

AgroSym

BOOK OF PROCEEDINGS

AgroSym 2018



IX International Scientific Agriculture Symposium
"Agrosym 2018"
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PREFACE

A Word from the Editor-in-Chief

Dear colleagues,

In your hands are the Proceedings of the 9th International Scientific Agricultural Symposium “AGROSYM 2018” held on 4-7 October 2018 in Jahorina, Bosnia and Herzegovina. The Symposium gathers about 1200 participants from 85 different countries and organizers received over 1200 abstracts/full papers. Symposium themes covered all branches of agriculture and were divided into seven sessions: 1) Plant production, 2) Plant protection and food safety, 3) Organic agriculture, 4) Environmental protection and natural resources management, 5) Animal husbandry 6) Forestry and Agro-forestry, and 7) Rural Development and Agro-economy.

In the plenary lectures was presented the importance of new information and communication technologies for agriculture in the 21st century and biological protection in plant production. Furthermore, a particular attention was devoted to avoiding knowledge waste through networking and partnership.

Agriculture has a complex relationship with natural resources and the environment, thus attributing specific environmental effects to agriculture is difficult and not fully understood. Today, it is obvious that conventional methods of agricultural production, in addition to providing sufficient food and other products, have led to a number of negative impacts, including direct or indirect effects on human health. Excessive use of agrochemicals can cause various disorders in the biological equilibrium of agroecosystems and beyond. These negative impacts raise serious questions about long-term sustainability of high-input agriculture. Measures to protect soil and water in agriculture include comprehensive and complex undertakings and pre-planned measures. These problems are a constant reason for ‘popularisation’ of all ecological trends in agriculture (e.g. organic agriculture, permaculture, biodynamic agriculture, conservation agriculture, regenerative agriculture, integrated farming, agroecology, etc.). Meanwhile, there are also calls for a genuine, deep transformation of agro-food systems that goes beyond ‘ecologisation’ of agricultural production. All these developments in agricultural research field, as well their implications on farmers’ fields, were discussed during the 4 days of AGROSYM 2018.

All papers included in the Proceedings were peer-reviewed. Full texts of the accepted contributions are available in electronic form on AGROSYM website (<http://agrosym.unssa.rs.ba>).

I hope that the Proceedings will be useful to many agriculturalists and to those engaged in related fields and enable better collaboration of scientists, researchers and producers.

Many thanks to all the authors, reviewers, session moderators and colleagues for their help in editing the Proceedings “AGROSYM 2018”. Special thanks go to all co-organizers for their unselfish collaboration and comprehensive support.

East Sarajevo, 07th October 2018



Prof. Dušan Kovačević, Editor-in-Chief

CONTENT

PLANT PRODUCTION	37
STUDY ABOUT SOME ECOLOGICAL ASPECTS OF GRAIN OAT CULTIVARS (Avena sativa L.) IN ALBANIAN CONDITIONS	
Adrian DOKO, Simir KRASNIQI, Albert KOPALI, Asllan CELAMI, Isuf KAZIU	38
QUALITY OF NECTARINE FRUIT IN HERZEGOVINA REGION	
Aida ŠUKALIĆ, Vedrana KOMLEN, Alma MIČIJEVIĆ	46
INFLUENCE OF PRODUCTION SYSTEM ON THE CONTENT OF LYCOPENE IN TOMATO FRUIT AT VARIOUS AGRO-ECOLOGICAL CONDITION	
Omer KURTOVIĆ, Aleksandra GOVEDARICA-LUČIĆ, Jelena PLAKALOVIĆ, Ivana BOŠKOVIĆ, Alma RAHIMIĆ	53
GROWTH PARAMETERS OF TOMATO TRANSPLANTS CULTIVATED BY THE FLOATING CONTAINERS TECHNOLOGY	
Elma SEFO, Nikolina TADIĆ, Zdravko MATOTAN, Ivan SPUŽEVIĆ, Lutvija KARIĆ, Zrinka KNEZOVIĆ	59
INFLUENCE OF THE SELECTED VARIETIES OF LETTUCE (<i>Lactuca sativa</i> L.) ON YIELD AND NITRATE CONCENTRATIONS	
Lutvija KARIĆ, Čerima ZAHIROVIĆ, Dragan ŽNIDARČIĆ, Josip JURKOVIĆ, Seval MUMINOVIĆ, Almina HADŽIASIMBEG, Elma SEFO	65
NITROGEN DYNAMICS IN THE SOIL - PLANT SYSTEM UNDER DEFICIT IRRIGATION STRATEGIES IN POTATOES	
Mirjana JOVOVIC, Zorica JOVANOVIĆ, Radmila STIKIĆ	69
COMPARATIVE VALUE OF GRASS AND LEGUMES PROTEIN YIELD AT DIFFERENT CUTTING REGIMES IN TEMPORARY GRASSLANDS	
Muamer BEZDROB, Aleksandar SIMIĆ, Teofil GAVRIĆ, Saud HAMIDOVIĆ, Nermin RAKITA	73
DIVERSITY OF <i>IN SITU</i> WILD PEAR (<i>Pyrus communis</i> L.) POPULATION IN THE LOCALITY OF KOZARA (Bosnia and Herzegovina)	
Nada ZAVIŠIĆ, Gordana ĐURIĆ	78
POMOMETRIC PROPERTIES OF POMEGRANATE (<i>PUNICA GRANATUM</i> L.) IN HERZEGOVINA REGION (BOSNIA AND HERZEGOVINA)	
Paulina ŠARAVANJA, Zlatko ČMELIK, Zrinka KNEZOVIĆ, Radica ĆORIĆ	84
VEGETATION OF THE CLASS <i>STELLARIETEA MEDIAE</i> IN THE "LIJEVČE POLJE" AREA IN NORTHERN BOSNIA AND HERZEGOVINA	
Sanja ČEKIĆ, Zlatan KOVAČEVIĆ, Danijela PETROVIĆ	90
EFFECTS OF PLANT DENSITY ON THE YIELD AND TOTAL PHENOLIC CONTENTS OF TARTARY BUCKWHEAT	
Teofil GAVRIĆ, Drena GADŽO, Mirha ĐIKIĆ, Muamer BEZDROB, Sabrija ČADRO, Fejzo BAŠIĆ	97
THE ACCUMULATION OF BIOMASS IN TRITICALE VARIETIES DEPENDING ON THE TREATMENT WITH PGRs AND DIFFERENT FERTILIZATION LEVELS	
Hristofor KIRCHEV, Rumyana GEORGIEVA	103

