



**XII INTERNATIONAL SYMPOSIUM ON
AGRICULTURAL SCIENCES**

BOOK OF ABSTRACTS

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**XII INTERNATIONAL
SYMPOSIUM ON
AGRICULTURAL SCIENCES**

**24-26, May, 2023
Trebinje
Bosnia and Herzegovina**

BOOK OF ABSTRACTS



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24-26. May, 2023; Trebinje, Bosnia and Herzegovina

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24-26 May, 2023
Trebinje
Bosnia and Herzegovina

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AGRICULTURE**
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Sciences and Food



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the Republic of Srpska

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SYMPOSIUM PROGRAM

PROGRAM OVERVIEW

Wednesday 24 May, 2023		
16:00 – 19:00	Symposium registration	Colosseum
17:00 – 17:30	Opening ceremony	Hall 2
17:30 – 18:45	Plenary lectures	
19:00	Coctail	Konoba Etno selo
Thursday 25 May, 2023		
08:30 – 17:00	Symposium registration	Colosseum
09:00 – 09:50	Plenary lectures	Hall 2
10:00 – 11:45	Session: Agricultural economics and rural development 1	Hall 1
10:00 – 12:00	Session: Horticulture 1	Hall 2
11:45 – 12:30	Coffee break	Hotel Panorama
12:15 – 14:10	Session: Agricultural economics and rural development 2	Hall 1
12:30 – 14:00	Session: Horticulture 2	Hall 2
14:00 – 16:00	Lunch break	Hotel Panorama
15:30 – 17:00	Workshop 1: Ecosystem services: not only benefits for environment, but also financial revenues for farmers	Hall 2
17:00 – 18:00	Workshop 2: What is needed to make research capacities in agricultural water management grow?	Hall 1
20:00	Cultural event	Dom kulture Trebinje
Friday 26 May, 2023		
08:30 – 17:00	Symposium registration	Colosseum
09:00 – 09:50	Plenary lectures	Hall 2
10:00 – 11:40	Session: Crop Science 1	Hall 2
10:00 – 11:15	Session: Animal Science	Hall 1
11:15 – 12:15	Coffee break	Hotel Panorama
12:15 – 14:00	Session: Crop Science 2	Hall 2
12:00 – 13:30	Session: Horticulture 3	Hall 1
14:00 – 16:00	Lunch break	Hotel Panorama
16:00 – 18:00	XXVIII savjetovanje inženjera poljoprivrede Republike Srpske	Hall 2
20:00	Galla evening	Hotel Panorama

SCIENTIFIC PROGRAM

Wednesday, May 24

OPENING CEREMONY		The City of Sun'Trebinje	Hall 2
17:00 – 17:30	<ul style="list-style-type: none"> ➤ Zlatan Kovačević, Dean of the Faculty of Agriculture, University of Banja Luka; ➤ Radoslav Gajanin, Rector of the University of Banja Luka; ➤ Savo Minić, Minister of Agriculture, Forestry and Water Management of the Republic of Srpska; ➤ Željko Budimir, Minister for Scientific and Technological Development, Higher Education and Information Society; ➤ Mirko Ćurić, Mayor of the Trebinje City; ➤ Branimir Nježić, President of the Organizing Committee. 		
PLENARY LECTURES		The City of Sun'Trebinje	Hall 2
	Chair: Borut Bosančić		
17:30 –18:00 PL_01	Guido D'Urso EARTH OBSERVATION FOR CROP WATER REQUIREMENTS FROM THE FIELD TO THE REGIONAL SCALE: FROM RESEARCH TO OPERATIONAL APPLICATIONS		
18:00 –18:30 PL_02	Carmelo Rapisarda IMPACT OF CLIMATE CHANGE ON INSECT PESTS AND THEIR MANAGEMENT: A CHALLENGE FOR FUTURE CROP PROTECTION		
18:30 –19:00 PL_03	Dimitrije Markovic PLANT RESPONSE TO TOUCH - ECOLOGICAL AND AGRONOMIC IMPLICATIONS		
19:00	Coctail		Konoba Etno selo

Thursday, 25 May

	PLENARY LECTURES	Hall 2
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Chair: Željko Vaško

09:00 – 09:25 PL_04	Fernández-Lorenzo, Juan Luis IN VITRO MICROGRAFTING: SWEET CHESTNUT AND MULBERRY AS CASE STUDIES
09:25 – 09:50 PL_05	Karmen Pažek METHODS AND TOOLS FOR DECISION SUPPORT IN AGRICULTURAL MANAGEMENT

	SESSION: HORTICULTURE 1	Hall 2
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Chair: Viktor Gjamovski, Boris Pašalić, Boban Đorđević

10:00-10:15 O2_01	Eligio Malusa, Invited lecture SOIL MANAGEMENT IN ORGANIC FRUIT PRODUCTION: AN AGROECOLOGICAL APPROACH
10:15-10:25 O2_02	Gordana Đurić OPEN ISSUES OF KNOWLEDGE TRANSFER IN FRUIT GROWING IN BOSNIA AND HERZEGOVINA
10:25-10:35 O2_03	Gordana Đurić, Jelena Davidović Gidas CHALLENGES IN APPLE PLANTING MATERIAL PRODUCTION AND EXPORT IN BOSNIA AND HERZEGOVINA
10:35-10:45 O2_04	Miljan Cvetković, Jelisaveta Seka Cvijanović INFLUENCE OF PLUM VARIETY ON THE MECHANIZED PRUNING EFFICIENCY
10:45-10:55 O2_05	Nataša Čereković, Majken Pagter, Hanne Lakkenborg Kristensen, Hanne Lindhard Pedersen, Rex Brennan, Karen Koefoed Petersen THE EFFECT OF IRRIGATION DURING FLOWER INITIATION AND FLOWERING TIME ON BLACKCURRANT
10:55-11:05 O2_06	Miljan Cvetković, Petar Nikolić, Milan Šipka IOT BASED DIGITAL FARM MANAGEMENT FOR ORCHARD
11:05-11:15 O2_07	Vuk Pavić, Mirko Jokić DEVELOPMENT OF AUTOMATIC PEST TRAP BASED ON IOT (INTERNET OF THINGS) TECHNOLOGIES
11:15-11:45	Poster presentations: P2_01 – P2_17
11:45-12:00	Discussion
12:00-12:30	Coffee break

Chair: Dragan Nikolić, Dushko Nedelkovski, Darko Jakšić

12:30-12:45 O2_09	Darko Jakšić, Veljko Perović, Ivan Bradić, Jordana Ninkov, Vesna Maraš, Pierfederico La Notte, Mirjam Vujadinović Mandić, Invited lecture THE APPLICATION OF ADVANCED TECHNOLOGIES IN THE RESEARCH OF TERROIR FACTORS IN VITICULTURE AND OENOLOGY
12:45-12:55 O2_10	Vanja Miljanić, Jernej Jakše, Denis Rusjan, Andreja Škvarč, Nataša Štajner HIGH-THROUGHPUT SEQUENCING AND MULTIPLEX RT-PCR FOR DIAGNOSTICS OF GRAPEVINE VIRAL PATHOGENS
12:55-13:05 O2_11	Veroslava Kocić, Dušica Čirković, Dragana Stanisavljević, Dobila Ranđelović, Milica Stojanović, Jelica Lazić Saković, Aleksandar Veličković THE INFLUENCE OF RAW MATERIALS AND THE PRODUCTION PROCESS ON THE QUALITY OF ROSÉ WINE
13:05-13:15 O2_12	Stefan Gordanić, Dragoja Radanović, Snežana Mrđan, Jelena Golijan-Pantović, Sara Mikić, Željana Prijić, Tatjana Marković EXAMINATION OF THE INFLUENCE OF SOIL TYPE ON THE YIELD AND MORPHOLOGICAL PARAMETERS OF <i>Mellisa officinalis</i>
13:15-13:25 O2_13	Milena Lakićević, Lazar Pavlović, Saša Orlović, Emina Mladenović INVENTARISATION OF THE WOODY PLANTS IN NOVI SAD
13:25-13:45	Poster presentations: P2_18 –P2_42
13:45-14:00	Discussion

SESSION: AGRICULTURAL ECONOMICS AND RURAL DEVELOPMENT 1

Hall 1

Chair: Vesna Mrdalj, Branislav Vlahović, Črtomir Rozman

10:00-10:15 O3_01	Hrabrin Bachev, Bozidar Ivanov, Invited lecture ABOUT THE GOOD GOVERNANCE OF BULGARIAN AGRICULTURE
10:15-10:25 O3_02	Veselin Krastev FARM SUSTAINABLE DEVELOPMENT OF THE EU NEW MEMBER STATES
10:25-10:35 O3_03	Carsten Hümmer, Marius Funk, Markus Dirschl, Matthias Schneider, Dragan Brkovic, Peter Breunig, Johannes Holzner ECONOMICS AND INNOVATIONS IN MILK PRODUCTION AND PROCESSING IN GERMANY UP TO 2030 - PROSPECTS AND CHALLENGES

10:35-10:45 O3_04	Gordana Rokvić Knežić, Ljiljana Drinić, Miljan Erbez ANALYSIS OF INDICATORS OF RURAL DEVELOPMENT OF SELECTED MUNICIPALITIES IN THE REPUBLIC OF SRPSKA
10:45-10:55 O3_05	Željko Vaško, Marko Ivanković, Suzana Madžarić, Nemanja Jalić MODELLING OF ADDITIONAL RANKING OF AREAS WITH NATURAL CONSTRAINTS IN BOSNIA AND HERZEGOVINA
10:55-11:05 O3_06	Katerina Kareska, Silvana Pashovska ECONOMIC INDICATORS FOR THE SUSTAINABILITY OF TOBACCO PRODUCTION IN THE REPUBLIC OF NORTH MACEDONIA
11:05-11:15 O3_07	Črtomir Rozman ECONOMICS OF IRRIGATION IN NORTH-EASTERN SLOVENIA
11:15-11:25 O3_08	Nataša Vukelić, Vesna Pavlović, Nebojša Novković, Veljko Šarac, Beba Mutavdžić MANAGERIAL CAPACITIES OF MILK PRODUCERS IN TITEL MUNICIPALITY
11:25-11:35 O3_09	Dragan Dokić, Vera Popović, Vesna Gantner THE SIGNIFICANCE OF THE FISCAL RELIEF OF WHEAT AND CORN PRODUCTION IN THE FUNCTION OF PROTECTING THE FOOD MARKET IN THE REPUBLIC OF CROATIA
11:35-11:45	Discussion
11:45-12:15	Coffee break

SESSION: AGRICULTURAL ECONOMICS AND RURAL DEVELOPMENT 2	Hall 1
Chair: Gordana Rokvić Knežić, Hrabrin Bachev, Nebojša Novković	
12:15-12:25 O3_10	Branislav Vlahović, Anton Puškarić FOREIGN TRADE OF WINE IN THE REPUBLIC OF SERBIA
12:25-12:35 O3_11	Aleksandar Ostojić, Luka Vračar, Nemanja Jalić CONSUMER ATTITUDES ABOUT PURCHASING AND CONSUMING VEGETABLES
12:35-12:45 O3_12	Nemanja Jalić, Nikola Ružević, Aleksandar Ostojić Z GENERATION ATTITUDES AND OPINIONS ABOUT BEER
12:45-12:55 O3_13	Nistoroiu Bianca Florentina, Nicolae Iuliana GENDER TRENDS IN MODERN AGRICULTURE: THE CASE OF FEMALE FARMERS IN EUROPE
12:55-13:05 O3_14	Blagoje Paunović, Nebojša Novković EVALUATING OF ENVIRONMENTAL IMPACT IN COST BENEFIT ANALYSIS OF INVESTMENT PROJECTS IN AGRICULTURE
13:05-13:15 O3_15	Branislav Raketic CHALLENGES FOR THE FURTHER DEVELOPMENT OF THE ORGANIC SECTOR IN WESTERN BALKAN COUNTRIES/TERRITORIES

13:15-13:25 O3_16	Senka Ždero, Zorica Srđević, Bojan Srđević SELECTING SOCIO-ENVIRONMENTAL INDICATORS TO UNDERSTAND THE EFFECTS OF DROUGHT ON RAMSAR SITES
13:25-13:35 O3_17	Gvozden Mićić, Dimitrije Marković, Gordana Đurić TOOL FOR AGROECOLOGY PERFORMANCE EVALUATION TESTING IN BOSNIA AND HERZEGOVINA
13:35-13:45	Discussion
	Chair: Željko Vaško, Katerina Kareska, Dragan Brković
13:45-13:55	Poster presentations: P3_01 – P3_09
13:55-14:10	Discussion

	WORKSHOP 1	Hall 2
15:30-17:00	ECOSYSTEM SERVICES: NOT ONLY BENEFITS FOR ENVIRONMENT, BUT ALSO FINANCIAL REVENUES FOR FARMERS - SUPPORTED BY THE PROJECT EU4FITO-BiH	
	Chair: Branimir Nježić	
	Eligio Malusa SUSTAINABLE USE OF IPM	
	Eduardo Ucciero PLANT HEALTH - A COMMON AFFAIR OF THE ENTIRE SOCIETY	
	Petar Nikolić WILD BEES, VITAL POLINATORS IN OUR ECOSYSTEM	
	Branimir Nježić ENTOMOPATOGENIC NEMATODES IN MANAGEMENT OF INSECT PESTS	
	Discussion	

	WORKSHOP 2	Hall 1
15:30-17:30	WHAT IS NEEDED TO MAKE RESEARCH CAPACITIES IN AGRICULTURAL WATER MANAGEMENT GROW? - SUPPORTED BY THE PROJECT SMARTWATER	
	Chair: Enrique Playán	

Friday 26 May, 2023

	PLENARY LECTURES	Hall 2
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Chair: Sava Vrbničanin

09:00 – 09:25	Jovan Pavlov, Nenad Delić, Sofija Božinović, Zoran Čamdžija, Nikola Grčić
PL_06	CURRENT TRENDS IN MAIZE BREEDING AT MAIZE RESEARCH INSTITUTE “ZEMUN POLJE”
09:25 – 09:50	Ivana Tlak Gajger
PL_07	THE RELATIONSHIP BETWEEN NUTRITION AND THE HEALTH OF HONEYBEE COLONIES

	SESSION: CROP SCIENCE 1	Hall 2
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Chair: Novo Pržulj, Sava Vrbničanin

10:00-10:15	Nataša Čereković, Vojo Radić, Jovana Žunić, Mladen Babić, Milan Šipka, Marinko Vekić, Goran Banović, Sandra Petković, Mladen Todorović, Nery Zapata, Teresa Afonso do Paço, Wilk Almeida, Sabrija Čadro, Benjamin Crljenković, Mihajlo Marković, Invited lecture
O1_01	IRRIGATION AND NITROGEN APPLICATION FOR IMPROVING MAIZE YIELD GROWN AT DIFFERENT LOCATIONS IN BOSNIA AND HERZEGOVINA
10:15-10:30	Zoran Bročić, Jasmina Oljača, Danijel Pantelić, Jelena Rudić, Dobrivoj Poštić, Ivana Momčilović, Invited lecture
O1_02	EFFECTS OF CULTIVAR AND PLANT ORIGIN ON THE AEROPONIC PRODUCTION OF POTATO MINITUBERS
10:30-10:40	Enrique Playán, Nataša Čereković, Alen Mujčinović, Mihajlo Marković, Mladen Todorovic, Željko Vaško, Nevena Stojaković, Sabrija Čadro, Teresa Afonso do Paço, Wilk Almeida, Farida Dechmi, Piluca Paniagua, Nery Zapata
O1_03	A ROADMAP TO CONSOLIDATE AGRICULTURAL WATER MANAGEMENT RESEARCH IN BOSNIA-HERZEGOVINA
10:40-10:50	Snežana Brajević, Željko Dželetović, Aleksandar Simić, Gordana Andrejić, Marija Čosić, Uroš Aleksić
O1_04	ORGANIC CARBON STOCK AND SUSTAINABLE LAND USE UNDER PERMANENT GRASSLANDS IN ZLATIBOR MOUNTAIN

