



UNIVERZITET U
Kragujevcu
AGRONOMSKI FAKULTET U
ČAČKU



UNIVERSITY OF
Kragujevac
FACULTY OF
AGRONOMY
ČAČAK

1st INTERNATIONAL SYMPOSIUM ON BIOTECHNOLOGY

17–18 March 2023

Faculty of Agronomy in Čačak, University of Kragujevac, Serbia

- PROCEEDINGS -



1st INTERNATIONAL SYMPOSIUM ON BIOTECHNOLOGY
XXVIII Savetovanje o biotehnologiji sa međunarodnim učešćem

- PROCEEDINGS -

ORGANIZER AND PUBLISHER

University of Kragujevac, Serbia
Faculty of Agronomy in Čačak

Organizing Committee

Prof. Dr Pavle Mašković, Serbia, CHAIR; Dr Vesna Milovanović, Serbia SECRETARY;
MEMBERS: Dr Gorica Paunović, Serbia; Dr Vladimir Dosković, Serbia; Dr Nenad Pavlović, Serbia; Dr Marko Petković, Serbia; Dr Nemanja Miletić, Serbia; Dr Marija Gavrilović, Serbia; Dr Igor Đurović, Serbia; Dr Milevica Bojović, Serbia; Dušan Marković, BSc, Serbia.

International Programme Committee

Prof. Dr Vladimir Kurćubić, Serbia, CHAIR; Prof. Dr Tomo Milošević, Serbia; Prof. Dr Leka Mandić, Serbia; Prof. Dr Milun Petrović, Serbia; Dr Vesna Đorđević, Serbia; Prof. Dr Aleksandar Paunović, Serbia; Dr Čedomir Radović, Serbia; Prof. Dr Vladeta Stevović, Serbia; Prof. Dr Snežana Tanasković, Serbia; Prof. Dr Tomislav Trišović, Serbia; Prof. Dr Gordana Šekularac, Serbia; Dr Jelena Mašković, Serbia; Prof. Dr Andrej Bončina, Slovenia; Dr Kristina Kljak, Croatia; Prof. Dr Milomirka Madić, Serbia; Prof. Dr Snežana Bošković-Bogosavljević, Serbia; Prof. Dr Drago Milošević, Serbia; Prof. Dr Goran Dugalić, Serbia; Prof. Dr Milena Đurić, Serbia; Dr Ivan Glišić, Serbia; Prof. Dr Zvonko Antunović, Croatia; Prof. Dr Enisa Omanović-Mikličanin, B&H; Prof. Dr Ljiljana Bošković-Rakočević, Serbia; Prof. Dr Radojica Đoković, Serbia; Prof. Dr Biljana Veljković, Serbia; Prof. Dr Mlađan Garić, Serbia; Prof. Dr Sanja Radonjić, Montenegro; Dr Goran Marković, Serbia; Prof. Dr Željko Vaško, B&H; Dr Jelena Mladenović, Serbia; Prof. Dr Branko Čupina, Serbia; Dr Milan Nikolić, Serbia; Prof. Dr Vladan Bogdanović, Serbia; Dr Dragan Vujić, Serbia; Dr Marijana Pešaković, Serbia; Dr Simeon Rakonjac, Serbia; Dr Mirjana Radovanović, Serbia; Dr Dalibor Tomić, Serbia; Vera Vukosavljević, MSc, Serbia; Dr Vesna Đurović, Serbia; Dr Adrijana Filipović, B&H; Prof. Dr Ivana Janeska-Stamenkoska, North Macedonia; Dragan Đurović, MSc, Serbia; Radmila Ilić, BSc, Serbia; Miloš Marjanović, MSc, Serbia; Jelena Pantović, BSc, Serbia.

Technical editors

Prof. Dr Pavle Mašković; Dr Vesna Milovanović; Dušan Marković, BSc

Print-run: 100

Printed by

Copy Xerox, Cara Dušana 11, 32000 Čačak

ISBN 978-86-87611-88-7

Year of publication: 2023

© Faculty of Agronomy in Čačak 2023

PREFACE

“The scientific man does not aim at an immediate result. He does not expect that his advanced ideas will be readily taken up. His work is like that of the planter - for the future. His duty is to lay the foundation for those who are to come, and point the way.”

Nikola Tesla

Agriculture is a primary and strategic activity that ensures food security and food market stability, and protects living standards for people. We have witnessed that, in crisis situations in the world, agriculture has responded to its task as the main support in supplying the market with food products. The production of sufficient quantities of safe food enables the development of the working-age population that actively participates in the economic development of society. The specific conditions in which agriculture develops require economic support measures and subsidies from the state to preserve domestic agriculture. Planned investments in agriculture through the introduction of modern technologies and efficient organization in both production and trade reduce economic and market risks, thus enabling stable business conditions. The development of agriculture must be based on a multifunctional connection with other activities (food industry, trade, tourism, etc.)

Agricultural science and agriculture as a profession monitor and study changes occurring in this area, point out problems in agricultural practice, and find solutions. The Faculty of Agronomy in Čačak, in addition to educating students, traditionally organizes the Symposium on Biotechnology every year. This year marks the 28th anniversary of the Symposium. The main goal of the Symposium is to acquaint the wider scientific and professional public with the results of the latest scientific research, and bring together domestic and foreign scientists in the fields of primary agricultural production, food processing, and environmental protection.

At the 1st International Symposium on Biotechnology, a total of 71 papers were presented in the fields of Field, Vegetable and Forage Crops, Pomology and Viticulture, Livestock Production, Plant Protection, Food Safety and the Environment, Food Technology and Applied Chemistry.

We owe great gratitude to the **Ministry of Science, Technological Development and Innovation of the Republic of Serbia** and the **City of Čačak** for their financial support and patronage to this Symposium, which they provide every year. We thank companies, entrepreneurs, stakeholders and all

long-time friends of the Faculty of Agriculture for their material and organizational support.