ENHANCING THE ADAPTATION OF SUGAR APPLE AND CHERIMOYA TO SOIL CONDITIONS OF SOUTH LEBANON BY GRAFTING AND IRON FERTILIZATION

Layla NAIM, Zeina EL SEBAALY, Tony Kevork SAJYAN, Youssef Najib SASSINE 109

PEA (*PISUM SATIVUM* L.) DIVERSITY IN BULGARIA AND A STRATEGY FOR ITS UTILIZATION

Siyka ANGELOVA, Mariya SABEVA 116

POST EFFECT OF ORGANIC AND MINERAL NUTRITION ON GROWTH, YIELD AND QUALITY OF SPINACH (*SPINACIA OLERACEA* L.)

Ivanka MITOVA, Nikolai DINEV, Nidal SHABAN, Eman KADHUM 122

TEMPERATURE CONDITIONS FOR GROWING CHERRY (*PRUNUS AVIUM* L.) AND PEACH TREES (*PERSICA VULGARIS* MILL.) IN BULGARIA

Valentin KAZANDJIEV, Petya MALASHEVA 128

THE EFFECT OF PGRs AND DIFFERENT FERTILIZATION LEVELS ON THE DRY MATTER FORMATION AND PHENOLOGICAL DEVELOPMENT OF TRITICALE VARIETIES

Rumyana GEORGIEVA, Hristofor KIRCHEV 134

COMPARATIVE STUDY OF GRAIN MAIZE HYBRIDS IN THE REGION OF NORTH – EAST BULGARIA

Vanya DELIBALTOVA 139

EFFECT OF INTERCROPPING MAIZE WITH COWPEA ON FORAGE YIELD AND QUALITY

Darko UHER, Ivan HORVATIĆ, Martina KOVAČEVIĆ, Dubravko MACÉŠIĆ, Zlatko SVEČNJAK 146

EFFECT OF INTERCROPPING MAIZE WITH SOYBEAN ON FORAGE YIELD AND QUALITY

Darko UHER, Ivan HORVATIĆ, Dubravko MACÉŠIĆ, Zlatko SVEČNJAK, Dubravka DUJMOVIĆ-PURGAR, Dario JAREŠ 151

TECHNIQUE OF THE ACCELERATED RECEIVING OF BASIC (ELITE) SEEDS OF NEW AND DEFICIT VARIETIES

Tsotne SAMADASHVILI, Gulnari CHKHUTIASHVILI, Mirian CHOKHELI 157

SINGLE-PLANT SELECTION AT ULTRA-LOW DENSITY OF THREE BEAN CULTIVARS AND SALINITY TOLERANCE DURING GERMINATION

Fokion PAPATHANASIOU, Fotini PAPADOPOULOU, Ioannis PAPADOPOULOS 164

STUDY OF THE PERFORMANCE OF GREEK DURUM WHEAT CULTIVARS IN A COLD ENVIRONMENT

Theano B. LAZARIDOU, Foteini TZIOUMERKA 170

PLANT PROTECTION OF GERANIUM (*PELARGONIUM*) IN HORTICULTURAL OF KECSKEMÉT

Viktor József VOJNICH, Nóra PAP 175

EFFECT OF ETHYLENE ON ANTIOXIDANT ENZYMES ACTIVITY IN ETHYLENE-INSENSITIVE CUT ROSES (*ROSA HYBRIDA* L.)