10:50-11:00 O1_05	Danijela Kondić, Stevan Trivković, Desimir Knežević, Zoran Bročić INTERACTION OF AGRONOMIC TREATMENTS IN A FUNCTION OF WINTER WHEAT YIELD
11:00-11:10 O1_06	Helena Majstorović, Bogdan Garalejić, Maja Sudimac, Babka Jan, Miloš Pavlović PHOSPHORUS CONTENT AND STRATIFICATION IN THE SOIL LAYER 0-30 CM IN CONVENTIONAL (CT) AND NO-TILL (NT) TILLAGE SYSTEMS LONG TERM EXPERIMENT
11:10-11:20 O1_07	Bozhidar Ivanov, Daniela Tsvyatkova COMPARATIVE ANALYSIS OF SLUDGE UTILIZATION IN AGRICULTURE IN EU COUNTRIES
11:20-11:35	Poster presentations: P1_01 – P1_17
11:35-11:45	Discussion
11:45-12:15	Coffee break

	SESSION: CROP SCIENCE 2	Hall 2
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Chair: Anđa Radonjić, Ljiljana Brbaklić	
12:15-12:30 O1_08	Dragan Perović, Yu Cai, Robert Hoffie, Peter Dracatos, Invited lecture FROM GERMPASM SCREENING TO GENETICS AND GENOME EDITING IN BARLEY LEAF RUST RESISTANCE BREEDING
12:30-12:45 O1_09	Desimir Knežević, Danijela Kondić, Aleksandra. Yu. Novoselskaya Dragovich, Alexander M. Kudryavtsev, Mirela Matković Stojšin, Veselinka Zečević, Adriana Radosavac, Aleksandar Paunović, Invited lecture VARIABILITY OF WHEAT TECHNOLOGICAL QUALITY PROPRIETIES AND THEIR RELATIONSHIPS WITH GLIADIN AND GLUTENIN ALLELES
12:45-13:00 O1_10	Anđa Radonjić, Olivera Petrović-Obradović, Invited lecture MONITORING OF APHIDS AS VECTORS OF VIRUSES IN FIELD CROPS IN SERBIA
13:00-13:10 O1_11	Cody Watzig, Francesco Vuolo, Aleksandar Dujakovic, Andreas Schaumberger, Andreas Klingler IMPROVING GRASSLAND CUT DETECTION METHODOLOGY BASED ON SENTINEL-2 TIME SERIES TO RESPOND TO THE CHALLENGES OF THE AUSTRIAN GRASSLAND PRODUCTION
13:10-13:20 O1_12	Ahmad Ratib Sharafat INFLUENCE OF DIMETHYL SULFOXIDE ON THE PRODUCTION OF EMBRYOS AND GREEN PLANTS FROM ANthers CULTURE OF WHEAT (<i>Triticum aestivum</i> L.)

13:20-13:30 O1_13	Ranko Gantner, Zvonimir Steiner, Vesna Gantner LOW-INPUT FARMING FOR AGRICULTURAL SUSTAINABILITY
13:30-13:40 O1_14	Snežana Gošić Dondo, Dragan Grčak, Željko D. Popović, Danijela Ristić, Milosav Grčak, Danijela Kondić, Desimir Knezevic VARIABILITY OF DAMAGE IN MAIZE GENOTYPES CAUSED BY ATTACK CORN BORER <i>Ostrinia nubilalis</i> HBN.
13:40-14:00	Poster presentations: P1_18 – P1_33
14:00-14:10	Discussion

	SESSION: HORTICULTURE 3	Hall 1
Chair: Mirjana Ljubojević, Dragana Šunjka, Branimir Nježić		
12:30-12:45 O2_14	Mirjana Ljubojević, Goran Barać, Tijana Narandžić, Jovana Ostojić, Biljana Božanić Tanjga, Milica Grubač, Magdalena Pušić, Invited lecture REMODELING HORTICULTURAL PLANTS' BREEDING TO MEET SUSTAINABLE DEVELOPMENT GOALS	
12:45-12:55 O2_15	Ranko Sarić, Snežana Branković EFFECT OF WEED CONTROL IN A POPLAR PLANTATION CLONE <i>Populus x euramericana</i> 'I-214'	
12:55-13:05 O2_16	Dragana Šunjka, Sanja Lazić, Slavica Vuković, Antonije Žunić, Aleksandra Sušnjar DIETARY RISK ASSESSMENT OF DIAMIDE INSECTICIDES IN PEACH FRUITS	
13:05-13:15 O2_17	Zorana Đekanović, Đorđe Kusalović, Nevena Jokić, Jovana Radić, Relja Suručić, Vojo Radić, Ranko Škrbić, Duška Delić EVALUATION OF EFFICACY OF SOME PLANT EXTRACTS FOR THE CONTROL OF FUSARIUM WILT (<i>Fusarium oxysporum</i>) AND ALTERNARIA LEAF SPOT (<i>Alternaria alternata</i>)	
13:15-13:25 O2_18	Milan Ivanović, Milan Šević, Anđelka Prokić, Jelena Adamović, Aleksa Obradović USE OF ANTIBIOTICS IN CROP PROTECTION: YES OR NO?	
13:25-13:35 O2_19	Dragana Marinković EFFECTS OF IONIZING RADIATION ON FOOD	
13:30-13:45	Poster presentations: P2_43 - P2_61	
13:45-14:00	Discussion	

SECTION: ANIMAL SCIENCES		Hall 1
Chair: Ivana Tlak Gajger, Đorđe Savić, Vesna Gantner		
10:00-10:15 O4_01	Vesna Gantner, Biljana Rogić, Invited lecture THE IMPORTANCE OF EDUCATION IN THE FIELD OF AGRICULTURE IN TERMS OF CHANGES OF CLIMATE	
10:15-10:25 O4_02	Aleksandar Ignjatović, Kazimir Matović, Goran Jevtić, Nebojša Nedić THE INFLUENCE OF GEOGRAPHICAL AREA ON MORPHOMETRIC PARAMETERS OF HONEY BEE IN SERBIA	
10:25-10:35 O4_03	Stoja Jotanović, Predrag Ilić, Slaven Grbić, Jasmin Kazazović CHANGE IN PULSE FREQUENCY IN HORSES AS AN INDICATOR OF STRESS CAUSED BY LOADING	
10:35-10:45 O4_04	Vesna Gantner, Ivana Jožef, Dragan Solić, Ranko Gantner, Zvonimir Steiner VARIABILITY OF MASTITIS OCCURRENCE IN DAIRY SIMMENTALS DUE TO RECORDING TIME	
10:45-11:00	Poster presentations: P4_01 – P4_15	
11:00-11:15	Discussion	
11:15-11:45	Coffee break	

XXVIII SAVJETOVANJE INŽENJERA POLJOPRIVREDE REPUBLIKE SRPSKE		Hall 2
Stručno savjetovanje na temu: “Proizvodnja, arome i greške u voćnim destilatima”		
Moderator: Božana Odžaković		
Pozdravna riječ: Zlatan Kovačević i Borut Bosančić		
Izlagrač: Branko Drljača		
16:00-17:30	Proizvodnja (Sirovina; Enološki aditivi; Fermentacija; Destilacija) Arome (Izvor i formiranje aroma; Tipične arome voćnih destilata, Arome iz bureta) Greške u destilatima (Najčešće greške; Uzrok i formiranje; Greške iz radnih faza)	

LIST OF THE POSTERS

SESSION: CROP SCIENCE 1	
P1_01	Dushko Mukaetov, Hristina Poposka, Marjan Andreevski SPATIAL ASSESSMENT OF SOIL ORGANIC CARBON CONTENTS UNDER DIFFERENT LAND USE TYPES IN OHRID VALLEY
P1_02	Radoš Zemunac, Milica Vranešević, Boško Blagojević, Radovan Savić, Atila Bezdán, Stanko Milić, Andrea Salvai TRENDS OF KEY IRRIGATION WATER QUALITY PARAMETERS IN THE ENDANGERED WATERCOURSES IN VOJVODINA (SERBIA)
P1_03	Vojo Radic, Ilija Komljenovic, Borislav Petkovic, Nikola Krstovic INFLUENCE OF IRRIGATION ON SEED PRODUCTION OF MAIZE HYBRIDS IN DRY SEASONS
P1_04	Ivica Đalović, Aleksandar Paunović NITROGEN FERTILIZATION AND HYBRID INTERACTIONS ALONG CLIMATIC CONDITIONS DETERMINE MAIZE YIELD IN CALCAREOUS SOIL
P1_05	Nikola Grčić, Zoran Čamdžija, Jovan Pavlov, Milomir Filipović, Sofija Božinović, Marko Mladenović ZP 4019- A NEW MAIZE HYBRID DEVELOPED USING DOUBLED HAPLOID (DH) TECHNOLOGY
P1_06	Milan Biberdžić, Jelena Stojiljković, Vera Đekić, Saša Barać, Dragana Lalević, Milomirka Madić THE IMPORTANCE OF HYBRIDS AND SOWING DENSITY ON MAIZE YIELD IN THE SOUTHERN PART OF SERBIA
P1_07	Dalibor Tomić, Vladeta Stevović, Ivan Marković, Miloš Marjanović, Nenad Pavlović, Mirjana Petrović, Vladimir Zornić, Đorđe Lazarević, Jasmina Knežević FORAGE YIELD AND YIELD COMPONENTS OF SUDAN GRASS DEPENDING ON SOWING DENSITY
P1_08	Đorđe Todić RESULTS OF BREEDING WORK ON SMALL GRAINS AT THE AGRICULTURAL INSTITUTE OF THE REPUBLIC OF RRPSKA
P1_09	Andreas Schaumberger, Aleksandar Dujaković, Francesco Vuolo, Andreas Klingler, Cody Watzig SATELLITE-BASED MODELLING OF GRASSLAND YIELD AND QUALITY DYNAMICS (SATGRASS)
P1_10	Sanja Mikić, Verica Takač, Ljiljana Brbaklić, Milan Mirosavljević, Dušan Trajković, Nataša Buha, Maja Šumaruna ESTIMATION OF YIELD POTENTIAL OF LOCAL WHEAT LANDRACES WITH NDVI, FLAG LEAF AREA AND CHLOROPHYLL CONTENT
P1_11	Borislav Petković, Ilija Komljenović, Vojo Radić, Darko Aćimović VARIATION OF SILAGE YIELD OF MAIZE HYBRIDS ON SOILS OF POOR FERTILITY IN HILLY AREAS

P1_12	Zoran Čamdžija, Aleksandar Popović, Vojka Babić, Natalija Kravić, Jovan Pavlov, Nikola Grčić, Milomir Filipović EVALUATION OF COMBINING ABILITIES OF LOCAL MAIZE LANDRACES FOR STARCH, PROTEIN AND OIL CONTENT IN GRAIN
P1_13	Željko Dolijanović, Snežana Oljača, Milena Simić, Vesna Dragičević, Zoran Jovović THE EFFECT OF DIFFERENT MICROBIAL FERTILIZER ON THE WEEDINESS OF MAIZE
P1_14	Gorica Cvijanović, Vesna Stepić, Marija Bajagić, Vojin Đukić, Jovana Sekulić, Nenad Đurić, Zlatica Miladinov Mamlić THE INFLUENCE OF THE APPLICATION OF EFFECTIVE MICROORGANISMS ON THE WEIGHT OF 1000 GRAINS AND THE YIELD OF DIFFERENT MAIZE GENOTYPES
P1_15	Marija Gavrilović, Ranko Koprivica, Miloš Zelić, Biljana Veljković, Zoran Mileusnić, Branislav Dudić, Aleksandra Dimitrijević Petrović ENERGY EQUIPMENT WITH TRACTORS IN THE COOPERATIVE "AGROPROM"
P1_16	Zoran Malicevic, Milan Jugovic ASSESSMENT OF THE QUALITY OF WORK OF AGGREGATES FOR BASIC TILLAGE
P1_17	Pawel Plottek, Rafał Ramut, Stanislaw Minta INNOVATIONS IN AGRICULTURE - RAPE SEED DRILL BASED ON AN AFTER-CROP SEEDER AS AN EXAMPLE OF FARMER' HIMSELF INNOVATION
	SESSION: CROP SCIENCE 2
P1_18	Ljiljana Brbaklić, Sanja Mikić, Milan Mirosavljević, Radivoje Jevtić, Vladimir Aćin, Dragan Živančev, Vera Popović ON-FARM CONSERVATION, MANAGEMENT AND USE OF BARLEY, OATS, RYE AND WHEAT GENETIC RESOURCES IN SERBIA
P1_19	Petr Konvalina, Trong Nghia Hoang WINTER WHEAT MIXTURES SYSTEM AS THE WAY FOR STABILIZATION OF YIELD AND INCREASE OF GRAIN QUALITY IN ORGANIC FARMING
P1_20	Jelena Golijan Pantović, Mile Sečanski, Ljubica Šarčević Todosijević BENEFITS OF ORGANIC FOOD PRODUCTION
P1_21	Jelena Golijan Pantović, Bojan Dimitrijević, Mile Sečanski, Stefan Gordanić ORGANIC SOYA BEAN PRODUCTION IN SERBIA
P1_22	Jelena Golijan Pantović, Bojan Dimitrijević, Aleksandar Popović, Mile Sečanski THE STATE OF ORGANIC BARLEY PRODUCTION IN SERBIA
P1_23	Jelena Golijan Pantović, Stefan Gordanić BIOHERBICIDES IN ORGANIC AGRICULTURE
P1_24	Ivo Mitrushev, Brankica Spaseva, Danica Andreevska, Dobre Andov, Marija Gjosheva Kovachevikj, Gordana Glatkova ASSESSMENT OF SEED VIABILITY IN LONG-TERM STORED <i>Oryza sativa</i> L. ACCESSIONS AFTER MORE THAN A DECADE
P1_25	Ljubica Šarčević-Todosijević, Kristina Vojvodić, Vladimir Filipović, Aleksandra Ivetić, Jelena Golijan, Vera Popović, Dragutin Đukić INFLUENCE OF PESTICIDES ON SOIL MICROORGANISMS
P1_26	Ljubica Šarčević-Todosijević, Marko Vojvodić, Kristina Vojvodić, Aleksandra Ivetić, Snežana Pakić, Vera Popović, Jelena Golijan SIGNIFICANCE AND ECONOMIC JUSTIFICATION OF APPLICATION OF MICROBIOLOGICAL FERTILIZERS IN PLANT PRODUCTION

P1_27	Ljubica Šarčević-Todosijević, Kristina Vojvodić, Vladimir Filipović, Aleksandra Ivetić, Vera Popović, Jelena Golijan, Dragutin Đukić INFLUENCE OF MINERAL FERTILIZERS ON SOIL MICROORGANISMS
P1_28	Vera Karličić, Jelena Jovičić-Petrović, Igor Kljujev, Blažo Lalević, Milan Nikolić, Saud Hamidovic, Vera Raičević ANTIFUNGAL ACTIVITY OF <i>Bacillus amyloliquefaciens</i> D5 ARV
P1_29	Slavica Kerečki, Milica Bogdanović, Igor Kljujev, Jelena Jovičić-Petrović, Vera Karličić, Blažo Lalević, Vera Raičević ROOT COLONIZATION OF DIFFERENT PLANT SPECIES BY <i>Bacillus megaterium</i>
P1_30	Vesna Vidović, Radijana Đekanović, Goran Banović, Branimir Nježić THE IMPACT OF DIFFERENT IRRIGATION AND FERTILIZATION LEVELS ON THE POPULATION AND DAMAGES CAUSED BY <i>Ostrinia nubilalis</i> , HÜBNER (LEPIDOPTERA, CRAMBIDAE)
P1_31	Slavica Vuković, Dragana Šunjka, Sanja Lazić, Antonije Žunić, Dragana Bošković, Aleksandra Sušnjar APPLICATION OF THE INSECTICIDE TEFLUTHRIN FOR THE CONTROL OF ELATERIDAE AND SCARABAEIDAE IN MAIZE CROPS
P1_32	Andrija Vasilčić LABORATORY INVESTIGATION ON INSECTICIDAL EFFICACY OF ALTERNATIVE COMPOUNDS AGAINST RICE WEEVIL
P1_33	Ranko Gantner, Paul Schmit, Zvonimir Steiner, Domagoj Zimmer, Anamarija Banaj, Igor DelVechio, Vesna Gantner FIRST TESTING OF HORSE-DRAWN ROLLER-CUTTER FOR GREEN-MANURE CROPS MANAGEMENT IN CROATIA

