees as a criteria is not applicable in BH context; (iii) cooperatives are weak and therefore their turnover is very low. As a result, it is not possible to use EU annual turnover criteria as well. For these reasons all cooperatives were divided into three groups according to the value of their assets: small cooperatives with assets worth up to 100,000 BAM, medium cooperatives of 100.00 - 1,000,000 BAM and large cooperatives with the value of assets over 1,000,000 BAM. This division was made according to local adjusted criteria since in the total

[2] AFIP (Agency for Financial, Informatics and Mediatory Services of FBH) and APIF (Agency for Financial, Informatics and Mediatory Services of RS)

number of studied cooperatives, they provide the most uniform strength in all three categories. It is important to emphasize that the number of cooperatives during the three-year- period is different because some of the cooperatives have stopped to operate in this period, while on the other hand new ones have emerged.

For all the three groups of cooperatives financial safety and business successfulness based upon commonly used indicators (Ognjenović et al., 2012, Žager and Žager, 1999, Walsh, 1999) were taken into consideration: the average assets, revenues, income, solvency, profitability and cost-effectiveness and productivity. Three-year change (2008-2010) in the value of these indicators is discussed.

DISCUSSION

Cooperatives have a very important place in the entire chain of food production. On the one hand, through cooperatives, grouping of property and specialization, individual farmers can significantly increase the production capacity and the level of technical equipment, be in the position to use all the advantages of economies of scale. Thus, for small and medium farmers grouping represents a simple way to improve competitive position, which in the same time does not demand high additional financing (Group of authors, 2011). In this sense cooperatives should enable farmers an easier access to financial and investment funds and provide the conditions for starting a new cycle of investment and development of the sector. Cooperatives' human resource quality, financial strength and stability of their business results shape their capability to support small producers and thus become agents of agricultural development.

Table 1 shows that all cooperatives have modest human resources, a small number of people who do not have the capacity to take over additional tasks and projects. Hence, when it comes to human resources, all types of cooperatives show weakness. In addition, according to BiH Association of Cooperatives (2011), most cooperatives do not face difficulties in business planning, investments, and organization (38%), yet cooperative members would benefit significantly from business education (88%). Those cooperatives with problems do not think that their personnel are adequately trained to provide good business plans and are unsure of how to reduce their risk in a free market economy (e.g., low and fluctuating prices). So, human resource quality is low which decreases the cooperatives' ability to raise trust and ensure efficient exchange of ideas, knowledge and information necessary to develop and implement investment of any kind. This becomes even more concerning if we know that cooperative is being emphasized as a channel for selling the farm produces, which puts it in the context of a "rescuer" at the time when selling the family farm products upon their own initiative is hard to achieve. (M. Tratnik, S. Radinović, Đurđica Žutinić, 2007). Farmers do not perceive cooperative either as a place where they can get new information and learn about new trends, or a partner in improving the quality of business performance and overall progress. For this reason, transfer of knowledge and new technologies is reduced, which has a negative impact on the overall agricultural development.

Large cooperatives have the highest income in a three year period, averaging 1,061,099 BAM3, while the lowest income has the group of small cooperatives with an average of 67,355 BAM. It is evident that large cooperatives have disproportionately low income in relation to the average asset value when compared with small and medium-size cooperatives. Although they have assets of about 10 times bigger than the middle-size cooperatives, their income was only two times higher, while small-size cooperatives had income two times higher than their property value. In other words, assets of large cooperatives are not utilized efficiently which is indicative of their lower capability to take advantage of market opportunities and attract investments. However, at the same time, only the large cooperatives were able to increase income during the three year period. So, they are still vital, which indicates that they can become more important in the future.

Profitability, the rate of return on assets, points out cooperative's capability to generate new added value within the sector. Profitability thus gives us the opportunity to indirectly assess the quality of their human resources. During this three year period, small and medium cooperatives showed poor profitability on average, while the large ones were not profitable and showed gradual decrease in total assets.

[3] 1€ = 1,9558 BAM

Table 1: Average income, profit, profitability and economy according to assets for 2008-2010 period

Description	Year			Average
	2008	2009	2010	
INCOME (BAM)				
Small cooperatives	69,240	66,336	66,488	67,355
Medium cooperatives	456,875	342,357	254,655	351,296
Large cooperatives	1,059,706	973,027	1,150,564	1,061,099
Average	460,903	423,428	421,736	435,356
PROFIT (BAM)				
Small cooperatives	1,174	618	-487	435
Medium cooperatives	7,671	-572	-5,215	628
Large cooperatives	-12,824	-16,979	-18,873	-16,225
Average	150	-4,713	-7,062	-3,875
PROFITABILITY (in %)				
Small cooperatives	0.90	2.53	-2.81	0.21
Medium cooperatives	1.78	0.25	0.34	0.79
Large cooperatives	-0.40	-0.75	0.14	-0.34
Average	0.91	0.76	-0.90	0.26
EFFICIENCY				
Small cooperatives	1.54	1.06	1.08	1.22
Medium cooperatives	0.92	0.86	0.89	0.89
Large cooperatives	0.84	0.84	0.76	0.81
Average	1.10	0.92	0.93	0.98
NUMBER OF EMPLOYEES				
Small cooperatives	1.1	1.1	1.1	1.1
Medium cooperatives	3.1	2.9	2.9	3.0
Large cooperatives	13.1	12.0	11.5	12.2
Average	4.8	4.8	4.5	4.7
PROFIT/EMPLOYEE (BAM)				
Small cooperatives	1,067	562	-443	395
Medium cooperatives	2,475	-197	-1,798	209
Large cooperatives	-979	-1,415	-1,641	-1,330
Average	31	-982	-1,569	-824

*Note: Profitability = (Profit/Total Assets)*100; Efficiency = Income/ Expenditures*

Source: APIF and AFIP

Cost-effectiveness is an indicator of the art of business aimed at achieving the highest revenue for the least expenditure of resources. Thus, the efficiency indicates the level of technical and technological knowledge and defines the level of productivity of any company. It also shows company's ability to use business opportunities to raise income. According to research results the most efficient cooperatives were the small cooperatives with the average return on costs of 1.22, while the other two types of cooperative were inefficient (return of cost was lower than 1). It means that small cooperatives are the most vibrant ones and have higher ability to generate higher level of new value added. When it comes to productivity, it can be seen that small cooperatives are most productive with a profit per employee of 395 BAM while middle cooperatives realized 209 BAM of profit per employee. Large cooperatives had negative profits.

It is noted that large cooperatives, even though they have the greatest assets available, show poorer business performance in relation to small and medium cooperatives. This is primarily a result of their

poor capability to put existing assets in operation. This is due to war and post war privatization of those large cooperatives. Part of their assets has only substantial book value, and often due to unsolved ownership rights, their utilization is restricted (Group of authors). Such situation generates high fixed costs, causing stated losses. This problem has to be solved by improving the regulatory and institutional framework.

Table 2 shows that large cooperatives, in relation to small and medium ones, have significantly more assets and that their solvency is far more favorable. During the studied period only 32% of large cooperatives' entire property was financed by borrowed capital, while 97% of small cooperatives' assets was financed by borrowed capital. It is clear that large cooperatives have by far better capacity to borrow additional money to ensure project's implementation. Therefore, such cooperatives have better capability to attract IPARD funds, as they have higher capability to borrow additional money.

Table 2: Average assets, liabilities and solvency of observed cooperatives according to assets for the period 2008 2010; year and index changes 2010/2008

Description	Year			Average	Index
	2008	2009	2010		2010/2008
TOTAL ASSETS (in BAM)					
Small cooperatives	38,387	39,225	37,121	38,244	96.70
Medium cooperatives	383,810	370,887	384,957	379,885	100.30
Large cooperatives	4,875,658	4,975,416	4,949,027	4,933,367	101.50
Average	1,368,063	1,534,709	1,465,834	1,456,202	107.15
SOLVENCY					
Small cooperatives	0.73	1.52	0.67	0.97	91.61
Medium cooperatives	0.70	1.15	0.62	0.82	87.33
Large cooperatives	0.33	0.28	0.35	0.32	107.59
Average	0.62	1.04	0.57	0.74	91.45

Source: APIF and AFIP

During the studied period there were no significant changes in the value of property and all the three groups of cooperatives showed certain stability. However, when it comes to solvency ratio the situation is quite different. Specifically, while large cooperatives demonstrated financial stability throughout the three-year period, small and middle ones were prone to oscillations, and in 2009 year showed insolvency. This is the result of low value of their assets and poor ability to generate higher income to respond to new financial obligations.

CONCLUSION

It was shown that large cooperatives have far less debt than the other two groups, so they have a higher capability to borrow money, or better to say to meet IPARD requirement regarding pre-financing. However, the quality of their business performances was poorer than in the other two cooperative groups. This indicates that quality of their human resources was poor which diminished their potential to utilize their assets and business tradition. The quality of human resources calls into question their actual ability to design and implement projects, although they have the financial capability (the possibility of additional loans) to implement them.

Small and middle size cooperatives have a very low number of employees, but it seems that their quality is much better (higher efficiency and productivity). On the other hand, these groups show a low level of solvency, which means that they have a low ability to borrow capital, or better to say low ability to meet IPARD requirement regarding pre-financing. Thus, according to this study neither group has noticeable ability to attract IPARD funds, which could jeopardize further development of the sector. The access to capital must be facilitated through state's co-financing of the projects and the provision of favorable loans with longer grace period and low interest rates.

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ASSESSING THE COMPETITIVENESS OF SPECIALISED AND MIXED FRUIT TREE FAMILY FARMS IN ALBANIA

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ABSTRACT

Most of family fruit tree farms in Albania are mixed ones, with fruit trees as the main crop but associated with secondary activities like vegetable growing, livestock, etc. Farm specialisation is not so common. The purpose of this research was to study the competitiveness of both specialised and mixed fruit tree farms. It was conducted from 2009 – 2011 in Vlora region collecting financial information from 70 fruit tree farms, distributed in different levels of altitude and slopes, both features which has an impact on the choice of crops, cultural practices and market access. The average income of rural families (proxy for the Reproduction Threshold) acted as a reference against which the economic viability of both farming systems was evaluated. In general, despite the farm typology (mixed or specialised), location and differences in net incomes, the farms under study have low net incomes, were 95 percent are under the reproduction threshold. This is mainly due to their small farm surface and consequently low productivity. Therefore, there is an incapability to accumulate capital and intensify the production, maintaining the extensive type of fruit growing. Under these conditions, 60 per cent of the farmers interviewed are involved in other secondary agricultural activities.

Key Words: Competitiveness, agricultural policy, fruit tree farms

INTRODUCTION

Since 2005, the Government of Albania is providing subsidies for competitive agricultural sectors, mostly fruit growing. However, there is a general lack of data regarding farm revenues, profitability and competitiveness and the criteria are not very restrictive in terms of orchard size or capital (Çakalli, 2012).

Fruit tree growing in Albania has received particular interest by both farmers and policymakers due to higher competitiveness of such crops under limited farm size. Olives, apples, grapevine and nuts are among the key species planted supported by subsidies. Most of fruit tree farms are mixed ones, with fruit trees as the main crop but associated with secondary activities like vegetable growing, livestock, etc. Farm specialisation is not so common.

Studies on farm economics conclude that by increasing specialisation (i.e. cultivating only grapevine or olives), incomes are raised due to higher efficiency. However, under our country's conditions characterised by small farm size, lack of a consolidated market chain, the above statement is debatable. In this case, more important is the economic sustainability (lowering risks) due to integration of several species (fruit trees, grapevine and olives) within the same farm.

The purpose of this research was to study the competitiveness of both specialised and mixed fruit tree farms under the specific conditions in terms of farm structure and market.

MATERIALS AND METHODS

The study was conducted from 2009 – 2011 in Vlora region. Farms were randomly selected by the farm database of the Agricultural Technology Transfer Centre of Vlora with a total of 700 family farms with fruit tree cultivation as their main activity.

To ensure equal representation of climatic (climate, soil), agro-technical (opportunities for irrigation, fertilisation, mechanisation, etc.) and market (mainly distance from the main market) conditions, farms were selected at different altitudes (the ecological, agro-technical and market influence) and slopes (agro-technical influence). A group of 100 farms was aimed but only data from 70 farms were considered reliable and complete for the financial analysis.

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Farms were divided into two broad categories: specialised farms (cultivating only fruit trees (FT) or grapevine (GR) or olives OL)) and mixed fruit tree farms (cultivating one of the combinations between fruit trees, grapevine and olives (FT+GR, FT+OL, GR+OL).

From the methodological point of view, a major part of this study involved an adaptation of the conceptual basis of Agrarian System Diagnosis (FAO, 1999). The Reproduction Threshold (RT) was introduced as a benchmark for assessing the farms' level of incomes and therefore their profitability. For Family Farms as in the present study, the RT is the minimum income per family below which farmers are unable to adequately pay for all inputs and to completely restore capital productivity in order to begin a new production cycle. The average income of rural families in Vlora region, 550 000 lek (about 4000 EUR/year) (proxy for the Reproduction Threshold) acted as a reference against which the economic viability of farming systems was evaluated (INSTAT, 2000).

Student *t* was used for all comparisons of indicators between specialised and mixed fruit farms.

RESULTS

The following tables show the differences between specialized and mixed fruit tree farms in terms of changes in costs and prices of grapes (Table 1), olives (Table 2) and fruits (Table 3).

Table 1. Costs and prices of grape of specialised and mixed fruit farms (lek/kg)

Farm code	*Specialised fruit farms*		*Farm code*	*Mixed fruit farms*	
	Cost of grapes	*Price of grape*		*Cost of grapes*	*Price of grapes*
11	47.4	69.8	1	63.7	91.0
18	51.0	77.0	2	17.1	25.2
27	51.0	75.0	3	50.8	71.6
30	40.8	60.0	5	47.7	72.2
32	55.6	81.8	6	47.6	76.7
33	56.7	83.3	7	47.4	66.8
34	33.4	49.0	8	36.1	43.0
36	34.0	50.0	9	68.4	77.0
40	37.3	54.8	10	55.4	52.0
41	38.2	54.5	12	36.1	53.7
42	43.8	62.5	19	32.7	79.8
43	52.0	74.3	20	47.1	71.3
44	46.7	66.6	21	85.0	12.5
45	40.0	57.1	22	25.9	38.1
50	22.3	33.8	23	34.0	50.0
58	70.2	40.0	24	49.5	75.0
59	27.2	40.0	26	33.0	50.0
63	27.2	40.0	46	40.8	60.0
64	70.2	40.0	47	26.7	39.3
			48	29.4	43.3
			49	18.5	44.0
			53	28.1	40.2
			65	18.7	27.5
			66	34.0	50.0
			67	43.5	12.5
			69	27.2	40.0
Averages	*44.47*	*58.24*		*40.17*	*52.41*

Table 2. Costs and prices of olives of specialised and mixed fruit farms (lek/kg)

Farm code	Specialised fruit farms		Farm code	Mixed fruit farms	
	Cost of olives	Price of olives		Cost of olives	Price of olives
28	63.0	100	1	64.4	90.6
29	78.8	125	2	26.9	39.6
57	65.0	100	3	50.4	72.0
68	40.6	62.5	4	59.8	85.5
71	42.5	62.5	5	50.8	72.5
			6	49.1	72.2
			7	45.3	66.6
			9	44.0	66.6
			10	13.2	20.0
			18	52.0	76.8
			19	52.8	80.0
			20	49.3	72.5
			21	87.5	125.0
			22	26.6	38.0
			23	34.0	50.0
			24	49.5	75.0
			25	82.5	125.0
			47	27.2	40.0
			48	43.3	43.3
			65	9.9	14.6
			66	32.5	50.0
			67	8.1	126.0
			69	26.0	40.0
			70	65.0	100.0
Averages	57.98	90.00		43.75	68.41

Table 3. Costs and prices of fruits of specialised and mixed fruit farms (lek/kg)

Farm code	Specialised fruit farms		Farm code	Mixed fruit farms	
	Cost of fruits	Price of fruits		Cost of fruits	Price of fruits
13	51.3	78.8	2	14.3	53.8
14	31.4	48.3	8	26.4	40.0
15	38.4	59.0	12	36.1	53.8
16	26.0	40.0	21	85.0	125.0
38	28.9	44.4	53	28.0	40.0
54	26.0	36.0	65	10.2	15.0
			67	81.9	43.5
			69	26.7	41.0
			70	65.0	100.0
Averages	36.67	51.08		41.51	56.9

Statistical information shows no significant difference between specialised and mixed fruit tree farms in terms of costs and prices. This is also due to the high variance within the variables (costs or prices of either mixed or specialised farms).

Table 4. Yields of grapes, olives and fruits of specialised and mixed fruit farms (kg/dy)

Grape yields				Olive yields				Fruit yields			
Code	Spec	Code	Mix.	Code	Spec	Code	Mix.	Code	Spec	Code	Mix.
11	1730	1	1200	28	333.4	1	200	28	333.4	2	1176
27	2000	2	183.4	29	400	2	480	29	400	8	400
30	1375	3	1800	57	500	3	200	57	500	12	616.7
32	1100	5	1700	68	400	4	183	71	266.7	22	666.7
33	1200	6	1800	71	266.7	5	200			53	600
34	2650	7	1875			6	180			54	1000
36	1000	8	150			7	150			65	600
40	1033	9	165			9	225			67	250
41	733.4	10	1666			10	200			69	909.1
42	1333	12	1500			18	417			70	1000
43	1168	18	2083			19	300				
44	1275	19	18			20	80			10	
45	700	21	1000			21	312.5			26	
50	2000	22	1000			22	233.4				
58	1600	23	666.7			23	200				
59	1000	24	2000			24	222.2				
63	2000	46	1333			25	500				
64	2667	47	1500			65	750				
		48	1429			66	500				
		49	1500			67	400				
		53	1250			69	333.4				
		65	1200			70	1000				
		66	1000								
		67	200								
		69	1000								
	1475		1169		380		330		375		722

In general, yields are lower compared the optimum levels found in countries with a developed fruit growing.