Faezeh KHATAMI, Farzaneh NAJAFI, Fataneh YARI, Ramazan Ali KHAVARI-NEJAD 181

PHYSIOLOGICAL EFFECTS OF GRAFTING IN APRICOT TREES	
Roberto TOMASONE, Carla CEDROLA, Mauro PAGANO	187
EFFECTS OF NANO-FERTILIZERS AND GREENHOUSE CULTIVATION ON PHENOLOGICAL DEVELOPMENT-STAGES AND YIELD OF SEEDLESS TABLE GRAPES VARIETIES	
Israa Youssef EL MASRI, Carine SAMAHA, Youssef Najib SASSINE, Falah ASSADI	192
MITIGATING SALINITY EFFECTS ON ZUCCHINI PLANTS BY APPLICATION OF GLYCINE BETAINE	
Waad ALLAW, Nahla AL ARAB, Zeina EL SEBAALY, Youssef SASSINE, A.M.R. ABDEL-MAWGOUD	197
DETERMINATION OF CHEMICAL COMPOSITION AND AMINO ACIDS IN WHEAT BY NEAR INFRARED REFLECTANCE SPECTROSCOPY	
Saulius ALIJOSIUS, Romas GRUZAUSKAS, Vilma SASYTE, Asta RACEVICIUTE-STUPELIENE	204
THE IMPACT OF CLIMATE CONDITIONS ON THE LEAF SIZE OF BASMA TOBACCO	
Karolina KOCHOSKA, Romina KABRANOVA	210
QUALITY OF THE POMEGRANATES VARIETIES "HICAZ" AND "KARAMUSTAFA" FROM THE REGION OF MACEDONIA	
Violeta DIMOVSKA, Fidanka ILIEVA, Sanja KOSTADINOVIC VELICKOVSKA, Ljupco MIHAJLOV, Biljana KOVAČEVIĆ, Zorica LELOVA.....	216
FRUIT CHARACTERISTICS OF FEIJOA GROWN IN A TROPICAL HIGHLAND OF MEXICO - PULP COMPOSITION, OIL IN SEEDS, AND ESSENTIAL OILS	
Karla Elizabeth GONZÁLEZ-GARCÍA, Diana GUERRA-RAMÍREZ, Juan Guillermo CRUZ-CASTILLO.....	221
MORPHOLOGICAL CHARACTERISCS OF FRUITS AND PITS OF SOME JUJUBE (<i>ZIZIPHUS JUJUBE</i> MILL.) GENOTYPES	
Miroslav ČIZMOVIĆ, Ranko PRENKIĆ	227
QUALITY OF CEREAL GENOTYPES AS NUTRITION IMPROVEMENT TOOL EVEN AT INTOLERANT CONSUMER POPULATION	
Zoran JOVOVIĆ, Suzana JORDANOVSKA, Vesna PETRESKA, Vinko STANOEV	233
POTENTIAL ADAPTABILITY OF PIGEON-PEA GENOTYPES UNDER DIFFERENT AGRO-ECOLOGICAL ENVIRONMENTS OF MOROCCO	
Asmae BAGGAR, Nadia BENBRAHIM, Fatima GABOUN, Mona TAGUOUTI	241
EFFECT OF OSMOTICUM AND SILICA-GEL DESICCATION ON SOMATIC EMBRYOGENESIS FROM CALLUS CULTURES OF <i>BIGNONIA ADENOPHYLLA</i> D.C	
Muhammad AKRAM, Faheem AFTAB	246
THE INFLUENCE OF GROUND PARAMETERS ON SELECTED TRACTION ABILITIES OF AGRICULTURAL VEHICLE	
Dariusz ZATYLNÝ, Marek BRENNENSTHUL	253
MORPHOLOGICAL PROPERTIES OF DIRECTLY SOWED SWEET CORN PLANTS CULTIVATED WITH COVERING TECHNOLOGIES	
Ferenc OROSZ.....	258

Ljubiša ŽIVANOVIĆ, Ljubica ŠARČEVIĆ – TODOSIJEVIĆ, Vera POPOVIĆ, Jela IKANOVIĆ, Mladen TATIĆ, Pašaga AVDIĆ, Divna SIMIĆ	326
PARENTAL POLYMORPHISM ANALYSIS IN MARKER ASSISTED SELECTION FOR β-CAROTENE RICH MAIZE	
Marija KOSTADINOVIĆ, Dragana IGNJATOVIĆ-MICIĆ, Jelena VANČETOVIĆ, Danijela RISTIĆ, Ana OBRADOVIĆ, Milan STEVANOVIĆ, Snežana MLADENOVIĆ DRINIĆ	333
PROPAGATION OF <i>COTONEASTER MULTIFLORUS</i> BUNGE. BY SOFTWOOD CUTTINGS	
Marija MARKOVIĆ, Mihailo GRBIĆ, Dragana SKOČAJIĆ, Matilda ĐUKIĆ, Danijela ĐUNISIJEVIĆ-BOJOVIĆ	339
THE INFLUENCE OF THE SUBSTRATE COMPOSITION ON ROOTING OF HARDWOOD CUTTINGS OF <i>LYCIUM BARBARUM</i> L.	
Marija MARKOVIĆ, Mihailo GRBIĆ, Dragana SKOČAJIĆ, Matilda ĐUKIĆ, Danijela ĐUNISIJEVIĆ-BOJOVIĆ	343
GRAIN YIELD AND STABILITY PARAMETERS OF ZP MAIZE HYBRIDS GROWN IN CENTRAL SERBIA IN THE PERIOD 2014-2017	
Milan STEVANOVIĆ, Jovan PAVLOV, Ana OBADOVIĆ, Marija KOSTADINOVIĆ, Nikola GRČIĆ, Danijela RISTIĆ, Ana NIKOLIĆ	348
CORRELATION BETWEEN AGGRESSIVENESS AND SYNTHESIS-ABILITY OF MYCOTOXIN ISOLATES OF <i>Fusarium graminearum</i> IN MAIZE IN SERBIA	
Ana OBRADOVIĆ, Vesna KRNJAJA, Milan STEVANOVIĆ, Marija KOSTADINOVIĆ, Danijela RISTIĆ, Nikola GRČIĆ, Slavica STANKOVIĆ	353
CORRELATION BETWEEN GRAIN YIELD AND YIELD COMPONENTS IN TRITICALE (<i>x Triricosecale</i> Wittmack)	
Milomirka MADIĆ, Dragan ĐUROVIĆ, Desimir KNEŽEVIĆ, Aleksandar PAUNOVIĆ, Vera ĐEKIĆ	360
KINETICS OF DRY MATTER CONTENT DURING DRYING OF CV 'ČAČANSKA RODNA' FRUITS	
Miodrag KANDIĆ, Olga MITROVIĆ, Branko POPOVIĆ	366
VARIABILITY AND PATH ANALYSIS FOR YIELD COMPONENTS OF DIFFERENT WHEAT GENOTYPES	
Mirela MATKOVIĆ STOJŠIN, Veselinka ZEČEVIĆ, Sofija PETROVIĆ, Miodrag DIMITRIJEVIĆ, Borislav BANJAC, Danica MIĆANOVIĆ, Desimir KNEŽEVIĆ	372
A 10-YEARS ANALYSIS OF GRAPE PRODUCTION IN SERBIA	
Milosav GRČAK, Dragan GRČAK, Dragana GRČAK, Miroljub AKSIĆ, Marko AKSIĆ, Vera ĐEKIĆ	378
THE INFLUENCE OF WEATHER CONDITIONS AND FERTILIZING METHOD ON PLANT HEIGHT AT DIFFERENT CULTIVARS OF WINTER WHEAT	
Nadica TMUŠIĆ, Jasmina KNEŽEVIĆ, Vera ĐEKIĆ, Katerina NIKOLIĆ	385
ESTIMATION OF ABOVEGROUND BIOMASS AND GRAIN YIELD OF WINTER WHEAT USING NDVI MEASUREMENTS	
Nataša LJUBIČIĆ, Marko KOSTIĆ, Oskar MARKO, Marko PANIĆ, Sanja BRDAR, Predrag LUGONJA, Milivoje KNEŽEVIĆ, Vladan MINIĆ, Bojana IVOŠEVIĆ, Radivoje JEVTIĆ, Vladimir CRNOJEVIĆ	390