SESSION: HORTICULTURE 1

P2_01	Anastasija Đurić, Predrag Ilić, Gordana Đurić FRUIT SET OF TRADITIONAL APPLE CULTIVARS IN THE CONDITIONS OF BANJA LUKA
P2_02	Ivana Radović, Aleksandar Radović, Slađana Savić, Milena Marjanović, Zorica Jovanović MORPHOLOGICAL AND QUALITY ATTRIBUTES OF SELECTED AUTOCHTHONOUS APPLE GENOTYPES FROM SERBIA
P2_03	Danilo Vidović, Nikola Mičić, Gordana Đurić THE INFLUENCE OF THE COMBINATION OF ROOTSTOCK AND INTERSTOCK ON THE INITIAL GROWTH OF THREE SWEET CHERRY CULTIVARS
P2_04	Boris Pašalić, Zlatan Ristić, Marina Antić, Predrag Ilić, Sonja Umičević, David Ducanović, Borut Bosančić POSITIVE EFFECT OF GIBBERELIC ACID TREATMENT ON FRUIT COLOUR IN TWO CHERRY VARIETIES 'NEW STAR' AND 'BING'
P2_05	Melpomena Popovska, Julijana Cvetković, Bojan Popovski PRIMARY EFFECTS OF GAMMA RADIATION (CZ137) ON THE CONTENT OF SOME NUTRITIVE AND BIOACTIVE MATTERS IN THE LEAVES OF SELECTED CHERRY PLANTS
P2_06	Boban Đorđević, Marko Sretenović, Dejan Djurović, Gordan Zec, Nemanja Tešić, Milana Stojanoski INFLUENCES OF <i>Bacillus subtilis</i> AND <i>Trichoderma harzianum</i> TO PRODUCTIVITY AND FRUITS QUALITY OF STRAWBERRY CULTIVAR 'CLERY'

P2_07	Marina Ocokoljić, Tomo Milošević, Jelena Mladenović, Gorica Paunović, Radmila Ilić, Ivan Glišić BIOLOGICAL AND PRODUCTION CHARACTERISTICS OF THE RASPBERRY (<i>Rubus idaeus</i> L.) OF WILLAMETE AND FERTODI ZAMATOS CULTIVARS IN THE PERIOD OF FULL FRUITING
P2_08	Ivana Radovanović, Ljiljana Bošković-Rakočević, Jelena Mladenović, Gorica Paunović, Zoran Dinić, Radmila Ilić THE INFLUENCE OF NITROGEN FERTILIZER APPLICATION ON SOIL CHANGES AND RASPBERRY FRUIT QUALITY
P2_09	Dino Hasanagić, Ivan Samelak EFFECTS OF FREEZE-THAWING ON BIOCHEMICAL PARAMETERS OF PLUM FRUIT QUALITY
P2_10	Božana Odžaković, Vanja Čupina, Slavica Grujić, Staniša Latinović DEVELOPMENT OF GELS FROM CORNELIAN CHERRY FRUIT WITH USE OF DIFFERENT GELLING AGENTS
P2_11	Mohamed El Alaoui, Mohamed Sbaghi FUNCTIONAL RESPONSES OF IMMATURE STAGES OF <i>Cryptolaemus montrouzieri</i> TO THE CACTUS PEAR SPECIFIC SCALE PEST <i>Dactylopius opuntiae</i>
P2_12	Marina Dervišević, Draga Graora <i>Ceroplastes rusci</i> (L.) (HEMIPTERA: COCCIDAE), A NEW SOFT SCALE SPECIES IN SERBIA
P2_13	Dušanka Jerinić-Prodanović, Anđa Radonjić, Dragica Smiljanić, Milica Črkić Matijević WALNUT FLY <i>Rhagoletis completa</i> (CRESSON, 1929) (DIPTERA: TEPHRITIDAE) - FLIGHT DYNAMICS, DISTRIBUTION AND HARMFULNESS IN SERBIA
P2_14	Vojislav Trkulja, Gordana Babić, Bojana Čurković, Bojana Vuković, Jovana Prijjić, Bogdan Nedić <i>Geosmithia morbida</i> AND <i>Pityophthorus juglandis</i> SURVEYS, THE CAUSAL AGENT OF THOUSAND CANKERS DISEASE OF WALNUT IN REPUBLIC OF SRPSKA
P2_15	Biljana Lolić, Marina Antić, Tatjana Milaković, Sonja Umićević BACTERIAL DIEBACK OF PEACH AND NECTARINAE CAUSED BY THE QUARANTINE PATHOGEN, <i>Pseudomonas syringae</i> pv. <i>persicae</i> IN THE REPUBLIC OF SRPSKA
P2_16	Dušanka Jerinić-Prodanović, Anđa Radonjić, Milica Črkić Matijević, Dragica Smiljanić CURRENT STATUS OF THE MEDITERRANEAN FRUIT FLY <i>Ceratitis capitata</i> (WIEDEMANN, 1824) (DIPTERA:TEPHRITIDAE) IN SERBIA
P2_17	Stefani Tepić, Anica Živković, Branimir Nježić, Nikola Grujić NEW RECORDS OF <i>Oscheius</i> spp. IN REGION OF BANJA LUKA
SESSION: HORTICULTURE 2	
P2_18	Đorđe Boškov, Dragan Milatović, Gordan Zec, Dejan Đurović, Boban Đorđević, Nemanja Tešić, Milana Stojanoski, Dunja Sotonica THE EFFECT OF PACLOBUTRAZOL APPLICATION ON THE GROWTH LENGTH OF FIVE SWEET CHERRY CULTIVARS
P2_19	Biljana Korunoska, Klime Beleski, Vladan Pešić, Nenad Bunjac, Stevan Stojković ANALYSIS OF MEIOSIS IN THE FLOWERS OF SOME VINE VARIETIES USING THE METHOD OF CHIASMA FREQUENCY AND NORMAL CROSSINGOVER

P2_20	Tatjana Jovanović – Cvetković, Nataša Štajner, Tjaša Cesar, Jernej Jakše, Rada Grbić MICROSATELLITE ANALYSIS OF PATERNITIES OF GRAPEVINES AFTER CROSS-POLLINATION
P2_21	Dushko Nedelkovski, Venelin Roychev, Klime Beleski, Hristina Poposka, Dimitar Dimitrov INFLUENCE OF ALTITUDE ON THE AMPELOMETRIC CHARACTERISTICS OF VRANEC VARIETY LEAVES
P2_22	Nebojša Marković, Zoran Pržić, Mitar Popadić COMPARATIVE ANALYSIS OF POTENTIAL CLONES OF THE ŽILAVKA VARIETY IN THE AREA OF THE SUBREGIONS OF MIDDLE NERETVA AND TREBIŠNJICA
P2_23	Darko Jakšić, Ivan Bradić, Radoslav Milić, Federica Bonell, Miloš Ristić, Zlata Vidanović, Ivana Mošić CERTAIN CHARACTERISTICS OF GRAPES AND GRAPE MUST OF THE LOCAL VINE VARIETY BAGRINA
P2_24	Dushko Nedelkovski, Venelin Roychev, Klime Beleski, Dimitar Dimitrov, Viktor Rajčin INFLUENCE OF ALTITUDE ON THE FERTILITY OF THE VINE VARIETY VRANEC
P2_25	Hristina Poposka, Dusko Mukaetov, Dusko Nedelkovski, Milena T. Gjorgjijevski EFFECT OF FOLIAR CALCIUM AND NITROGEN TREATMENTS ON YIELD AND FRUIT QUALITY OF TABLE GRAPES
P2_26	Zorica Ranković-Vasić, Saša Matijašević, Milica Glišić, Mihailo Andrić, Danijela Živojinović, Dragan Nikolić CHARACTERISTICS OF THE NEWLY CREATED TABLE GRAPEVINE VARIETY SIMONA
P2_27	Dunja Sotonica, Marija Čosić, Mirjam Vujadinović Mandić, Zorica Ranković-Vasić, Nevenka Đurović, Aleksa Lipovac, Ružica Stričević, Milana Stojanovski, Anastasiia Chistiakova, Branislav Anđelić THE IMPACT OF THE IRRIGATION REGIMES ON THE RAVAZ INDEX IN VINEYARD PLAVINCI UNDER CLIMATE CHANGE
P2_28	Milena Taseska-Gjorgjijevski, Dushko Nedelkovski, Roze Dzoljevska Milenkovska, Goran Milanov, Klime Beleski, Biljana Korunoska, Viktor Rajčin CONTENT AND CORRELATION OF ORGANIC COMPOUNDS IN SOME AUTOCHTHONOUS GRAPEVINE VARIETIES (<i>Vitis vinifera</i> L.)
P2_29	Biljana Korunoska, Goran Milanov, Milena Taseska-Gjorgjijevski, Duško Nedelkovski, Hristina Trišeska, Roze Dzoljevska Milenkovska, Viktor Rajčin REDUCTION OF THE CONTENT OF HEAVY METALS IN WHITE WINES OF THE ITALIAN RIESLING VARIETY BY CERTAIN TREATMENTS USED IN R.N. MACEDONIA
P2_30	Katerina Bandjo Oreshkovikj, Biljana Kuzmanovska, Rade Rusevski CONTROL EFFECTS OF VARIOUS FUNGICIDES AGAINST POWDERY MILDEW OF GRAPEVINE
P2_31	Katerina Bandjo Oreshkovikj, Rade Rusevski, Biljana Kuzmanovska CONTROL OF <i>Plasmopara viticola</i> WITH THE NOVEL CLASS OF FUNGICIDES
P2_32	Roze Dzoljevska-Milenkovska, Goran Milanov, Milena Taseska-Gjorgjijevski, Dushko Nedelkovski, Klime Beleski, Biljana Korunoska CHEMICAL COMPOSITION OF WINE PRODUCED FROM THE NEWLY INTRODUCED VARIETY REBO (<i>Vitis vinifera</i> L.)

P2_33	Vasiliki Ragkousi, Federica Bonello, Maurizio Petrozziello, Giuseppe Meglioli, Nir Levav MANAGEMENT OF DISSOLVED GASES DURING WINEMAKING AND THEIR EFFECT ON WINE QUALITY AND TYPICITY OF THE AROMA
P2_34	Tatjana Jovanović-Cvetković, Danijela Starčević, Aleksandar Savić, Rada Grbić EFFECT DURATION OF MACERATION AND TEMPERATURE ON CHARACTERISTICS OF RED WINE
P2_35	Aleksandar Petrović, Nikolina Živković, Ivana Plavšić Janjatović, Danka Mitrović, Ivana Sredović Ignjatović EFFECTS OF WINEMAKING TECHNIQUE OF NEWLY CREATED CV. VLADUN ON TOTAL PHENOLIC CONTENT AND ANTI-DPPH RADICAL ACTIVITY OF WINE
P2_36	Sunčica Bodružić, Gordana Đurić DENDROFOND OF THE PARK ARCHITECTURE MONUMENT „UNIVERSITY CITY” - BIOECOLOGICAL BASIS FOR THE VALORISATION OF EXISTING GREEN AREAS
P2_37	Sunčica Bodružić, Nikola Travar, Marina Antić, Jelena Davidovic Gidas, Nataša Pašalić PLANT COLLECTION IN THE BOTANICAL GARDEN OF THE UNIVERSITY OF BANJA LUKA
P2_38	Marko Šušnjara, Boris Dorbić, Emilija Friganović, Željko Španjol, Marko Duvančić, Anita Pamuković PERCEPTIONS OF THE ORNAMENTAL VALUE AND APPLICATION OF SELECTED WEEDS FOR FLOWER BEDS
P2_39	Svjetlana Zeljković, Marina Pekez, Jelena Davidović Gidas, Margarita Davitkovska, Emina Mladenović INFLUENCE OF MICROBIOLOGICAL PREPARATION BACILLOMIX ON THE GERMINATION OF <i>Challistephus chinensis</i> L.
P2_40	Jelena Davidović Gidas, Svjetlana Zeljković, Gordana Đurić USE OF LED LIGHTS IN MICROPROPAGATION OF ROSEMARY (<i>Rosmarinus officinalis</i> L.)
P2_41	Sara Mikić, Željana Prijjić, Vladimir Filipović, Stefan Gordanić, Snežana Mrđan, Ana Dragumilo, Tatjana Marković APPLICABILITY OF DIFFERENT METHODS FOR DISINFECTION OF HERBACEOUS PEONY SEEDS NATIVE TO SERBIA
P2_42	Željana Prijjić, Sara Mikić, Vladimir Filipović, Ana Dragumilo, Stefan Gordanić, Petar Batinić, Natalija Čtović, Tatjana Marković SEED WEIGHT AND OPTIMAL IMBIBITION PERIOD FOR SOME HERBACEOUS PEONY (<i>Paeonia</i> spp.) SPECIES NATIVE TO SERBIA
SESSION: HORTICULTURE 3	
P2_43	Slobodan Bandzo SPIDER MITE CONTROL ON MEDICAL CANNABIS MOTHER PLANTS
P2_44	Sonja Umićević, David Ducanović, Borut Bosančić, Marina Antić FRUIT CHARACTERISTICS OF PEPPER ACCESSIONS (<i>Capsicum annuum</i> L.) FROM THE GENE BANK OF THE REPUBLIC OF SRPSKA
P2_45	Lovro Sinkovič, Mojca Škof, Barbara Pipan, Vladimir Meglič MORPHOLOGICAL DIVERSITY OF ONION GENETIC RESOURCES AT THE AGRICULTURAL INSTITUTE OF SLOVENIA

P2_46	Sonja Umićević, Marina Antić, Dragana Rajković, Lovro Sinković, Nevena Nagl, Smiljana Goreta Ban, Vladimir Meglič, Vida Todorović, Ana Marjanović Jeromela, Barbara Pipan MOLECULAR CHARACTERIZATION OF LEAFY KALE GENETIC RESOURCES (<i>Brassica oleracea</i> var. <i>acephala</i> L.)
P2_47	Slađana Savić, Marina Dervišević, Lela Belić, Milena Marjanović, Ivana Radović, Veselinka Zečević, Zorica Jovanović RESPONSE OF TWO TOMATO LINES TO DROUGHT STRESS BASED ON THE PROLINE CONTENT IN FRUITS AND YIELD
P2_48	Vojin Cvijanović, Mladen Petrović, Nebojša Momirović, Đorđe Moravčević, Marija Bajagić THE EFFECT OF DIFFERENT SYSTEMS OF GROWING TOMATOES IN A PROTECTED AREA ON MORPHOLOGICAL PROPERTIES AND BUSINESS RESULTS
P2_49	Biljana Drvoshanova, Afrodita Ibushoska, Katerina Bandjo Oreshkovikj, Hristina Poposka INCREASING CLIMATE RESILIENCE IN PEPPER SEED PRODUCTION THROUGH <i>Trichoderma harzianum</i> AND SOIL FERTILIZER TREATMENTS IN NORTH MACEDONIA
P2_50	Đorđe Moravčević, Sandra Vuković, Sofija Kilibarda, Ana Vujošević, Jelena Pantović, Maja Sudimac, Stefan Gordanić, Aleksandar Ž. Kostić QUALITY OF CUCUMBER SEEDLINGS GROWN IN DIFFERENT SUBSTRATE VOLUMES
P2_51	Tatjana Milaković, Biljana Kelečević, Vida Todorović, Siniša Mitrić INFLUENCE OF PHOTOSYNTHESIS INHIBITORS ON CHLOROPHYLL CONTENT
P2_52	Sandra Vuković, Đorđe Moravčević, Aleksandar Ž. Kostić, Jelica Gvozdanović-Varga, Ana Vujošević, Sofija Kilibarda, Danijel D. Milinčić, Ilinka Pećinar COULD RAMAN MICROSPECTROSCOPY CONFIRM DIFFERENCES OF TWO ALLIUM SPECIES GROWN UNDER DIFFERENT SELENIUM TREATMENTS?
P2_53	Nikolina Đekić, Milica Bosnić, Vida Todorović, Mirjana Žabić ONION PRODUCTION CHARACTERISTICS DEPENDING ON THE SIZE OF ONION SETS AND PLANTING TIME DURING THE PRODUCTION IN THE OPEN FIELD
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PLENARY LECTURES

Keynote speaker



Guido D'Urso- University of Naples, Italy

Earth Observation for crop water requirements from the field to the regional scale: from research to operational applications

His research focus is on:

Use of active sensors in the microwave field for determining the water content of soils with "in-situ" and remote techniques.