Doing agriculture, in addition to economy and business, is also a noble social activity, considering that it satisfies people's basic daily needs of food. Agricultural producers deserve reputation and respect in society and should be enabled to make a decent living from their work, and society should recognize this.

In Čačak, March 2023

Programme and Organizing Committee
1st INTERNATIONAL SYMPOSIUM
ON BIOTECHNOLOGY
(28th SYMPOSIUM ON BIOTECHNOLOGY
with international participation)

CONTENTS

Section: Field, Vegetable and Forage Crops

<i>Jasmin Šutković, Anissa Van Wieren, Ahmet Yildirim: MAPK₂ AND NRAMP₆ EXPRESSION ANALYSIS UNDER CD STRESS IN DOMESTIC KALE VARIETIES FROM BIH.....</i>	15
<i>Vojin Đukić, Jegor Miladinović, Gordana Dozet, Marija Bajagić, Gorica Cvijanović, Zlatica Mamlić, Vojin Cvijanović: THE INFLUENCE OF THE TIME OF BASIC TILLAGE AND FERTILIZATION ON SOYBEAN YIELD.....</i>	23
<i>Mihajlo Marković, Nataša Čereković, Đurađ Hajder, Milan Šipka, Nery Zapata, Teresa A. Paço, Erminio E. Riezzo, Sabrija Čadro, Mladen Todorović: PROMOTING SMART AGRICULTURAL PRACTICES IN MAIZE PRODUCTION IN BIH - H2020 SMARTWATER PROJECT.....</i>	31
<i>Jordan Marković, Đorđe Lazarević, Vladimir Zornić: CONTENT OF POLYPHENOL COMPOUNDS IN THE DRY MATTER OF ITALIAN RYEGRASS.....</i>	39
<i>Kamenko Bratković, Kristina Luković, Vladimir Perišić, Jelena Maksimović, Jasna Savić, Vera Dekić, Mirela Matković Stojšin: ANALYSIS OF GENOTYPE BY ENVIRONMENT INTERACTION FOR SPIKE TRAITS IN WINTER SIX-ROW BARLEY.....</i>	45
<i>Violeta Mickovski Stefanović, Dragana Stanisaavljević, Jasmina Bačić, Predrag Brković, Miloš Pavlović, Mirela Matković- Stojšin: INFLUENCE OF HEAVY METALS ON WHEAT STEM DEVELOPMENT.....</i>	55
<i>Violeta Mickovski Stefanović, Predrag Brković, Svetlana Roljević Nikolić, Helena Majstorović, Dragana Stanisaavljević, Predrag Ilić: THE INFLUENCE OF HEAVY METALS ON THE DEVELOPMENT OF THE SURFACE OF WHEAT LEAVES.....</i>	63
<i>Marija Gavrilović, Miloš Zelić, Biljana Veljković, Ranko Koprivica, Branislav Dudić, Nenad Pavlović: EQUIPMENT AND USAGE OF TRACTORS IN THE AGRICULTURAL COOPERATIVE “AGROPROM”.....</i>	71
<i>Danijela Žunić, Vladimir Sabadoš: INVESTIGATION OF ZINC CONTENT IN AGRICULTURAL LAND IN THE AREA OF THE CITY OF SOMBOR.....</i>	77
<i>Silvana Pashovska, Katerina Kareska: ANALYSIS OF THE MEANING AND IMPACT OF SUBSIDIES ON THE DEVELOPMENT OF TOBACCO PRODUCTION IN MACEDONIA.....</i>	83
<i>Dušan Marković, Uroš Pešović, Dalibor Tomić, Vladeta Stevović: CROP WEEDS DETECTION USING NEURAL NETWORK MODELS.....</i>	93
<i>Vladimir Zornić, Mirjana Petrović, Snežana Babić, Đorđe Lazarević, Vesna Đurović, Dejan Sokolović, Dalibor Tomić: NPK FERTILIZER ADDITION EFFECT ON NARDUS STRICTA TYPE GRASSLAND IN KOPAONIK MOUNTINE.....</i>	99

Dalibor Tomić, Vladeta Stevović, Milomirka Madić, Miloš Marjanović, Nenad Pavlović, Dorđe Lazarević, Mirjana Petrović, Vladimir Zornić, Jasmina Knežević: THE ROLE OF COBALT IN FORAGE LEGUMES..... 105

Milomirka Madić, Dalibor Tomić, Aleksandar Paunović, Vladeta Stevović, Milan Biberdžić, Dragan Đurović, Miloš Marjanović: GRAIN YIELD OF MAIZE HYBRIDS IN DIFFERENT LOCATIONS IN CENTRAL SERBIA..... 115

Section: Pomology and Viticulture

Ivan Glišić, Radmila Ilić, Tomo Milošević, Gorica Paunović, Ivana Glišić, Zorica Radičević: FLOWERING PHENOPHASE OF SOME APRICOT (*P. armeniaca* L.) CULTIVARS DEPENDING ON AIR TEMPERATURE..... 125

Nebojša Milošević, Ivana Glišić, Milena Đorđević, Slađana Marić, Sanja Radičević, Darko Jevremović: 'DIVNA' AND 'PETRA' NEW LATE RIPENING PLUM CULTIVARS RELEASED AT FRUIT RESEARCH INSTITUTE, ČAČAK..... 133

Ivana Jasnić, Slađana Janković, Dragan Janković, Dragan Milatović, Dragan Grčak, Milosav Grčak: POMOLOGICAL PROPERTIES OF SELECTED WALNUT GENOTYPES FROM THE NATURAL POPULATION..... 143

Mlađan Garić, Ivana Radojević, Dragan Nikolić, Vera Rakonjac, Aleksandar Petrović, Zorica Ranković-Vasić: PRODUCTION AND TECHNOLOGICAL CHARACTERISTICS OF PROSPECTIVE VINE HYBRIDS IN THE NIS WINE-GROWING REGION..... 149