TESTING AND SELECTING NEW, PROMISING MAIZE HYBRIDS

Jovan PAVLOV, Nenad DELIĆ, Milan STEVANOVIĆ, Zoran ČAMDŽIJA, Nikola GRČIĆ, Miloš CREVAR, Danijela RISTIĆ 398

THE EFFECT OF MOVEMENT OF TRACTORS AND MOBILE SYSTEMS ON SOIL COMPACTION AND THE YIELD OF VARIOUS MAIZE HYBRIDS IN THE CONDITIONS OF SOUTHERN SERBIA

Saša BARAC, Milan BIBERDŽIĆ, Dragan PETROVIĆ, Jelena STOJILJKOVIĆ, Aleksandar ĐIKIĆ, Rade RADOJEVIĆ, Aleksandar VUKOVIĆ 402

MICROPROPAGATION OF CHRYSANTHEMUM CULTIVARS IN SERBIA

Slađana JEVREMOVIĆ, Angelina SUBOTIĆ 408

THE RESPONSE OF ALFALFA TO INOCULATION WITH INDIVIDUAL AND COMBINED CULTURES OF MICROORGANISMS

Snežana ANĐELKOVIĆ, Jasmina RADOVIĆ, Tanja VASIĆ, Snežana BABIĆ, Jasmina MILENKOVIĆ, Vladimir ZORNIĆ, Goran JEVTIĆ 414

ANALYSIS OF VARIABILITY OF MEADOW FESCUE (*FESTUCA PRATENSIS* HUDS.) POPULATIONS AND CULTIVARS

Snežana BABIĆ, Dejan SOKOLOVIĆ, Jasmina RADOVIĆ, Snežana ANDJELKOVIĆ, Zoran LUGIĆ, Tanja VASIĆ, Aleksandar SIMIĆ 419

CHEMICAL PROPERTIES OF BLACK CURRANT (*RIBES NIGRUM* L.) BERRY AND LEAF EXTRACTS

Svetlana M. PAUNOVIĆ, Mihailo NIKOLIĆ, Rade MILETIĆ, Mira MILINKOVIĆ, Žaklina KARAKLAJIĆ-STAJIĆ, Jelena TOMIĆ, Marijana PEŠAKOVIĆ 425

GENETIC POTENTIAL AND YIELD COMPONENTS OF WINTER BARLEY

Vera ĐEKIĆ, Vera POPOVIĆ, Milan BIBERDŽIĆ, Milomirka MADIĆ, Nadica TMUŠIĆ, Dragan GRČAK, Dragan TERZIĆ 432

THE STABILITY PROPERTIES OF TRITICALE PRODUCTION ON ACID SOIL

Vera ĐEKIĆ, Jelena MILIVOJEVIĆ, Dragan TERZIĆ, Vera POPOVIĆ, Zoran JOVOVIĆ, Snežana BRANKOVIĆ 438

EFFECT OF LIGHT CONDITIONS ON THE TERRESTRIAL MICROALGAE GROWTH RATE DYNAMICS

Vladimira SEMAN, Timea HAJNAL JAFARI, Simonida DJURIC, Dragana STAMENOV 445

EFFECTS OF LOW TEMPERATURES ON CABERNET SAUVIGNON AND SAUVIGNONE BLANC CV. RESISTANCE GROWN IN CONDITIONS OF OPLENAC (TOPOLA MUNICIPALITY IN SERBIA)