Interpretation and analysis of multispectral satellite observations for the estimation of irrigation needs.

Techniques for the application and validation of distributed models for the simulation of soil hydrological balance.

Simplified methods for estimating soil hydraulic properties.

Methodologies and tools for the management of irrigation districts.

PL_01

Earth Observation for crop water requirements from the field to the regional scale: from research to operational applications

Guido D'Urso¹

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Abstract

The intensive crop production sector in the Mediterranean countries, represented by irrigated agriculture, is a major pillar of global and national food security and often the only driver of rural economies, while it is also the largest water consumer and a major soil and water polluter. More sustainable crop management strategies as well as new incentives and policies for ensuring the sustainability of agriculture and ecosystem services are of crucial importance for improving yields without compromising environmental integrity or public health. In this context, tools such as agro-hydrologic models combined with crop models and data derived from remote sensing technologies (Earth Observation, EO), allow for estimating current and potential crop water use and for evaluating irrigation performances. Major technical innovation has been possible by the comprehensive space-time coverage of free EO data from the European satellites Sentinel-2A and 2B, with the support of other data sources from the Copernicus system of the European Union, as well as free data from the Landsat platforms of NASA. These advancements has led to the development of EO-based information services for irrigation management, providing "diagnostic" data and other information from subplot level to irrigation scheme or river basin levels.

Outputs from research projects can now be transferred to operational applications for improving the management of irrigation based on a more accurate evaluation of crop water requirements, namely:

1. improved estimation of canopy biophysical parameters e.g. Leaf Area Index (LAI), fractional vegetation cover and Canopy Chlorophyll Content by exploiting the full spectral data from Sentinel-2 sensors;
2. detection of actual irrigated areas by means of machine learning classification approaches applied to time-series of biophysical parameters;
3. assessment of water status in the soil-canopy ensemble (grades from very dry to very wet) by using shortwave infrared observations from Sentinel 2

(thus substituting thermal infrared observations, available only from Landsat, with limited spatial and temporal resolution);

4. estimation of the canopy resistance (r_c) from the previous point for ET calculation in soil water limiting conditions by using combination equations of evapotranspiration i.e. Penman-Monteith and Shuttleworth and Wallace. Examples of applications of these EO-based technologies will be described to demonstrate their maturity for supporting sustainable management of water resources in agriculture from field to basin/region scale.

Key words: crop water requirements, evapotranspiration, irrigation, Earth Observation, Sentinel-2.

Keynote speaker



Carmelo Rapisarda – University of Catania, Italy

Impact of climate change on the insects pests and their management

Mainly involved in studies on sap-sucking insects (especially whiteflies, psyllids and scale insects), their impact on cultivated plants and their integrated and biological control. Both at national and international level, he is involved in research projects related to various noxious whitefly species (Citrus whitefly; Woolly whitefly; Japanese bayberry whitefly; Spiralling whitefly; Tobacco whitefly). He also carries out research on strategies for protecting natural resources and insect diversity while managing a rational pest control. Results of his studies are reported in more than 200 published papers and book chapters

PL_02

Impact of climate change on insect pests and their management: a challenge for future crop protection

Carmelo Rapisarda

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Abstract

Present days global agriculture is highly impacted by climate change. Primarily droughts, caused by reduced precipitation, and increased evapotranspiration, due to higher temperatures, directly affect plant growth and crop yields. But increase in temperatures, combined with consequent change of other climate variables, have also many indirect impacts on agriculture (reduced crop duration; shift in weed flora; etc.). Within this context, more serious and damaging pest infestations are expected as potential consequence of climate change, due to both biological adaptations and increasing reproductive performances in already existing pests, as well as new biological invasions. As to the latter aspect, alien species can be defined as “invasive” when they become introduced into areas outside their natural range, where they negatively impact native biodiversity and ecosystem services. All phases of a biological invasion (e.g.: introduction, colonization, establishment, and spread) are influenced by climate change, which facilitates the spread of many alien species and creates new opportunities for them to become invasive, but also reduces the resilience of habitats to biological invasions, with the agroecosystems being particularly vulnerable due to their low diversity. The genetic potential of various pest species to invade new regions, combined with climate change, is growing the phytosanitary importance of newly introduced pest species as well as, in some cases, worsening damage created by native ones, creating the need to intensify research on control possibility of their infestations. Some case studies are reported, relating to: i) the potential future spread of noxious pest species; ii) the deterioration of phytosanitary problems caused by already existing pest species; as well as iii) the reduced efficacy that could derive to consolidated biological control strategies as a result of climate change.

Key words: global warming; agro-ecosystems; harmful invasions; pest control; future expectations.

Keynote speaker



**Dimitrije Marković - University of Banja Luka,
Republic of Srpska, B&H**

Plant response to touch - ecological and agronomic
implications

His recent scientific interest focus on the wider ecological implications of plant response to touch and their effect on plant-plant and plant-insect interactions. Key research questions include the early detection of changes in biomass allocation, gene expression and the emission of specific volatiles. Currently he is studying wider ecological context of plant defense responses in neighbors after exposure to volatiles emitted by touched plants.

PL_03

Plant response to touch - ecological and agronomic implications

Dimitrije Markovic

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Abstract

The sessile nature of plants has led to a dependence on their ability to sense, process, and respond to a range of different environmental stimuli. Touch is one of the most common stimuli by which plants can rapidly detect the presence of neighbors. In response to touch a single plant can exhibit a multitude of adaption responses including physiological and morphological changes in order to match the upcoming competition. Our results show that adaption to brief touching can induce changes in plant biomass allocation and increase in density of trichomes and pavement cells on adjacent leaves via a systemic effect, without any effect on yield. Within minutes, plants can trigger transcription of defense-related genes in response to touch and consequently rapidly change the emission of volatile compounds (VOCs). Touch-induced VOCs have considerable effects on higher trophic levels affecting host plant selection by aphids and habitat searching by ladybirds. Perception of touch-induced VOCs has broader ecological significance as these volatiles are directly involved in plant–plant communication as an effective trigger for rapid defense synchronization among nearby plants of the same species. Understanding the complex regulation of genetic and morphological mechanisms in plants after exposure to brief touch could provide an important tool for development of sustainable agriculture practices.

Key words: Adaption, coexistence, induced defenses, plant-plant interactions, plant-insect interactions, volatile emission.

Keynote speaker



**Fernández Lorenzo, Juan Luis - University of
Santiago de Compostela**

In vitro micrografting. Experiences in sweet chestnut
and mulberry

In last years, his research is focused on the development of micropropagation protocols and on micrografting of several woody species (namely *Castanea sativa* varieties, chestnut hybrids resistant to ink disease, *Quercus robur*, and *Morus* spp. varieties), and on the study of factors involved in adventitious rooting and rejuvenation. I am currently in charge of the Laboratory of Micropropagation of the Higher Polytechnic Engineering School of Lugo (USC).

PL_04

'In vitro micrografting: sweet chestnut and mulberry as case studies'

Juan Luis Fernández Lorenzo

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Abstract

Micrografting involves grafting of relatively small vegetative parts, micro-scion and micro-rootstock of two different genotypes. Micrografting can be carried out in vivo or in vitro, but the latter, carried out under aseptic conditions, which are maintained until graft union formation, is more common. In in vitro micrografting, micro-scions and micro-rootstocks are obtained through tissue culture, and rootstocks can have or not roots in the moment of grafting. If unrooted rootstocks are used, after successful in-vitro grafting (or even during the union formation), the grafted shoots can be cultured on a rooting medium for root initiation. In the last decades, micrografting has become a relatively conventional tool to obtain virus-free plants in several species, thanks to the relatively “clean” condition of the plant meristem and the improved chances of survival and development of the meristem if it is micro-grafted in a suitable rootstock and in the proper conditions. There are many examples of the use of micrografting in the field of horticulture for other purposes, as virus indexing, propagation of hard-to-root materials, achievement of rejuvenation, to improve the organogenetic ability of mature material, early assessment of graft incompatibility, and protection of sensible varieties by using rootstocks resistant or tolerant to different biotic and abiotic stresses. In our lab, micrografting was applied in two woody species of horticultural interest, mulberry and chestnut, selected for different purposes. In mulberry, micrografting served to tackle the problem of the difficulty of rooting of a *Morus nigra* clone (selected both for fruit and for use as fodder), by micrografting it on *Morus alba* clones with high rooting ability. In chestnut, previous studies in our laboratory had shown that micrografting could be used as a rejuvenation method, with varying success. Today, we focus on micrografting to obtain micro-grafted plants of selected chestnut varieties on hybrid rootstocks resistant to ‘ink’ disease, trying to find a suitable protocol to be used at a commercial level.

It is expected that, along this century, micropropagation-facilitated in-vitro grafting may open new dimensions to the commercial horticulture sector for propagating fruit and vegetable plants.

Key words: grafting, aseptic conditions, propagation, micro-scion, micro-rootstock

Keynote speaker



Karmen Pažek – University of Maribor, Slovenia

Methods and Tools for Decision Support in Agricultural Management

She has been a postdoctoral lecturer in farm management at the University of Maribor, Faculty of Agriculture and Life Sciences and became a full professor in 2016. She holds several courses at all levels of study. Currently, she is the head of the 1st degree programme in Agricultural Economics and Rural Development and the Vice Dean for Education. Her research areas include development of decision support tools and systems for farm management (simulation modelling, multi-criteria decision analysis, option models, risk management), economics of agricultural production, and other modern methods of operational research.

PL_05

Methods and Tools for Decision Support in Agricultural Management

Karmen Pažek

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Abstract

Agricultural systems science generates knowledge that enables researchers to look at complex problems or make informed agricultural decisions. Modelling is an indispensable tool for agricultural systems. Nowadays, an agricultural scientist should consider the so-called next-generation models, data, and knowledge products. A series of events in the past, as well as general technological advances in other research areas, have contributed greatly to the development of models for agricultural systems, models based on past observations (network planning), mathematical optimization methods (model for optimising feed rations for different animals and categories, crop rotation, optimization of agrotechnical production data. These models are usually based on the calculation of component requirements in terms of expected daily needs, yields, and mathematical programming), risk management (the flexibility process through further decision making processes related to the financial aspect of agri-food projects could be evaluated using the main financial indicators; net present value (NPV_t), expected net present value (ENPV) and expected net present value based on perfect information (ENPVPI) involving the decision tree modelling procedure (DTA). The appropriate methods that could be used are: NPV_t, ENPV, and ENPVPI in the context of traditional cost-benefit analysis (CBA) under the condition of uncertainty), methods and option modelling (the real options approach can be useful in evaluating projects with uncertainty, sunk costs, and irreversibility, and can provide a new approach for testing agricultural investment decisions), simulation models (calculating the total cost or enterprise budget of different agricultural production systems), and multi-criteria decision analysis (qualitative and quantitative decision methods based on a hierarchical structure of the observed problem). Decision support methods and tools, which are typically software-based, can be an important component in pursuing evidence-based decision making in agricultural management to improve productivity and economic efficiency. These tools can guide decision makers through clear steps and suggest optimal decision paths or serve as sources of information to improve their decisions for further

planning of agriculture and food production. The presentation provides information and guidance on how agriculture in its broadest sense can benefit from appropriate methods and tools in the decision-making process through further planning.

Key words: decision methods, tools, agriculture, agri-food, planning process, evaluation

Keynote speaker



Jovan Pavlov - Maize Research Institute „Zemun Polje“, Serbia

Current trends in maize breeding at Maize Research Institute „Zemun Polje

He graduated from the Faculty of Agriculture in Zemun, Department of Agriculture in 2006, and received his doctorate in 2013 at the same faculty, at the Department of Genetics and Plant Breeding. In 2019, he was elected to the scientific title of senior research associate.

At the Maize Research Institute, he works as the head of the department for scientific and technical cooperation. So far, he has published 86 publications, He is the author and co-author of 25 maize hybrids registered at the national level, as well as two maize hybrids registered at the international level.

PL_06

Current trends in maize breeding at Maize Research Institute “Zemun Polje”

Jovan Pavlov¹, Nenad Delić¹, Sofija Božinović¹, Zoran Čamdžija¹, Nikola Grčić¹

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Abstract

Maize breeding program at the Maize Research Institute "Zemun Polje" begun during the fifties of the last century and it was based on the principles of inbreeding hybridization. During the sixties, first maize hybrids were registered and each subsequent decade a new generation of hybrids was created. So far, more than 800 maize hybrids have been registered in Serbia and more than 170 hybrids abroad. Testing program includes field evaluations of experimental hybrids in a large number of locations in Serbia, paying attention to the correct choice of environments. Each season 5000-7000 new hybrid combinations have been tested in Serbia. Additionally, the most promising hybrids of different maturity groups are being tested at more than 20 locations abroad, with the aim of selecting the best hybrids for each foreign market. In order to accelerate breeding procedure, service of winter generation in Chile is used, with the aim of obtaining two generations during one calendar year. Since 2014, the application of double haploid technology in maize breeding has started. So far, 13000 double haploid lines have been created from 350 original populations. Optimization of each step in the methodology towards the higher efficiency is the main task for breeders: higher induction rate, higher duplication rate, better agronomic traits of inducers. This year the first hybrid containing a double haploid line has been registered. In addition, several hybrids developed using this method are in registration procedure. Application of molecular markers represents an essential part of modern breeding programs. Use of SNP markers became a routine tool in breeding program of Maize Research Institute. In the last few years, 400 most elite ZP maize inbred lines were characterized using this type of markers. In addition to the creation of hybrids with standard grain quality, breeding program of specific maize hybrids exists and it includes breeding for hybrids with white endosperm, sweet maize and popcorn.

Breeding for herbicide tolerance resulted in registration of several cycloxdim tolerant hybrids during last decade. Also, several hybrids with red grain color,

which are characterized by higher anthocyanin content, have been registered so far. Recent innovation in maize breeding program is implementation of cloud-based software platform, which will enable better data collection and management, creation of new experiments and improved statistical analysis.

Key words: maize, hybrids, breeding program, innovation

Keynote speaker



Ivana Tlak Gajger – University of Zagreb, Croatia

The relationship between nutrition and the health of bee colonies

The field of her scientific work is the biology and pathology of beneficial insects. Prof. Tlak Gajger established cooperation with numerous research groups of scientists from different universities, which, in addition to conducting joint research, resulted in her being approved as a coordinator in front of the partner of the Veterinary for the international project Best practices and innovations for a sustainable beekeeping (B-THENET) - Thematic networks to compile and share knowledge ready for practice HORIZON-CL6-2021-GOVERNANCE-01-28 financed by the European Commission(2022-2026).

PL_07

The relationship between nutrition and the health of honeybee colonies

Ivana Tlak Gajger¹

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Abstract

Honeybee colonies (*Apis mellifera* L.) represent the most important social insects due to their crucial role in plant pollination and close link to global food production and natural biodiversity balance maintaining. Their specific nutrition physiology and flight behavior patterns show complex interactions with environmental ecosystems. Bacterial symbionts in the honeybee gut have important functions for host nutrition, food digestion, metabolism, development, weight gain, reproduction, behavioral physiology, and immunity through pathogen and insecticide resistance. Dysbiosis in honeybees is often defined as gut-intestinal microbial imbalance linked to a host deficiency such as deficient development, lower body mass, earlier workers mortality, and in general health, metabolism, and fitness status when the different environmental influences (e.g., immune response suppression caused by oxidative stress or *Nosema* spp. infections) could change the composition of gut bacterial phylotypes and remaining microbiome components, leading to the appearance of visible clinical signs of opportunistic diseases and colonies weakening. To facilitate full therapeutic success there is a need for the appliance of bio-inspired honeybee colony protection products in form of feed supplements and novel technology designs, based on natural ingredients active against microsporidia pathogens. The other possibility is to trigger honeybees' immune defense responses. The aim of this study was to evaluate the therapeutic effects of additional food for bees on *Nosema* spp. infection levels and relation to honeybee colony strength and the gut microbiota composition obtained using NGS analyses. If the changes in the gut microbiome are supported by implemented feed supplementation, it may be possible for this beekeeping management practice to reduce the negative effect of environmental xenobiotics on honeybees.