Jelena Tomić, Boris Rilak, Marijana Pešaković, Žaklina Karaklajić Stajić, Svetlana M. Paunović: COMPARATIVE STUDY OF PRODUCTIVITY AND FRUIT QUALITY OF STRAWBERRY CULTIVAR 'SENGA SENGANA' GROWN IN THE OPEN FIELD AND PLASTIC-GREENHOUSE..... 157

Tatjana Jovanović-Cvetković, Aleksandar Savić, Danijela Starčević, Boris Pašalić: INFLUENCE OF MACERATION CONDITIONS ON THE ANTIOXIDATIVE PROPERTIES OF VRANAC AND MERLOT RED WINES..... 167

Section: Livestock Production

Nebojša Novković, Veljko Šarac, Nataša Vukelić, Dragana Tekić, Beba Mutavdžić: THE INFLUENCE OF CORN PRICE IN THE CURRENT YEAR ON THE PIGS NUMBER AND FATTENING PRICE OF THE FOLLOWING YEAR..... 175

Vladimir Kurćubić, Slaviša Stajić, Nemanja Miletić, Marko Petković: INSIGHTFUL APPLICATION OF HERBAL EXTRACTS IN THE PREVENTION AND TREATMENT OF ANIMAL DISEASES AND IMPROVEMENT OF MEAT QUALITY AND SAFETY..... 181

Simeon Rakonjac, Snežana Bogosavljević-Bošković, Vladimir Dosković, Miloš Lukić, Zdenka Škrbić, Veselin Petričević, Milun D. Petrović: THE EFFECT OF THE REARING SYSTEM AND GENOTYPE OF LAYING HENS ON FATTY ACID COMPOSITION OF EGGS 189

<i>Blagoje Stojković, Bojan Stojanović, Nenad Đorđević, Vesna Davidović: EFFECT OF ELEVATED HEAT AND HUMIDITY ON CHEWING ACTIVITY, YIELD AND CHEMICAL COMPOSITION OF MILK IN LACTATING COWS.....</i>	195
<i>Blagoje Stojković, Nenad Đorđević, Aleksa Božičković, Saša Obradović: THE INFLUENCE OF INOCULATION ON THE CHANGE OF NITROGEN SUBSTANCES IN SILAGE.....</i>	205
<i>Biljana Veljković, Milica Kostić, Simeon Rakonjac, Ranko Koprivica, Marija Gavrilović, Milun Petrović: ECONOMIC RESULTS OF BROILERS PRODUCTION ON THE FAMILY FARM.....</i>	213
<i>Vladimir Dosković, Snežana Bogosavljević-Bošković, Zdenka Škrbić, Božidar Milošević, Miloš Lukić, Simeon Rakonjac, Veselin Petričević: EFFECT OF PROTEASE ADDED IN FOOD AND SEX ON CHICKEN MEAT CLASSES.....</i>	223
<i>Radojica Đoković, Biljana Anđelić, Marko Cincović, Miloš Ži. Petrović, Aleksandar Čukić, Miroslav Lalović: RELATIONSHIPS BETWEEN SERUM ENZYME ACTIVITIES IN THE MILK AND BLOOD IN DAIRY COWS DURING DIFFERENT STAGE OF LACTATION PERIOD.....</i>	231

Section: Plant Protection, Food Safety and the Environment

<i>Milica Vranešević, Atila Beždan, Boško Blagojević, Radovan Savić, Radoš Zemunac, Gordana Šekularac, Miroslav Aksić: ASSESSMENT OF GROUNDWATER QUALITY FOR IRRIGATION IN NORTHERN VOJVODINA.....</i>	241
<i>Ljubica Šarčević-Todosijević, Kristina Vojvodić, Bojana Petrović, Vera Popović, Vladimir Filipović, Ljubiša Živanović, Jelena Golijan, Marko Burić: CULTIVATION, IMPORTANCE AND POSSIBILITIES OF APPLICATION OF MEDICINAL PLANTS IN MEDICINE.....</i>	249
<i>Goran Petrović, Violeta Mitić, Jelena Nikolić, Milan Mitić, Marija Dimitrijević, Aleksandra Đorđević, Vesna Stankov Jovanović: APPLICATION OF SEQUENTIAL EXTRACTION TO DETERMINE THE COMPOSITION OF ZEOLITE FOR ITS SAFE USE IN AGRICULTURE.....</i>	259
<i>Goran Petrović, Aleksandra Đorđević, Jelena Stamenković, Violeta Mitić, Jelena Nikolić, Milan Mitić, Vesna Stankov Jovanović: INCLUSION COMPLEXES OF PESTICIDES IN HYDROXYPROPYL-β-CYCLODEXTRINE. EFFECTS ON THEIR WATER SOLUBILITY.....</i>	265
<i>Valentina Nikolić, Marijana Simić, Slađana Žilić, Danka Milovanović, Beka Sarić, Marko Vasić: NOVEL TRENDS IN APPLICATION AND PRETREATMENT OF LIGNOCELLULOSIC AGRICULTURAL WASTE.....</i>	271
<i>Nataša Kojadinović, Milena Radenković, Simona Đuretanić, Aleksandra Milošković, Marija Jakovljević, Tijana Veličković, Vladica Simić: LENGTH-WEIGHT RELATIONSHIP OF NINE FISH SPECIES FROM GRUŽA RESERVOIR, SERBIA.</i>	277