Table 5. Comparison between costs, gross incomes and net incomes per dynym (1000 m^2) from specialized and mixed fruit farms (lek)

Farm code	Specialised fruit farms			Farm code	Non-specialised fruit farms		
	Costs	Gross Income	Net		Costs	Gross Income	Net Income
13	37 167	56 533	19 366	1	40 000	57 143	17 143
14	40 300	43 500	3 200	2	20 629	30 337	9 708
15	51 350	78 000	26 650	3	517 590	129 000	-388 590
16	10 400	16 000	5 600	5	81 025	122 750	41 725
11	82 076	120 700	38 624	6	85 660	129 800	44 140
27	102 000	150 000	48 000	7	266 425	125 250	-141 175
28	21 000	33 333	12 333	8	27 460	40 100	12 640
29	31 500	50 000	18 500	9	37 620	52 333	14 713
30	81 600	82 500	900	10	46 200	45 333	-867
32	61 200	90 000	28 800	12	47 183	56 917	9 734
33	68 000	100 000	32 000	18	105 383	159 667	54 284
34	139 400	130 000	-9 400	19	66 550	93 833	27 283
36	34 000	50 000	16 000	20	80 025	121 250	41 225
38	6 500	10 000	3 500	21	63 750	93 750	30 000
40	70 267	56 667	-13 600	22	25 943	38 143	12 200
41	81 667	40 000	-41 667	23	10 462	15 385	4 923
42	75 833	83 333	7 500	24	33 000	50 000	17 000
43	77 000	86 667	9 667	25	41 250	62 500	21 250
44	70 875	85 000	14 125	26	19 800	30 000	10 200
45	114 333	40 000	-74 333	46	71 400	80 000	8 600
50	91 400	67 500	-23 900	47	14 571	21 429	6 858
57	32 500	100	-32 400	48	27 425	40 333	12 908
58	43 520	64 000	20 480	49	54 950	66 000	11 050
59	27 200	40 000	12 800	53	31 500	45 000	13 500
63	54 400	80 000	25 600	54	35 980	36 400	420
64	72 533	106 667	34 134	65	17 000	12 500	-4 500
68	32 500	25 000	-7 500	66	21 130	33 333	12 203
71	63 000	16 667	-46 333	67	23 636	18 182	-5 454
				69	22 846	34 615	11 769
				70	97 500	100 000	2 500
Average	43 697.86	48 704.51			64 927.84	62 622.03	

Table 6. Comparison of net income and total income per farm (000 lek) from specialized and mixed fruit farms (lek)

Farm code	Net Income from Fruit Tree Activity of Specialised Farms	Income from Other Agricultural Activities	Total Income	Farm code	Net Income from Fruit Tree Activity of Mixed Farms	Income from Other Agricultural Activities	Total Income
13	1 696	20	1 716	1	800	175	975
14	435	185	620	2	540	120	660
15	780	10	790	3	387	1 800	2 259
16	640	0	640	4	34	0	34
11	1 207	0	1 207	5	518	0	518
27	1 500	0	1 500	6	714	0	714
28	500	0	500	7	561	1 000	1 561
29	250	0	250	8	401	15	416
30	330	150	480	9	314	28	342
32	900	0	900	10	272	148	420
33	1 000	0	1 000	12	683	162	845
34	260	150	410	18	550	0	550
36	350	0	350	19	1 126	84	1 210
40	170	140	310	20	543	100	643
41	230	120	350	21	1 000	0	1 000
42	75	250	325	22	400	0	40
43	260	70	330	23	200	100	300
44	340	65	405	24	300	0	300
45	370	120	490	25	250	0	250
50	270	284	554	26	300	0	300
57	100	0	100	46	240	75	315
58	320	0	320	47	150	0	150
59	200	0	200	48	484	0	484
63	240	0	240	49	264	50	314
64	320	0	320	53	450	0	450
68	50	50	100	54	364	150	514
71	100	600	700	65	100	100	200
				66	100	100	200
				67	200	200	400
				69	900	0	900
				70	200	100	300
Reproduction Threshold			550				550

DISCUSSIONS and CONCLUSIONS

In general, despite the farm typology, location and differences in net incomes, the farms under study have low net incomes, were 95 per cent are under the reproduction threshold (Table 6). This is mainly due to their small farm surface and consequently low productivity. Therefore, there is an incapability to accumulate capital and intensify the production, maintaining the extensive type of fruit growing. This is found also in other similar studies with European family farms (Cristoiu 2009). Despite the fact that they reduce efficiency, other agricultural activities, like livestock, cultivation of field crops, forages, etc serve to increase the economic sustainability of these family farms making them rather multifunctional.

In the future, as far as regards to fruit growing, farm surface must be expanded through various forms of cooperation. Current small farm size does not allow for intensification of farm production, like use of mechanization, in order to reduce production costs. In this development phase, production should be specialized, to get higher incomes and provide optimal return rate on the highest retention rate to price volatility and performance. Conditions should be established for increasing the use of agricultural inputs because the yields seem to be lower than the optimal ones (Table 4).

In terms of supportive policies, re - directing subsidies to small farms will give a better income guarantee to the low income categories, but it will also delay the necessary restructuring of agriculture in the country. Subsidies received by 'below-RT' farmers will not contribute much to improving the structure of agriculture. The 'below-RT' farms may even have a significant negative impact on the competitiveness of the agricultural sector as a whole, as unwillingness to sell the land will make it more difficult for other farms to grow in order to reach the RT, and to take advantage of economies of scale.

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COMPETITIVENESS OF SPECIALISED FRUIT TREE NURSERY PRODUCTION IN ALBANIA

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ABSTRACT

Nursery sector, in particular nursery fruit tree production, is considered as a profitable economic activity since the fruit tree sector is expanding rapidly, with more than a thousand hectares per year, under a supportive governmental policy. There are more than 180 nurseries in Albania selling about 2 million nursery trees. Nonetheless, production of healthy and certified nursery trees is one of the primary conditions for an intensive and stable development of fruit tree sector. Despite the economic importance of the sector and the need for proper economic management, the activity is scarcely considered by economic research. The purpose of this research, conducted from 2009 - 2010 was to assess the competitiveness of these nurseries in view of potential subsidies offered by the government. Thirty-six nurseries were interviewed having quite an intensive production of nursery trees located. Twenty nurseries were specialized, producing only one species of fruit trees, 8 nurseries producing two species and other 8 producing three or four species. The data showed that all the nurseries studied are profitable. On average their net income is 20000 EUR/farm. The ratio between incomes and costs is 1:0.45. Furthermore, farms producing nursery trees of up to two species have better financial indicators than those producing 3 to 4 species. Moreover, the specialised nurseries had lower costs of more than 3 percent for all the categories of nursery trees.

Key Words: Nursery, specialisation, fruit tree farms

INTRODUCTION

Today, tree fruit nursery production is strictly regulated by European Union (EU) norms, and it is the first important step in the fruit production chain, as it influences the quality and quantity of the performance of farm investments and also the type and quality of fruits, with consequent results on profits. Nursery sector, in particular nursery fruit tree production, is considered as a profitable economic activity since the fruit tree sector is expanding rapidly, with more than a thousand hectares per year, under a supportive governmental policy. There are more than 180 nurseries in Albania selling about 2 million nursery trees. Only 9 per cent of fruit tree planting material is imported. Nonetheless, production of healthy and certified nursery trees is one of the primary conditions for an intensive and stable development of fruit tree sector.

Despite the economic importance of the sector and the need for proper economic management, the activity is scarcely considered by economic research (Borsellino et al. 2011, Bucca and Zarbà, 2003; Golino, 2000; La Via and Bucca, 2003) focusing more on the pathogens and viruses. Moreover, one of the main weaknesses of the grapevine nursery is related to the farmers' difficulties in planning nursery production (Borsellino et al. 2011; Lovisa, 2009). Customers' suggestions, entrepreneurs' intuition and perceptiveness, and the market dynamics of the previous year all play a strategic role in planning supply, which is most complex. Nonetheless, only one of the surveyed nurseries makes inquiries within its own sales network or makes use of market studies produced by public and private research centres (Borsellino et al. 2011).

The purpose of this research, conducted from 2009 - 2010 was to assess the competitiveness of these nurseries in view of potential subsidies offered by the government.

MATERIALS AND METHODS

Thirty-six nurseries were interviewed during the period 2010 – 2011 having quite an intensive production of nursery trees located in four districts: Berat, Shkoder, Kavaja and Tirana.

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Table 1. Nurseries studied categorised by region and level of specialisation

Region	Nurseries	Specialised	Mixed
Berat	14	6	8
Shkoder	8	5	3
Kavaja	4	2	2
Lezha	9	5	4
Total	35	18	17

Out of 35 nurseries, 62.2 % were specialised in one species (11 for grapevine nursery trees, 6 for olives, 2 for fruit trees and 1 for citrus), 20.2 % in two species and 17.6 % in three and four species.

Data elaboration through the survey form has enabled to individualize the gross production saleable, production costs, profit, net product and the net profit of each nursery, referred to all the species presented in each of them (Bencardino and Marotta, 2003; Crescimanno, 2007; Schimmenti, 2007, 2009).

In order to make the data of individual nurseries comparable, these were subsequently converted to a hectare.

The gross production saleable was determined referring to the quantities commercialised and average sale prices declared by individual nurseries during 2010. Transport costs were not included since they are paid by the buyers.

Costs elements considered for the purposes of determining the production costs, include both expenses for purchasing materials and services on the market as well as for labour, either costs related to production factors directly given by the nurseryman (labour, capital and land) which has monetarily incurred.

RESULTS

The notable variability of the nursery trees per unit of surface between nurseries is related to the species and cultivars grown, typology of production, technical choices and the duration of the growing cycle in the nursery.

Table 2. Nursery type

No.	Districts	No. of nurseries	Family-type		Family plus employees		Employees	
			No.	%	No.	%	No.	%
1	Berat	14	12	85.2	2	14.3	-	-
2	Shkoder	8	5	62.5	2	25.0	1	12.5
3	Kavaja	4	3	75.0	1	25.0	-	-
4	Lezha	9	6	66.7	2	22.2	1	11.1
	Total	35	26	74.3	7	20.0	2	5.7

Table 3. Nursery organisation

No.	District	Total no. nurseries	Specialised nurseries		Mixed nurseries	
			No.	%	No.	%
1	Berat	14	6	42.9	8	57.1
2	Shkoder	8	5	62.5	3	37.5
3	Kavaja	4	4	100	-	-
4	Lezha	9	6	66.7	3	33.3
	Total	35	21	60.0	14	40.0

Table 4. Organisation of nursery plant production

No.	District	Total nursery plants (000)	Total surf. (ha)	Specialised nurseries				Mixed nurseries			
				Surf. (ha)	% to total	no. of plants (000)	% to total	Surf. (ha)	% to total	no. of plants (000)	% to total
1	Berat	283	5.48	2.27	41.4	165	58.3	3.21	58.6	118	41.7
2	Shkoder	97	2.42	1.54	63.7	56	57.7	0.88	36.3	41	42.3
3	Kavaja	311	4.5	4.5	100	311	100	-	-	-	-
4	Lezha	336.9	2.09	1.41	67.4	242.2	71.9	0.68	32.5	94.7	28.1
	Total	1 027.9	14.49	9.72	67.1	774.2	75.3	4.77	32.9	253.7	24.68

Table 5. Incomes and costs by nursery organisation (specialised and mixed) (1 EUR = 138 ALL)

No.	Nursery type	Total no. nurseries	Total no. plants (000)	Total surf. (ha)	Expenses		Incomes		Net Income per Nursery (000 ALL)
					Total (000 ALL)	per ha (000 ALL)	Total (000 ALL)	per ha (000 ALL)	
1	Specialised	21	659.2	6.8	33978	4996.8	66993	9851.9	3349.7
2	2 Species	8	227	4.6	19665	4265.7	59460	12898	7432.5
3	> 2 species	6	141.6	3.1	14081	4571.8	24033	7803.2	3004.2
	Total	35	1027.8	14.5	67724	4673.8	150486	10385	4180.2

Table 6. Nursery plant costs and prices (1 EUR = 138 ALL)

No.	Nursery type	Cost (ALL/nursery plant)				Price (ALL/nursery plant)			
		grapevine	olive	fruit trees	citrus	grapevine	olive	fruit trees	citrus
1	Specialised	43.7	187.6	90.9	130	90	318	149.6	410
2	2 Species	40	137.6	102.7	115.8	104	335.2	332.7	386.8
3	> 2 species	100.8	204.9	81.6	142.7	106.3	330	141.7	312.5
	Total	45.1	179.5	96.6	121.6	93.2	328.6	257.3	373.4

DISCUSSIONS AND CONCLUSIONS

Variability of the production costs (Table 2) are mainly due to different densities of cultivation and the adoption of different growing systems implemented by the nurseries. In other similar studies (Çakalli, 2012), in general, 42% of the costs is labour, 38% is materials, 9% mechanisation and 10% water and energy. The fruit tree nursery sector in Albania is characterised by reduced dimensions for most of the nurseries, which in many cases is refrained to introduce technological innovation processes, for the minute supply, lack of marketing strategies and valorisation of products at private and public level. We can say that yet fruit tree nursery production is a family-based business.

Different district show different levels of nursery specialisation but except for Kavaja, these differences are not significant (Table 3). In these nurseries there's a higher level of specialisation but in general, with a larger number of nursery plants per unit of land produced (Table 4). Increasing nursery surface and specialisation are two elements of an intensive nursery development.

Compared to the average of four districts, the incomes per farm for the specialised nurseries (1 species) are 19.9 % lower, for the second group (2 species) 77.8 % higher and for the third group (> 2 species) 28.14 % lower. Table 5 clearly shows that nurseries producing 2 species of nursery plants have almost the double of net income compared to nurseries producing 1 species or more. The species are olive and citrus.

In terms of incomes per ha, again compared to the average of the three groups of nurseries, are respectively: in the first group, 5.15 % lower, in the second group, 24.2 % higher and for the third group 24.87 % lower. The incomes of the first groups compared to third one are respectively: 26.25 % and 65.3 %. Moreover, incomes per farm, compared to the average of the four regions, are 2.04 times for group I, 2.16 times higher for group II and 46 % lower for group III. The ratio between gross income and net income is 1 : 0.55 with minor differences by group.

The adoption of the profit as the exclusive indicator of "performance" does not allow for properly assessing the profitability of the species, because it refers purely to the nursery business; in this sector, operate entrepreneurs that uses different production factors.

The micro-economic analyses conducted, through the analysis of several cases studies, has revealed good profitability levels (despite the variability of quantities produced and sale prices) that more than compensate the high production costs.

However, judging from the net profit values and the income per square meter generated, there is still a need for increasing the efficiency especially by improving the technology.

In terms of the best model of nursery, those producing two species of fruit trees, followed by those producing one species.

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EFFICIENCY OF FARMING, FRUIT-GROWING AND VITICULTURE AND ANIMAL PRODUCTION IN THE FEDERATION OF BOSNIA AND HERZEGOVINA

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ABSTRACT

The research identified indicators of agricultural efficiency for 5 farms, 6 orchards – vineyards and 6 animal husbandry productions in the Federation of B&H in the years 2007 and 2008. The research was conducted under the Project "The Economics of Primary Agricultural Production and Agricultural Policy Measures in the Federation of B&H," which included 176 farms; 82 in the first and 94 in the second year.

Efficiency of production is expressed in terms of cost coefficient, calculated in two ways: the relationship between values and production costs, and the relationship of total revenues and production costs. The first indicator shows the efficiency of production without subsidies, and the second with the subsidies.

The results show that the observed orchard – viticulture productions are efficient even without any means of subsidies, whereas agricultural ones are ineffective or on the threshold of cost effectiveness. In animal husbandry, efficiency is realized without the subsidies in milk production in the plains and in the larger farms in the mountain area. Sheep farming without subsidies is efficient on medium and large farms, and on the threshold of efficiency on the small farms. In pig farming, efficiency is achieved without subsidies in the second year, while it is inefficient in the first year.

Key Words: Efficiency, production, farm, subsidies

INTRODUCTION

Budgetary support of agricultural production is the most important measure of agrarian policy in the Federation of B&H. Other measures of market-price policies are either not under the jurisdiction of the Federation or their application is, due to various reasons, difficult or impossible. There are three forms of this group of measures (co called "direct payments").

The first form are price compensations, that is output based payments through premiums; the second form are payments to producers based on the planted area or the number of cattle, while the third form is direct support through subsidizing inputs. The role of price compensations or premiums is ensuring cheaper raw materials for processing industry, while protecting agricultural producers' profits at the same time. Direct payment to producers based on the achieved output is the best measure to boost productivity and overall output growth. The first products for which premiums were paid out in the Federation of B&H were milk, wheat and tobacco. With subsequent increase in agricultural budget this measure was extended to other agricultural products, primarily to meat production, and then to production of wheat, rye and potatoes. There is still no clear strategic commitment in the Federation of B&H towards development of specific productions for which favorable production and economic conditions exist; therefore, production of almost all cultures is supported. In this way, the measures are more social than economical. Besides price compensations paid through the budget of the Federal Ministry of Agriculture, there are those paid from the budgets of cantonal ministries of agriculture. These are usually additions to the premiums from the federal level; however, there are payments for productions not on the entities' lists, which are deemed economically or traditionally important for certain cantons. The first concrete forms of direct payments in the Federation of B&H begin in the year 2002, with support of husbandry of breeding animals of almost all species of livestock. Since 2005 these payments have been used for various types of livestock fattening and since 2006 for production of seedlings of wheat and potatoes, and production of forage, mercantile soybean, alfalfa, industrial plants and medicinal and aromatic plants. The cantons have also participated in direct support to producers or productions per area unit and head of livestock, determined by the Federal Ministry of Agriculture. A range of productions supported at the cantonal level mostly followed the federal level; however, there were some that were not covered by federal regulations. The cantons have often supported producers who could not obtain support based on federal regulations. In this way, support was given to producers

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who produced mostly to cover their own needs, so that cantonal measures of agricultural policy were more social than economical in nature. In the period from 2002 to 2008 there have been significant changes in the amount and structure of two most important direct payments to agricultural producers. During the first three years, the majority of direct support was in the form of payments based on output, while during the later years, the payments were based on the number of animals and planted area. The tendency to reduce payments based on output in favor of payments based on area and livestock number in the Federation of B&H has both good and bad sides. The good side is reflected in compatibility with the EU and WTO demands and gradual adjustment of producers to the support system, which has to be implemented as a part of the process of adaptation of B&H agrarian policy with the Common Agricultural Policy (CAP) of the EU in future integration processes. The downside is that the reduction of support based on output, due to still small total production level and average yield in the Federation of B&H, will have an adverse impact on the level of imports and price competitiveness of domestic agricultural products. Subsidizing inputs is a measure that directly influences prices of agricultural products. Reduction of the cost of production is achieved either through direct budgetary support or through fiscal relief of agricultural inputs. Due to direct impact this measure has on the prices of agricultural products, it is considered to be one of the most distortive measures in the entire system of agricultural policies. Support to agriculture by subsidizing inputs was not carried out at the federal level, but some cantons took part in this form of support. The other direct payments paid to producers in the Federation of B&H are reimbursements of damages caused by natural disasters and due to presence of infectious diseases in animals and plants. Total support for the first pillar of the agricultural policy of the Federation of B&H shows a tendency of constant growth. From 8,6 million KM in the year 2002, appropriations have been increased more than five times in the year 2008 and amount to 49 million KM. Although during the period from 2002 to 2008 in the Federation of B&H a series of measures of market and prices policies have formally been implemented, the most important level of support has been achieved through the measures of direct budgetary support to producers or productions.