Key words: honeybee colony; gut microbiota; *Nosema* spp.; colony strength; NGS

Section: CROP SCIENCE

Oral Presentations

01_01

Irrigation and nitrogen application for improving maize yield grown at different locations in Bosnia and Herzegovina

Nataša Čereković¹, Vojo Radić¹, Jovana Žunić¹, Mladen Babić¹, Milan Šipka¹, Marinko Vekić¹, Goran Banović¹, Sandra Petković¹, Mladen Todorović², Nery Zapata³, Teresa Afonso do Paço⁴, Wilk Almeida⁴, Sabrija Čadro⁵, Benjamin Crljenković⁵, Mihajlo Marković¹

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Abstract

Climate change and drought stress have become more common during the important stages of maize development in Bosnia and Herzegovina (BiH), affecting the crop's ability to produce sustainable yield. Optimum use of water and nutrients is becoming increasingly important for yield optimization. A two-year of field experiments were conducted in Bosnia and Herzegovina at two locations, Aleksandrovac and Butmir, which are characterized by a moderate climate and different soil characteristics. The objective was to evaluate the response of the local hybrid maize BL-43 to three water regimes, full irrigation, deficit irrigation and rainfed, and different nutrient management schemes, two at Aleksandrovac, full and half ammonium nitrate requirements applied at six leaf stage and fourteen leaf stage leaf stages, and one at Butmir, using calcium ammonium nitrate following common agricultural practices. The results showed that interannual variability, pedoclimatic conditions, water availability and nutrients applications had a significant effect on yield at these two locations. Differences in yield might be attributed to different temperature ranges, precipitation patterns, soil texture, fertility and irrigation management. This study confirmed the importance of irrigation and the optimal use of nutrients to attenuate the negative impacts of water stress on maize production in BiH.

Key words: *Zea mays* L., irrigation management, nutrient management, yield, climate change.

01_02

Effects of cultivar and plant origin on the aeroponic production of potato minitubers

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Abstract

Aeroponics is eco-friendly, soilless technology for the cultivation of vegetable plants that can be used for the production of pathogen-free pre-basic seed potato, namely minitubers. In aeroponic modules, the underground parts of potato plants grow suspended in the mist of finely dispersed nutrient solution to produce tubers, while the shoots grow above the module under greenhouse conditions. This study aimed to evaluate the effects of the cultivar and origin of planting material on the minituber production in an aeroponic facility in Guča, Serbia. Two potato cultivars, Sinora and Agria, and two types of planting material, acclimated microplants and plants originating from sprouted minitubers, were used in the study. Plants were grown in the 2019 season with a planting density of 24 plants per m² and ~14-day harvest intervals. Agria plants of both plant origins steadily tuberized during most of the cultivation period and formed a significantly larger number of minitubers (13.61) compared to cultivar Sinora (3.35), which quickly completed the growth cycle. In both investigated cultivars, the mass of formed minitubers was significantly higher in the plants originating from minitubers (18.80 g) compared to plants of *in vitro* origin (9.04 g). Agria plants of minituber origin produced the heaviest minitubers (19.05 g), while Sinora plants of *in vitro* origin formed the least heavy tubers (5.29 g). The highest yield of minitubers, 6.26 kg m⁻², was recorded for Agria plants of minituber origin. The results of our study suggest that both plant origin and potato genotype significantly affect minituber production in aeroponics.

Key words: potato, aeroponics, pre-basic seed potato, minitubers

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01_03

A roadmap to consolidate agricultural water management research in Bosnia and Herzegovina

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Abstract

The SMARTWATER project was funded by the Horizon 2020 Framework Programme of the European Commission. This project, coordinated by the University of Banja Luka, seeks: 1) to reinforce the networking, research and innovation capacities of the University of Banja Luka (UNI-BL), University of Sarajevo (UNSA) and other institutions from Bosnia and Herzegovina (BiH) in the field of sustainable agricultural water management; and 2) to increase their competences and fund-raising skills for a successful participation in the EU Research and Innovation Programs. The project is also partnered by CIHEAM Bari (Italy), CSIC (Spain), ISA (Portugal) and Sysman (Italy). SMARTWATER is developing a large set of joint activities promoting networking, joint experimental fields, research cooperation and the exchange of knowledge and experts. The focus is on the application of smart technologies (cloud-based and remote sensing) in agricultural water management, the optimization of the water–energy–food nexus, climate change impacts and adaptation measures. One of the activities of the project is the elaboration of a realistic and feasible road map to consolidate agricultural water management research in BiH. This activity will structure the enabling factors and the actions

needed to consolidate the scientific excellence and innovation capacity achieved throughout the twinning. The roadmap will link to the information and outcomes of the evaluation and analysis of current research in agricultural water and the results of the consultations with stakeholders, resulting in a document establishing relations among the key enabling factors and the needs of the stakeholders involved. Interviews and roundtables will be conducted during the months of April and May, and a first version of the document will be drafted in July. The final document will be discussed at the last Stakeholder Consultation of the SMARTWATER project, by the end of 2023. The final road map document will be released shortly afterwards.

Key words: BiH road map, research agricultural water management, stakeholder consultation

01_04

Organic carbon stock and sustainable land use under permanent grasslands in Zlatibor mountain

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Abstract

Grassland covers a significant proportion of agricultural land in Serbia (20%) and, despite its steady decline in recent decades, represents an important resource for feeding livestock. In addition to agricultural use, grasslands have a great capacity for water and soil conservation and carbon storage. The largest amounts of organic matter on agricultural land are found in near-surface layer below the grass cover. Sampling carried out in 2020 on natural grassland in western Serbia, in the Zlatibor Mountain, took place at different altitudes and in two layers: the surface layer (0-20 cm) and the subsurface layer (20-40 cm). The average concentration of soil organic carbon (SOC) ranges from 4.89 to 8.97% (average 6.57%) in the surface layer and from 1.88 to 5.45% (average 3.42%) in the subsurface layer of the soil. In addition, SOC was compared with soil productivity parameters. The results suggest that mountain soils in Western Serbia have a considerable capacity for carbon sequestration, depending on altitude, and potentially have a positive impact on climate change by reducing greenhouse gas emissions. Furthermore, organic carbon concentrations show a strong ($r = 0.855$ in the surface layer) to very strong correlation ($r = 0.948$ in the subsurface layer) with the concentration of total nitrogen in the soil.

Key words: high-mountain meadows, pastures, western Serbia, soil organic carbon

01_05

Interaction of agronomic treatments in a function of winter wheat yield

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Abstract

Wheat is the most important bread grain and one of the strategic products in the Republic of Srpska and in Bosnia and Herzegovina. The grain yield of wheat is a complex trait and is a function of genotype, environment, and genotype \times environment interaction. The appearance of an interaction effect in the analysis of the basic factors means that the tendencies of the examined factors and the tendencies of their modalities in their interactions are not the same. The experiment was set up as a four-factor field trial in a randomized block system with three replicates. The tested wheat cultivars were sown at five sowing densities, three sowing dates, and three fertilization models. The average yield of wheat cultivars in the multi-year cultivation period (2016-2017) can be viewed as the general average potential, that is, biometrically, the average value of wheat yields in the examined region. Productivity modeling represents the search for an optimal solution for the multiple functions of the combination of agro-technical practices and ecological factors as independent variables. Thus, viewed biometrically, the goal is to establish a combination of independent variables whose resultant is as close as possible to the projected value of a particular property.

Key words: wheat, interactions, cultivars, grain yield

01_06

Phosphorus content and stratification in the soil layer 0-30 cm in conventional (CT) and no-till (NT) tillage systems long term experiment

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Abstract

Phosphorus in the soil is an essential nutrient less mobile than nitrogen and there is a need to determine its spatial variability. Attention is also paid to its loss because it is a pollutant of the environment. The aim of the study was to determine the patterns of phosphorus (P) distribution in the soil, stratification, after ten years of no-tillage (NT) system compared to the conventional tillage system, moldboard plowing (CT). The tillage systems were fertilized with the same amount of NPK fertilizers and urea and tillage was done on a conventional system (CT). The crop and sowing date are the same. Sampling was done with a soil probe sampling kit Eijkelkamp 04.01.SB. A soil layer of up to 30 cm (in 10 cm intervals) was sampled and analyzed in the laboratory. The soil was air-dried and ground, and in each of the samples the content of readily available P (as P₂O₅) determined by the AL method according to Egner-Riehm (spectrophotometrically). The obtained values of readily available P in the NT system in the layer 0-10 cm are 32.79 mg/100g which is the highest in relation to the layers 10-20 cm - 25.54 mg/100g and 20-30 cm - 18.89 mg/100g and the values of same layers at CT. There is no such pronounced stratification and the values are 23.52, 23.21 and 22.55 mg/100g per layer in CT. The results of the study show a pronounced vertical stratification of P in the no-till (NT) system. The results show the need to raise the phosphorus level above the maximum value of the optimal content, above 25 mg/100g, in order to create a reserve before changing the conventional (CT) to the no-till (NT) system.

Key words: conventional tillage, no-till, phosphorus, stratification

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01_07

Comparative analysis of sludge utilization in agriculture in EU countries

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Abstract

The purpose of this study is to find out the development level of sludge utilization in agriculture demonstrated by convergence performance. The usage of sludge from wastewater plants in the agriculture is a popular and effective way to deal with those materials in the past, which in the contemporary time is less promoted and put in various restrictions across EU. Although the constricts, the agriculture is still a well-positioned industry to utilize in different forms the wastes from treatment plants thus the topic is not phased out and is relevant. The application of wastewater sludge in agriculture is interesting and relevant from the bioeconomy perspective and in the view of agriculture bound to reduce the mineral fertilizers usage in order to contribute to climate changes mitigation, diminish the greenhouse gas emissions and improve the biodiversity in agricultural lands. The focus of the paper is designated to study the Bulgarian convergence of sludge utilization in agriculture compared with other EU countries. The applied convergence method is adopted in a way using the principles and approaches of standard Beta and Sigma convergence methods, revealing the absolute and relative change and growth of the objected country with compared ones. In the paper is analyzed not only the issue of agricultural utilization but also the sludge production and disposal from treatment plants, which is important to trace up the ecological and technical capacity across EU countries in terms of sewerage infrastructure and wastewater management. It is noted that there are not significant differences in performance of selected countries from the indicators point of view as almost in each of three indicators the convergence of Bulgaria is in similar pattern to selected member states, which means that there is a relationship between level of sludge production in the countries and designation to agriculture.

Key words: wastewater utilization, agriculture, convergence, EU countries, prospects, economic rationality

01_08

From germplasm screening to genetics and genome editing in barley leaf rust resistance breeding

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Abstract

Among many pathogens that affect barley production, leaf rust caused by (*Puccinia hordei*) is one of the most destructive. Usually barley leaf rust (BLR) causes up to 32% yield losses in susceptible varieties, with losses as high as 60% in very susceptible varieties. In order to assist barley breeding in producing more resilient and better performing varieties, we took a variety of approaches to identify and characterise genes involved in BLR resistance. In frame of the project IdeMoDeResBar2 supported with an Alexander von Humboldt fellowship, we are applying modern sequencing techniques, i.e. PAC Bio long read sequencing of targeted loci and Resistance Gene Enrichment Sequencing (RENSEQ) and Mutational base RENSEQ (MutRENSEQ), to facilitate the development of functional or diagnostic allele-specific markers, allowing for a precise incorporation of the respective alleles in barley breeding programmes. In this regard, genetic analysis of BLR resistance in landrace MBR1012 from ex-Yugoslavia, revealed a complex genomic architecture. In addition to a major resistance locus on barley chromosome 1HS that has been targeted for map-based cloning two further resistance loci were also identified. An adult-plant resistance (APR) locus explaining 21% of phenotypic variance was mapped to chromosome 2HL and seedling resistance locus on chromosome 5H. The identified genes will be subjected to targeted mutagenesis using Cas endonuclease technology and virus induced gene silencing (VIGS) for functional analysis and further characterisation. In summary, we support breeding programmes by providing material, markers and methods facilitating the transfer of valuable resistances into elite cultivars.

Key words: barley, leaf rust, resistance gene isolation, NGS

01_09

Variability of wheat technological quality properties and their relationships with gliadin and glutenin alleles

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Abstract

The storage proteins influence technological quality value of grain wheat, dough quality traits and loaf quality. The aim of this study estimation of variability grain protein content, sedimentation volume, dry gluten content, loaf volume and their relationships with encoding allele of gliadin and glutenins. For investigation used wheat genotypes grown in two vegetation season (2015/16 and 2016/17). The analysed technological quality traits varied in wheat genotypes within and between vegetation season. In both vegetation season were established the highest grain protein content in G-3627-1 (14.40% and 14.60%), the highest protein sedimentation volume in G-3606-5 (46.0 ml and 52.0 ml), the highest dry gluten content in G-3621-1 (30.23% and 31.15%) and the highest value of loaf volume in the G-3621-1 (530 ml and 540 ml). In both vegetation were found the least protein sedimentation volume in genotypes G-3636-3 (34.0 ml and 36. ml), the least grain protein content in G-3606-4 (13.10% and 13.00%), the least dry gluten content was in G-3606-6 (25.42% and 25.98%) and the least loaf volume in G-3606-6 (380 ml and 390 ml). The composition of gliadin and glutenin alleles at the analyzed wheat genotypes was different. In analysed wheat genotypes at six Gli- loci were

identified 24 alleles and at three Glu-1 loci eight alleles. Genotypes carrying Gli-B1b, Gli-D1b, Gli-D2b and Glu-A1b, Glu-B1c, Glu-D1d had the highest sedimentation volume, genotype that carried Gli-B1l and Glu-A1b, Glu-B1c, Glu-D1d had high volume of bread. The results showed relationships of gliadin and glutenin alleles with analysed grain, flour and bread traits quality.

Key words: wheat, gliadin, glutenin, allele, bread, quality

01_10

Monitoring of aphids as vectors of viruses in field crops in Serbia

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Abstract

Aphids (Hemiptera: Aphididae) cause significant economic loss on crops by direct feeding and by vectoring the viruses. Monitoring of aphids flight activity is a good way for timely intervention and reduction of virus infection. The research was carried out in potato, sugar beet and wheat. Aphids were collected using the yellow water traps. The time of placing the traps and the longevity of aphids flight monitoring are adapted to the crop. The maximum of aphid flight activity in potato was in May when potato is the most sensitive to virus infection. The most numerous species and the most important vector of potato viruses is *Myzus persicae*. Timely desiccation of potato canopy could prevent the virus from descending from the leaf to the tubers. The highest number of individuals in sugar beet recorded at the end of May/beginning of June when sugar beet develops intensively, so the risk of virus infection is the highest. The most important vectors are *Aphis fabae*, *Aphis spiraeicola* and *M. persicae*. Insecticide treatments during that period could prevent the spread of the virus. In wheat, the highest risk of infection is in autumn, when wheat sprouts and aphids land in the fields in search of a winter host. *Rhopalosiphum padi* and *Sitobion avenae* are the most abundant species and the most important vectors. Later sowing, towards the end of the optimal term, could reduce the possibility of infecting plants with viruses because the maximum flight of aphids in autumn is avoided. Control of vectors is a complicated task and must be adapted to the plant species being monitored.

Key words: Aphididae, vectors of viruses, potato, sugar beet, wheat

01_11

Improving grassland cut detection methodology based on Sentinel-2 time series to respond to the challenges of the Austrian grassland production

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Abstract

The relationship between yield and quality of grassland fodder is an important factor that farmers must take into consideration when deciding to cut and harvest. Farmers may largely control the quality of their output by selecting the timing of the harvest. However, even for experienced farmers, estimating this relationship is difficult as external factors, such as weather, can impact the growth rate of individual plants. Satellite remote sensing techniques allow for the detection of cut dates which may allow for a regional estimation of fodder quality, but cut detection methods vary in both form, function and accuracy. This study set out to create an improved and transferable methodology capable of operating in both a post- and in-season cut detection. The approach is tested across the Austrian landscape using only freely available Copernicus Sentinel-2 imagery on the Google Earth Engine (GEE). The resulting methods utilize a fitted idealized NDVI curve, by iteratively smoothing the actual observations using the Whittaker smoothing algorithm. Cuts are detected by meeting a threshold in the difference of the idealized curve and actual observed values. Additional steps were designed to decrease the impact cloud cover has on the results. A ruleset for the methods was trained on 97 plots and validated on a further 502 plots from 2020, 2021 and 2022. The method performed well in plots with two to four cuts per season, but occasionally struggled in more intensively managed systems. A pooled post-season use intensity f-score of 0.87 and cut date detection f-score of 0.78 and absolute detection error of 4.6 days suggests the methods can accurately detect cuts. The results indicate a general improvement of existing methodologies by combining the methods and ideas of the reviewed rule-based methodologies and this despite performing the cut detection across the fragmented and mountainous Austrian landscape.