<i>Darko Jevremović, Bojana Vasilijević, Tatjana Anđelić, Tatjana Vujović: APPLICATION OF QPCR FOR PLUM POX VIRUS DETECTION DURING CRYOTHERAPY.....</i>	283
<i>Vladanka Stupar, Markola Saulić, Milica Blažić, Zlata Živković, Darko Stojićević, Marko Stokić, Bojan Stević: STATE OF SOIL FERTILITY IN THE AREA OF THE POŽAREVAC CITY.....</i>	289
<i>Dragutin Đukić, Leka Mandić, Vesna Đurović, Marijana Pešaković, Monika Stojanova: BIOINDICATION ASSESSMENT OF WATER, AIR AND SOIL QUALITY.....</i>	297
<i>Gorica Djelic, Milica Pavlovic, Snezana Brankovic, Dusko Brkovic, Zoran Simic, Vesna Velickovic: CONTRIBUTION TO THE KNOWLEDGE OF THE ANTIOXIDANT POWER, PHENOLIC AND MINERAL COMPOSITION OF SANGUISORBA MINOR SCOP.</i>	305
<i>Vesna Đurović, Leka Mandić, Marija Igrošanac, Mirjana Radovanović, Marijana Pešaković, Jelena Mladenović, Dragutin Đukić: CELERY (APIUM GRAVEOLENS L.) AS A SOURCE OF PHYTOCHEMICALS WITH ANTIOXIDANT AND ANTIBACTERIAL EFFECTS.....</i>	315
<i>Slobodanka Stanojević-Nikolić, Milan P. Nikolić, Marina Šćiban, Vladimir V. Srdić, Vladimir B. Pavlović: KINETIC AND EQUILIBRIUM STUDIES OF BIOSORPTION OF Cd(II) IONS USING SILICA-ALGINATE-YEAST COMPOSITES.....</i>	323

Section: Food Technology

<i>Nikola Stanišić, Nevena Maksimović, Bogdan Cekić, Dragana Ružić-Muslić, Ivan Ćosić, Nemanja Lečić, Maja Petričević: MEAT COLOUR DIFFERENCES BETWEEN ALPINE, BALKAN AND SERBIAN WHITE GOAT BREEDS SLAUGHTERED AT 18 KG OF BODY WEIGHT.....</i>	331
<i>Radoslava Savić Radovanović, Slobodanka Jančićević, Jelena Aleksić Radojković: MICROBIOLOGICAL ASSESSMENT OF ICE CREAM SOLD AT THE TERRITORY OF BELGRADE.....</i>	341
<i>Slaviša Stajić, Vladimir Kurćubić, Vladimir Tomović, Dušan Živković: INSTRUMENTAL COLOUR AND TEXTURE PROPERTIES OF FRANKFURTER-TYPE SAUSAGES WITH PLANT OILS.....</i>	349
<i>Vladimir Kurćubić, Slaviša Stajić, Nemanja Miletić, Marko Petković, Igor Đurović, Vesna Milovanović: NATURAL ANTIMICROBIAL AGENTS: APPLICATION IN FOOD PRESERVATION AND FOOD BORN DISEASE CONTROL.....</i>	357
<i>Alexander D. Lukyanov, Svetlana G. Studennikova, Luidmila N. Alekseenko, David E. Bidenko, Vladimir Mladenović, Marko Petković, Ekaterina A. Mardasova: MICROCONTROLLER CONTROL SYSTEM FOR A CONVECTIVE DEHYDRATOR.....</i>	365
<i>Darko Manjenčić, Vladan Mičić, Anja Manjenčić: SYNTHESIS AND CHARACTERIZATION OF CROSSLINKED SILICONE NANOCOMPOSITES AND THEIR POTENTIAL APPLICATION IN FOOD INDUSTRY.....</i>	375

<i>Dobriła Randelović, Svetlana Bogdanović, Ivana Zlatković: NUTRITIONAL VALUE AND MICROBIOLOGICAL QUALITY OF VARIOUS TYPES OF BREAD.....</i>	381
<i>Senita Isaković, Enver Karahmet, Saud Hamidović, Jasmina Tahmaz, Ajla Smajlović: EFFECT OF PACKAGING ON HEALTH SAFETY OF SAUSAGE.....</i>	387
<i>Danka Milovanović, Valentina Nikolić, Slađana Žilić, Marijana Simić, Beka Sarić, Snežana M. Jovanović, Marko Vasić: THE INFLUENCE OF MICRONIZATION OF CEREALS AND LEGUMES ON FEED CONVERSION, DIGESTIBILITY, AND DAILY GAIN OF WEANED PIGLETS.....</i>	399
<i>Aleksandar Petrović, Ivana Plavšić-Janjatović, Nikolina Lisov, Maria Čebela, Uroš Čakar, Ivan Stanković, Brižita Đorđević: ANTIOXIDANT PROPERTIES AND BIOLOGICAL ACTIVITY OF FRUIT WINES.....</i>	405
<i>Dragana Stanisavljević, Jovana Mihajlović, Ivan Nešović, Milica Stojanović, Dušica Ćirković, Violeta Mickovski Stefanović, Predrag Ilić, Dobriła Randjelović, Dragan Veličković, Zvonko Zlatanović: PLUM AS A RAW MATERIAL AND ITS INFLUENCE ON THE QUALITY OF BRANDY.....</i>	413
<i>Dragana Stanisavljević, Aleksa Crkvenjakov, Jelica Lazić Saković, Nebojša Milosavljević, Svetlana Bogdanović, Violeta Mickovski Stefanović, Predrag Ilić, Jovan Ćirić, Dejan Davidović, Aleksandar Veličković: WATER COMPOSITION AND THEIR INFLUENCE ON THE WORK OF MALT AMYLOLYTIC ENZYMES.....</i>	421
<i>Aleksandra Stojićević, Biljana Rabrenović, Mališa Antić: NUTRITIONAL VALUE OF COLD-PRESSED SUNFLOWER OIL.....</i>	429
<i>Jasmina Tahmaz, Amra Sejić, Enver Karahmet, Sabina Operta, Senita Isaković: SENSORY PROPERTIES OF HOMEMADE AND INDUSTRIAL MAYONNAISE.....</i>	439
<i>Valerija Pantelić, Nemanja Miletić, Vesna Milovanović, Igor Đurović, Marko Petković: THE ANTIOXIDANT POTENTIAL OF CONVECTIVE AND MICROWAVE-DRIED RASPBERRIES.....</i>	445
<i>Valerija Pantelić, Nemanja Miletić, Vesna Milovanović, Igor Đurović, Marko Petković, Alexander Lukyanov, Vladimir Filipović: ENERGY USAGE AND RASPBERRY CONVECTIVE AND MICROWAVE DRYING PARAMETERS.....</i>	451
<i>Tomislav Trišović, Branimir Grgur, Svetomir Milojević, Zaga Trišović: MOBILE DEVICE FOR CHEMICAL CLEANING OF HEAT EXCHANGERS.....</i>	457
<i>Tomislav Trišović, Branimir Grgur, Zaga Trišović: MOBILE DEVICE FOR WATER PURIFICATION WITH BOILER.....</i>	465