The research identified indicators of efficiency for seventeen selected agricultural productions in the Federation of B&H in the years 2007 and 2008. Five farms, six orchards - vineyards and six animal husbandry productions had been observed. The purpose of the research was to establish indicators of efficiency for selected productions in the Federation of B&H, that is the level of their efficiency with and without subsidies. For each observed production, the following categories have been identified: extent and value of production, amount of subsidies and total income, expenses and efficiency indicators.

MATERIALS AND METHODS

The research was conducted under the Project "The Economics of Primary Agricultural Production and Agricultural Policy Measures in the Federation of B&H." The most important agricultural productions in the Federation of B&H in 2007 and 2008 had been observed. The sample consisted of 176 farms, 82 in the first and 94 in the second year of the research.

Efficiency of production is expressed in terms of cost coefficient (CC), calculated in two ways: the relationship between production values (PV) and total costs (TC), and the relationship of total revenues (TR) and total costs (TC). Production value is the product of multiplication of actual production volume and its selling price, while total revenue is the sum of production values and actual subsidies in that production. The first indicator, which excludes subsidies, shows the amount of production values generated per unit cost. The second indicator, which includes actual subsidies, shows the amount of total revenue generated per unit cost. Production is efficient if the calculated coefficient is greater than one (CC>1), on the threshold of efficiency if the coefficient equals one (CC=1), while it is inefficient if it is less than one (CC<1). Methods used to collect data on selected farms are surveys and interviews, while methods used for their processing and analysis are analytical, calculative and comparative.

RESULTS AND DISCUSSION

In order to reach the established objective, for each selected agricultural production in the Federation of B&H on 82 farms in 2007 and 94 farms in 2008, accrual calculation has been done, and on its bases the indicators of efficiency with and without subsidies have been established. Table 1 shows established indicators of efficiency for 17 observed agricultural productions in the Federation of B&H in 2007 and 2008.

Table 1. Efficiency indicators for selected agricultural productions in the Federation of B&H (2007-2008)

Production	Indicators of Efficiency			
	2007.		2008.	
	Without subsidies	With subsidies	Without subsidies	With subsidies
	CC=PV/TC	CC=TR/TC	CC=PV/TC	CC=TR/TC
1. Wheat	0.89	1.22	1.02	1.27
2. Corn for grain	1.12	1.18	1.10	1.17
3. Virginia tobacco	0.83	1.40	0.77	1.26
4. Burley tobacco	0.74	1.31	0.74	1.31
5. Soybean	0.97	1.21	1.00	1.50
6. Plum	1.30	-	1.49	-
7. Apple	1.96	-	1.20	-
8. Strawberry	1.57	-	1.44	-
9. Raspberry	2.32	-	2.12	-
10. Table grapes	1.79	-	1.61	-
11. Wine grapes	1.72	-	1.61	-
12. Cow's milk				
Plains area:				
a) small farms	1.12	1.35	1.02	1.25
b) medium farms	1.16	1.42	1.06	1.35
c) larger farms	1.33	1.61	1.10	1.39
Mountainous area:				
a) small farms	0.96	1.19	0.92	1.19
b) medium farms	1.08	1.32	0.94	1.28
c) larger farms	1.19	1.46	1.09	1.40
13. Cattle fattening	0.94	1.03	1.00	1.14
14. Breeding heifers	0.95	1.08	0.99	1.10
15. Sheep milk and meat				
Plains area:				
a) small farms	1.06	1.07	1.05	1.15
b) medium farms	1.20	1.22	1.23	1.24
c) larger farms	1.41	1.43	1.44	1.46
Mountainous area:				
a) small farms	1.02	1.05	1.02	1.04
b) medium farms	1.18	1.20	1.14	1.19
c) larger farms	1.31	1.36	1.30	1.35
16. Piglet production	0.94	1.02	1.08	1.14
17. Fattening pigs	0.91	1.08	1.17	1.41

Source: Economics of primary agricultural production and agricultural policy measures in Federation of Bosnia and Herzegovina. 2010.

The data in the table show that within farming only corn production is efficient in both observed years without subsidies. while wheat and soybean production are on the threshold of efficiency in the second year. All observed farming productions are efficient with subsidies. Observed fruit-growing and viticulture productions are efficient without subsidies. In cow's milk production in the plains area od the Federation of B&H. efficiency without subsidies was achieved on small. medium and large farms in both years. while in the mountainous area it was achieved on medium and larger farms in the first year. and on

larger farms in the second year. Concerning cattle fattening and breeding heifers. production without subsidies is inefficient in the first year. and on the threshold of efficiency in the second year. All cattle husbandry productions are efficient with subsidies. Regarding sheep husbandry for meat and milk production. efficiency was achieved without subsidies on larger and medium farms in the plains and mountainous areas of the Federation of B&H in both observed years. while it was on the threshold of efficiency on small farms. In pig husbandry. regarding piglet production and fattening of pigs. production without subsidies is efficient in the second year. while it was inefficient in the first year.

CONCLUSIONS

Results show that within observed fruit-growing and viticulture productions in the Federation of B&H. production of apples. plums. raspberries. strawberries. as well as table and wine grapes are efficient even without subsidies. Regarding crop production. only corn production is efficient without subsidies. while wheat. soybean and tobacco productions are either inefficient or on the threshold of efficiency. Regarding cow's milk production. efficiency without subsidies was achieved on small. medium and larger farms in the plains area and on larger farms in the mountainous area in both years. while on medium farms it was achieved in the first year. In sheep milk and meat production. without subsidies production is efficient on larger and medium farms in both plains and mountainous areas in both years. while it was on the threshold of efficiency on small farms. With regard to piglet production and fattening of pigs. efficiency without subsidies was achieved only during the second year. Based on the obtained results. it can be concluded that fruit-growing and viticulture and to some extent sheep and cattle husbandry productions in the Federation of B&H are economically self-sufficient. while sustainability of other productions depends exclusively on the federal and cantonal subsidies.

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A RESEARCH ON MILK CONSUMPTION BEHAVIORS IN KUCUK MENDERES BASIN OF IZMIR PROVINCE

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ABSTRACT

In Turkey, various studies have been carried out on milk consumption behaviour of people living in the provinces and country districts. However, no studies have been made about the dairy consumption behaviour of people living in rural parts of Izmir Province. The objective of this study was to determine milk consumption behaviour based on the level of education and income of consumers in the Küçük Menderes Basin of Izmir Province. The region has a significant livestock potential. The research was carried out during the year 2008 and covered 498 consumers living in Ödemiş and Tire districts. Average age of consumers was 37.9 years, average level of education was 4 years and the average number of family members was 3.5 people. About 16% of consumers had a monthly income of less than 1000 TL[3], 67% had incomes between 1000-3000TL and 17% had more than 3000 TL. It was found that 76.5% of the participants consumed milk whereas 23.5% did not. The rate of people consuming milk every day on a regular basis was 38.9% and on an irregular basis 61.1%. Most consumers preferred pasteurized milk (48.2%), raw milk (38.6%) and UHT milk (10.4%).

Key Words: Milk, Consumer Behaviors, Küçük Menderes Basin, Izmir.

INTRODUCTION

Milk is a significant food source and nutrient. It is composed of protein, carbohydrate, fat, water-soluble vitamins, minerals and water. In addition, milk nutrient composition regulates body functions, and develops bones and teeth (Şimşek et al., 2005). Therefore, great efforts are made to increase milk consumption worldwide (Demirci et al., 1998).

In Turkey, there has been some research into milk consumption consumer behaviour and preferences. A research study carried out in urban parts of Şanlıurfa reported preferences of consumers as being 46.3% raw milk and 53.7% packaged milk (Çelik et al., 2005). Researchers also reported that consumers considered several factors when buying packaged milk such as brand, fat content, price, expiration date, and size.

In the another study carried out on milk consumption in Istanbul and factors affecting milk consumption, it was determined that the average annual milk consumption of families was 34 liters per capita and that consumers preferred 11% raw milk (not packaged, from milkmen), 49% pasteurized milk and 40% long-life milk (Şimşek et al., 2005). In addition, 2% of consumers found milk prices cheap, 51% normal and 47% expensive, while 47% of costumers mentioned the importance of the brand they preferred.

Güneş et al. (2002), carried out a survey in 28 provinces of Turkey and reported consumer preferences as 39.9% for raw milk, 15.3% for daily pasteurized milk, 6.9% for long-life milk and the remaining 33.2% for milk from their own livestock.

Andiç et al. (2002), investigated dairy consumption habits of people living in Van city center and reported average annual milk consumption as 243.4 kg raw milk, 37.2 kg pasteurized milk, 180.1 kg yoghurt, 17.4 kg white cheese, 6.2 kg cheddar cheese, 3.7 kg cheese, 74.6 kg local herb mixed cheese and 16.5 kg butter.

There was a lack of data about milk consumption of people living in Izmir; therefore a survey was carried out to determine milk consumption of people with different socio-economic levels and living in the Küçük Menderes Basin.

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[3] 1€:1,91TL, 1$:1,31TL

MATERIAL AND METHODS

The original data were collected by a survey carried out on consumers in different socio-economic levels in the Küçük Menderes Basin (Ödemiş and Tire district). To determine milk consumption behaviours in the year 2008, a total of 498 consumers in the Ödemiş and Tire districts of Izmir Province were surveyed with a questionnaire containing 30 questions.

To determine sample size, approximately 30000 households were taken into consideration in the population under study (GTHB, 2012). The number of consumers to be surveyed was determined by proportional sampling method, and the optimum sample size was calculated as 498 people (Miran, 2002).

In this study, milk consumption behaviours were considered as related to the education and income levels of consumers. Surveyed consumers were classified according to levels of education and divided into 3 groups: primary, secondary and higher education. With regard to monthly income levels, the same consumers were divided into 3 groups: less than 1000 TL, 1000 - 3000 TL and more than 3000 TL.

SPSS statistical software was used to evaluate the data.

RESULTS AND DISCUSSION

General characteristics of the consumers

The sample group contains 198 female and 300 male participants. The youngest was 17 and the oldest was 87 years old and average age was 37.9. The average household size was 3.5 people. About 67.3% of the respondents lived in their own home and 32.3% of them lived in rented apartments.

Education levels of participants were very high. They were mostly self-employed (34%) or government official (32%). The reason for this is that the research carried out in the central districts and people in low education level refused to participate in the survey.

Monthly incomes of participants were determined as 16% for less than 1000 TL, 67% for 1000 - 3000 TL and 17% for more than 3000 TL. Food shopping was carried out 44% by women, 26% by men and 18% by both of them.

Effect of education and income levels on milk consumption habits of consumers

The effect of education levels on milk consumption habits is given in Table 1. Only 76.5% of the respondents consumed milk. 23.5% stated that they didn't drink any milk. Şimşek et al. (2005) reported completely different results for Istanbul (33% consumed and 67% not consumed). Ministry of Health also reported contrasting results in the year 2006 and indicated that more than half of all individuals (51.4%) didn't drink milk. In the present study, milk consumption rates were higher than these studies. This might be explained by the fact that producers were closer to costumers than the cities; therefore consumers can get raw milk and/or packaged milk from local markets whenever they want and some of them were relatives of producers. Also, there were some local dairy processing plants to buy dairy products.

Among the participants drinking milk, 39.1% drank milk on a regular basis but 60.9% did not have a regular milk drinking habit. About 35.8% of regular drinkers drank 250-500 ml per day, 35.1% drank 100-250 ml and 29.1% drank more than 500 ml of milk per day. Among the non-drinkers, 69% indicated that they simply did not have the habit, 32% disliked the smell and taste of milk, 11% indicated discomfort from milk drinking and 5% indicated poverty as the reason for non-purchase of milk. Şimşek et al. (2005) reported the reasons for not-drinking milk as 64% not having the habit, 22% taste and smell and 14% discomfort. The Ministry of Health also reported the most important cause of not drinking milk as "dislike of milk". Akbay and Tiryaki (2007) reported the reasons for not drinking milk as dislike (31.8%), no habit (51.5%) and health problems (10.6%).

Results indicated that regular consumers usually had higher education levels. However, among regular consumers primary school graduates consumed 250-500 ml per day, while secondary education and higher education consumers consumed 100-250 ml per day. The basic reason for not drinking milk in all education groups was indicated as not having a milk drinking habit. Other reasons were reported as dislike of the taste or odor of milk, discomfort and poverty.

Table 1. Effect of education level on milk consumption habits

		Level of education							
		Primary education		Secondary education		Higher education		Total	
		n	%	n	%	n	%	n	%
Milk consumption	No	25	5.0	63	12.7	29	5.8	117	23.5
	Yes	77	15.5	143	28.7	161	32.3	381	76.5
	Total	102	20.5	206	41.4	190	38.1	498	100.0
Milk drinking habits	Regular	32	8.4	54	14.2	63	16.5	149	39.1
	Irregular	45	11.8	88	23.1	99	26.0	232	60.9
	Total	77	20.2	142	37.3	162	42.5	381	100.0
Daily milk consumption	100-250 ml	5	3.4	24	16.2	23	15.5	52	35.1
	250-500 ml	18	12.1	13	8.8	22	14.9	54	35.8
	>500 ml	9	6.1	17	11.5	17	11.5	43	29.1
	Total	32	21.6	54	36.5	62	41.9	149	100.0
Reasons for not drinking milk	No habit	15	12.9	36	30.8	18	15.3	69	59.0
	Smell-Taste	7	6.0	20	17.1	5	4.3	32	27.3
	Discomfort	1	0.8	7	6.0	3	2.6	11	9.4
	Poverty	1	0.8	1	0.8	3	2.6	5	4.3
	Total	24	20.5	64	54.7	29	24.8	117	100.0

The effect of income levels on milk consumption habits is shown in Table 2. Second income group have higher and more regular milk consumption than the other groups. In Group 2, daily milk consumption was 100 to 250 ml while in Group 3 daily consumption was 250-500 ml. The reasons for not drinking were similar in all income groups.

Table 2. Effect of income level on milk consumption habits

		Level of income							
		Group 1		Group 2		Group 1		Total	
		n	%	n	%	n	%	n	%
Milk consumption	No	26	5.2	73	14.7	18	3.6	117	23.5
	Yes	56	11.2	259	52.0	66	13.3	381	76.5
	Total	82	16.4	332	66.7	84	16.9	498	100.0
Milk drinking habits	Regular	17	4.5	98	25.7	34	8.9	149	39.1
	Irregular	39	10.3	161	42.2	32	8.4	232	60.9
	Total	56	14.8	259	67.9	66	17.3	381	100.0
Daily milk consumption	100-250 ml	3	2.0	38	25.5	11	7.4	52	35.1
	250-500 ml	7	4.7	33	22.1	14	9.4	54	35.8
	>500 ml	7	4.7	27	18.1	9	6.1	43	29.1
	Total	17	11.4	98	65.7	34	22.9	149	100.0
Reasons for not drinking milk	No habit	14	12.0	43	36.7	12	10.3	69	59.0
	Taste-odor	7	6.0	17	14.5	8	6.8	32	27.3
	Discomfort	2	1.7	7	6.0	2	1.7	11	9.4
	Poverty	4	3.4	1	0.9	0	0.0	5	4.3
	Total	27	23.1	68	58.1	22	18.8	117	100.0

1€:1,91TL, 1$:1,31TL

The consumer preferences in the purchase of milk

The milk purchasing preferences of respondents are given in Table 3. About 19% of participants didn't buy milk at all, 46.4% bought pasteurized milk, 37.2% raw milk and 10% UHT milk. Şimşek et al. (2005) determined that most consumers in Istanbul preferred pasteurized milk (49%), 40% UHT milk (such results were in contrast to our findings) and finally 11% raw milk. Andiç et al. (2002) reported that 64% of consumers in Van province preferred raw milk, and 36% pasteurized or UHT milk. Çelik et al., (2005) found that consumers purchased 46.3% raw milk and 53.7% packaged milk. Therefore, it was concluded that people living in rural areas prefer raw milk more than those living in urban areas.