Zoran PRŽIĆ, Nebojša MARKOVIĆ, Slavica TODIĆ 451

BANANA FIBER FROM CANARY ISLANDS: SCIENCE AND EXTRACTION

Francisco Javier TOLEDO MARANTE, Alba GONZÁLEZ BENKOVICS 457

ASSESSMENT OF GENETIC SIMILARITY AMONG THE PROGENIES OF THREE APPLE SEEDLING ROOTSTOCKS BY USING SSR MARKERS

Bayan M. MUZHER, Ola T. ALHALABI 463

INFLUENCE OF STRATIFICATION PERIODS AND CULTURE MEDIUMS ON THE GERMINATION OF APPLE ROOTSTOCK SEEDS

Ola T. ALHALABI, Bayan M. MUZHER 469

QUALITY OF THE POMEGRANATES VARIETIES "HICAZ" AND "KARAMUSTAFA" FROM THE REGION OF MACEDONIA

Violeta DIMOVSKA*, Fidanka ILIEVA, Sanja KOSTADINOVIĆ VELIČKOVSKA, Ljupco MIHAJLOV, Biljana KOVAČEVIĆ, Zorica LELOVA

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Abstract

Pomegranates are valuable fruits due to the high level of anthocyanins in juice and phenolic compounds responsible for antimicrobial activity of pomegranate peel. Significant amounts of phenolic acids, vitamin C and other polyphenolics are responsible for health benefits of the consumers. The objects of our study was the impact of variety on the quality of pomegranates grown in the region of Macedonia. More precisely, morphological parameters for fruits and chemical characteristics of pomegranate juice were significantly affected to the variety of pomegranates. Morphological parameters, in particular fruit weight, fruit height, equatorial and calix diameter favored "Hicaz" variety in comparison to autochthonous "Karamustafa" variety of pomegranates. Furthermore, the pH value of fruit juice, the level of phenolic acid and percentage of glucose and fructose indicate significant differences between varieties. The quantity of anthocyanins (537 mg/L), catechins (50 mg/L) and total phenolic compounds (3367 mg/L) indicated higher quality of pomegranate juice from "Hicaz" pomegranate variety. The effect of pasteurization did not influenced significantly to the quality of pomegranate juices from both varieties.

Key words: *pomegranate juices, morphological parameters, total phenolic compounds, anthocyanins, catechins*

Introduction

Pomegranates are valuable fruits due to the level of anthocyanins in juice and phenolic compounds responsible for antimicrobial activity of pomegranate peel (Dimovska *et al.*, 2018). Significant amounts of phenolic acids, vitamin C and other polyphenolics are responsible for health benefits of the consumers (Dimovska *et al.*, 2017).

Pomegranates are native from Persia and it is believed that the origin is in Central Asia. The morphological changes might have occurring during domestication and the most indicative changes are usually notice on flower, rind and aril colour, fruit size, percentage of sugar and organic acids as well as quality of the seeds (Teixeria da Silva *et al.*, 2013)

The objects of our study were the impact of variety on the quality of pomegranates grown in the region of Macedonia. More precisely, this study examined the effect of variety on morphological parameters for fruits and chemical characteristics (Brix, pH, organic acid, total phenolic compounds, catechins and anthocyanins) of pomegranate juice from the autochthons varieties "Karamustafa" and "Hicaz".

Materials and Methods

Sample preparation

The sampled fruits were selected randomly in order to separate three replicates for analysis, using 20 kg per repetition and cultivar. Pomegranates were weighed, cut in halves, and arils were hand separated from the pith avoiding contamination by components in membranous walls (septum). Juices of each cultivar were obtained by pressure of arils and weighed to determine the juice yield. Samples of freshly prepared juice from both varieties ("Hicaz" and "Karamustafa") were stored frozen one year (-20 °C) until have been analyzed.

Physical properties

Size of the randomly selected 100 dried arils was determined from the axial dimensions of arils. Length was measured using a digital caliper at the accuracy of 0.01 mm. Weight of the hundred dried arils was determined by randomly selecting five samples and weighing in an electronic balance of 0.001 g sensitivity.

Chemical analyses

For determination of titratable acidity (TA), 2 ml of fresh juice was diluted with 70 mL of distilled water and titrating with 0.1 M NaOH to an end point of pH 8.2 using a Metrohm 862 compact titrosampler (Herisua, Switzerland). The results were expressed as percentage of citric acid (% CA). Total soluble solids (TSS, °Brix) was measured using a digital refractometer (Atago, Tokyo, Japan) calibrated with distilled water. The pH values were determined at room temperature using a calibrated pH meter (Crison, Model 00924, Barcelona, Spain). All measurements were made by three repetitions

The total phenolic content of pomegranate juices was determined with Folin–Ciocalteu reagent. For each sample, 50 µL of diluted (1:5) oil extract were added to 750 µL water and 50 µL of Folin–Ciocalteu reagent. The solution with total volume of 850 µL was incubated in the dark for 5 min. Then, 150 µL of 20% sodium carbonate solution was added and samples were incubated in the dark for 1 h. Reference solution was prepared with distilled water instead pomegranate juice and treated with the Folin–Ciocalteu reagent in the same way as the assayed samples. The samples turned to a blue colour with different degrees, depending on the content of phenolic compounds in the samples. The absorbance at 765 nm was recorded against the absorbance of the reference solution. The color intensity was measured spectrophotometrically by UV/VIS spectrophotometer (Shimadzu 1800, Shimadzu corporation, Kyoto, Japan). Determination of monomeric anthocyanins was performed by the colorimetric method of Singleton and Rossi (1965). The measurements were performed by three repetitions

Results and discussion

The chemical parameters of the samples of pomegranate juices from two varieties are presented in Table 1. As we can see, there is no significant difference between results obtained for Brix and pH for both pomegranate varieties. Furthermore, there is no statistical difference between pasteurized and fresh pomegranate juices. On the other hand, there is significant difference between the level of organic acids, monomeric anthocyanins, total phenolic compounds (TPC) and total catechins which were higher for "Hicaz" variety in comparison to "Karamustafa" variety.