Section: Applied Chemistry

<i>Nevena Matić, Nevena Barać, Danka Mitrović, Ivana Sredović Ignjatović, Miroљjub Barać: PHENOLIC CONTENT AND IN VITRO ANTIOXIDANT ACTIVITY OF BLACK MULBERRY (<i>Morus Nigra</i> L.) FRUIT, JUICE AND POMACE.....</i>	473
---	-----

<i>Vojkan Miljković, Marko Mladenović, Niko Radulović</i> : BOVOLID – CHEMICAL COMPOUND FOR EVALUATING THE AGE OF WHITE MULBERRY LEAVES..	479
<i>Vojkan Miljković, Ivana Gajić, Jelena Mrmošanin, Milica Nešić</i> : THE DIFFERENCE IN LYCOPENE AND β -CAROTENE CONTENT IN <i>CITRUS PARADISI</i> FRUIT AND <i>ROSA CANINA</i> DRIED FRUIT.....	485
<i>Milan Mitić, Jelena Mitić, Jelena Nikolić, Pavle Mašković</i> : CLASSIFICATION OF FRUIT TREE LEAVES ACORDING TO PHENOLIC PROFILE USING PRINCIPAL COMPONENT ANALYSIS.....	491
<i>Petar Stanić, Darko Ašanin, Marijana Vasić, Tanja Soldatović, Biljana Šmit</i> : KINETICS OF THE REACTION OF AN ARYLIDENE 2-THIOHYDANTOIN DERIVATIVE WITH SOME Pd(II) COMPLEXES.....	497
<i>Jelena Mašković, Gorica Paunović, Pavle Mašković, Ivana Kaplarević</i> : CHEMICAL ANALYSIS OF DIFERENT BRANDS OF ORANGE JUICE IN SERBIAN MARKET.....	503
<i>Jelena Mladenović, Đorđe Jovanović, Nenad Pavlović, Milena Đurić, Ljiljana Bošković-Rakočević, Jasmina Zdračković</i> : CHEMICAL COMPOSITION OF LEMON GRASS EXTRACTS.....	509
<i>Vesna Milovanović, Miloš Petrović, Vladimir Kurćubić, Marko Petković, Nemanja Miletić, Igor Đurović</i> : COMPARISON OF COW'S MILK WITH PLANT-BASED MILK ALTERNATIVES: SELECTED CHEMICAL AND PHYSICAL ANALYSIS.....	517
<i>Aleksandar Petrovic, Nikolina Lisov, Ivana Plaovic-Janjatovic, Ivana Sredovic-Ignjatovic, Danka Mitrovic</i> : THE INFLUENCE OF THE ENOLOGICAL TANNINS APPLICATION ON THE PHENOLIC COMPOSITION OF WINE.....	523
<i>Denis Mitov, Stefan Petrović, Aleksandar Ranđelović, Jelena Mrmošanin, Aleksandra Pavlović, Snežana Tošić</i> : UPTAKE OF HEAVY METALS BY ALFALFA (<i>Medicago sativa</i> L.): POT EXPERIMENT.....	533
<i>Denis Mitov, Stefan Petrović, Nikola Đorđević, Jelena Mrmošanin, Aleksandra Pavlović, Snežana Tošić</i> : UPTAKE OF HEAVY METALS BY WHEAT (<i>Triticum aestivum</i> L.): POT EXPERIMENT.....	539
<i>Alexander D. Lukyanov, Danila Y. Donskoy, Vladimir Filipović, Tamara B. Asten</i> : A MATHEMATICAL MODEL FOR CONTROLLING THE ACIDITY OF A SOLUTION IN A BIOREACTOR OF THE ARTIFICIAL GIT OF POULTRY.....	545
<i>Alexandr D. Lukyanov, Danila Y. Donskoy, Miroslav A. Vernezi, Maria S. Mazanko, Tatiana S. Onoyko</i> : MICROBIOLOGICAL COMPLEX FOR MODELING PROCESSES IN THE GASTROINTESTINAL TRACT OF ANIMALS.....	551

THE INFLUENCE OF THE TIME OF BASIC TILLAGE AND FERTILIZATION ON SOYBEAN YIELD

Vojin Đukić¹, Jegor Miladinović¹, Gordana Dozet², Marija Bajagić³, Gorica Cvijanović⁴, Zlatica Mamlić¹, Vojin Cvijanović⁵

Abstract: The time of basic tillage and fertilization are very important agrotechnical measures that have a high impact on soybean yield. Winter basic tillage of the soil reduces the harvest yield by 8.53%, and spring tillage by 21.18%, the application of NPK fertilizers increased the yield by 13.96%, the foliar application of water extract from plant material by 9.57% and the application of AN by 8.44%. Autumn basic tillage is most conducive to achieving high and stable soybean yields, and fertilization has a positive effect on soybean yields.

Keywords: basic tillage, soybean fertilization, NPK fertilizer, water extract of plant material, AN.