Table 3. The consumer preferences in the purchase of milk

	n	%
Preference of milk		
Raw milk	187	37.7
Pasteurized milk	237	47.5
UHT milk	53	10.6
All the types	2	0.4
Not buying milk	19	3.8
Purchased place		
Grocery	62	13.0
Market	152	31.7
Hypermarket	114	23.8
Milkman	64	13.4
Dairy house	61	12.7
Own production	26	5.4
The preference reasons of purchased place		
Cheap	73	15.2
Safe	337	70.4
Own production	26	5.4
Other	43	9.0
Which one is cheaper?		
Grocery	26	5.2
Market	86	17.3
Hypermarket	117	23.5
Milkman	138	27.7
Dairy house	105	21.1
Own production	26	5.2

In the present study, the average price of milk was 1.22 TL/kg. Almost 49% of participants stated that milk prices were appropriate. But milk price was expensive for 27.5% and cheap for 23.5%. Şimşek et al., (2005) reported that 51% of consumers in Istanbul found that the price of milk was appropriate. But the price was expensive for 47% and cheap for 2%. This reflects that milk prices in Istanbul were higher than the Küçük Menderes Basin.

The level of awareness about milk drinking habits is shown in Table 4.

Table 4. Level of awareness about drinking milk

	n	%
Which milk is produced at healthier conditions?		
Raw milk	149	29.9
Pasteurized milk	272	54.6
UHT milk	74	14.9
No idea	3	0.6
Is your purchased milk produced in healthy conditions?		
No	38	7.6
Yes	279	56.0
No idea	181	36.4
Is your purchased milk is marketed in healthy conditions?		
No	49	9.8
Yes	324	65.1
No idea	125	25.1
Is the milk consumption low in Turkey?		
No	45	9.0
Yes	453	91.0
The reasons of low milk consumption		
No habit	170	37.5
Unawareness of the people	139	30.7
High price of milk	110	24.3
Lack of government support	34	7.5
Is there encouraging milk consumption in Turkey?		
No	374	75.1
Yes	124	24.9
Ways to encourage the consumption of milk		
Newspaper-magazine	35	7.0
Radio-TV	293	58.8
Seminar	61	12.3
All of them	49	9.8
Other	60	12.1

Among survey participants, 58.5% indicated that most efficient way to encourage milk consumption was radio and television. 12.3% of the respondents indicated the seminars, 7% indicated the newspaper and magazines. Şimşek et al., (2005) found similar results with present study (74% radio and television, 7% seminars and 12% newspapers and magazines).

CONCLUSION

Average age of participants was 37.9 years and the average household size was 3.5 people. The majority of participants were milk drinkers. However, the ratio of regular drinkers was very low. The consumers having higher education level drank milk higher amounts and more regular than the others. Middle-income group also consumed milk more and more regularly. All education and income groups expressed similar reasons for not drinking milk. The reasons were indicated as not having the habit, taste and smell, discomfort and poverty.

Approximately 80% of participants consumed raw milk or pasteurized milk. About half of the participants purchased milk from markets and hypermarkets, while the other half bought from milkmen, groceries and dairy houses.

Almost 54.6% thought that pasteurized milk was the healthiest milk, 29.9% raw milk and 14.9% UHT milk.

Survey participants expressed that the reasons of low milk consumption in Turkey were not having the habit, lack of awareness, high price, and lack of support. To encourage consumption of milk, approximately 60% of respondents said that the most effective way was radio and television.

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THE FACTORS THAT INFLUENCE CONSUMERS' PREFERENCES OF NATURAL BOTTLED WATER IN THE REGION OF BOSNIA AND HERZEGOVINA

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ABSTRACT

From a marketing standpoint, the purpose of consumer behavior research is to improve marketing strategies. The resulting information enables better understanding of consumer needs and motives for shopping in order to increase sales and competitiveness of products, in this case of bottled water. Given that the decision of consumers to purchase natural bottled water produced is influenced by multiple factors, the focus of this paper is focused on socio-demographic factors, but also on the purchasing habits of consumers in order to define the profile of consumers who prefer natural bottled water of B&H producers and their impact on consumer preferences. A sample of 200 consumers of natural bottled water is formed by deliberate selection. Data obtained from the survey were analyzed using descriptive statistics and analysis of variance (ANOVA) to determine the relation between socio-demographic factors and natural bottled water consumer preferences. The results of this study can serve producers of natural bottled water in the Bosnia and Herzegovina to create marketing programs and researches to conduct further exploration of consumer behavior of this product.

Key Words: Bottled water, consumer preferences, marketing strategies

INTRODUCTION

The global consumption of bottled water is growing faster than 10 percent per year with substantial growth in sales volumes on every continent. The slowest growth rate is occurring in European countries, where bottled water has long had a commercial foothold Gleick (2004). It is due to the fact that drinking of bottled water has become a part of a modern living stile in this century which characterizes consumers with lack of time and with a positive attitude towards health and welfare. Bosnia and Herzegovina bottled water market is emerging and thus numerous bottled water companies compete on that market. Some of them are already created their specific brand. Bottled water is a particularly competitive market, hence companies need to develop diverse marketing strategies, such as accessing new markets by owning or developing partnership with regional brands. Natural mineral water and other bottled waters, as well as regular drinking water, must meet strict consumers quality requirements in order to ensure market success. So for the water bottled companies it is very important to understand consumers' preferences and factors shaping them. Kotler *et al.* (2008) agree that the next factors strongly influence the buying behavior of consumers: cultural, social, personal and psychological factors. The consumer's choice therefore results from the complex interplay of all these factors. Although the producer cannot influence many of these factors, they can be useful in identifying potential customers to serve their needs better. Just like any other product, bottled water requires extensive research in terms of consumer preferences that will affect marketing activities. Especially considering that the bottled water market is one of the fastest growing markets in the beverage category (Durga, 2010). Therefore, objective of this paper is to provide an overview of the bottled water market situation, and to analyze consumers' preferences in Bosnia and Herzegovina. In another words, research objective was to determine whether there is a relation between socio-demographic factors and consumer behavior of natural bottled water.

MATERIAL AND RESEARCH METHODS

The research is organise to test following hypothesis:

1. **There is a relationship between gender and buying behavior,**
2. **There is a relationship between age and consumers' buying behavior,**
3. **There is a relationship between education level and consumers' buying behavior,**
4. **There is a relationship between income and consumers' buying behavior.**

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The market survey was organized at whole BiH territory. The nonrandom sample of 200 respondents was formed. The survey questioner consisted of 16 questions. The first group of questions was related to socio-demographic characteristics of respondents and the second group of questions was related to buying behavior of natural bottled water consumers. Data were analyzed in the statistical software SPSS 17.0, and descriptive statistical analysis was done. The single factor analysis of variance was used to determine a statistically significant impact of demographic factors on consumers' preferences. T-test was used for the factor "gender" because it consists of only two groups. ANOVA was performed for all other variables such as age, education level and monthly income, considering that there are more than two groups for analysis. LSD post-hoc test was used in the case where ANOVA (Sig. less or equal to 0.05) showed a statistically significant difference between group. This test found exactly where are the differences between groups. The following table shows the sample structure.

Table 1. Socio-demographic sample structure

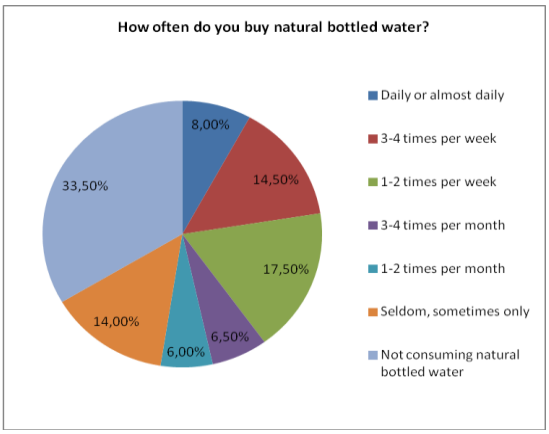
	N	%		N	%
Gender:					
male	91	45,5			
female	109	54,5			
Age group:			**Employment status:**		
Up to 20 years	10	5	**scholar**	5	2,5
21 - 30 years	53	26,5	**student**	26	13
31 - 40 years	55	27,5	**employed**	123	61,5
41 - 60 years	62	31	**unemployed**	27	13,5
over 60 years	19	9,5	**retired**	16	8
Missing	1	0,5	**disabled veterans**	3	1,5
Education level:			**Mounthly income (KM):**		
No education	1	0,5	**Up to 200**	9	4,5
Elementary school	17	8,5	**201 - 500**	13	6,5
Secondary school	71	35,5	**501 - 800**	34	17
High education	22	11	**801 - 1.000**	39	19,5
University degree	75	37,5	**1.001 - 1.500**	38	19
MD	11	5,5	**1.501 - 2.000**	28	14
PhD	3	1,5	**2.000 - 3.000**	23	11,5
			Over 3.000	10	5
			Missing	6	3

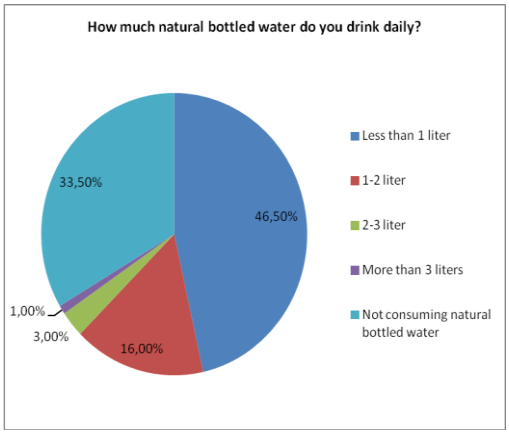
Source: own research

RESULTS AND DISCUSSION

The consumption of natural bottled water occupies a significant portion of respondents' eating behaviors. Out of the total respondents 66,5% consume natural bottled water, while 33,5% don't consume this product[2]. Concerning the frequency of purchase of natural bottled water, the highest percentage of respondents (17,5%) buy this product 1-2 times per week, while monthly amount of purchases shows that 54% of respondents buy less than 30 liters of this product. It indicates that these respondents are not big consumers of natural bottled water and that they also consume a tap water (Figure 1A). Daily consumption of natural bottled water confirms, what has already been noted, that the highest percentage of respondents (46,5%) drink less than 1 liter per day (Figure 1B).

[2] Examinees who do not consume natural bottled water were asked to skip a few questions after this one as they were for those who consume this product

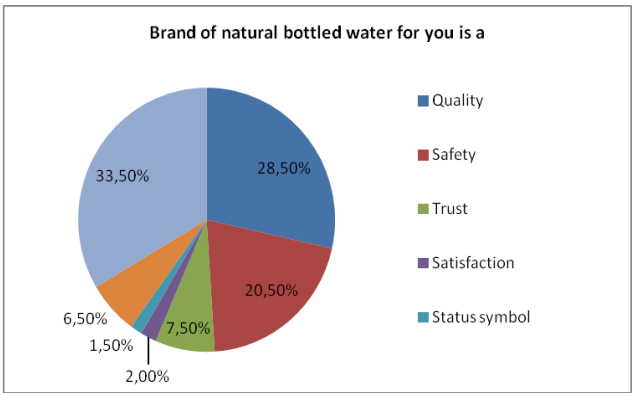




Source; own research

Figure 1. Frequency of buying bottled natural water (A) and daily quantity of natural bottled water consumption (B)

A very important question for respondents was related to the brand of natural bottled water and what does it represent for them. The largest percentage of respondents (28,5%) thinks that a brand represents the quality, while the smallest percentage (1,5%) stated that the brand of this product is a status symbol for them (Figure 2.). The most important factors driving customer choice were quality (45% of respondents), price (11% of respondents), brand (6,5% of respondents). The remaining 33,5% of respondents are not consumers of natural bottled water.



Source; own research

Figure 2. The importance of the brand of natural bottled water for the respondents

Responded most frequently buy natural bottled water in supermarkets (30% of respondents), grocery store (7% of respondents) and tobacco shop (3% of respondents). The remaining 33,5% of respondents are not consumers of natural bottled water.

Concerning the quality of natural bottled water the largest number of respondents (37,5%) said that the taste of natural bottled water is the main feature of this product, the composition is important for 19% of respondents, appearance for 5% of respondents, packaging for 3,5% of respondents, odor for 0,5% of respondents and for 1% of respondents something else. The remaining 33,5% of respondents don't consume natural bottled water.

The majority of respondents (56%) consume domestic bottled water, compare to 6,5% of those who prefer foreign bottled water. Respondents who don't pay attention to the origin of natural bottled water were represented by 4%, while the remaining 33,5% was related to those who don't consume natural bottled water.

The single factor analysis of variance was used to determine a statistically significant impact of demographic factors on consumers' preferences. T-test was used for the factor "gender" because it consists of only two groups. ANOVA was performed for all other variables such as age, education level and monthly income, considering that there are more than two groups for analysis.

T-test showed that there is no relationship between gender and consumers' buying behavior. Concerning that the value Sig. (2-tailed) is greater than 0.05. The consumers' buying behavior of both genders showed a similar trend. The first hypothesis is rejected.

The single factor analysis of variance showed that there is relation between age and buying behavior of consumers. There was a relationship between respondents that belong to different age groups and purchase frequency of natural bottled water (Sig. 0,039) and daily consumption of this product (Sig. 0,025). Subsequent LSD post-hoc test showed that natural bottled water buy less frequently respondents from under 20 years age group in comparison to those that belong to 21-30 years age group. Also, respondents from over 60 years age group buy less frequently this product in comparison to respondents from 21-30 and 31-40 years age groups. Regarding the relationship between age and daily consumption of natural bottled water, subsequent LSD post-hoc test showed that respondents from over 60 years age group drink bigger amount of bottled water daily in comparison with respondents that belong to other groups. Second hypothesis is accepted.

Table 2. ANOVA – respondents' age group and consumers' buying behavior

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
How often do you buy natural bottled water	Between Groups	28.072	4	7.018	2.608	.039
	Within Groups	336.428	125	2.691		
	Total	364.500	129			
What is your daily consumption of natural bottled water	Between Groups	4.582	4	1.146	2.897	.025
	Within Groups	49.425	125	.395		
	Total	54.008	129			

Source: own research

Analysis of variance was used to determine is there a relation between respondents' education level and consumers' buying behavior of natural bottled water. It was found that there is a relationship between education level and buying frequency of natural bottled water (Sig. 0,031), monthly amounts that are bought (Sig. 0,037) and daily consumption of this product (Sig. 0,043). With subsequent LSD post-hoc test was found that respondents who finished elementary school more frequently buy natural bottled water in comparison with those who completed medium, higher or university education. The relationship between respondents' education level and monthly purchase amounts shows that respondents with higher educational level purchase higher monthly amounts of natural bottled water compared with those respondents with lower educational level. Regarding the daily consumption of natural bottled water, subsequent LSD post-hoc test showed that respondents who belong to groups with completed medium, higher or university education drink daily bigger amounts of natural bottled water in comparison with those respondents that belong to the group that completed only elementary school. The third hypothesis is accepted.

Table 3. Respondents' education level and consumers' buying behavior

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
How often do you buy natural bottled water	Between Groups	33.872	5	6.774	2.544	.031
	Within Groups	332.861	125	2.663		
	Total	366.733	130			
What is your monthly amounts of purchase	Between Groups	3.235	5	.647	2.451	.037
	Within Groups	32.734	124	.264		
	Total	35.969	129			
What is your daily consumption of natural bottled water	Between Groups	4.712	5	.942	2.370	.043
	Within Groups	49.701	125	.398		
	Total	54.412	130			

Source: own research

ANOVA there is no relationship between respondents' monthly income and consumers' buying behavior of natural bottled water (Sig. > 0,05). Fourth hypothesis is accepted.

CONCLUSION

According to research results, in Bosnia and Herzegovina there is no difference in consumers' buying behavior regarding the gender. It means that brand promotion and design should be acceptable for both genders. In the same time the research results suggests that respondents with higher education level drink more bottled water in comparison with those respondents that belong to groups with lower education level. Respondents from over 60 years age group drink bigger amounts of this product compare to the other age groups, but they less frequently buy natural bottled water. It is important to emphasize that this is an indication, because the conclusion is based on nonrandom sample. Companies should have in mind all these findings when they are creating brand and determining marketing strategies.

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AGRICULTURAL COOPERATIVES CAPABILITY TO ENSURE FASTER REVIVAL OF AGRICULTURE IN BOSNIA AND HERZEGOVINA

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ABSTRACT

Undergoing transition, BIH agricultural sector suffers from low competitiveness mostly due to very unfavourable farms structure (average farm size is 3.1 ha) that increases transaction and production costs and decreases possibility to use modern technology. This structural weakness is and will be in the future major constrains for faster revival of BiH agriculture. However, in short run this sector weakness can be mitigated trough farmers merge into the agricultural cooperatives that will enable farmers to reach economy of size and scope. Currently in B&H, there are two types of cooperatives: "old one" from socialistic era which are privatized and "new one" established after the war. Previous research (group of authors, 2011), outlines low capability of cooperatives (both types) to provide needed services for farmers to induce faster sector development. Therefore, this research objective is to provide detailed analysis of cooperative sector transition and to identify their business performances and ability to support agricultural development. Indicators of business performances were calculated on the basis of annual financial statements of all 237 cooperatives officially registered in B&H.

Regardless, observed differences between business quality of "old" and "new" cooperatives, their poor economic performance prevents both types of cooperatives from being the key drivers of sector's development. For this reason it is very important to recognize the significance of improving the cooperatives' performance and promoting the concept of cooperative based on true cooperative principles.

Key Words: Business performance of cooperatives, behaviour of cooperatives, transition of cooperative sector in BiH.

INTRODUCTION

Cooperatives as community based organizations, network of people and sustainable forms of enterprises able to withstand crisis are very important part of social fabric (USDA, 2002) which ensure higher level of cohesion, inclusion and employment generation. Generally speaking, cooperatives facilitate diffusion of information, strengthening of personal and group capacity to cope with life and market challenges, increase networking collaboration, contributes to feeling of trust and reciprocity and belongings giving sense of purpose to the community alongside with decreasing of transaction costs and overall efficiency (Beekman et al. 2009, Bateman, Pennarz, 2009, Osterberg, Nilsson 2009. Westley et al. 2011, Nilsson et al. 2012). It is important to emphasize that all these positive effects can be expected only when the cooperative are formed as a real expression of the needs of farmers to solve their problem (internal motivation), which implies that all members of cooperatives are actively contributing to business results of cooperatives. However, when the cooperative are formed under influence of external incentives (policy, short term personal interest), then they have a very low capacity to ensure trust development and motivate members to participate in decision making have questionable capacity to support development. This trend is observed in transitional and development countries and in the countries social and political conflicts encourage distrust and deterioration of social capital (Baamonde Noche, 2005), such as Ireland, CEEC and Balkan countries (CEDAR, 2011, Babović et al., 2009). So it is expected to see that different ways of cooperatives establishing can have a significant impact on the quality of their business, especially on the sustainability of their development.