Data from physical and morphological characterization of pomegranates from "Hicaz" and "Karamustafa" varieties from 2016 and 2017 vintage years are presented in Tables 2 and 3. The pomegranates from "Hicaz" variety had higher average fruit weight. Percentages of grain and peel were higher for "Karamustafa" variety as well as weight of 100 berries and percentage of skin. The percentage of carpels was more than double for "Hicaz" variety as well as equatorial and calyx diameter and fruit height with and without calyx (Table 3). Pomegranates from "Karamusfata" variety had reddish yellow colour of the fruit and pink colour of the fruit juice. On the other hand, pomegranates from "Hicaz" variety had reddish colour of the fruit and dark pink colour of the fruit juice (Table 1 and Fig.1.). The average fruit weight of pomegranates from "Hicaz" variety was the same as "Chioukhi" variety of pomegranates from Morocco. On the other hand, calix diameter for "Hicaz" variety of pomegranates was similar to Moroccanish "Ounk Hmam" variety and calyx for "Karamusfata" variety was more similar to some Spanish varieties of pomegranates [5].

Table 1. Chemical parameters of pasteurized and fresh pomegranate juice

Pomegranate juice	Brix	pH	Organic acids g/l	Total phenolic compounds (TPC) mg/l GAE	Total catechins mg/l TCE	Total anthocyanins mg/l
Karamustafa (fresh)	17	3.05	5.4	2038	22.91	117.31
Hicaz (fresh)	16	3.04	29.6	3367	50.1	537.13

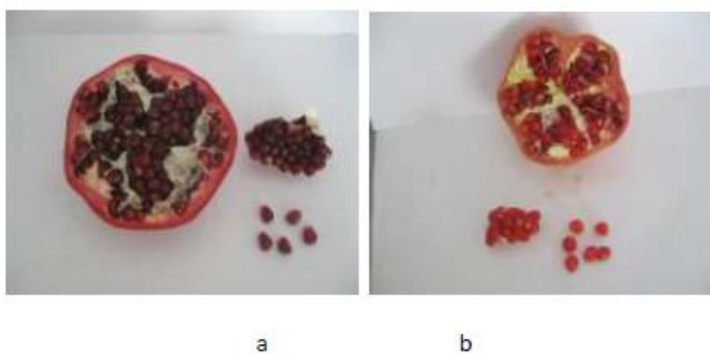


Fig.1. Pomegranate seeds from "Hicaz" (a) and "Karamustafa" variety (b)

Table 2. The technological characteristics of pomegranate fruits

Variety	Years	Repetition	Average fruit weight (g)	Percentage of grain (%)	Percentage of peel (%)	Weight of 100 seeds g	Weight of 100 berries g	Percentage of skin %	Percentage of carpels %	Percentage of juice (%)	Color of fruit	Color of juice
Hicaz	2016	I	525.00	50.24	25.95	4	30.37	0.49	15.59	45.21	Reddish	Dark pink
		II	368.75	50.85	31.36	3	32.50	0.78	14.91	46.08		
		III	283.75	50.92	31.72	3	28.12	0.70	15.77	45.49		
	2017	I	398.90	50.74	25.41	4.5	28.61	1.61	12.05	45.26	Reddish	Dark pink
		II	340.44	47.42	24.30	4.0	29.32	1.74	14.84	45.58		
		III	240.77	50.35	23.35	3.5	23.41	1.74	13.04	47.21		
Karamustafa	2016	I	285.43	53.85	42.14	3	27.86	1.50	8.10	48.26	Reddish yellow	Pink
		II	235.00	51.06	35.56	2.5	27.86	2.13	6.08	46.48		
		III	198.28	53.31	37.10	2.5	29.28	2.37	7.20	48.76		
	2017	I	370.12	64.19	22.55	2.5	33.12	0.55	5.70	50.70	Reddish yellow	Pink
		II	246.06	61.58	21.19	2.5	35.39	0.90	5.19	51.00		
		III	225.76	55.86	19.56	2.8	37.63	1.00	5.24	49.25		

Table 3. The morphological characteristics of the fruits

Variety	Year	Repetition	Fruit weight (g)	D1 (mm)	D2 (mm)	L1 (mm)	L2 (mm)	L3 (mm)
Hicaz	2016	I	525.00	101.0	26.8	90.3	101.6	27.1
		II	368.75	90.0	23.3	80.6	87.6	26.1
		III	283.75	84.7	18.2	75.0	85.2	25.3
	2017	I	398.90	93.6	21.8	82.2	98.6	33.0
		II	340.44	87.1	24.5	78.0	93.6	26.0
		III	240.77	77.4	23.0	67.1	79.0	24.0
Karamustafa	2016	I	285.43	84.8	17.7	73.3	87.3	29.3
		II	235.00	80.0	18.9	70.8	82.9	28.1
		III	198.28	75.5	16.5	66.1	80.2	27.0
	2017	I	370.12	91.3	14.2	82.1	94.6	25.7
		II	246.06	79.1	11.9	96.6	79.5	25.0
		III	225.76	79.0	11.0	67.3	74.6	25.1