Introduction

To achieve high and stable soybean yields, it is necessary to apply all agrotechnical measures correctly and in a timely manner (Đukić i sar., 2018), but we must bear in mind that the most important agronomic and chemical properties of each variety are strongly influenced by external environmental factors and are subject to changes in depending on climate and soil conditions (Miladinović i sar., 2013). Basic tillage and pre-sowing preparation of the soil are very important agrotechnical measures that participate with about 20% in the total amount of yield achieved (Khurshid i sar., 2006) and affect the sustainable use of the soil through the influence on its properties (Lal, 2013). Spring basic tillage affects yield reduction and deterioration of soil quality, while autumn basic tillage reduces soil compaction due to more favorable soil moisture for tillage and more favorable temperature conditions (Al Kaisi i Hanna, 2010). In an unfavorable year for soybean production, when low

¹Field and Vegetable Crops Institute, Maksima Gorkog 30, 21000 Novi Sad, Serbia (vojin.djukic@ifvcns.ns.ac.rs)

²Megatrend University, Faculty of Biofarming, M. Tita 39, Bačka Topola, Serbia

³University Bijeljina, Faculty of Agruculture, Pavlovića put bb, Bijeljina, Bosna and Hercegovina

⁴University of Kragujevac, Institute for information Technologies, Jovana Cvijića bb, Kragujevac, Serbia

⁵Institute for Science Application in Agriculture, Bulevar Despota Stefana 68b, Beograd, Serbia

average yields are achieved, spring basic tillage has a very large impact on the reduction of soybean yields, while in favorable years, without a marked lack of precipitation, spring basic tillage has a small impact on reducing soybean yields (Adee, 2018) In the case of spring tillage compared to autumn basic tillage, the yield of soybeans in a favorable year for soybean production was reduced by 7.41%, while in a dry, unfavorable year, the yield was reduced by 36.41% (Dozet i sar., 2018). Autumn basic processing is a prerequisite for achieving high yields of soybeans, and delays in the implementation of this agrotechnical measure statistically significantly reduce the yield, especially in unfavorable years with a pronounced dry period (Bajagić i sar., 2022).

Aqueous extracts of plant material are increasingly used in plant production, floriculture, vegetable growing, but also in agriculture, both in organic and conventional production (Đukić i sar., 2021). Foliar fertilizers contain elements that are easily absorbed by plants, and their effectiveness depends on the amount of nutrients in the soil, the plants' need for certain elements, the condition of the crops and the time of application (Miladinov i sar., 2018; Cvijanović i sar., 2022).

Fertilizing soybeans with different fertilizers continuously represents a research challenge (Miladinov et al., 2018). For the correct fertilization of soybean crops, we must know the characteristics and agrochemical properties of the soil, the plants' nutrient requirements, climatic conditions, crop rotation, application of manure and mineral fertilizers, plowing of the harvest residues of the pre-crops, the intensity of production on the plot in previous years, the yield of the pre-crops and the expected yield of soybeans (Mamlić i sar., 2021). Aqueous extracts of plant material, in addition to macro and microelements, also possess physiologically active substances that stimulate the growth and development of plants, often have fungicidal and insecticidal effects, are easily prepared on the farm, do not require large investments and are suitable for organic production since there is no negative effect on the environment (Mamlić i sar., 2022). Nettle is suitable for making extracts because it has fungicidal and insecticidal effects, and when fermented it becomes a significant source of nutrients for plant nutrition through feeding (Dozet i sar., 2019), it also contains growth stimulators (Di Virgilio 2013), and the banana fruit is rich in potassium, phosphorus, calcium, manganese, magnesium, selenium, contains vitamins C and B and vitamin A.

The aim of these researches is to assess the influence of the time of basic tillage and the influence of fertilization on soybean yield.

Materials and methods

A two-year experiment on the influence of the time of basic tillage and fertilization on soybean yield was conducted in 2020 and 2021 on a private plot in the vicinity of Bač, Bačka region, Vojvodina. In the experiment, there were three variants of the basic processing time: autumn in October, winter in January and spring in March. The four subvariants with fertilization were: the control variant without fertilization, the application of NPK fertilizer formulation 8:15:15 in the amount of 300 kg ha^{-1} , the application of AN in the amount of 150 kg ha^{-1} and the variant with the application of a diluted aqueous extract of nettle, comfrey and banana fruit, in the amount of 450 liter ha^{-1} . NPK fertilizer was applied immediately before the basic tillage, and nitrogen fertilizer AN with pre-sowing soil preparation. The aqueous extract was prepared by chopping the above-ground part of nettle (250 g), the above-ground part of comfrey (250 g) and banana fruits (500 g) and 10 l of water was added to the plant material. The container for the fermentation of plant material was placed in the shade and mixing of the plant material in the container was done every day. After 20 days, at the end of fermentation, the aqueous extract was filtered through cheesecloth, and during foliar application, the aqueous extract was diluted in a ratio of 1:15. Foliar application of the aqueous extract was carried out in the vegetative phase, before the flowering of soybean plants. The experiment was set up in 4 repetitions and the mid-late variety Rubin from the II ripening group was used. During the growing season, the standard technology for growing soybeans was applied, and in the stage of technological maturity, harvesting, measurement of samples and grain moisture, and yield calculation with 14% moisture were performed. The results were processed statistically in the "Statistica 10" program, and the significance of the results was tested using the LSD test. The results are tabulated.

Results and discussion

The influence of the time of basic tillage and fertilization on soybean yield is shown in table 1.

Looking at the years of research, it can be seen that the average yield in 2020 (2853 kg ha^{-1}) is statistically significantly higher than the yield achieved in 2021 (2485 kg ha^{-1}).

Observing the average yields according to the time of basic tillage, it can be noted that the highest yield was achieved in the autumn basic tillage (2955 kg ha^{-1}), which is statistically very significantly higher than the winter basic

tillage (2725 kg ha^{-1}) and the spring basic tillage (2329 kg ha^{-1}). Statistically very significant differences in yield were also between winter and spring basic tillage.

According to the fertilization variants, it can be observed that the highest soybean yield was achieved with the application of NPK fertilizer (2809 kg ha^{-1}), which is statistically very significantly higher than the other fertilization variants (control 2495 kg ha^{-1} , foliar application of water extract from plant material 2701 kg ha^{-1} and application of nitrogen fertilizer AN 2673 kg ha^{-1}). A statistically very significantly higher value for soybean yield was achieved in the variants with the application of aqueous extract from plant material and in the application of nitrogen fertilizer AN compared to the control variant of the experiment.