After the war, within new socioeconomic and legislative framework, existed (socially owned) cooperatives and newly established cooperatives started to operate in Bosnia and Herzegovina. "Old" socially owned cooperatives were badly damaged during the war and after that they had been privatized. During that process most of their assets had been either taken over by the state or aliened by "unknown" persons. Currently most of cooperatives are trying to reclaim seized assets. They had inherited the old way of doing business, where members had the status of a "third party" (cooperants) that operates with the cooperative, but not decide on its development. So, they are carrying "the burden" of the previous,

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socialist system. In the same time, "new" cooperatives were established from the scratch. "New" cooperatives are formed under initiative of its future members, usually small farmers. Due to the poor investment capacity of small farmers the initial capital of "new" cooperatives is usually very low. Very often new cooperatives were established as a part of the project or its establishment was driven by different measures of public policy. So, the question is whether the members of "new" cooperatives actually actively participate in the daily work of cooperatives, which makes it stronger and increase cooperative sustainability and capacity to support agricultural development in BiH? Therefore the objective of this paper is to analyze if there is a difference in the business performance quality between privatized cooperatives ("old") and those that occurred after the war ("new"), to determine which type of cooperative has a higher capacity to support the further accelerated development of agriculture in BiH.

MATERIAL AND METHOD

The main research assumption is that "new" cooperatives, which were created partly as an expression of the real farmers needs, will be more successful than the "old one" and will generate better business results, and thus show higher capacity to induce faster and more efficient sector growth. To determinate whether the initial hypothesis is correct first general indicators of business performances for each type of cooperatives had been calculated. Additionally, changes in these indicators in the period 2006 to 2010 have been analyzed as well.

In order to determine the significance of observed differences between the business quality of new and old cooperatives the analysis of variance (ANOVA) and Lsd. test have been performed. This analysis was chosen to determine if business performance has any impacts on the cooperative type factor, while Lsd. test was used to determine statistical significance of those differences.

The set of officially reported financial data (annual financial statements) for each registered agricultural cooperatives had been used. Those data had been obtained from the Agency for the financial, information and intermediary services in two BiH entities (Federation of Bosnia and Herzegovina and Republic of Srpska).

RESEARCH RESULTS AND DISCUSSION

As it could be see in table 1 "old" cooperative in average have higher assets and bigger number of employee, while the new cooperatives show that better management competences and capacities (they have a higher rate of profitability and efficiency). Regardless of the differences between old and new cooperatives, it should be noted that both type of cooperatives have a small number of employees and low assets, so that their capacity to support the rapid sector development is actually very low. Trend of further downsizing in employee number by as much as 25% in the studied period represents an additional concern. With such weak human resources, cooperatives cannot be efficient in the preparation of plans for withdrawing resources from the international development funds.

Table 1. The basic characteristics of cooperatives according to its type (old, new) and entity in 2010 year

	Type of cooperative	Number of cooperatives	Employee/cooperative		Capital/cooperative		Revenues/cooperative		Efficiency[1] (%)	Profitability[2] (%)
			Number	Change (%) '06-'10	Amount (BAM)	Change (%) '06-'10	Amount (BAM)	Change (%) '06-'10		
BiH	New	158	3	65,5	271.883	91,3	324.277	109,7	100.9	4,3
	Old	68	9	68,1	3.145.359	97,8	709.636	94,7	96.2	0,3
	Total	226	5	69,6	1.136.468	104,1	440.226	105,1	98.6	1,0
FBiH	New	87	2	78	249.215	106,4	294.536	139	101,3	4,9
	Old	30	5	79,4	5.508.075	100,5	742.948	122	98,2	0,2
	Total	117	3	80,8	1.597.641	110,2	409.513	134,8	99,8	0,8
RS	New	71	4	60,3	299.658	81,4	360.722	92,9	100,6	3,7
	Old	38	12	66	1.280.057	82,6	683.337	80,1	94,6	0,7
	Total	109	6	66,7	641.449	87	473.193	88,8	97,5	1,6

*Note: [1]Efficiency is calculated as revenues/expenses x 100; Profitability is calculated as profit/capital*100*

Results of ANOVA and Lsd test are presented in Table 2 show that business performance at state level varied significantly, depending on type of cooperative. When it comes to the analysis of business performance at entity level, a statistically significant difference existed only at RS level, whereas such a conclusion couldn't be made about the Federation of BiH. Generally, business performance of new cooperatives at all the levels was slightly higher relative to that of the old ones. This particularly refers to the newly established cooperatives in RS, where in 2007 the highest level of business performance was recorded.

Table 2. Business performance of cooperatives in BIH in the period 2006-2010

Performance		F statistics	F 0.05	Lsd 0.05
Efficiency	BiH	9,20*	3,89	1,23*
	FBIH	0,07	3,89	
	RS	6,42*	3,89	2,28*
Profitability	BiH	12,32*	3,89	1,27*
	FBIH	28,71*	3,89	0,51*
	RS	4,41*	3,89	2,72*
Liabilities /Assets	BiH	1117,25*	5,14	1,09*
	FBIH	140,45*	5,14	3,17*
	RS	131,56*	5,14	2,06*

Note: statistically significant difference

According to the results of analysis of variance, a statistically significant difference was determined in business profitability between the new and old cooperatives at all the levels in BiH. The biggest profit in relation to invested capital was made by new cooperatives, at the level of RS, slightly lower at BiH level and the least at the level of the Federation of BiH. Such poor and varying business performances indicate an unstable access to market, which is going to be a major issue for cooperatives in the future.

Looking at the ratio of assets and liabilities, one could say that there is a statistically significant difference between new and old cooperatives. This ratio is much more favorable in old cooperatives, particularly at the FBiH level. Otherwise, all the cooperatives are solvent, i.e. their assets are sufficient to cover all of their liabilities, which mean that there is enough latitude for further borrowing and investing that is withdrawal of resources from EU funds. Unlike other business performances that do not provide any optimistic results, this indicator constitutes a possibility of cooperatives' development.

CONCLUSIONS

Analysis of old and new cooperatives at both state and entity levels, has shown that their economic performances are not at satisfactory level in BiH. Based on presented data it can be concluded that new cooperatives have better efficiency and profitability than the old ones. New cooperatives are closer to the concept of modern cooperative which implies better business and marketing knowledge and skills, however, their huge disadvantage with regard to a small number of employees prevents them from being able to prepare business plans for a timely application to various investment funds. Profitability, though it differs significantly, is small and concerning in both new and old cooperatives, as they (particularly the old ones) seem to lack ability to attract capital and start a new development cycle. In addition, the old cooperatives are burdened with unproductive property which poses an obstacle to faster development. In contrast with previous indicators, solvency of (all) cooperatives constitutes a possibility of development, i.e. a possibility to use credits from EU funds, given that there is enough latitude for further borrowing.

Poor economic performance prevents cooperatives from being the key drivers of sector's development. For this reason it is very important to recognize the significance of improving the cooperatives' performance and promoting the concept of cooperative based on true cooperative principles. This can only be achieved by strengthening the capacity of cooperatives, i.e. increasing the number of employees and improving their business and marketing knowledge and skills, especially those that are pertinent to the application for international programs, as well as by strengthening the internal management structure in cooperatives.

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FARMERS' WILLINGNESS TO PARTICIPATE IN LAND CONSOLIDATION: A CASE IN ARDABIL COUNTY OF IRAN

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ABSTRACT

Land is one of the most important factors in agriculture. Small- acale operation due to unefficient use of technology, machinery and other agricultural production is one of the main limiting factors of efficiency and productivity in agriculture. Separated and small pieces of farmlands is one of the major barriers to agricultural development in Ardabil province of Iran. This problem leads to increase costs, reduced productivity and loss of agricultural inputs. This survey was conducted in two selected villages of Ardabil, viz. Baruq and Garjan. The purpose of this study was to evaluate thexamine landowners' willingness to participate in the land consolidation program. The statistical population of the study was consisted of all farmers of mentioned rural areas. A sample of 250 farmers were selected for this study. Data gathered using a questionnaire which validated by a panel of experts. To achieve the reliability of the instrument, a pilot test was conducted and the Cronbach's alpha coefficient obtained 0.76 showing high reliability of the instrument. Results show that the Variables such as education, the extent of land ownership, farming experience, farmers confidence to both governmental programs and other farmers was significantly associated with their willingness to participate in land consolidation programs.

Key Words: Land consolidation, Ardabil, participate

INTRODUCTION

According to crop land distribution, planners and agricultural policy makers suggest land integration. It improves agricultural products, rationalize the operation, optimize usage of high tech machinery and technology (Dijk Van, 2002). The integration of agricultural land is considered as one of the major reforms in agriculture. Land integration had been remarkable agricultural reform in developed contries which made them to have first rank of agricultural crop producers (Zhou, 1999).

According to Todorova and a Lulcheva (2005), distribution of land limits using new farming methods and reduces production efficiency in Bulgaria. Supporting and training the farmers in this country are also considered motivations to farmers in order to cooperate with the govrenment.

Georgievski (2005), states that the scattered lands away from each other, increased cost of production, established rural cooperatives and a technical support of the government are the major incentives for land consolidation in Macedonia.

Backman (2002), argues that the integration of rural lands has developed agriculture in Sweden. education level, geographic conditions, farmers training and number of land pieces were main factors which motivated farmers to participate in that plan.

Gonzales Garcia (2007), showed that integration is an important step toward workforce efficiency and productivity of agricultural lands in Spain . increasing farmers' awareness about economical and social results of the land integration, communicating useful information to farmers, and governmental support programs were important factors in farmers acceptance of this system.

MATERIAL AND METHODS

This study was conducted in 2011-2012 farming year in two selected villages, viz. Garjan and Baruq of Ardabil county. All farmers of the mentioned villages (N= 500) were consisted the statistical population of the study from which 300 and 200 were residents of Garjan and Baruq villages, respectively. A sample of 250 farmers (50% of population) were selected for data collection using random sampling method. The research instrument was validated by a panel of experts. T chieve the reliability of the instrument a pilot study was conducted with 30 farmers out of main study area and the Cronbach's alpha coefficient

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obtained 0.76 showing high reliability of the instrument. Neccessary reforms were carried out on the questionnaire after each above stages. Finally, the modified questionnaire was used for data gathering.

Variables and measurement

The independent variables include age, education level, farming experience, trust to each other, trust to the government programs, knowledge of subject matter, distance of farm from the village center, distance from water resources, distance from main road, extent of farming area, type of ownership (owner or renter), the number of land pieces, the number of cultivated crops, agricultural knowledge resources and participation in agricultural training courses. The dependent variable of the study was farmers' willingness to participate in the land consolidation program.

RESULTS

The average age of farmers was 54 years and their average farming experience was 33 years (Table 1). The average size of each family was 5.6 people per family. Over 50 percent of respondents were literate and about 47.6% of them were illiterate. Average amount of land operation of each family was 5 hectares (Sd= 4.33). This shows unequal distribution of farmlands among rural families. The number of operators' cultivating land pieces were variable with a mean of 3/3 pieces and mean area amount was 1.37 hectares. The average number of crops cultivated were two crops. Average annual family income was 15.980 million rials infrom which about some 34.8 percent earned from non-farming professions. this suggests that households which were significantly related to non-farm income were also entered in the sample. Average distances of land pieces from the water resources, village centers, main roads and land pieces from each other were .894, 1.8, 1.2 and 1.6 kms, respectively. (Table 1).

Table 1. Socioeconomic and farm operation characteristics of respondents

Parameters	Average	Median	Standard deviation	Minimum	Maximum
Age	54	55	10.75	26	70
Education	5	5	1.305	0	16
Experience	33	35	9.94	10	45
Number of families	5.52	6	1.79	1	12
Income	5.15	4	4.33	0.5	25
The amount of land	4.93	3	3.9	1	24
Number of land pecies	3.38	3	1.74	1	12
distance to the water resource (km)	0.89	0.5	1.178	0	5
distance to the village center (km)	1.78	1	1.272	1	6
distance to roads (km)	1.2	1	0.74	0	3

Source: Research findings

Analysis of farmers willingness revealed that 52% of the respondents were agreed on participating in land consolidation program (Table 2). The results show that there was significant relationship between literacy levels of farm operators and their willingness to participate in land consolidation program. Results also show that the higher literacy levels increase the owners' knowledge of intergrtion program. It results in tendency to participate in the program. The results indicate that there was significant relationship between the extenr of land ownership and farmers' willingness to participate in the land consolidation program. The correlation coefficient reflects the fact that the owners of larger farms were

more interested to integrate their fragmented operations. The rationale for this tendency may be related to the following reasons:

1- Land consolidation will increase the value of their land;

2- Allow more efficient use of resources and increased productivity;

3- Farm mechanization and ability to use modern farm machineries.

Table2. Farmers willingness to participation in land consolidation program

Agreed		Disagreed	
n	%	n	%
130	52	120	48

According to results, there was a significat correlation between farmers confidence to each other and their willingness to participate in the land integration program. This means that the more farmers trust each other, the increased incentive will be made to participate in the program. Also, it can be result in more cooperation with each other as well as more coopertion government's program of land integration. This means that because the government implements land integration program, farmers will satisfied and joint to the program. The results show that the literacy level of landowners and their willingness to participate in the integration of farmlands were significantiy correlated which means that with increasing level of knowledge of the advantages and of this program farmers will be more enthusiastic to participate in land consolidation. As results of Table 3 show, farmers' willingness to participation will increase with aquiring information about the advantages of land consolidation and integration programs.

Table 3. The relationship between independent variables and willingness to participate in agricultural land consolidation

Dependent variable	Independent variable	Pearson correlation coefficient	Significant levels
Willingness to participate in the land consolidation	Education	0.790	0.000
	Ownership of Land	0.551	0.002
	Farmers to Confidence each other	0.889	0.000
	Confidence in government	0.791	0.000
	Age	0.542	0.002
	Not awareness of the topic	0.936	0.000

Source: Prepared with using Table 1.

DISCUSSION AND CONCLUSION

According to the results of this study, factors such as farmers' education levels, farmers' family members, knowledge about the methods and advantages of land condolidation, land quality, land situational values, farming experiences and confidence in each other as well as confidence to govrenment programs in agricultural development were the most important factors affecting respondents' willingness to participate in land integration in the studied area. On the other word, factors like education, farm size and farmers' awareness of land cosolidation programs had positive impact on farmers willingness to integrate their fargmented farmlands which means with each of these variables, may increases the integration process trend. factors such as family size, land quality and lack of trust in each other or government had negative impacts on willingness to participate in the land integration by

respondents. High number of family members, high land quality and low confidence of farmers in each other, all decreas farmers tendency to integrate their farmland. The results about the factors affecting the integration process confirms the findings of previous studies such as Backman (2002), vitikainen (2004), Todorova and Lulcheva (2005), Gonzales Garcia (2007).

Considering all these factors, extension campaigns to train farmers to increase their knowledge for optimum use of new technologies such as modern farm machineries and equipments and other farming inputs are necessary after implementation of land consolidation program. finally, land exploitation with destructive and erosive effects on soil should be prevented.

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RAISIN PRODUCTION AND MARKETING IN TURKEY

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ABSTRACT

Turkey is located in the most suitable climate conditions for growing grape. Turkey is the second largest producer and the first exporter for the dried grapes in the world. The aim of this study is to evaluate the developments of raisin production and marketing in Turkey. In this study all needed materials have been derived from some sources such as FAO, IGEME, Aegean Exporters Union, during the period 2007 to 2011. The data have been analyzed with the use of percentages. SWOT analysis has been used to identify the strengths, weaknesses, opportunities and strengths for raisin sector in Turkey. The number of raisin processing units has been increased rapidly after 1990. Producers are not unconscious of using pesticides and fertilizers. Good Agricultural Practices and traceability in production of raisin grape is necessary to protect present market and to find new export market.

Key Words: Raisin, production, marketing, Turkey

INTRODUCTION

Grapes are the most widely grown commercial fruit crop in the world. Though grapes are adapted to a wide range of climates the best production occurs in regions that meet certain specific climatic conditions. Turkey's climate is suitable for production of high-quality raisin. Turkey is situated between 36'-42' north latitudes and 26'-45' east longitudes, one of the most favorable areas for viticulture, which has an old past in the cradle of great civilization, and one of the main fruit production centers of the world (Kara, 2007). Turkey is one of the world's largest grape producers. According to FAO 2010 statistics', Turkey has the 5th-largest area of land devoted to vineyards, with 478.000 hectares. And it is the 6th-largest world grape producer with 4.2 million tons annually. Turkey has 1200 different types of grapes. Sultani grape is the main variety for raisins. Most of the grapes are used as raisins. World raisins production is estimated at 1.1 million tons for the 2011/12 season the raisin production for Turkey is 260,000 tons in 2011. The export volume is 215.000 tons in 2011. Approximately 70-80% of the annual production goes to exporting.

This study deals with an analysis of the raisin sector in Turkey during the period 2007 to 2011. SWOT analysis has been done for raisin sector in Turkey.

MATERIAL AND METHODS

Data for this study were obtained from secondary sources such as FAO, IGEME, Aegean Exporters Union, during the period 2007 to 2011. The data have been analyzed with the use of percentages. SWOT analysis has been used to identify the strengths, weaknesses, opportunities and strengths, (SWOT) for raisin sector in Turkey.

RESULTS

Raisin Production in Turkey and Selected Countries

The global raisin production was 1,140,000 tons for the 2011, a slight increase compared to the previous years. The United States is the largest raisin producer, accounting for nearly 30% of total world raisin production. Turkey is the second largest producer with 260,000 tons, in the world. Turkey, United States, China and Iran are the world's largest raisin producers. Combined, these four countries account for about 81% of global production (Table 1).