Key words: grassland, agriculture, NDVI, land use intensity, optical remote sensing

01_12

Influence of Dimethyl Sulfoxide on the production of embryos and green plants from anthers culture of wheat (*Triticum aestivum* L.)

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Abstract

The aim of the study was to evaluate the consequence of Dimethyl Sulfoxide (DMSO) on the process of embryogenesis in anther culture. Three winter bread wheat genotypes viz., Altindane, Dariel, and Pehlivan were evaluated on five combinations of nutrient medium (MS1, MS2, CHB-3, CHB-3+MS2, and CHB-3+DMSO), and the addition of 1% DMSO to the sterilization solution. Spikes of all three genotypes were sterilized with 70% ethanol for one minute; however, for genotype Pehlivan, 70% ethanol with 1% DMSO was used. The result showed that out of 45 cultured anthers with CHB-3 medium, the Altindane genotype produced the most embryoid (97), while the Dariel and Pehlivan genotypes produced only three and zero, respectively. On the other hand, the addition of 1% DMSO to the same medium had a negative impact on embryoid production as compared to the medium without DMSO. Sterilizing spikes with 70% ethanol solution mixed with 1% DMSO increased the number of embryoids approximately from 0-17.8% and 1-48.4% in the CHB-3 and CHB-3+DMSO induction medium, respectively. Furthermore, the Altindane genotype produced 10 plantlets (8 albino and 2 green plants) from the CHB-3 medium and 8 albino plantlets from CHB-3+DMSO medium. Pehlivan genotype which was sterilized with 1% DMSO the number of plantlets (three albino plants) from 0 to 4.4 % in CHB-3+DMSO medium. Based on the results and facts application of DMSO in the medium did not induce the process of embryogenesis. However, the use of 1%DMSO in sterilization solution increased the number of embryoids but did not produce green plants.

Key words: Dimethyl Sulfoxide, doubled haploid, embryogenesis, *Triticum aestivum*, wheat

01_13

Low-input farming for agricultural sustainability

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Abstract

The aim of this paper is to characterize the low-input farming considering the resources it uses, scale of farming operations to which it suits, and its environmental impacts along with sustainability issues. The research was conducted by literature review. Low input farming systems seek to optimize the management and use of on-farm resources and to minimize the use of production inputs as off-farm resources, such as purchased fossil fuels, chemical fertilizers, and pesticides. The research has shown that low-input farming can contribute to lessening the use of synthetic pesticides, fertilizers, and fossil fuels while enabling the recovery of soils' fertility, and biodiversity in the agroecosystems. Thanks to the expected recovery of soil fertility and porosity, there is anticipated greater resilience of low-input farming to extreme climatic events like droughts when compared with currently prevailing intensive farming. Therefore, the low-input farming can be much appreciated among the farming options for the improved sustainability.

Key words: low-input farming, soil fertility, pesticide emissions, biodiversity, resilience

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01_14

Variability of damage in maize genotypes caused by attack corn borer *Ostrinia nubilalis* hbn.

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Abstract

Corn borer, *Ostrinia nubilalis* Hbn. is a pest that can cause significant economic damage on maize crop. The aim of this work is study variation of percentage damaged maize plants, number of perforation and length of channels on plant stem, caused by feeding of larvae corn borer, under application of insecticides. For study included three maize genotypes ZP 427, ZP 555 and ZP 606 and three insecticides, chlorantraniliprole (200 g l-1), bifenthrin (100 g l-1) and [lufenuron (50 g l-1)+(cypermethrin (50 g l-1) + chlorpyrifos (500 g l-1))], were applied 15 days from the peak of the second generation of corn borer. Experiment was set up in three repetition on a basic plot of 10.5 m², conducted on field of Maize Research Institute "Zemun Polje" in 2020. The results showed that on control (without insecticide) in all three maize genotypes, the highest number of damaged plants ~ 95% which was significantly higher than on variant treatments by insecticide. The percentage of damaged plants for all three maize genotype was the lowest on treatment with chlorantraniliprole 72%, higher on treatment with insecticide bifenthrin (82%; 86%;80%) and on treatment with [lufenuron+(cypermethrin+chlorpyrifos)] – (84.8%; 87.2% ; 81.6%). On average, for all treatments, genotype ZP 427 had the smallest number of perforation (~41) and the smallest length of channels in the stem (189 cm), while ZP 606 had the smallest number of damaged plants (82.56%). The established differences for intensity of attack and degree of damages varied depending on genotype and type of applied insecticide.

Key words: maize, pest, damage, insecticide, genotype

Section: CROP SCIENCE

Poster Presentations

PI_01

Spatial assessment of soil organic carbon contents under different land use types in Ohrid valley

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Abstract

Spatial assessment of key soil properties is a basic prerequisite for the evidence-based decision making and sustainable use and management of soil. Processes ruling carbon turnover from one to the other pools are heavily influenced by a wide set of environmental factors or soil management practices. The aim of this work was to integrate the site-specific soil data collected during field survey with continuous and discrete datasets of environmental covariates, serving as predictors. The selected test area outlines the variability of factors influencing SOC content and spatial distribution. Soil sampling locations were randomly distributed within a predefined mesh with a 1-sq.km spatial resolution and further stratified to outline different types of land use within each mesh square. Soil samples were collected from 93 locations in three depths on each 20 cm., covering a total area of 10 thousand ha of arable, forestland and land under natural vegetation. The content of soil organic carbon in the top layer (0-20 cm.) of forestland, out of 21 examined locations is in average 6.81%, while on a 22 examined locations under grassland, the average content is 4.07%. Arable land, which is under continuous human impact, has the lowest contents of SOC of 2.5 under field crops and 2,61 in perennials. A set of additional environmental dataset were collected: soil map, land use map, geology map, digital terrain model and its derivatives, satellite images, climate data as well as a set of indices NDVI, SAVI, BI etc., developed from the remote sensing datasets. Multiple linear regression was used for evaluating the regression pattern between the environmental predictors and the target variable. For estimation the spatial variability several regression trees methods were used. Results gained with this approach gave a better spatial overview for the most vulnerable areas regarding SOC depletion.

Key words: carbon, soil mapping, modelling, land use

PI_02

Trends of key irrigation water quality parameters in the endangered watercourses in Vojvodina (Serbia)

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Abstract

Irrigation water quality is presented by ion concentrations and parameters such as electroconductivity (EC), pH and total hardness (TH). Enlarged values of these indicators can have negative effects on irrigated soils and crops. Watercourses, highly endangered by different influences, were selected for analysis: Krivaja, Jegrička, Plazović, Vrbas-Bezdan (canal of the DTD hydrosystem) and Zlatica. The trend analysis was performed on the basis of monthly parameter values, published by public institutions (period 2001-2020). Because considered parameters have a seasonal character, seasonal Kendall test was used. This is a non-parametric trend test that takes into account serial correlation, and therefore intra-year fluctuations of values. From the aspect of irrigation, increasing trends are more important. The results show the existence of statistically significant ($\alpha=0.05$) trends. Increasing trends of Mg^{2+} and EC were detected in the Krivaja watercourse. In Jegrička watercourse, increasing trends of Ca^{2+} and EC were detected, while in Plazović watercourse were detected increasing trends of Na^+ , CO_3^- , Cl^- , EC and pH. In the Vrbas-Bezdan canal were detected increasing trends of Mg^{2+} , Na^+ , K^+ , CO_3^- , Cl^- , EC and pH. The increase in concentration of K^+ and Cl^- can be associated with the influence of industrial centers located along this canal. Zlatica watercourse is characterized by increasing trends of Ca^{2+} , Mg^{2+} , SO_4^{2-} , EC and TH. Such results in this watercourse can be related to the influence of leachate from the surrounding saline soils and transboundary impacts. The obtained results indicate to possible problems in the practice of irrigation using water from these watercourses.

Key words: irrigation, water quality, trend, watercourses

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change and extreme hydrometeorological phenomena (contract no. 142-451-3114/2022-01/2) funded by the Provincial Secretariat for Higher Education and Scientific Research activity.

PI_03

Influence of irrigation on seed production of maize hybrids in dry seasons

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Abstract

In the production of hybrid corn seeds, there are always several factors that, individually and in interactions, cause the success of seed production. The production of seed corn directly depends on the genotype, inbred lines, fertilization success, external conditions during the growing season and other factors. As material for study in this paper, the production of eight Novi Sad corn hybrids in "PD Semberija" during two growing seasons was analyzed. The critical periods of seed corn according to the lack of easily accessible water in the soil are silking, fertilization and grain formation. In the silking period, seed corn is most sensitive to soil drought, when the greatest lack of moisture is observed. During the vegetation period of 2021 and 2022, there was a deficit of precipitation and extremely high temperatures for a long period. Both analyzed years were extremely dry. On the plots that were irrigated, a higher seed yield was achieved by 3-8 times compared to the areas that were in water deficit. The highest average yield was achieved with hybrids NS 444 (3800 kg ha⁻¹) and NS 640 (3000 kg ha⁻¹), which were irrigated, and the lowest with hybrids NS 3022 (400 kg ha⁻¹) and NS 5010 (800 kg ha⁻¹) without irrigation. Corn seed production in this climate with variable amounts and distribution of precipitation should be based exclusively on irrigation conditions. In addition to increasing yield, irrigation has a favorable effect on seed quality.

Key words: corn, hybrid, irrigation, drought, yield

PI_04

Nitrogen fertilization and hybrid interactions along climatic conditions determine maize yield in calcareous soil

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Abstract

Maize (*Zea mays* L.) is the most important cereal worldwide. Climatic conditions significantly affect the maize productivity. Identifying the contributions of climate factors and fertilization to maize yield is significant for the assessment of climate change impacts on maize production. This two-year field study investigated the effects of four N levels (T1: 0, T2: 60, T3: 120, and T4: 150 kg N ha⁻¹) on the grain yield of four divergent maize cultivars (NS-4023, NS-640, NS-6010 and NS-6030). The results showed that maize yield were significantly affected by year (Y), genotype (G), N fertilization (N), and Y × G × N interaction. The grain yield was increased from 5320 kg ha⁻¹ in the control to 7250-9880 kg ha⁻¹ in the treatments T3 and T4. Results indicated that the effect of nitrogen fertilizer and hybrids effects on the content chlorophyll a and b, leaf area, the number of grains per ear, number of grains per row, 1000 grain weight of maize, grain yield were significant. N management by the application of 150 kg N/ha⁻¹ produced significantly more leaf area, number of grains row⁻¹, number of grains ear⁻¹, 1000-grain weight (g), grain yield. These results implied that maize yield were significantly affected by changes in genotypes and environments (mainly climatic changes from years).

Key words: maize, fertilization, climatic conditions, calcareous soil, yield

PI_05

ZP 4019- a new maize hybrid developed using doubled haploid (DH) technology

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Abstract

The history of maize breeding in Maize Research Institute Zemun Polje has been going on for more than seven decades. Maize breeders in the Institute create their breeding programs in such way to respond to actual market demands and modern trends in maize cultivation but also by using available new technologies that accelerate and increase the efficiency of maize hybrid development. One of the tools that makes this possible is double haploid (DH) breeding technology, which has been applied in the Maize Institute since 2014. Breeding programs with the use of DH are realized by the use of inducers with high induction rate, additional winter generations and the development of a reliable system (markers) induced haploid recognition. In this way, ZP 4019 was created at the Institute Zemun Polje as the first official maize hybrid with a parental inbred line obtained by DH technology. This is a modern maize hybrid intended to respond to the changes in maize cultivation in recent years caused by increasingly frequent periods of draught, unfavorable precipitations and temperatures in the flowering and grain filling stages, as well as demands for higher yields and easy grain harvesting without the need for grain drying. ZP 4019 plant habitus is characterized by a low stem, a well-developed root system, a significant leaf area, erect position of the upper leaves and a lower planted ear which enables growing in higher densities. In testing on different agroecological environments, this hybrid showed high adaptability and stability. ZP 4019 was tested in official test trials of the Section for plant variety registration during 2021 and 2022 and performed significantly better than check hybrids NK PAKO and ZEROS, while its grain moisture content was below the official threshold for the FAO 400 maturity group.

Key words: maize, hybrid, doubled haploid, yield

PI_06

The importance of hybrids and sowing density on maize yield in the southern part of Serbia

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Abstract

The aim of the research was to examine the influence of sowing density on the yield of more maize hybrids of different vegetation lengths in the conditions of southern Serbia (Leskovac). For this purpose, during 2016 and 2017, an experiment was set up with 6 maize hybrids (ZP 434, NS 4023, ZP 555, NS 5051, ZP 666, NS 6030) and 3 sowing densities (71428; 57142 and 47619 plants ha⁻¹). The experiment was set up according to the random block system in 3 repetitions and was processed by the method of analysis of variance. The results are shown as a two-year average and they showed that the average grain yield for all densities, depending on the hybrid, ranged from 9.33 t ha⁻¹ in the hybrid NS 4020 to 11.16 t ha⁻¹ in the hybrid ZP 555. Hybrids of medium and long vegetation period had significantly higher grain yields than hybrids with a shorter vegetation period. The average yield for all hybrids, depending on the sowing density, ranged from 10.06 t ha⁻¹ at the highest sowing density to 10.66 t ha⁻¹ at the medium sowing density. Hybrids with a shorter vegetation period achieved the highest average yields at the highest sowing density, while hybrids with a longer vegetation period had the highest average yields at the lowest sowing densities. The hybrids ZP 555 and NS 6030 had the highest average yields of 11.77 and 11.02 t ha⁻¹ at medium and lower sowing densities, respectively. Based on this, it is recommended to sow hybrids of medium and longer vegetation period in the range of 57142 to 47619 plants ha⁻¹.

Key words: maize, plant density, vegetation period, yield

PI_07

Forage yield and yield components of Sudan grass depending on sowing density

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Abstract

The paper analyzes the influence of different sowing densities on the forage yield and yield components of Sudan grass crops in post-harvest sowing. The field trial was staged in Velika Plana in 2020. The Srem cultivar sudan grass is sown on vertisol type of soil. Sowing was done on July 15. The experiment was set up according to the split-plot system by sowing in two densities, 12 and 25 cm row spacing. The seed amount in sowing was 15 and 30 kg ha⁻¹, respectively. Forage yield components were analyzed in the panicle phenophase of the plants, immediately before mowing. After mowing, the forage and hay yield were determined. A significantly higher internodes number per plant (8.3) and plant height (2.12 m) was recorded in the treatment with a higher crop density compared to the treatment with a lower density (7.7 and 1.93 m respectively). A significantly higher leaves number per plant (3.7) was recorded in the treatment with lower crop density compared to the treatment with higher density (3.5). Sowing density had no significant effect on the panicles number per plant. The mass of the above-ground part of the plant was significantly higher in the treatment with higher seeding density. The forage yield was significantly higher in the treatment with a higher sowing density (51.6 t ha⁻¹) compared to the treatment with a lower density (30.4 t ha⁻¹). The dry matter yield ranged from 10,184 t ha⁻¹ at lower sowing density to 18,238 t ha⁻¹ at higher density.