Table 1. The influence of the time of basic tillage and fertilization on soybean yield (kg ha^{-1})

Year (A)	Time of basic tillage (B)	Fertilization (C)				Average AxB	Average A
		Control	NPK	AN	Foliar		
2020	Autumn	2867	3280	3204	3196	3137	2853
	Winter	2643	3014	2905	2907	2867	
	Spring	2408	2646	2591	2574	2555	
	Average AxC	2640	2980	2900	2892		
2021	Autumn	2605	2935	2767	2783	2772	2471
	Winter	2352	2711	2448	2641	2538	
	Spring	1914	2267	2122	2106	2102	
	Average AxC	2291	2638	2446	2510		
Average BxC	Autumn	2736	3107	2985	2989	Average B	2955
	Winter	2498	2862	2676	2774		2703
	Spring	2161	2457	2356	2340		2329
	Average C	2465	2809	2673	2701	-	-
Average 2020-2021							2662

LSD	A	B	C	AxB	AxC	BxC	AxBxC
1%	110,5	57,8	68,8	89,3	106,5	122,0	175,0
5%	48,2	33,0	41,6	50,7	63,8	73,8	105,9

Observing the same year and different time of basic tillage, it can be seen that in 2020 the highest yield was achieved on the trial variants with autumn basic tillage (3137 kg ha^{-1}), which is statistically very significantly higher value compared to winter basic tillage (2867 kg ha^{-1}) and spring basic tillage (2555

kg ha^{-1}). Statistically very significant differences also existed between the values recorded on the variants with winter basic tillage and spring basic tillage. In 2021, the highest yield was achieved on the trial variants with autumn basic tillage (2772 kg ha^{-1}), which is statistically very significantly higher value compared to winter basic tillage (2583 kg ha^{-1}) and spring basic tillage (2102 kg ha^{-1}). Statistically very significant differences also existed between the values recorded on the variants with winter basic tillage and spring basic tillage.

Looking at the same year and different fertilizing variants, it is noted that the highest yield of soybeans in 2020 was achieved on the variant with the application of NPK fertilizer (2980 kg ha^{-1}), which is in addition to the yields on the variants with the application of nitrogen fertilizer AN (2900 kg ha^{-1}) and foliar application of water extract (2892 kg ha^{-1}) statistically very significantly higher value compared to the control variant (2640 kg ha^{-1}). With the application of NPK fertilizer, the yield of soybeans was statistically significantly higher compared to the application of nitrogen fertilizer AN and the application of water extract from plant material. In 2021, the yields of soybeans on variants with the application of NPK fertilizer (2638 kg ha^{-1}) and water extract from plant material (2510 kg ha^{-1}) were statistically very significantly higher compared to the control variant of the experiment (2350 kg ha^{-1}), while with the application of nitrogen fertilizer AN yields are statistically significantly higher (2446 kg ha^{-1}). A statistically very significantly higher yield was also achieved on the variant with the application of NPK fertilizer compared to the variants with the application of aqueous extract from plant material and nitrogen fertilizer AN, and statistically significantly higher yield was also obtained with the application of aqueous extract from plant material compared to the application of nitrogen fertilizers AN.

Observing the same time of the basic tillage of the soil and different variants of fertilization, it is observed that in the autumn basic tillage the highest yield was recorded with the application of NPK fertilizer (3107 kg ha^{-1}), which is statistically very significantly higher yield compared to the control variant of the experiment (2736 kg ha^{-1}) and the application of nitrogen fertilizer AN (2985 kg ha^{-1}) and a statistically significantly higher yield compared to the application of aqueous extract from plant material (2989 kg ha^{-1}). Compared to the control variant of the experiment, a statistically very significantly higher yield was also achieved on the variants with the application of aqueous extract from plant material and nitrogen fertilizer AN. In the winter basic tillage, the lowest yield of soybeans was achieved in the control variant of the trial (2587 kg ha^{-1}), which is a statistically very significantly lower value compared to the application of

NPK fertilizers (2862 kg ha^{-1}), water extract from plant material (2774 kg ha^{-1}) and nitrogen fertilizer AN (2676 kg ha^{-1}). A statistically very significantly higher yield was achieved with the application of NPK fertilizer compared to the application of AN nitrogen fertilizer and a statistically significantly higher yield compared to the application of aqueous extract from plant material. In the spring basic tillage with the application of NPK fertilizer (2457 kg ha^{-1}), a statistically very significantly higher soybean yield was achieved compared to the control variant of the experiment (2161 kg ha^{-1}) and a statistically significantly higher yield compared to the application of AN nitrogen fertilizer (2356 kg ha^{-1}) and water extract from plant material (2340 kg ha^{-1}). A statistically very significantly higher yield was also recorded on the variants with the application of nitrogen fertilizer AN and water extract from plant material compared to the control variant of the experiment.

Conclusion

Based on the analysis of the two-year results of the influence of the time of basic tillage and fertilization on soybean yield, it can be concluded:

The highest yield of soybeans is achieved during the autumn basic tillage of the soil, and during the later basic tillage, the yields of soybeans decrease very significantly.

The application of NPK fertilizer achieves the highest soybean yield, while the foliar application of aqueous extract from plant material and nitrogen fertilizer AN contributes to a significant increase in soybean yield.

Acknowledgement

The research presented in this article is part of... (project title and project number) financially supported by.... (source of funding).

References

- Adee, E. A. (2018). Tillage Study for Corn and Soybeans: Comparing Vertical, Deep, and No-Tillage," Kansas Agricultural Experiment Station Research Reports, 4 (7).
- Al-Kaisi, M., Hanna, M. (2010). Fall versus spring tillage, which is better. Integrated Crop Management, Iowa State University.