Turkey is an important role in raisin production in the world because of its favorable ecological conditions. Raisins production differs from year to year due to weather conditions. In 2008 Turkish raisin production has reached the high level of 310,000 tons (Anonymous, 2011). The raisin growing area is

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85,000 ha. It is mainly produced in the Aegean region, especially in Manisa, Turgutlu, Salihli, Akhisar, Menemen, Kemalpaşa, Çal and Çivril.

Sultani grape is the main variety for raisin. Major production of raisin (90 per cent) in the world is from this variety. Sultani is a white, thin skinned grape, which produces the best raisins available today. Its small berries are oval and elongated. It does not contain seeds and has high sugar content. One kilogram of raisins requires about four to five kilograms of fresh grapes.

Seedless grape production expanded significantly in Turkey in the 1990's due to more intensive cultivation and better irrigation techniques. Seedless grapes generally are grown on small farms averaging about 1.3 hectares. It is estimated that nearly 65,000 growers produce seedless grapes in Turkey (Anonymous, 2009). Growers sell their raisins to cooperative (TARIS) or exporter. After harvesting, Sultani grapes are dipped to alkali emulsion with olive oil for accelerating drying. Then grapes spread on concrete floors or trellis systems. When the top layer of berries browned and shriveled nearly one week later, the grapes are turned upside down. After 2 weeks light coloured (golden coloured) raisins are obtained (Uzun, 2008). Processing generally includes: size grading, washing, and sorting to discard any unwanted material and ensure that the final product meets exacting standards. After final inspections, the raisins are weighed and packed for distribution. Turkish companies using the latest technology of the sector work in compliance with international quality standards and most of them have ISO 9000 and HACCP system certificates. The sector has intensely invested to develop final quality of their products and has substantially improved the quality of Turkish raisins through better growing, harvesting and drying techniques. Thus there is a big potential of raisin industry in Turkey in terms of the marketing of this product in domestic and international market

Table 1. Raisin Production in Selected Countries (tons) (2007-2011)

	2007		2008		2009		2010		2011	
	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%
United States	326,600	29.18	354,100	32.00	304,400	27.24	347,800	31.24	335,000	29.39
Turkey	250,000	22.34	310,000	28.02	260,000	23.27	250,000	22.46	260,000	22.81
China	150,000	13.40	150,000	13.56	185,000	16.56	160,000	14.37	175,000	15.35
Iran	166,000	14.83	75,000	6.78	145,000	12.98	147,000	13.20	150,000	13.16
Chile	67,350	6.02	80,000	7.23	65,000	5.82	67,000	6.02	70,000	6.14
Afghanistan	24,500	2.19	26,000	2.35	28,000	2.51	30,000	2.69	34,000	2.98
South Africa	40,200	3.59	24,000	2.17	43,000	3.85	27,000	2.43	30,000	2.63
Argentina	28,000	2.50	26,000	2.35	27,000	2.42	26,000	2.34	27,00	2.37
Uzbekistan	37,000	3.31	25,700	2.32	26,000	2.33	26,000	2.34	25,00	2.19
Australia	11,000	0.98	17,100	1.55	13,600	1.22	14,000	1.26	15,000	1.32
Other	18,500	1.65	18,500	1.67	20,300	1.82	18,500	1.66	19,000	1.67
Total	1,119,150	100.00	1,106,400	100.00	1,117,300	100.00	1,113,300	100.00	1,140,000	100.00

Source: http://www.fas.usda.gov/ Raisins: World Markets and Trade

Raisin Exports in Turkey and Selected Countries

Raisin has traded domestic and export markets in Turkey. A great majority of total raisin production has been exported. Wholesaler, cooperatives (TARIS) and exporting firms have big shares in marketing channel in Turkey. Wholesalers are located in the Aegean Region, where raisins are cleaned, sorted, graded, and packaged for domestic and export markets. Like the wholesalers, exporters that process raisins for cleaning, sorting, grading, and/or packaging for export markets. TARIS (Sultana Raisins Union), is one of the longest established agricultural cooperatives in Turkey and is raisin buyers and exporters of Turkey. It has approximately 15,000 member growers.

Raisin consumption in domestic market in Turkey is low. It is estimated at approximately 0.6 kg/capita compared to consumption in the United Kingdom (roughly, 2 kg/capita); Canada

(1.20kg/capita); and Germany and the U.S. (about 1 kg/capita). Mainly raisins are consumed as a snack food in Turkey. The domestic consumption for raisin is around 45,000 tons.

Around 83% of Sultani production is exported. The top raisin exporters are Turkey, United States and Iran. In calendar year (CY) 2011, Turkey exported 215,000 tons, while the United States exported 155,000 tons. Turkey provides 29% of raisin exportation of the world. World exports were 731,000 tons, a 4% increase in 2011 (Table 2).

Table 2. Raisins Exports Amount From Selected Countries (tons) (2007-2011)

	2007		2008		2009		2010		2011	
	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%
Turkey	205,900	28.53	274,900	40.04	213,200	28.86	212,000	30.22	215,000	29.41
USA	152,400	21.11	144,300	21.02	168,100	22.76	146,700	20.91	155,000	21.20
Iran	138,000	19.12	58,700	8.55	122,000	16.52	122,600	17.47	125,000	17.10
Chile	65.600	9.09	78,300	11.40	63,600	8.61	65,000	9.26	68,000	9.30
China	31,900	4.42	27,500	4.01	48,000	6.50	50,000	7.13	55,000	7.52
Afghanistan	20,700	2.87	21,500	3.13	23,700	3.21	26,300	3.75	30,000	4.10
S. Africa	38,800	5.38	23,200	3.38	40,200	5.44	22,000	3.14	25,000	3.42
Argentina	23,950	3.32	22,200	3.23	23,250	3.15	22,000	3.14	23,000	3.15
Uzbekistan	29,700	4.11	21,100	3.07	21,900	2.96	21,600	3.08	21,000	2.87
EU-27	7,500	1.04	7,600	1.11	9,000	1.22	8,700	1.24	9,000	1.23
Other	7,350	1.02	7,300	1.06	5,700	0.77	4,700	0.67	5,000	0.68
Total	721,800	100.00	686,600	100.00	738,650	100.00	701,600	100.00	731,000	100.00

Source: IGEME, 2011

Raisin is one of the traditional agricultural export items of Turkey, which exports to approximately 100 countries on five continents depending on changing market conditions. Traditionally the EU countries have been the top export destinations for Turkey. United Kingdom, Germany and Holland continued to be the top three importers of Turkish raisins. Exports to UK alone accounted for 137 million $ in 2010. Apart from EU countries, Russian Federation, Australia, New Zealand and Canada are the other important destinations for raisin. Raisin exports to Australia increased from 19 million $ in 2007 to 22 million $ in 2010 (Table 3). As shown in table 3, while prices of raisins have constantly increased. The export prices of raisins have increased by %37 from 2007 to 2011 in Turkey. The average export price for raisins in 2011 is 2363 $/ton.

Table 3. Major Export Destinations for Raisin (2007-2011)

	2007		2008		2009		2010		2011*	
Country	Quantity (tons)	Value (000$)	Quantity (tons)	Value (000$)	Quantity (tons)	Value (000$)	Quantity (tons)	Value (000$)	Quantity (tons)	Value (000$)
United King.	53,160	92,600	58,380	92,054	52,587	99,713	59,853	136,962	30,171	71,551
Germany	29,979	51,843	46,489	72,034	35,568	67,427	36,495	88,588	21,490	51,790
Holland	29,056	48,588	33,110	48,464	28,611	52,373	26,154	59,354	13,313	30,845
Italy	17,233	28,733	17,689	28,357	16,809	31,686	16,238	36,437	11,634	27,209
France	14,132	24,158	16,059	24,153	14,821	27,984	14,827	34,153	6,495	15,729
Belgium	7,074	12,264	11,823	17,102	8,839	16,533	10,559	23,541	5,123	11,618
Ireland	4,952	8,310	5,817	8,678	3,780	6,565	4,050	9,285	2,534	5,636
Spain	2,903	5,078	4,036	5,945	3,369	6,102	3,272	7,694	2,362	5,567
Russia Fed.	2,760	4,994	6,154	9,415	3,444	7,180	2,642	6,663	1,308	3,504
Australia	11,528	19,341	17,252	25,872	11,140	19,981	9,530	21,534	7,857	17,598
New Zealand	3,705	6,628	4,888	7,415	4,291	8,047	3,598	7,977	1,675	3,870
Japan	1,865	3,268	1,502	2,806	1,309	2,763	1,111	2,654	588	1,491
Canada	3,863	6,418	11,451	17,488	4,908	8,842	4,573	10,392	3,655	8,572
Other	13,009	23,501	39,637	59,668	18,114	34,660	12,228	29,155	7,917	19,452
TOTAL	195,219	335,724	274,287	419,452	207,589	389,857	205,130	474,391	116,122	274,432

** As of 01/09/2011 - 04/02/2012*
Source: Aegean Exporters Union records, 2012, Izmir.

Raisin Imports in Selected Countries

Today dried fruit consumption is widespread. Nearly half of the dried fruits sold are raisins. Raisins may be eaten snack, raw or used in cooking, baking. EU was the leading import market for raisins, importing 340,000 tons in 2011. The major EU countries importing raisins were United Kingdom, Germany, and the Netherlands. Turkey is the main supplier to the EU market. Other important raisin import markets included Russia, Canada and Japan, whose imports totaled 131,000 tons accounted for 17.14% of the total imports (Table 4).

Table 4. Raisins Imports Amount From Selected Countries (tons) (2007-2011)

	2007		2008		2009		2010		2011	
	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%
EU-27	349,900	49.58	325,000	49.04	338,600	47.77	338,000	49.37	340,000	48.16
Russia	70,500	9.99	64,500	9.73	71,700	10.12	54,000	7.89	60,000	8.50
Canada	32,500	4.61	31,300	4.72	29,300	4.13	32,800	4.79	32,000	4.53
Japan	32,300	4.58	27,300	4.12	29,700	4.19	29,300	4.28	29,000	4.11
Australia	28,900	4.10	26,500	4.00	22,700	3.20	25,000	3.65	25,000	3.54
Brazil	22,700	3.22	19,500	2.94	27,000	3.81	23,000	3.36	25,000	3.54
Ukraine	20,100	2.85	16,000	2.41	17,600	2.48	19,000	2.78	20,000	2.83
USA	21,600	3.06	19,300	2.91	21,100	2.98	19,400	2.83	20,000	2.83
China	13,600	1.93	11,300	1.71	13,300	1.88	16,200	2.37	19,000	2.69
UAE	12,300	1.74	6,300	0.95	16,900	2.38	17,800	2.60	18,000	2.55
Iraq	6,000	0.85	14,400	2.17	15,900	2.24	16,000	2.34	16,000	2.27
Mexico	13,100	1.86	15,500	2.34	16,900	2.38	14,300	2.09	15,000	2.12
Other	82,200	11.65	85,800	12.95	88,100	12.43	79,800	11.66	87,000	12.32
Total	705,700	100.00	662,700	100.00	708,800	100.00	684,600	100.00	706,000	100.00

Source: http://www.fas.usda.gov/ Raisins: World Markets and Trade

SWOT Analysis of Raisin Sector in Turkey

The SWOT analysis is used as a diagnostic tool for identifying the strengths, (sectors' areas that need further development, and area that could seriously impact the ability to stay competitive), and the problematic area, which, need further adjustment to the market conditions. The SWOT analysis is as follows in terms of raisin sector in Turkey.

Strengths

- ✓ **Suitable ecological conditions and good climate for raisin production**
- ✓ **Turkey's strategic location, particularly in relation to Asia and Europe**
- ✓ **Low labour costs of the grape production**
- ✓ **Increase in investments related to processing plants of raisin**

Weaknesses

- ✓ **Production depending of the natural conditions**
- ✓ **Lack of capital investments**
- ✓ **Low income for the grape growers**
- ✓ **Small farm size**
- ✓ **Highly fragmented farm structure**
- ✓ **Weak grape growers' organization**
- ✓ **It is not planned according to the market needs**
- ✓ **Producers are not unconscious of using pesticides and fertilizers**
- ✓ **Weak government support**

Opportunities

- ✓ **Existence of scientific and research institutions**

- ✓ **Turkey's strategic geographical position offers significant opportunities for trade**
- ✓ **Competitive labor prices**
- ✓ **Increased interest in organic farming due to the rising focus on health issues**
- ✓ **Adoption of good agricultural practices for the production availability of new markets taking the necessary measures,**

Threats

- ✓ **Lack of traceability in production**
- ✓ **Inadequate consultant service**
- ✓ **Lack of keeping records by growers**
- ✓ **High competition at the world market**
- ✓ **Pressure on the government to reduce agricultural subsidies**

CONCLUSION

Turkey has good ecological conditions for growing raisin grapes. It has strategic geographical position offers significant opportunities for trade. The relatively cheap and abundant labor force puts Turkey in an advantageous position compared to other countries. Turkey will continue to acting important roles in raisin production and marketing in the world. Good Agricultural Practices and traceability in production of raisin grape is necessary to protect present market and to find new export market.

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ANALYSIS OF THE AGRICULTURAL SITUATION ON PRIVATE FARMS IN WESTERN KOSOVO

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ABSTRACT

In western Kosovo, the structure of agricultural land and agroenvironmental conditions, primarily abundant water resources, bodies of water and irrigation channels, have stimulated farmers in the region surveyed to engage in agriculture.

In order to facilitate the development of agricultural production in western Kosovo, production potentials in the Municipalities of Istog, Deçani, Gjakova and Peja were analysed using statistical data on Kosovo, farmer poll results and information gathered through a personal insight into the situation on the ground. Random sampling was the method used to select villages and family farms for poll purposes. The data collected and analysed showed the average farm size, available land area, crop structure, number of animals, and number of tractors and attachment machines.

The poll covered 215 private farms in 58 villages. Sown meadow and alfalfa stands, and arable land account for 44% and 32% of the total farm land available, respectively, the rest being forests. The average farm size in the area polled is 9.51 ha of the total land area, with 7.23 ha of land used for cultivation. The most common crops include maize and wheat, cultivated on over 50% and 39% of land, respectively, followed by oat, barley and other crops. As part of livestock production, an average farm rears 10 animals, 55 % of which being dairy cows. Apart from cattle, 15 sheep per farm are reared on average.

The farms surveyed have insufficient machinery; therefore, this problem hinders the improvement of agricultural production. Only 78% of the farms surveyed own two-axle tractors that have a cultivation rate of 9 ha and 2.6 attachment machines.

Key Words: Agricultural production, livestock production, private farms, machines

INTRODUCTION

More than a third of the Kosovo population are engaged in agricultural production as the main source of subsistence for many families. According to the agricultural household survey conducted by the Statistical Office of Kosovo in 2004, the total agricultural population is estimated at 1 million people, 60% of whom are under 30 years of age. Namely, Kosovo is the youngest nation in Europe, with 40% of the population being 1-15 years of age, as confirmed by the data collected in western Kosovo in the municipalities surveyed. The private sector and agricultural farms own 86% of land.

The Municipality of Peja is the centre of the western Kosovo region. It covers an area of 602 km² and has a population of about 160,000, with about 52% and 48% of people living in urban and rural areas, respectively. The Municipality has 76 villages predominantly and traditionally oriented towards agricultural production (livestock production, fruit and vegetable production). The fertile lowlands along the Lumbardhi (Bistrica) River and the natural beauty of neighbouring mountains and intact forest landscapes stretching towards the border with Montenegro offer opportunities for local tourism development. The natural resources of this region and favourable agroenvironmental conditions give large prospects for the rural development of the municipality. The economic potentials of the region include a private sector initiative and modest industrial and craftsmanship capacities.

The Municipality of Gjakova covers an area of 586 km², has a favourable geographical location, and is linked with major towns (Peja, Prizren and Prishtina) via main regional roads. It has a population of about 150,800, with 51% and 49% of the people living in urban and rural areas, respectively. Gjakova used to be a developed trading and industrial centre providing employment for about 7,000 people, mostly in the textile and metal industries. Like other towns in Kosovo, Gjakova has a high unemployment rate. Its 86 villages are mostly located in the lowlands. The fertile lowlands and irrigation capacities have favoured the development of crop and livestock production. The favourable agroenvironmental conditions of the region have paved the way for the long tradition of agriculture on family farms.

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The Municipality of Istog, covering an area of 450 km^2, has a population of about 64,000 and a population density of 140 people/km^2 (lower than the average population density in Kosovo, but taking into account the fact that part of the upland region along the border with Montenegro is completely uninhabited). The Municipality comprises 50 villages where people mostly engage in cereal, vegetable, fruit and livestock production. The abundant water resources of the Istog River have ensured the construction of surface irrigation channels, thereby facilitating the development of different types of agricultural production, both crop and livestock production.

The Municipality of Deçani has a residing community of about 61,000 people, with 65.5% of them being under 30 years of age. It covers an area of 372 km^2 within 40 villages, and has a population density of 163 people/km^2. Agriculture is the main economic sector providing employment for 65% of people.

All of the above municipalities are experiencing unemployment as a serious economic problem that can be overcome through improvements in agriculture and environmental protection.

The agroenvironmental conditions in western Kosovo, its agricultural land structure, abundant water resources, rivers and irrigation channels have stimulated farmers in the region surveyed to engage in agriculture. However, the potential for agricultural development in this part of Kosovo as well as in the wider area has been underexploited Veljković et al. (2011).

MATERIALS AND METHODS

The analysis of agricultural production in western Kosovo in this study covers four leading municipalities of the region, including Peja, Gjakova, Istog and Deçani. Random sampling was the method used to select villages and farms for poll purposes. The poll covered 58 villages and 215 private farms, mostly family ones. According to the methodology Lazic and Turan 1996 and Veljkovic et al 2011. the questionnaires were used in the poll to obtain required data from farm owners. The data included information on farms, economically active family members, land area owned, land quality, production structure, type of production, average yields, number of animals by type, breed and category, number of tractors, type of attachment machinery, market situation, and trade of agricultural products. The poll data were grouped, subjected to mathematical statistical methods, and presented in both tabular and graphic form. Additional data included also the official statistics of the Kosovo Agency of Statistics. Based on the collected data and their processing and analysis, the data analysed showed the predominant farm models in this region.