D1-equatorial diameter, D2 – calyx diameter, L1 – fruit height without calyx, L2 – total fruit height, L3 – calyx height,

Conclusion

The purpose of the present study was to evaluate the morphological, physical and chemical parameters, in particular organic acids, total phenolic content (TIC), catechins and anthocyanins in two varieties of pomegranates juices from the region of Macedonia. The lower level of phenolic compounds and acids as well as catechins and anthocyanins had pomegranate juice from the autochthonous variety "Karamustafa" and the higher level had the pomegranate juice obtained from "Hicaz" variety. Based on the explanation above, we can summarize that pomegranate juice from "Hicaz" variety is enough rich source with polyphenolic compounds. Finally, we recommend the juice from this pomegranate variety for further investigation in order to identify and quantify the level of polymer compound and other valuable bioactive compounds with significant impact on human health.

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AUTHOR INDEX

A. Aytekin POLAT	795	Ali CANDAN	1254
A. D. AGYEKUM	1187	Ali JOUNAIDI	1812
A. Aytekin POLAT	801	Ali SOYUÇOK	1066
A.M.R. ABDEL-MAWGOUD	197	Alma MIČJEVIĆ	46, 837
Abdelghani ZEDAM	1379	Alma RAHIMIĆ	53
Abdel-Motagally F.M.F.	1312	Almina HADŽIASIMBEG	65
Abderrahmane BOULAHROUF	827	Almira SOFTIĆ	1654, 1662
Abdullah GAGIĆ	1654	Alpay BALKAN	556
Abdullah OKTEM	753	Alvydas ZIBAS	1497
Abdurahman ONARAN	1265	Amanzou Nogbou Andetchi AUBIN	2029
Adam WASILEWSKI	2044	Amarraque ABEDRAHIM	933
Adrian DOKO	38	Amel SLAMANI	1379
Adriana RADOSAVAC	673, 1956	Amela KATICA	1662, 1843
Adriano CIANI	1887	Amina HRKOVIĆ - POROBIJA	1662
Agnes AMONGIN	725	Ammar OUFFROUKH	827
Agnieszka KURDYŚ-KUJAWSKA	1930	Ana MANDIĆ	1439
Agnieszka SOMPOLSKA-RZECZULA	1930	Ana MARJANOVIĆ JEROMELA	290, 1216
Ahmed BIROUK	940	Ana NIKOLIĆ	348, 1836
Ahmed CHORANA	2085	Ana OBADOVIĆ	348
Ahmed El-TOKHY	1158	Ana OBRADOVIĆ	280, 333, 353, 708
Ahmed SAMIR	866	Ana VELEMIR	2114
Ahmet EŞİTKEN	527, 575	Ana VELIMIR	1294, 2128
Aida KAVAZOVIĆ	1662	Anamarija STOJANOVIĆ	1212
Aida KUSTURA	1654	Anastasiia NEOBERDINA	2154
Aida ŠUKALIĆ	46, 837	Anastasiia STAKHURLOVA	978
Aiga TRUPA	1829	Ancuta ISBASOIU	2015
Aigars INDRIKSONS	2142	Andra ZVIRBULE	1905, 1911
Aikaterini GEORGALA	1162	András TAKÁCS	895
Aina DOBELE	1905, 1911	Andrea PURDEŠOVÁ	997
Ajla ALIŠAH	1654	Andreea - Raluca CHIRIAC	1944
Akide ÖZCAN	1107	Andrew GUPALO	1154
Alba GONZÁLEZ BENKOVICS	457	Andrijana BAUER-ŽIVKOVIĆ	2176
Albena STOYANOVA	1859	Angel SAROV	1445
Albert KOPALI	38	Angelina SUBOTIĆ	408
Albina TARJAN TOBOLKA	2158	Ankica MAKSIMOVIĆ	269
Aldin BOŠKAILO	1410, 1418	Anna GORCZYCA	946
Aleksandar ĐIKIĆ	402	Anna TRAKOVICKÁ	1797
Aleksandar ĐIKIĆ	1543	Annette REXROTH	881
Aleksandar DJIKIĆ	1539	Antanina STANKEVIČIENĖ	1491
Aleksandar LUČIĆ	2182	Ante GALIĆ	1181
Aleksandar MIKIĆ	290	Antoine KARANGWA	1280
Aleksandar PAUNOVIĆ	360	Antonela MUSA	1403
Aleksandar SIMIĆ	73, 419	Antonije ŽUNIĆ	997, 1001
Aleksandar STANOJKOVIĆ	991, 1776	Antonina RYPNEVSKAYA	984
Aleksandar VUKOVIĆ	402	Arafa GHRAB	1807
Aleksandr DIACHKOV	984	Arda SÖZCÜ	1818
Aleksandr ROMANOV	2154	Armands KVIESIS	1759
Aleksandra ANGEJELESKA	1766	Asllan CELAMI	38
Aleksandra DIMITRIJEVIĆ	290	Asmaa BENAYAD	927
Aleksandra GAVARIĆ	1212	Asmae BAGGAR	241
Aleksandra GOVEDARICA-LUČIĆ	53	Asta RACEVICIUTE-STUPELIENE	204
Aleksandra ŠARKOVIĆ	2062	Athanasios MAVROMATIS	1753
Aleksandra STANOJKOVIĆ SEBIĆ	1608	Atila Aytekin POLAT	484, 488
Aleksandra STANOJKOVIĆ-SEBIĆ	991, 1549	Audrius Sigitas MARUŠKA	916
Aleksejs ZACEPINS	1759	Aurelija RUDZIANSKAITĖ	1503
Alen KIŠ	2158	Aurelio REYES RAMÍREZ	1516
Alexandra D. SOLOMOU	2136	Aydın AKIN	474
Algirdas GAVENAUŠKAS	1329	Aydın IPEK	1818