<http://crops.extension.iastate.edu/cropnews/2010/09/fall-versus-spring-tillage-which-better>

- Bajagić, M., Đukić, V., Mamlić, Z., Dozet, G., Cvijanović, G., Miladinović, J., Randelović, P. (2022). Uticaj vremena osnovne obrade i folijarne prihrane na prinos soje. Zbornik radova Nacionalnog naučno-stručnog skupa sa međunarodnim učešćem „Biotehnologija i savremeni pristup u gajenju i oplemenjivanju bilja“, 03. novembar 2022., Smederevska Palanka, Srbija, 305-313.
- Cvijanović G., Dozet G., Đukić V., Mamlić Z., Bajagić M., Đurić N., Stepić V. (2022): Uticaj primene različitih mikrobioloških preparata na masu 1000 zrna i prinos pasulja, Zbornik radova, Nacionalni naučno-stručni skup sa međunarodnim učešćem „Biotehnologija i savremeni pristup u gajenju i oplemenjivanju bilja“, 03. novembar 2022. Smederevska Palanka, Srbija, 118-128.
- Di Virgilio, N. (2013). Stinging nettle: a neglected species with a high potential as multi-purpose crop. National Research Council of Italy. Institut of Biometeorology. Catania, Italy, 23.
- Dozet, G., Đukić, V., Miladinov, Z., Cvijanović, G., Đurić, N., Ugrenović, V., Popović, V. (2018). Uticaj međuredne kultivacije i vremena osnovne obrade zemljišta na prinos soje, Zbornik radova XXIII Savetovanje o biotehnologiji sa međunarodnim učešćem, Čačak, 09-10 Mart, 2018. 45-50 str.
- Dozet G., Đukić V., Miladinov Z., Đurić N., Ugrenović V., Cvijanović V., Jakšić S, (2019). Prinos soje u organskoj proizvodnji. Zbornik naučnih radova Instituta PKB Agroekonomik, Vol. 25, br. 1-2, 173-180. Beograd, Srbija.
- Đukić, V., Miladinov, Z., Balešević-Tubić, S., Miladinović, J., Đorđević, V., Valan, D., Petrović, K. (2018). Kritični momenti u proizvodnji soje, Zbornik referata 52. Savetovanja agronoma i poljoprivrednika Srbije (SAPS), Zlatibor, 21-27. januar 2018. Institut za ratarstvo i povrtarstvo, Novi Sad, Srbija, 34-44.
- Đukić, V., Miladinović, J., Mamlić, Z., Dozet, G., Cvijanović, G., Kandelinskaja, O., Miljaković, D. (2021). Uticaj vodenog ekstrakta banane i koprive sa gavezom na prinos soje. Zbornik radova Nacionalnog naučno-stručnog skupa sa međunarodnim učešćem „Biotehnologija i savremeni pristup u gajenju i oplemenjivanju bilja“ 15. decembar 2021. Smederevska Palanka, Srbija, 285-292.
- Khurshid, K., Iqbal, M., Arif, M. S., Nawaz, A. (2006). Effect of tillage and mulch on soil physical properties and growth of maize. International Journal of Agriculture and Biological Sciences, 8: 593–596.

- Lal, R. (2013). Principles of sustainable soil management in agroecosystems. CRC Press, pp. 568.
- Miladinov, Z., Đukić, V., Čeran, M., Valan, D., Dozet, G., Tatić, M., Randelović, P. (2018). Uticaj folijarne prihrane na sadržaj proteina i ulja u zrnu soje, Zbornik radova 59. Savetovanje industrije ulja: „Proizvodnja i prerada uljarica“, 17-22. jun 2018, Herceg Novi, Crna Gora, 73-78.
- Mamlić Z., Abduladim A., Đukić V., Vasiljević S., Katanski S., Dozet G., Uhlarik A. (2021). Jesenja i prolećna primena NPK đubriva u proizvodnji soje. Zbornik radova Nacionalnog naučno-stručnog skupa sa međunarodnim učešćem „Biotehnologija i savremeni pristup u gajenju i oplemenjivanju bilja“, 15. decembar 2021., Smederevska Palanka, 285-292.
- Mamlić, Z., Đukić, V., Miladinović, J., Dozet, G., Bajagić, M., Vasiljević, S., Cvijanović, G. (2022). Influence of aquatic extract banana and neetle with common comfrey combination on weight of plants and weight of 1000 grains soybeans. 5th International Scientific Conference „Village and Agriculture“, Book of proceedings, 30. September and 01. october 2022. Bijeljina, Republic of Srpska, BIH., 67-74.
- Miladinović, J., Vidić, M., Balešević-Tubić, Svetlana, Đukić, V., Đorđević, V. (2013). Soja u 2012. godini. Zbornik referata 47. Savetovanja agronoma Srbije, Zlatibor, 3-9.02.2013. Institut za ratarstvo i povrtarstvo, Novi Sad, Srbija 79-86.

CIP - Каталогизacija у публикацији
Народна библиотека Србије, Београд

63(082)
606:63(082)

INTERNATIONAL Symposium on Biotechnology (1 ; 2023 ; Čačak)

Proceedings / 1st International Symposium on Biotechnology, 17–18 March 2023 ; [organizer] University of Kragujevac, Faculty of Agronomy [in] Čačak. - Kragujevac : University, Faculty of Agronomy in Čačak, 2023 (Čačak : Copy Xerox). - 555 str. : ilustr. ; 24 cm

Na vrhu nasl. str.: Univerzitet u Kragujevcu, Agronomski fakultet u Čačku. - "XXVIII Savetovanje o biotehnologiji sa međunarodnim učešćem" --> kolofon. - Tiraž 100. - Bibliografija uz svaki rad.

ISBN 978-86-87611-88-7

a) Пољопривреда -- Зборници б) Биотехнологија -- Зборници

COBISS.SR-ID 110983945

DOI: [10.46793/NasKg2252](https://doi.org/10.46793/NasKg2252)