RESULTS

The polled region is situated between 42^{0}22`34" and 42$^0$39`36" North latitude and 20^{0}26`05" and 20$^0$17`36" East longitude. The average altitude is 550 m. The economically active population in Kosovo is a highly important resource for the development and further enhancement of agricultural production. The age structure of the population in the municipalities surveyed is also favourable, with about 63% of the people belonging to the age group of 15-64 years. This agricultural population plays the most important role in agricultural production (primarily in terms of the use of novel technologies) in the Municipalities of Peja, Gjakova, Istog and Deçani, as presented in Table 1.

Table 1. Age structure of agricultural population across municipalities

Age groups	Pejë	Gjakovë	Istog	Deçan
up to 14 years	28.6	33.8	30.0	28.7
15-29 years	28.1	29.6	29.7	30.6
30- 49 years	25.2	22.0	24.0	23.6
50- 64 years	10.6	8.3	9.6	10.7
over 65 years	7.6	6.3	6.8	6.4

Source: Prepared with using statistical database

Farmers over 65 years of age make the smallest age group, and they have a reduced work ability in agriculture. The youngest population of up to 14 years of age accounts for about 30% of the age groups.

Kosovo is predominantly characterised by small family farms and land fragmentation. Plot distance from the farmyard is often large and, hence, it is a constraint to a judicious use of machinery. The number of small farms is 4850 in Peja, 4210 in Deçani, 400 in Gjakova, and 214 in Istog. The number of large specialised farms is 13, 4, 85 and 40 in respective municipalities. (One of the polled specialised farms in Istok cultivates as many as 400 ha of land).

Table 2. Average farm size in the region surveyed

Municipality	Number of polled villages	Number of polled farmers	Total area in ha	Average farm size
Pejë	11	27	256.9	9.51
Gjakovë	16	79	647.51	8.2
Istog	14	60	885.1	14.75
Deçan	17	49	255.02	5.2
Total	58	215	2044.53	9.51

In the four municipalities, a total of 58 villages were polled, including 16 villages and 79 farms in Gjakova, 14 villages and 60 farms in Istog, 11 villages and 27 farms in Peja, and two regions in Deçani, i.e. 7 villages and 34 farms in the lowland region along the rivers, and 10 villages and 15 farms in the region near Junik (Table 2).

A total of 215 farms with 2,044.53 ha land were covered by the poll. Small-holder farmers (up to 3 ha land) are the most dominant, but their percent contribution to the total land area is the lowest. The number of farmers holding 3.1-6 ha land is almost identical to the number of those holding 6.1-10 ha land. Namely, farms up to 10 ha in size account for about 78.1% of the total land area, and have more than a third (37.07%) of the soils available. Only 9 farms hold land above 20 ha in size, but they make up about 37.99% of the total land area, as indicated in Table3.

Table 3. Family farm size in the region surveyed

Farm size	Number of farmers	Percentage %	Total area in ha	Percentage %
up to 3.0	70	32.56	120.78	5.91
3.1-6.0	50	23.26	235.85	11.54
6.1-10.0	48	22.32	401.35	19.63
10.01-15.0	28	13.02	355.95	17.41
15.1-20.0	10	4.65	153.80	7.52
above 20	9	4.19	776.80	37.99
Total	215	100	2044.53	100

The average land area including forest area owned by a farm is 9.51 ha, and the average agricultural land area is 7.23 ha, which accounts for 76% of the total land available. Noteworthy is the fact that the land owned by the farms is divided into a number of small-sized plots located away from the farmyard

A total of 2,044.53 ha land, including 1,556.03 ha of agricultural land, and 23.89% of forest land, were covered by the poll. There are three groups of agricultural land - arable fields and gardens, meadows and pastures, and permanent plantings. The target groups of this research were farmers engaged in livestock production, supported by field and forage crop production. Importantly, this region offers exceptional agroenvironmental conditions for fruit, grape and vegetable production.

The agricultural land structure of the polled region is dominated by meadows (897.92 ha or 43.9%) and arable fields (657.96 ha or 32.1% ha), followed by sown meadows and alfalfa stands. There are no privately owned pastures, but rather state-owned meadows used by farmers to graze cattle during the May-September period on a subsidy basis.

As regards the crop structure, cereal crops stand out as the basic crops used for livestock production planning purposes. There are differences in the crop structure on polled private farms across municipalities, depending on region-specific conditions (Table 4).

Table 4. Crop structure of arable fields in ha

Municipality	Pejë	Gjakovë	Istog	Deçan	Total
Wheat	63.5	76.65	93.1	20.9	254.15
Maize	69	147.9	72.5	42.66	332.06
Oats	6.6	14	30.4	4.8	55.8
Barley	0	1.65	4.5	1	7.15
Other	1	1	0.6	6.2	8.8
Total arable field	140.1	241.2	201.1	75.56	657.96

Source: Prepared with using statistical database

The analysis of the poll results showed that 17.67 % of the farmers (38) practise field crop production on their farms. Field crop production is focused on feed production. Small amounts of wheat are processed into flour used by farmers mostly to meet their own needs. Mixed stands of grass, clover and alfalfa are used for feed production purposes. The intensive exploitation of the available land area is manifested through yield increases resulting from the use of irrigation, irrigation systems and rivers. Under irrigated conditions, 3-5 cuttings are achieved per year, and higher yields of good-quality forage are produced. Haymaking is the predominant practise. Grass silage making has been underway over the last years, whereas silage has been traditionally produced from whole maize plants.

The crop structure is dominated by maize, which is grown on more than 50% of land, i.e. on 332.06 ha, and wheat, which accounts for 39% of the cultivated land, followed by oats and barley. Other crops include vegetables, which are grown mostly for farmers' own individual needs.

The analysis of livestock production in the municipalities surveyed shows the predominance of cattle and milk production. Local Spotted Simmental cattle, either pure-bred or mixed with other breeds, mostly with the indigenous Busha breed, are predominantly raised, but the Brown cattle breed is also reared in the uplands. According to the number of animals, cattle and sheep are the most predominant in the Municipalities of Istog and Gjakova (Table 5). Sheep farming is mostly practised in the upland region of the Istog Municipality, at the foot of Pashtrik in the Gjakova Municipality, and across Mts. Junik, Bogicevica and Bjeshkëte Nemuna (Prokletije) in the Deçani Municipality, where farmers drive their flocks of sheep to shepherds' summer settlements (conventional sheep farming).

A number of farms have specialised in and have adequate equipment for milk and meat production. Cattle are reared in stables during winter, and grazed for a period of 5 months on average during summer. An average milk production per cow is 14 litres.

Table 5. Number of animals in the municipalities surveyed

Category	Pejë	Gjakovë	Istog	Deçan	Total
Dairy cows	135	306	537	193	1171
Heifers	60	115	137	61	373
Bulls	28	36	46	45	155
Calves	48	128	134	107	417
Total cattle	271	585	854	406	2116
Sheep	195	746	1896	475	3312
Lamb	110	318	484	435	1347
Goats		6		2	8
Kids		3			3
Horses	5	9	9	4	27

The farms surveyed have 168 two-axle and 15 single-axle tractors, the latter being mostly used for meadow mowing in the uplands and inter-row cultivation.

Table 6. Number of tractors by farm size

Number of tractors	Farm size				Total
	0-3 ha	3-6 ha	6-10 ha	>10 ha	
Pejë	5	5	2	1	13
Gjakovë	14	15	16	16	61
Istog	3	13	12	21	49
Deçan	15	4	10	2	31
Junik	4	3	5	2	14
Total	41	40	45	42	168

The farms surveyed have insufficient machinery; therefore, this fact hinders the improvement of agricultural production. Only 78% of the farms surveyed have two-axle tractors. As regards the number of tractors by farm size, farms holding less than 3 ha and those holding over 10 ha of agricultural land have an almost similar number of tractors (Table 6). Farms having large areas of arable land own tractors with an engine power exceeding 60 kW. On average, a two-axle tractor has a cultivation rate of 9.26 ha of agricultural land. Tractors have insufficient attachment machinery, with 2.6 attachment machines per two-axle tractor. Intensive production requires adequate attachment machinery. A similar situation exists in southern Kosovo, as reported by Koprivica et al. (2010 a).

CONCLUSION

The research conducted in the municipalities surveyed and the analyses of the farm property structure, farm size, number of animals and available machinery suggest that the average farm in this region holds 7.23 ha arable land, cultivates maize as the most common crop, owns 10 head of cattle, 16 sheep and at least one tractor and two attachment machines. Further development and improvement of livestock production necessitates the following:

- **Improvement of feed production through maximum utilisation of arable land and irrigation system in order to obtain two harvests per year.**
- **Post-harvest use of small grain crop land for maize production for silage, with maize being combined with the last alfalfa cutting.**
- **Farmer training in quality feed i.e. silage production for better utilisation of meadows and pastures in order to achieve better milk and meat production results.**
- **Improvement of the cow breed structure through the use of high-productive dairy breeds of cattle.**

The analysis of machine availability on family farms suggests lack of tractors and insufficient use of tractors throughout the year, which is due to the lack of adequate attachment machinery and short-term dates for specific operations. Farmers cultivate only their own farms, and they rarely provide their services to other farmers. This indicates the need to purchase tractors and modern agricultural machinery and use them more effectively through machinery ring associations Koprivica et al. (2010 b).

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MANAGEMENT OF VALUE-ADDED BY-PRODUCTS FROM WINERY INDUSTRY

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ABSTRACT

Winemaking generates different residues characterized by high content of biodegradable compounds and suspended solids. The main solid by-products are grape stalks, frappe marc (pomace), wine lees and winery wastewater. The waste generation of the winery industry in EU-27 during 2008 was estimated for a wine production of 159.3 Miohl (International Organization of Vine and Wine - OIV, 2010) in, approximately 1138 x 10^3 tons/year of grape stalk, 3186 x 10^3 tons/year of grape marc, 1365 x 10^3 tons/year of wine lees and 95 x 10^6 m3 of winery wastewater. Serbia constitutes one of the middle grape and wine producers, with a grape production during 2010 was 330 070 tonnes of which remains about 7 000 tons of grape by-products, which is only used for the production of alcohol, and most of ending up in landfills as organic waste (Statistical Serbian Office –RZS, 2012). Today's technology for reusing these waste products is very limited, and industry mostly disposes of them through composting or incineration, costing millions of Euros and contributing to environmental problems. Recycled polyphenols from grape waste could be added to human food for their antioxidant qualities, for prevention of cancer and heart disease.

Key Words: Winery industry, value-added by-products, management waste

INTRODUCTION

According to the Food and Agriculture Organization (FAO), 75 866 square kilometers of the world are dedicated to grapes. Grapes are the world`s largest fruit crop with more than 60 million metric tons (67.5 x 106 tons during 2009) produced annually. Europe represents 44% of this worldwide production (International Organization of Vine and Wine - OIV, 2010). Approximately 71% of world grape production is used for wine, 27% as fresh fruit, and 2% as dried fruit (www.oiv.int).

The European Union (EU-27) has an important presence in the world wide market of wine, with approximately 49% of the vine growing area of the world and 60% of the wine production.

The world production of the wine during 2008 was about 267.4 Miohl in the EU-27, about 159.3 Miohl, the Mediterranean countries (Italy, France and Spain) being the main producers. Spain constitutes one of the main wine producers, with the highest vineyard area of the world (1165 mha, equivalent to 15.1 % of the world total vineyard area) and with a wine production during 2008 of 35.9 Miohl (13.4% of the world wine production) (OIV, 2010).

However wine making leads to the generation of large quantities of waste (around 5-9 million tonnes per year, worldwide), which considerably increase the chemical oxygen demand (COD) and the biochemical oxygen demand (BOD) due to a high pollution load (high content of organic substance such as sugars, tannins, polyphenols, polyalcohols, pectins and lipids) with detrimental effects on the flora and fauna of dischanged zones (Oreopoulou *et al.* 2007)

According to the European Council Regulation (EC) No. 479/2008 on the common organization of the market in wine (EC, 2008), grape marc and wile lees are considered by-products and must be sent to alcohol distilleries to extract alcohol and tartarates, producing a solid waste, exhausted grape marc and a liquid waste, vinasse. Grape stalk is obtained after the esteeming process and contains the stems of the grape, while grape marc, obtained after the pressing process, consists of processed skins and seeds. Wine lees are produced throughout the fermentation and clarification steps in the wine producing processed. On the other hand, the aerobic depuration of the winery effluents, vinasse and winery wastewater, generates another solid waste, winery sludge.

The composition of grape waste varies considerably, depending on grape variety, vintage and technology of winemaking. Thus, the waste generation of the winery industry during 2008 was estimated for a wine production of 159.3 Miohl in, approximately 1138 x 10^3 tons/year of grape stalk, 3186 x 10^3

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tons/year of grape marc, 1365 x 10^3 tons/year of wine lees and 95 x 10^6 m3 of winery wastewater (OIV, 2010).

Serbia constitutes one of the middle grape and wine producers, with a grape production during 2010 was 330 070 tonnes of which remains about 7 000 tons of grape by-products, which is only used for the production of alcohol, and most of ending up in landfills as organic waste (Statistical Serbian Office –RZS, 2012, www.stat.gov.rs).

Therefore, the treatment and disposal of winery waste must is a serious environmental problem and +winery waste must find another use other than as animal feed or as fertilizers. The problem of all these waste materials is their disposal and treatment due to their seasonal character (during September - November) and some characteristics which difficult their management. The cost of waste disposal and the penalties imposed on companies have therefore increased significantly, often reaching 30,000 – 40,000 Euros in EU.

In recent years, the growing concern about the environment has led authorities to look for economically viable solutions for recycling and /or valorising grape waste. The grape by-products contain a polyphenols that might protect against human diseases related to oxidative stress. Especially, the grape seed extract is characterized by high-phenol content because of poor extraction during winemaking, so that its use supports sustainable agricultural production. (Arvanitoyannis *et al.* 2006). The active ingredients contained in this value-added grape by-product are proanthocyanidins (Da Silva *et al.* 1991). Together with tannins and polyunsaturated fatty acids, these seed constituents display inhibitory activities against several experimental disease models, including cancer, heart failure and other disorders of oxidative stress.

Recent studies in animals, as well as some human studies, have shown that grape seed proanthocyanidin extracts possess a broad spectrum of biological, pharmacological and chemoprotective properties against free radicals and oxidative stress (Adamez et al. 2012; Baydar *et al.* 2004; Radovanović *et al*. 2009). Grape seed represents also a rich source of various high-value products as ethanol, tartarates, malates, citric acid, grape seed oil, hydrocolloids and dietary fibre and skincare products for many perceived health benefits.

Grape seed extract has also proven to be valuable in the treatment of inadequate blood flow in the capillaries and veins. Small studies have shown increased capillary strength using as little as 50 milligrams/day, and increased venous blood flow using 150 milligrams/day. Grape seed extract has become popular in recent years as a nutritional supplement, natural antioxidant and food additive (Gorduza *et al.* 2000; Kennedy 2008).

The aim of this work is to evaluate grape seeds as a sources antioxidant polyphenols for their possible use as dietary supplement or food antioxidants. To this purpose antioxidant capacity and total polyphenolic content of different red grape varieties, grown in Serbia was investigated.

MATERIALS AND METHODS

Chemicals

All chemicals used for analysis were of analytical degree of purity from Merck (Darmstadt, Germany). There was used the following chemicals: 2,2`-diphenyl-1-picrylhydrazyl free radical (DPPH), methanol, ethanol, acetone, hydrochloric acid, trifluoroacetic acid (TFA), gallic acid. The used reagents were of analytical quality.

Grape samples

The four red grape varieties: Cabernet Sauvignon, Pinot Noir, Vranac and Prokupac, which was used for analysis, were grown at the vineyards of Serbia (vintage September, 2010). Samples of grapes were collected at physiological ripeness phase. The sampling of these varieties was performed using the same procedure by randomly picking berries from the top, central and bottom part of the cluster. Berries were carefully removed from the stalk, washed and frozen at -18 °C and as that kept for analysis.

Preparation of grape seed extracts

For immediate analysis, from the frozen berries are particularly separated grape seeds. 0.5 g of seeds was extracted with 10 ml of solvent mixtures (methanol /acetone/water/TFA in relation 30/42/28/0.05). The samples were stirred for 30 min on a magnetic stirrer, and then centrifugated at room temperature

(Tehnica LC-320, Zelezniki, Slovenia) at 4000 rpm for 10 min the supernatants from three extraction procedures.

Determination of total polyphenols

Total phenol contents in the grape seed extracts were determined spectrophotometrically, as already reported (Mazza *et al*. 1999; Radovanović *et al*. 2010). After about 15 min, the absorbances (A) at 280 nm were recorded using an Agilent 8453 UV-visible spectrophotometer (Agilent Technologies, Santa Clara, CA, USA). Absorbance at 280 nm was used to estimate total phenols content, by using gallic as the standard compound.

Determination of antioxidant activity

Antioxidant activity of test grape samples was determined by using free radical scavenging (DPPH) assay (Radovanović *et al.* 2009). This antioxidant assay is based on the measurement of DPPH· colour loss due to the changes in absorbance at 517 nm, caused by the reaction of DPPH· with the test sample. After 20 min at room temperature, $A_{517\ nm}$ was measured against the blank. The DPPH-scavenging activity of each wine sample was calculated from the decrease in absorbance according to the following relationship:

Antioxidant activity (%) = $[1 - (A_{sample} - A_{blank})/A_{control}] \times 100$

where: $A_{control}$ is the absorbance of control (8.0×10^{-5} M methanol solution of DPPH·), A_{blank} is the absorbance of diluted wine sample and A_{sample} is the absorbance of the diluted wine sample with the same concentration of DPPH-radical as in control.