Key words: cultivation density, forage yield, Sudan grass, yield components

PI_08

Results of breeding work on small grains at the agricultural institute of Republic of Srpska

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Abstract

At the Agricultural Institute of the Republika Srpska, Banja Luka, several years of breeding work over the last few years resulted in the recognition by the variety commission in Serbia of one variety of winter wheat Julija, six-rowed barley variety Vitez and two-rowed spring barley variety Rojal, as well as the creation of several new ones lines of winter wheat that are planned for recognition in the current year. Newly recognized varieties have a high yield, good quality, excellent adaptability and stability, satisfactory resistance to major diseases and stressful situations. In our production conditions, the Julia variety behaves as optional because it has a low degree of winter hardiness, and at the same time excellent resistance to low temperatures. Based on the test results, it was characterized as an improver, first technological group. During the testing of the spring malting barley variety Rojal, it has an extremely short growing season, and in such a period it exhibits excellent genetic potential, and at the same time it can be grown as a winter variety. The Julija variety achieved an average yield of 8380 kg ha⁻¹ for both years of testing and all locations, the standard variety Ranesansa yielded 7830 kg ha⁻¹ and the standard variety Ns 40-S 8190 kg ha⁻¹. The highest yield of the Vitez variety was achieved under conditions of intensive production at the Pančevo location 10375 kg ha⁻¹, Sremska Mitrovica 8163 kg ha⁻¹ and Kikinda 7834 kg ha⁻¹. The Royal variety achieved an average yield of 5780 kg ha⁻¹ for both years of testing and all locations, and the NS Marko standard variety 5602 kg ha⁻¹. At the site of Novi Sad, during the period of testing, this variety achieved a maximum yield of 8974 kg ha⁻¹.

Key words: variety, breeding, wheat, barley, grain yield

Satellite-based modelling of grassland yield and quality dynamics (SatGrass)

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Abstract

With 1.34 million hectares, grassland represents the most important land-use system in Austria in terms of area. Among important ecological functions, grassland provides the feed basis for approximately 53,000 livestock farms. Various utilisation intensities caused by different site conditions, small-scaled structure and multiple harvests per growing season are impeding a systematic estimation of yield and quality. Such estimates have so far only been possible by using random samples in statistical models. The annual and regional yield variations, which are primarily dependent on weather conditions, cannot be pictured sufficiently in such a way. This particularly applies to the quantification of yield reductions and losses due to extreme events, which will occur more frequently in the future as a result of climate change. Yield and quality must be evaluated together in the assessment of grasslands. Harvesting at an early stage of development provides low dry matter yield but high forage quality. With further development of vegetation, biomass increases, but its quality drops sharply. Farmers can directly control the relationship between yield and forage quality by selecting the most appropriate cutting time. An objective assessment of the co-evolution of these two parameters is therefore decisive for the economic success and productivity of a grassland farm. With the help of earth observation services such as Copernicus, grasslands and utilisation frequency can be monitored continuously at field level. To derive vegetation dynamics, SatGrass combines remote sensing and weather data into a grassland growth model, which is calibrated and validated with numerous, destructive and spatially distributed yield and quality measurements. A cut date detection f-score of 0.79 suggests the method can accurately detect cuts, with

absolute detection errors of less than 5 days. Our results indicate a general improvement of existing methodologies despite performing the cut detection across the fragmented, mountainous and diverse Austrian landscape.

Key words: Optical remote sensing, Grassland management, NDVI Time series, Sentinel-2, Mowing

PI_10

Estimation of yield potential of local wheat landraces with NDVI, flag leaf area and chlorophyll content

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Abstract

Plant genetic resources are a valuable, but largely unexplored pool of potentially useful traits that could be useful for crop improvement for more resilience to fluctuating climates. Traditional varieties and landraces are, in general, well adapted to local environments, but usually mature late and have low yield, one of the most valued traits among both breeders and farmers. The aim of this study was to evaluate 30 local Serbian landraces and obsolete varieties for yield potential, earliness (as flowering time), and ability to remobilize nutrients to the grain, and to determine their correlations with NDVI, flag leaf area and chlorophyll content. A two-year field trial with 5 m² plots in three replications was performed at the experimental station at Rimski Šančevi, Novi Sad, Serbia. The yield, dry matter remobilisation efficiency (DMRE) and contribution (DMRC) were in positive correlations with NDVI, flag leaf area and chlorophyll content. Flowering time was negatively correlated to all other traits. The genotypes were separated as low (9 t/ha). Despite the negative correlation between the flowering time and other traits, several genotypes (landrace L285, varieties Novosadska crvenka, Hibrid 0.13 and Partizanka) showed earliness (130-133 days), high yields (9.11-9.88 t/ha), and high or medium DMRE (0.36-0.44) and DMRC (0.55-0.62) and harvest indices (0.55-0.60). Those varieties also had medium or, in case of L285, low flag leaf areas. The results indicated that this is an interesting potential breeding material being worthwhile for further investigations.

Key words: evaluation, genetic resources, landraces, *Triticum aestivum* L., wheat

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resources towards increased sustainability of grain-value chain and improved farmers' livelihoods in Serbia and Bulgaria-GRAINEFIT”.

PI_11

Variation of silage yield of maize hybrids on soils of poor fertility in hilly areas

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Abstract

The goal of the research was to investigate the yield of corn in the process of silage production in the conditions of a hilly area and soil with a poor chemical composition. Field trials were conducted during one year (2021). The test was carried out in Dobrnja on Manjača, at an altitude of 527 m, five hybrids of corn (BL-43, ZP-434, BC-408, BC-418, AS-144) were tested. Seeding of all hybrids was done by machine, at an inter-row distance of 70.0 cm in the optimal agrotechnical period. During the research period, the height of the plant, the weight of one plant, the number of plants at the time of ensiling and the yield of silage were studied. The AS-144 hybrid had the highest average plant height of 266 cm, the BC-408 hybrid achieved the highest mass of one plant and silage yield of 53,15 t ha⁻¹. Hybrid BL-43 had the highest number of plants per unit area at the time of silage 62110. During the growing season, chemical protection against weeds (after emergence), cultivation and top dressing was carried out. All measurements in these studies were performed in the optimal phase for corn ensiling. If we keep in mind the production conditions of the mountainous area, primarily weather conditions and soil quality, all hybrids achieved high silage yields and can be recommended for silage production in this location. In addition to the quality of the land, the risk in the production of corn silage at the research site is also the possibility of early autumn frosts (the third decade of September). The production of bulk fodder-silage from corn represents a significant and basic source of nutrients for livestock. The importance is even greater for the reason that this nutrient is not a marketable commodity.

Key words: yield, silage, corn, hybrid

PI_12

Evaluation of combining abilities of local maize landraces for starch, protein and oil content in grain

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Abstract

Plant genetic resources of any country represent its natural wealth. Gene Bank of the Maize Research Institute "Zemun Polje" with over 5,000 samples represents national guardian of such. Local maize populations, tributing to their diversity, represent a key source of desirable traits for breeding programs, such as nutritional values for protein, starch and lipids. Today's corn hybrids are based on a narrow genetic base, where in race for yield, often insufficient attention is paid to the nutritional composition of the hybrids themselves. Correct selection of material from the Gene Bank can only be achieved with pre-breeding selection. Such prebreeding would cover wide material and should detect and reduce it to a desirable and more acceptable volume that can further be introduced into commercial breeding programs. This paper covered analysis of protein, starch and lipid content in grain of 31 local maize populations, crossed with two commercial testers ZPL-217 (BSSS) and ZPL-255/75-5 (Lancaster Sure Crop) with line x tester method used for combining ability calculation. According to the results the best combiner for higher lipid content is A3 landrace with a GCA value of 0.33*, for protein content landraces A9 and A 38 with GCA values of 0.51* and 0.57*, respectively, were found. As for populations A 17 and A 37 with the GCA values of 1.52* and 1.36*, respectively, they proved to be the best combiners for starch. Mentioned populations showed significant GCA values with a probability level of 0.05, showing their possible significance in further breeding application.

Key words: maize landraces, nutritional values, combining abilities

PI_13

The effect of different microbial fertilizer on the weediness of maize

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Abstract

The maize cultivation trial was conducted at the Research and Experimental Field "Radmilovac" of the Faculty of Agriculture in Belgrade in 2022 on the soil type luvisol chernozem in completely randomized blocks. The cropping system included tillage with a disk harrow at 25-30 cm with complete incorporation of winter wheat crop residues and tillage with a harrow before sowing. Basic fertilizer was applied in the fall at 500 kg ha⁻¹ NPK (15:15:15). The following microbiological fertilizers were used for top dressing in spring: Biofertilizer ("Slavol", manufacturer "Agrounik" Serbia) with 5 l ha⁻¹ in two treatments and Eko lame with 10 l ha⁻¹ in 3 treatments. The top dressing in the control variant was done with nitrogen fertilizer AN at the rate of 60 kg ha⁻¹ N. Maize varieties (ZPSC 666) were used. The maize was grown in a six crop rotation. Statistical analysis confirmed that top dressing had a greater effect on weediness of maize. The weed community in maize crops consisted of 15 weed species, with terophytes dominating: *Stellaria media* (L.) Vill., *Veronica persica* Poir. and *Sonchus oleraceus* (annual species) and *Agropyrum repens* (L.) Beauv., *Cirsium arvense* (L.) Scop., *Convolvulus arvensis* L. and *Sorghum halepense* (L.) Pers. (perennial species). The obtained results show that the highest number of weeds, weeds per species, fresh and air-dry biomass were recorded in the control variant. The statistically lowest values for the number of weed plants per species and fresh biomass, as the most important parameters of weed infestation, were recorded in the treatment with Eko lame. The differences in weed population in the variants with microbiological fertilizers were not statistically significant, while there were statistically very significant differences compared to the control. The use of microbiological fertilizers affected the initial faster development of maize plants and increased competitiveness against weeds.

Key words: competition, weed, maize, top dressing

PI_14

The influence of the application of effective microorganisms on the weight of 1000 grains and the yield of different maize genotypes

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Abstract

Maize is a plant species that occupies a large area in world and Republic Serbia. For a high yield, mineral fertilizers are mainly used. In the conditions of climate change, the production of maize in the natural irrigation system is increasingly difficult. Given that there are increasing demands for environmental protection and reduction of greenhouse gas emissions from agriculture, corn production must be improved in order to achieve sustainable production. The aim of the work was to determine the influence of the application of the microbiological preparation EM Aktiv (trade name) on the weight of 1.000 grains and the yield of maize. The experimental trial was set up in the Mačva region in the period 2016-2017 (factor A). For plant nutrition, nitrogen was used in the amount of 120 kg ha⁻¹. Sowing was done with hybrids ZP 424, ZP 548, ZP 687 (factor B). The microbiological preparation was applied in two treatments (factor C). Treatment T1 - before sowing introduced into the soil in the amount of 20 l ha⁻¹ and T2 - T1+ foliar treatments in the phenophase of 5-7 leaves with 6 l ha⁻¹. The weight of 1000 grains was highly dependent on fertilization and hybrids. The highest mass of 1.000 grains was found in hybrid ZP 427 (253.00 g). The effect of year and treatment was highly significant on the yield. Treatment T2 had the greatest impact. Compared to the control, it increased the yield by 17.01%, and compared to T1 by 3.66%.

Key words: maize, microbiological preparation, weight 1000 grains, yield

PI_15

Energy equipment with tractors in the cooperative "Agroprom"

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Abstract

The agricultural cooperative "Agroprom" in Stara Pazova was audited to assess their agricultural machinery equipment. The article presents the results of the audit of agricultural machinery equipment of the agricultural cooperative "Agroprom" from Stara Pazova. The cooperative cultivates 2,592 ha with 35 two-axle tractors and 79 implements. In terms of the number of tractors, John Deere is the most represented with 15 units or 42.86%, while Landini Ghibli and IMT-542 are the least represented with 1 unit each or 2.86% of the total number of tractors. The total available engine power of all tractors is 3,655.0 kW, of which John Deere tractors account for more than half, 51.78% or 1,877.78 kW. The specific load of tractors on the cultivated area is 0.71 ha/kW. There are 1.31 tractors per 100 ha of cultivated area. The energy equipment of the cooperative is expressed on average by the nominal engine power of the two-axle tractors per unit area of 1.41 kW/ha. A tractor with an average engine power of 104.43 kW works 76.23 ha with 2.32 implements. The average age of tractors is less than 10 years. Most tractors are between 11 and 12 years old, 62.86%, and 5.71% of the total number of tractors are less than 5 years old. From the above data it can be concluded that the equipment of the agricultural cooperative "Agroprom" from Stara Pazova with modern agricultural machinery is at a satisfactory level.

Key words: cooperative, tractors, implements, power machinery, age of machinery

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PI_16

Assessment of the quality of work of aggregates for basic tillage

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Abstract

Basic processing restores the topsoil layer, and the quality of its workmanship is one of the most important factors ensuring stable crop production. In the case of a well-executed basic ploughing operation, the same applies to the appropriate structure, which implies a minimum energy consumption for the pre-settlement preparation. The aim of the study is to examine the possibility of adjusting basic parameters in order to increase the quality and productivity of labour. The research was carried out under field conditions and included basic parameters which are an indicator of the productivity of machinery and human labour. The Zetor Forterra tractor has an installed power of 100.02 kW and is in operation for the first time. The results obtained in this research indicate that despite the solid conditions of exploitation of aggregates, the effects that should be provided by new, modern mechanization during intensive production have not been achieved. Particular attention should be paid to parameters such as the coefficient of use of the extent of work, the efficiency of shift work and the productivity of machinery and human labour.

Key words: plow, basic processing, tractor, productivity, application in practice

PI_17

Innovations in agriculture - rape seed drill based on an after-crop seeder as an example of farmer' himself innovation

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Abstract

Agriculture is increasingly confronted with abiotic stresses: on the one hand, too little precipitation, long periods of meteorological drought and, on the other, heavy rainfall occurring at irregular intervals. The differences between seasons become blurred, adversely affecting the growing season and the farmer's final profit. An innovation is a new way of approaching a particular problem that is currently known or finding a way to solve a newly created one. Agriculture is one of the sectors of the economy where we deal with innovation all the time. Agricultural machinery companies are competing to incorporate new solutions into their machines that no competing company's machines have. Also farmers themselves refine their newly purchased equipment to their own requirements or build what no one has created before. The aim of the study is to present and discuss technical solutions for the prototype of a modernized catch crop seed drill adapted to precise sowing of rapeseed, which is an example of a product innovation prepared by a farmer himself. The reason for creating the prototype was to find a way of achieving higher rapeseed yields despite unfavorable environmental conditions. To achieve this, a rapeseed drill was developed on the basis of a catch crop drill. The prototype is a combination of several machines, or to be more precise, their various parts available on the market. In the whole project, only the catch crop drill is a machine that is completely commercially available. At the moment, the machine, is undergoing a testing phase to refine it and create a target production version that can be marketed. To create the prototype was used the available literature and own observations and technical and agricultural experiences.

Key words: product innovation, rape, seeder, agricultural modernization, farmer-innovator, machinery innovation

PI_18

On-farm conservation, management and use of barley, oats, rye and wheat genetic resources in Serbia

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Abstract

The study compiles the achievements of a two-year collecting mission conducted in 2020 and 2021 period in Serbia, which aimed at collecting small grains genetic resources and information about the state of their conservation, management and use. In total 12 samples were collected, namely seven accessions of barley landraces, two of oats, two of rye and one wheat variety in four regions of Serbia. The local traditional cereals were mostly preserved in remote and mountainous parts of southern and south-western parts of Zlatibor district. Most of the samples were collected at Pester mountain plateaux, where local farmers still grow very few traditional varieties on small areas for personal use. The local varieties are valued by farmers for different traits, some for resistance to lodging and diseases, some for their nutritional value for human consumption and animal feed. These local crops are cultivated either as a sole crop or in crop mixtures so-called „polovice“, on poorer soils with very low inputs, achieving modest yields. Recipes for traditional dishes from local cereals are preserved. The accessions were described and deposited in the long-term storage in Serbian National gene bank and Svalbard Global Seed Vault. All collected samples were multiplied for morphological characterization in field trials and distribution to farmers for on-farm evaluations. Recently, there have been initiatives to establish local community seed banks and promote seed exchange among farmers. The collected genetic resources could be a valuable material for pre-breeding activities and genetic diversity studies.

Key words: barley, collection, genetic resources, local farmers, oats, rye, genebank

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resources towards increased sustainability of grain-value chain and improved farmers' livelihoods in Serbia and Bulgaria-GRAINEFIT”.