Osman Kadir TOPUZ	1131	Roshan SHAALAN	853
Otilija SEDLAK	1962	Roxana CICEOI	971
Ouakoubo Gaston GNABRO	1893	Rumyana GEORGIEVA	103, 134
Özge KOYUTÜRK	596	Rūtenis JANČIUS	1329
Özlem ÖNAL AŞCI	508	Rutkay ATUN	583
Pašaga AVDIĆ	326	Rüveyda YÜZBAŞIOĞLU	1071
Paul OKULLO	725	Ş. Burak BÜKÜCÜ	1107
Paulina ŠARAVANJA	84	Saadet BUYUKALACA	522
Pavle SPASOJEVIĆ	1410, 1418	Saadet BÜYÜKALACA	564
Pébanagnan David SILUÉ	1893	Sabrija ČADRO	97
Penko ZUNEV	1736	Sadettin GURSOZ	769
Petar MITROVIĆ	290, 1216	Sahar BENNANI	940
Petar VUJICIC	1014	Şahinde ŞİLİ	2002
Peter ANITHA	602	Saida MOUJANE	927
Petya MALASHEVA	128	Salko MURATOVIĆ	1654
Philippe BURNY	1280	Salma SAMAHA	1486
Philippe LEBAILLY	1280	Samaneh YARI	607
Phokele MAPONYA	2189	Sameh RAMADAN	1746
Pierre-Alain JAYET	2015	Samet DUĞAN	787
Pierre-Guy MARNET	1807	Sami ABOU FAYSSAL	1172
Predrag IVANKOVIĆ	1679	Samuel K NJUKI	725
Predrag LUGONJA	390	Sandra CVEJIĆ	684
Predrag PERIŠIĆ	1782	Sandra MILETAKOVIC	1030, 1034
Qessaoui REDOUAN	933	Sandra VOČA	1181
Rade MILETIĆ	425	Sanel RIĐANOVIĆ	1410, 1418
Rade RADOJEVIĆ	402	Saniye KAYA	1071
Rade STANISAVLJEVIĆ	296	Sanja BRDAR	390
Radica ČORIĆ	84	Sanja ČEKIĆ	90
Radivoje JEVTIĆ	390	Sanja FABEK UHER	1181
Radmila CRCEVA-NIKOLOVSKA	1766	Sanja KOSTADINOVIĆ VELIČKOVSKA	216
Radmila ILIĆ	302	Sanja LAZIĆ	290, 997, 1001
Radmila PIVIĆ	991, 1549	Sanjin IVANOVIC	1975
Radmila STIKIC	69	Sara BENOUAKHIR	1621
Radojko LUKIC	1968	Sarah AJMANI	927
Radomir BODIROGA	1848	Sasa BARAC	1539
Radomir JOVANOVIĆ	1030, 1034	Saša BARAC	402
Radomir SAVIĆ	1776	Saša KALAMANDA	1289
Radosav CERović	1350	Sasa LALIC	843
Radoslava SPASIĆ	1167	Saud HAMIDOVIĆ	73
Radovan KASARDA	1797	Saulius ALIJOSIUS	204
Rafik ALOULOU	1807, 1812	Sebastian PRZEMIENIECKI	946, 952
ragana IGNJATOVIĆ-MICIĆ	333	Sebastian Wojciech PRZEMIENIECKI	965
Rahime KARATAŞ	596	Sedat ARSLAN	1567
Ramazan Ali KHAVARI-NEJAD	181	Selim AYTAÇ	587
Rami YAACOUB	1712, 1718	Şenay Burçin ALKAN	782, 1136
Ranko PRENKIĆ	227	Senka VIDOVIĆ	1212
Ranko ROMANIĆ	684	Serafeim PAPADOPOULOS	1753
Redhouane BENMEHAIA	1379	Serdar TÜRKER	795, 801
Remzi UGUR	522	Sergey GONCHAROV	264
Retjola TUSHE	1323	Sergey N. ANUCHIN	1373
Reyhan KARAYEL	537	Seval MUMINOVIĆ	65
Rikan HAMEED AL- BINDAWY	907	Sevgi PAYDAS KARGI	522
Rita SZABÓ	889	Sevgi PAYDAS KARGI	564
Roberto TOMASONE	187	Sevil SAĞLAM YILMAZ	591
Roger AL HANNA	1724, 1730	Sevim DEMİR	1585
Roland EDELBAUER	1394	Şeyma DOĞANCI	591
Roland EXLER	1398	Şeyma TOKSÖZ	1094, 1143
Romas GRUZAUSKAS	204	Sezai GÖKALP	596
Romina KABRANOVA	210	Şihli KÜÇÜKKOÇ	1232
Rosalina GRUMO	2021	Silviya IVANOVA	1736