Statistical analysis

Three analytical replicates were carried out on each grape sample. Measurements were averaged and results are given as mean ± standard deviation (SD). The standard deviation was calculated by ANOVA using the Minitab statistical package (Minitab Inc., State College, PA, USA).

RESULTS AND DISCUSSION

The phenolic composition in grape varies widely and is usually determined by several factors, such as: the variety of grape and conditions under which they was grown: soil, geographical location, light exposure, temperature, sun exposure of the clusters and weather (Gil-Munoz *et al.* 2010; Mazza *et al.* 1999; Xu *et al*. 2011).

Also, the amount and types of phenol compounds present in a particular grape seed extract can vary and is greatly influenced by the extraction process, as well as the source, variety and storage of the used seeds. Polyphenols in grape seeds are mainly flavonoids, including the monomeric flavan-3-ols and procyanidin dimers, trimers and more highly polymerized procyanidins (Kennedy 2008; Lachman *et al.* 2009). The content of total polyphenols of grape seed extracts obtained from two red international grape varieties: Cabernet Sauvignon and Pinot Noir, as well as two autochthonic grape varieties: Vranac and Prokupac, at physiological maturity, and their antioxidant activity have been determined by spectrophotometric assays (Table1. and Figure 1):

Table 1. ***Content of total polyphenols of Cabernet Sauvignon, Pinot Noir, Vranac and Prokupac grape seeds at physiological maturity, expressed as mg g^{-1} fresh weight and their antioxidant activity, expressed as %****

Variety of grape seeds	Total polyphenols (mg g^{-1})	Antioxidant activity (%)
Cabernet Sauvignon	322.44 ± 0.12	97.78 ± 0.09
Pinot Noir	325.79 ± 0.13	98.12 ± 0.11
Vranac	315.45 ± 0.11	97.52 ± 0.10
Prokupac	275.17 ± 0.05	85.45 ± 0.09

*$p > 0.05$

The grape varieties: Cabernet Sauvignon, Pinot Noir, Vranac and Prokupac, which were grown at the vineyards of Serbia, were with a very expressive vegetative power of vines. In the appropriate environmental conditions, these grape varieties have great economic importance because that their quality red wines are very appreciated in the domestic and foreign markets.

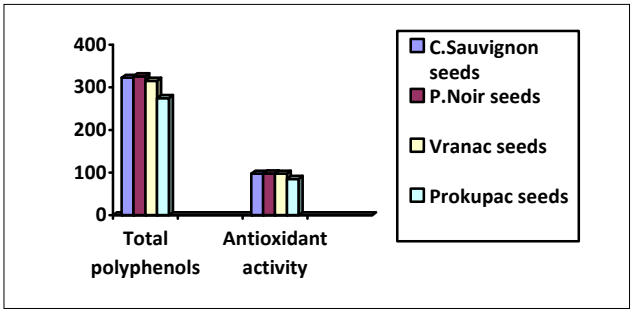

Figure 1.Content of total polyphenols of grape seeds of Cabernet Sauvignon, Pinot Noir, Vranac and Prokupac grape berries, at physiological ripeness phase, expressed as mg g^{-1} fresh weight and their antioxidant activity, expressed as % ($p > 0.05$).

The content of polyphenols of investigated grape seed extracts are ranged from 275.17 to 325.79 mg g^{-1}, which is in accordance with the previous data for red grape seeds (Adamez *et al.* 2012; Gorduza *et al.* 2000; Lachman *et al*. 2009; Lorrain *et al.* 2011; Mattivi *et al.* 2009). Also, all grape seed extracts had high antioxidant capacity ranged from 85.45% to 97.78%, which is in excellent correlation with their total polyphenolic content (Figure 2):

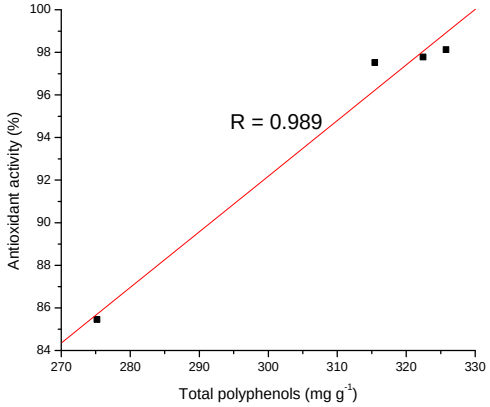

Figure 2. Correlation between content of total polyphenols and antioxidant activity of studied grape seed extracts ($p < 0.01$)

CONCLUSION

Based on results of this research we can conclude that investigated grape seeds have high antioxidant activity, which is in excellent correlation with their total polyphenolic content. For this reason, extraction of polyphenols from grape seeds has emerged as an opportune and vital business for the wine, food and pharmaceutical industry.

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INFLUENCE OF RIPENING STAGE ON PHENOLIC COMPOSITION AND ANTIOXIDANT ACTIVITY OF *VITIS VINIFERA L.* RED GRAPE VARIETIES

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ABSTRACT

Grapes (*Vitis vinifera L.)* are one of the most important sources of antioxidants such phenolic compounds. Tannins, such as flavan-3-ols are the most abundant category of soluble polyphenols in grape berries, found predominantly in the hypodermal layers of the skin and the soft parenchyma of the seeds. Anthocyanins are the second important group of phenolic compounds, which is co-located with tannins in the thick-walled hypodermal cells of the skin of grape. During grape ripening the concentrations of these phenolic compounds were changed. The aim of this work was to determine influence of ripening stage on autochthonous *Vitis vinifera L.*red grape varieties (grape seeds, skins and pulp) grown in Balkan region, which directly reflecting on wine quality. Antioxidant activity of grapes at different dates of harvest was determined by free radical scavenging (DPPH) assay. The harvest in optimal period ensures that significant portion of phenolics transfers into wine, the main product of grapes, where they affect much on wine quality and color.

Key Words: Vitis vinifera L. red grapes, ripening, phenolic composition, antioxidant activity

INTRODUCTION

Grape (*Vitis vinifera L.*) polyphenols cause great interest because of their chemical impact on the quality and biology activity of grape and wine. Reports indicated that grapes contain large amounts of phenolic compounds, such as anthocyanins, flavonoids and stilbens (Lorrrain *et al.* 2011). In the grape skins located molecules as flavan-3-ols, hydroxycinnamic tartaric acids, hydroxybenzoic acids, hydroxystilbens and anthocyanins in the grape seeds as flavan-3-ols and gallic acid (Da Silva *et al.* 1991; Mattivi *et al.* 2009) and in the grape juice as hydroxycinnamoyl tartaric acids (Nagel *et al.* 1979). Anthocyanins are red phenolic compounds responsible for the color of the red grapes and the amount of total polyphenols in the white grape varieties is lower compared to that of red grapes, since the white ones do not synthesize anthocyanins.

Polyphenols play an important role in human health, such as lowering of human low-density lipoprotein, as anti-inflammatory, antimicrobial and anti-aging effects and also play a preventing role from cardiovascular diseases (Baydar et al. 2004; Burns *et al*. 2000; Radovanović *et al.* 2010). Numerous studies focussed on antioxidant effects of grapes and wine (Gorduza *et al*. 2000; Lachman *et al.* 2009; Radovanović *et al.* 2009). Scientific studies have shown that the oxidative power of phenolic compounds presence in grapes is twenty times greater than vitamin E and fifty times greater than vitamin C.

Phenolic compounds in grapes are responsible for the quality and color of wine, the main product of grapes, because during wine making in the extraction processing the most part of phenolic compounds go into wine. During grape ripening the concentrations of polyphenols were changed. The aim of this work was to determine influence of ripening stage on two autochthonous *Vitis vinifera L.* red grape varieties: Vranac and Prokupac grown in Balkan region, which directly reflecting on the total content of polyphenols, hydroxycinnamic tartaric acids, flavonols and anthocyanins and their free radical scavenging activity. Autochthonous sorts of grapes Vranac and Prokupac probably came spontaneous crossing or as a result of spontaneous mutation. Vranac and Prokupac were varieties with a very expressive vegetative power of vines. The grapes are used for production top and quality red wines. Vranac and Prokupac wines were intensively colored, fresh, and harmonious with special varietal characteristics. In the appropriate environmental conditions, these grape varieties and red wines have great economic importance.

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MATERIALS AND METHODS

Chemicals

All chemicals used for analysis were of analytical degree of purity from Merck (Darmstadt, Germany). There was used the following chemicals: 2,2`-diphenyl-1-picrylhydrazyl free radical (DPPH), methanol, ethanol, acetone, hydrochloric acid, trifluoroacetic acid (TFA), quercetin, caffeic acid acid, gallic acid. The used reagents were of analytical quality.

Grape samples

The two red grape Vranac and Prokupac, which was used for analysis, were grown at the Nis (Serbia) vineyard region (vintage 2008). Samples of grapes were collected at three berry ripening phase: veraison, physiological ripeness and late harvest. The sampling of these varieties in the three phases was performed using the same procedure by randomly picking berries from the top, central and bottom part of the cluster. Berries were carefully removed from the stalk, washed and frozen at -18 °C and as that kept for analysis.

Preparation of grape extracts

For immediate analysis, from the frozen berries are particularly separated skins, seeds and pulps. Grape skins and seeds were grounded and the pulps were blended. 0.5 g of grape skin, seed and pulp samples were extracted with 10 ml of solvent mixtures (methanol/acetone/water/TFA in relation 30/42/28/0.05). The samples were stirred for 30 min on a magnetic stirrer, and then centrifugated at room temperature (Tehnica LC-320, Zelezniki, Slovenia) at 4000 rpm for 10 min the supernatants from three extraction procedures.

Determination of total polyphenols, hydroxycinnamic tartaric acids and flavonols

Total phenol, hydroxycinnamoyl tartaric acid and flavonol contents in the grape extracts were determined spectrophotometrically, as already reported (Mazza *et al*. 1999; Radovanovic *et al*. 2010). After about 15 min, the absorbances (A) at 280, 320 and 360 nm were recorded using an Agilent 8453 UV-visible spectrophotometer (Agilent Technologies, Santa Clara, CA, USA). Absorbance at 280 nm, A_{280}, was used to estimate total phenols content, $A_{320\,nm}$ was used to estimate hydroxycinnamoyl tartaric acids content and $A_{360\,nm}$ was used to estimate total flavonols content, by using gallic and caffeic acid, and quercetin as the standard compounds, respectively.

Determination of total anthocyanins

Total anthocyanins were determined by spectrophotometric method (Di Stefano *et al*. 1989). The grape extracts were diluted with a solution of acidified aqueous ethanol and the absorbance was measured immediately at 540 nm. Total anthocyanins are expressed as mg malvidin-3-glucoside equivalents in mg g^{-1} of fresh sample, calculated using the following equation:

$$TA = A_{540nm} \times 16.7d$$

where, A_{540nm} is the absorbance at 540 nm and d is the dilution.

Determination of antioxidant activity

Antioxidant activity of test grape samples was determined by using free radical scavenging (DPPH) assay (Anli and Vural 2009; Radovanovic *et al*. 2009). This antioxidant assay is based on the measurement of DPPH· colour loss due to the changes in absorbance at 517 nm, caused by the reaction of DPPH· with the test sample. After 20 min at room temperature, $A_{517\,nm}$ was measured against the blank. The DPPH-scavenging activity of each wine sample was calculated from the decrease in absorbance according to the following relationship:

$$\text{Antioxidant activity (\%)} = [1 - (A_{sample} - A_{blank})/A_{control}] \times 100$$

where: $A_{control}$ is the absorbance of control (8.0×10^{-5} M methanol solution of DPPH·), A_{blank} is the absorbance of diluted wine sample and A_{sample} is the absorbance of the diluted wine sample with the same concentration of DPPH-radical as in control.

Statistical analysis

Three analytical replicates were carried out on each grape sample. Measurements were averaged and results are given as mean ± standard deviation (SD). The standard deviation was calculated by ANOVA using the Minitab statistical package (Minitab Inc., State College, PA, USA).

RESULTS AND DISCUSSION

The accumulation and the distribution of polyphenols in grapes is influenced by many factors such as the time of vintage during the berry ripening, temperature, water availability, sun exposure of the clusters and variety (Mazza *et al.* 1999). The content of total polyphenols, hydroxycinnamic tartaric acids, flavonols and anthocyanins, as well as antioxidant activity of two red berries varieties: Vranac and Prokupac have been determined by spectrophotometric assays at three ripening phases: veraison, physiological ripeness and late harvest. In Table 1 was shown the relative amounts of these phenolic compounds in different locations of Vranac and Prokupac grape berry (pulp, skins and seeds) at physiological ripness, as well as their antioxidant capacity:

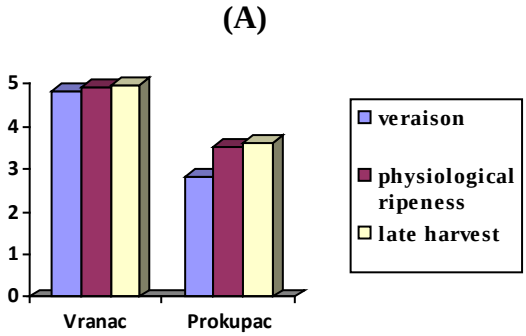
Table 1. ***Content of total polyphenols of Cabernet Sauvignon, Pinot Noir, Vranac and Prokupac grape seeds at physiological maturity, expressed as mg g^{-1} fresh weight and their antioxidant activity, expressed as %****

Grape variety	TP (mg g^{-1})	TH (mg g^{-1})	TF (mg g^{-1})	TA (mg g^{-1})	Antioxidant activity (%)
Vranac (pulp)	4.91 ± 0.08	1.49 ± 0.01	0.79 ± 0.02	0.11 ± 0.02	24.28 ± 0.12
(skin)	69.58 ± 0.12	3.53 ± 0.06	2.57 ± 0.05	8.17 ± 0.09	52.69 ± 0.13
(seed)	168.10 ± 0.11	5.25 ± 0.02	3.32 ± 0.13	-	81.93 ± 0.10
Prokupac (pulp)	3.53 ± 0.02	1.18 ± 0.02	0.65 ± 0.07	0.07 ± 0.03	19.88 ± 0.02
(skin)	54.58 ± 0.10	2.15 ± 0.04	2.09 ± 0.05	6.36 ± 0.05	48.15 ± 0.10
(seed)	122.11 ± 0.11	4.35 ± 0.12	3.02 ± 0.03	-	65.18 ± 0.06

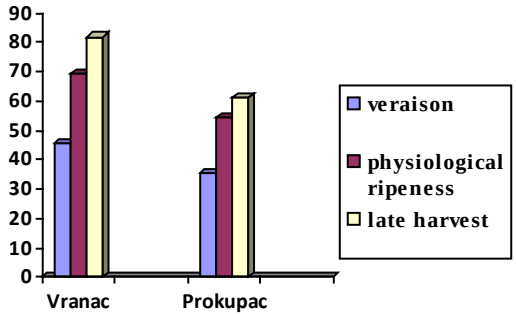
***p > 0.05**

As regards the total contents of analyzed phenolic compounds at physiological maturity, Vranac grape pulp, skins and seeds contained a higher amounts compared to Prokupac grape pulp, skins and seeds. Also, their antioxidant activities, expressed over percent as the grape extracts ability to neutralize DPPH radicals, have correlation of the amounts of polyphenols. In skins extracts were found significant concentrations of anthocyanins, plant pigments, which have great importance because they respond to the color of grape berries skin, and also the color of red wine. The results were substantially in accordance with the previous data for red grapes (Lachman *et al*. 2009; Xu *et al*. 2011).

The total content of polyphenols (TP) of Vranac and Prokupac red grape in the pulp, skins and seeds at the three different phases of ripening, determined by spectrophotometric assays, are presented in Figure 1 (A, B and C):



(B)



(C)

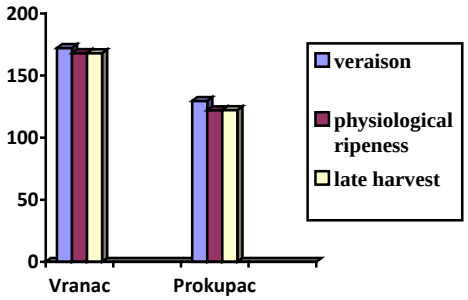


Figure 1.Total polyphenolic content of pulp (A), skins (B) and seeds (C) of Vranac and Prokupac grape berries at three ripening stages: veraison, physiological ripeness and late harvest, expressed as mg g^{-1} fresh weight ($p > 0.05$).

As stated in the literature (Kennedy *et al.* 2002) the amount of polyphenols in grapes increases throughout berry ripening, which is especially evident for anthocyanins, but could decline later in the berry development. Thus, the total polyphenolic content of the studied Vranac and Prokupac grape skins and seeds were increasing continuously from veraison, across the physiological ripeness, till the moment of the late harvest, when the highest content were observed (Figure 1.).The obtained results in this study are in accordance with the findings previously published for the changes of polyphenolic content in other grape varieties during ripening (Gil-Munoz *et al*. 2010).

During the ripening time, it was determined that the antioxidant activity in all grape extracts (pulp, skins and seeds) increased. Vranac and Prokupac grape seeds were the strongest antioxidant activity in range from 80.73% to 82.52% and from 64.28% to 65.25%, respectively. Vranac and Prokupac grape skins were antioxidant activity from 49.04% to 53.97% and from 45.75% to 48.59%. Then, Vranac and Prokupac grape pulp were the weakest antioxidant activity in range from 20.96% to 24.30% and 19.18% to 20.25%, respectively.

CONCLUSION

Based on results of this research we can conclude that the Vranac grape variety had a higher polyphenolic content compared Prokupac grape variety, which cause high antioxidant activity of Vranac grape extracts. The phenolic compounds are more presence in grape seeds and skins, and less in pulp, which is in accordance with the values of antioxidant activity of theirs extracts. The content of these compounds are also changed during grapes ripening, mostly increased. The harvest in optimal period ensures that significant portion of phenolics transfers into wine, the main product of grapes, where they affect much on wine quality and color.

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