PI_19

Winter wheat mixtures system as the way for stabilization of yield and increase of grain quality in organic farming

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Abstract

One of the leading market crops of organic farming is bread wheat (*Triticum aestivum* L.). As a result of the limitations given by the legislation, it is possible to achieve a high yield and grain quality in the organic farming system. There are more options for improving the productivity of wheat cultivation, but one option is the cultivation of varietal mixtures. The contribution aims to assess the influence of growing a mixture of wheat varieties on yield level and grain quality. A three-year field experiment was conducted at the organic-certified research area in the Czech Republic. We evaluated the response of four winter wheat varieties and their mixture's grain yield and quality. Two different seeding systems were also used - mixed seed or each variety seeded in a separate line as a single. Our experiment showed that growing wheat varieties mixture does not negatively impact yield but can stabilize grain quality. The most critical quality parameter was increased protein content in the two varieties mixture, where the low-quality variety Vanessa was included. Wet gluten (18%) and falling number (268 s.) as the highest numbers were obtained in Butterfly-Lorien and Butterfly-Vanessa, respectively. Wheat varieties mixtures growing system have the potential for improving grain quality and may apply in further research. Important will be considered depending on more wheat variety, agrotechnology, and each factor interaction, whereas the overall benefits from this approach as expected.

Key words: organic farming, wheat, variety mixtures, yield, quality

PI_20

Benefits of organic food production

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Abstract

Due to legal regulations and standards, organic agriculture provides the production of healthy, high-quality food, which has not only numerous benefits for human health, but also ensures the preservation of the environment. The relevant literature was surveyed for this study with the aim to point out to nutritive values of organic food and the advantages of food consumption. Furthermore, an overview of the beneficial effects on the environment was presented. The world population is increasingly attaching importance to the quality of food that is consumed due to adverse effects of conventional agricultural production and the use of chemicals. It is obvious that there is still a need for a greater number of analyses and studies in order to justify the value of organic food products, which are of higher quality and more nutritious and healthier than conventionally produced ones.

Key words: organic agriculture, food, nutritional composition, pesticides

PI_21

Organic soya bean production in Serbia

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Abstract

In Serbia during 2021, organic crop production was performed on the area of 23,527 ha. The area of 2121.6 ha on which industrial crops were grown ranked fourth comparing to the total arable area sown with organic crops. Soya bean is one of the most important legumes, primarily because of the exceptional chemical composition of the grain (40% proteins and 20% oil). This manuscript reveals the analyses and graphic presentation of the area trends and the regional distribution of organic soya bean production in Serbia in the 2011-2021 period. The desk research was applied. Organic farming of soya bean is carried out on the area of 481 ha, right behind the leading sunflower (1,165 ha). In the region of Vojvodina, there are the largest areas on which organic growth of soya bean is performed. However, the organic soya bean production in Serbia is still insignificant, despite favourable agroecological conditions and market demands.

Key words: organic production, soya bean, areas, regions

PI_22

The state of organic barley production in Serbia

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Abstract

In Serbia, in 2021, organic crop production was performed on the area of 23,527 ha. The organic cereal production was carried out on the area of 4.458,69 ha - the dominant role belonged to wheat, which was grown on the area of 1.581,18 ha, and was followed by rye (879,08 h), spelt wheat (491,79 ha) and barley (398,52 ha). The aim of this study was to show the range of areas under organic barley production in Serbia and to show the regional distribution for the 2011-2021 period. Data were obtained from the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia. The following methods were used in the study: desk research, content analysis, comparative analyses and analyses of base and chain indices. The largest production of barley in 2021 was recorded in the region of Vojvodina (358.09 ha). Although natural conditions for barley production in Serbia are exceptionally favourable, natural potentials have not been sufficiently used.

Key words: organic production, cereals, barley, areas

Bioherbicides in organic agriculture

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Abstract

Given that the use of synthetic pesticides is prohibited in organic agricultural production, the biggest challenge is plant protection. The fight against weed plants in organic production is a measure that has neither simple nor standard solutions. Since herbicides are prohibited in these plantations, the use of biopesticides represents a safe, legally permitted, natural alternative. Depending on the organism they control, biopesticides are divided into bioinsecticides, biofungicides, bioherbicides, and others. This paper aims to review the relevant literature that indicates the most critical agents used as bioherbicides in organic agriculture. Living organisms such as insects, nematodes, bacteria, and fungi, as well as natural products are used in the biological control of weeds. There are many plant extracts with bioherbicidal action, which is most often attributed to the feature of allelopathy. Natural products that are used in the fight against weed plants contain essential oils (such as clove oil, eugenol, and d-limonene), soaps (pelargonic acid), acids (acetic, citric), or iron compounds (chelates). Acetic acid and vinegar are the ingredients in several herbicide products. Over 20 bioherbicides are registered or commercialized on the world market, most of which are based on fungi (genera *Alternaria*, *Colletotrichum*, *Fusarium*, *Phomopsis*, *Phytophthora*, *Phyllosticta*, *Phoma destructiva*, *Puccinia*, etc.). Corn gluten meal and mustard seed meal are used as preemergence organic herbicides, and as post-emergence and burndown organic herbicides 40% ammonium nonanoate, vinegar (5, 10, 15 and 20% acetic acid), clove oil 55% d-limonene. However, the market for these products is still small, it is mainly dominated by chemical control. There are still no registered bioherbicides in Serbia. Bioherbicides have shown great potential in controlling weeds in organic agricultural production, and represent a sustainable, cheap, and environmentally friendly suppression method.

Key words: organic agriculture, weed, herbicides, fungi, essential oils

PI_24

Assessment of seed viability in long-term stored *Oryza sativa* L. accessions after more than a decade

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Abstract

The purpose of this research was to evaluate the seed viability of the 16 *Oryza sativa* L. accessions including valuable endangered landraces, breeder's line and advanced/improved cultivar after 13-14 years of long-term storage. Preservation of seed samples has been conducted ex situ at low temperatures (-18°C). The germination test (germination energy and total germination) was carried out according to ISTA methods and Kameswara (2006). Furthermore, the following variables were examined: germination index, root length, shoot length, root to shoot length ratio, total seedling length and seed vigour index. A Pearson correlation coefficient was computed to assess the linear relationship between vigour index and seedling length. All of the sixteen accessions have a high total germination rate, in the range of 89-100%, so there is no need for their regeneration. Germination energy and total germination showed statistically significant differences for two rice accessions at P-0.05 and P-0.01. The seed showing the high vigour index produced the seedlings with higher growth rates. Pearson correlation of vigour index and seedling length was found to be very highly positive and statistically significant ($r=0.99$, $p<0.001$). From the obtained results it can be concluded that the rice as a botanical species retains high seed viability during long-term conservation, however there are individual differences between the accessions which are due to the genetic constitution of each genotype.

Key words: genebank, ex situ storage, rice genotype, vigour index, seedling growth

PI_25

Influence of pesticides on soil microorganisms

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Abstract

Plant protection agents (pesticides) are products of chemical or biological origin, intended for the prevention, suppression and destruction of organisms harmful to cultivated plants (pests, pathogens and weeds) and are intensively used in agriculture and forestry. Decades of systematic and improper application of pesticides caused their accumulation in the environment and, through the food chain, pesticides also accumulated in living organisms, where they exhibit negative biological effects. Pesticides exhibit their biological effects on the members of all biocenosis, including the community of microorganisms (microbiocenosis), and especially on soil microorganisms. The results of scientific research in the field of the impact of pesticides on soil microorganisms are different. These results are due to the ecological (soil-climatic) conditions in which the experiments are performed, the types of plant crops grown, and the agricultural techniques used. Fumigants have the strongest inhibitory effect on soil microorganisms. Fungicides inhibit the growth of most soil fungi. Herbicides exhibit different effects, stimulatory or inhibitory, on different groups of soil microorganisms, which also depends on the prevailing effect of ecological factors in agroecosystems.

Key words: pesticides, soil microorganisms, ecological factors, agroecosystem.

Acknowledgment: The work is part of the project to develop the innovative product “Guardian feed” of the Raising Starts program of the Science and Technology Park Belgrade and the Government of Switzerland.

PI_26

Significance and economic justification of application of microbiological fertilizers in plant production

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Abstract

Plant production, based on scientific principles, and especially the application of fertilizers, enables the nutrition of the growing human population on the planet. However, intensive application of mineral fertilizers in agricultural production, especially nitrogen fertilizers, has led to environmental pollution. Primarily, nitrates and heavy metals accumulate in the soil, groundwater and plants. Also, the increased application of mineral fertilizers has a negative impact on the economic aspects of plant production. Mineral fertilizers are very expensive due to the reduced exploitation of fossil fuels, and the costs of fertilization in the total price of the cost of agricultural products range up to 25%. Microbiological fertilizers represent a rational replacement for the application of mineral fertilizers from an economic and environmental aspect. Microbiological fertilizers contain microorganisms from natural ecosystems. They produce compounds that stimulate the growth and development of plants: growth substances (auxins, gibberellins and cytokinins), polysaccharides, vitamins, enzymes, amino acids, etc., which affects the quality of the yield. Soil fertility depends on the dynamics of microbiological processes - mineralization and immobilization of nutrient elements in the soil, which is achieved by applying microbiological fertilizers, which have the ability to supply the plant with the required amount of nutrients during the growing season. Microbiological fertilizers do not have negative effects on agroecosystems and the environment and do not pose a danger to members of food chains. Acknowledgment: The work is part of the project for development the innovative product "Guardian feed" of the Raising Starts program of the Science and Technology Park Belgrade and the Government of Switzerland.

Key words: environmental pollution, economic and environmental justification, microbiological fertilizers

Acknowledgment: The work is part of the project for development the innovative product \"Guardian feed\" of the Raising Starts program of the Science and Technology Park Belgrade and the Government of Switzerland

PI_27

Influence of mineral fertilizers on soil microorganisms

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Abstract

During the period of several thousand years, traditional agricultural production has come a long way from the first domestication of wild plants to planned cultivation, which led to a great increase in the yield and quality of plant products. On the other hand, the survival of most cultivated plants today almost entirely depends on the application of pesticides and fertilizers. Mineral fertilizers, in addition to increasing the yield of cultivated plants, exert very complex and often negative effects on agroecosystems and members of the agrobiocenosis. They also manifest a very complex influence on soil microorganisms. Studying the effect of the amount of mineral fertilizers on microorganisms is very important because, in addition to plants, different ecophysiological groups of soil microorganisms are the most important links in the cycles of matter circulation in ecosystems and enable the maintenance of ecosystem productivity. Most of the conducted scientific research indicates that mineral nitrogen fertilizers, applied in smaller quantities, have a stimulating effect on the number of different ecophysiological groups of microorganisms: amino-heterotrophs, amino-autotrophs, cellulolytic microorganisms, actinomycetes, fungi, as well as on the total number of microorganisms compared to the control. Applied amounts of nitrogen fertilizers reduce the number of free nitrogen-fixing bacteria, such as the bacterial genus *Azotobacter*, due to the exceptional sensitivity of nitrogenase enzymes to molecular nitrogen. Applied larger amounts of nitrogen mineral fertilizers generally lead to a decrease in the abundance of all ecophysiological groups of microorganisms.

Key words: soil, microorganisms, nitrogen mineral fertilizers

Acknowledgment: The work is part of the project for development the innovative product "Guardian feed" of the Raising Starts program of the Science and Technology Park Belgrade and the Government of Switzerland.

PI_28

Antifungal activity of *Bacillus amyloliquefaciens* D5 ARV

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Abstract

Biological control is a key component of integrated pathogen management, and plant growth promoting bacteria are an integral part of this approach. The current study aimed to evaluate the antifungal potential of *Bacillus amyloliquefaciens* against *Botrytis cinerea*, *Fusarium oxysporum*, *Fusarium graminearum*, and *Macrophomina* sp. through confrontation test and effects of non-volatile and volatile organic compounds (VOCs). The non-volatile metabolites of *B. amyloliquefaciens* were collected in the stationary phase and prepared by filtration and autoclaving. In the confrontation test, *B. amyloliquefaciens* reduced the growth of *B. cinerea*, *F. oxysporum*, *F. graminearum*, and *Macrophomina* sp., by 37, 60, 46, and 33%, respectively. The VOCs inhibited mycelial growth of *B. cinerea* for 53%, *F. oxysporum* 30%, *F. graminearum* 47%. The growth of *Macrophomina* sp. was not inhibited. The mixture of bacterial metabolites significantly lost its activity after autoclaving. GC-MS analysis of *B. amyloliquefaciens* VOCs revealed presence of dimethylsilanediol, pentadecanoic acid, and hexanedioic acid, bis(2-ethylhexyl) ester. The last two are known for their antimicrobial and antifungal properties. The present study showed the biocontrol potential of *B. amyloliquefaciens*, which was result of multiple antifungal mechanisms, from the production of cell-wall degrading enzymes, and competition for nutrients (siderophores) to the production of antifungal non/volatile metabolites.

Key words: Biocontrol, *Bacillus amyloliquefaciens*, *Botrytis cinerea*, *Fusarium* spp., *Macrophomina* sp., VOC

Acknowledgments: This research was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (contract No. 451-03-47/2023-01/200116).

PI_29

Root colonization of different plant species by *Bacillus megaterium*

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Abstract

Bacterial colonization of the rhizosphere is a point for the establishment of interactions between plants and bacteria. It represents a key determinant of plant health, productivity and a possible protective mechanism against phytopathogens. Plants influence bacterial colonization primarily by the composition of their root exudates and by raising the innate immune response. The aim of this work is to investigate the ability of *Bacillus megaterium* 11/3 to colonize the roots of different plant species. The determination of colonization ability was based on determining the presence of bacteria on the surface and internal structures of plant roots after three weeks of cultivation. The model plants were: rapeseed and wheat. The ability of *Bacillus megaterium* 11/3 to colonize roots was examined using scanning-electron microscopy (SEM), confocal-laser-scanning microscopy (CLSM), as well as using the dilution method. The results showed that the degree of surface colonization of rapeseed root was 1.4×10^5 and 1.9×10^6 CFU/g fresh root mass on root surface of wheat. The degree of endophytic colonization was 2×10^2 and 3.6×10^4 CFU/g fresh root mass for rapeseed and wheat root, respectively. Using SEM and CLSM, a greater presence of *Bacillus megaterium* 11/3 was observed at the sites of growth and around root hairs than on the hairs themselves and the root cap. The presence of a large number of bacterial spores was also observed, which is the key to the survival of bacteria in unfavorable conditions. The results confirmed capability of *B. megaterium* 11/3 to colonize surface and internal spaces of rapeseed and wheat roots.

Key words: plant colonization, *Bacillus megaterium*, bacteria-plant interaction, SEM, CLSM.

Acknowledgments: This research was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (contract No. 451-03-47/2023-01/200116).

PI_30

The impact of different irrigation and fertilization levels on the population and damages caused by *Ostrinia nubilalis*, Hübner (Lepidoptera, Crambidae)

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Abstract

In this study the effect of three different levels of irrigation (I_{100} , I_{50} and I_0) and two fertilization (F_{100} , F_{50}) on the population of the European corn borer - *Ostrinia nubilalis* Hübner (Lepidoptera, Crambidae) and damages on corn (BLSC 43) were studied. The study was conducted at Educational-experimental center of Agricultural Faculty University of Banja Luka, Republic of Srpska during two years (2021 and 2022). Three levels of irrigation were applied; full field capacity - I_{100} , 50% of field capacity - I_{50} and without irrigation - I_0 . Fertilization was applied twice, at the stage of 6 and 14 leaves two doses, $F_{100} = \text{AN } 50.4 \text{ kg ha}^{-1}$ (100 %) and $F_{50} = \text{AN } 25.2 \text{ kg ha}^{-1}$ (50 %). All observed parameters of population level and damage were higher in 2021. Number of infested noduses, larvae per plant, holes and length of tunnels were higher in F_{100} than in F_{50} treatments in 2021, while in 2022 it was opposite. Number of larvae per plant in 2021 was the highest in I_0 (6.6), then in I_{50} (6.3) and the lowest in I_{100} (4.8) with F_{100} , while in 2022 the highest number of larvae was in I_{100} (3.5), than in I_{50} (2.5) and the lowest in I_0 (1.9) with F_{50} . In 2021 the longest tunnels length was in combination $I_{100} \times F_{100}$ (38.0 cm) and the shortest in combination $I_0 \times F_{50}$ (24.0 cm), while in 2022 the longest tunnels were in combination $I_{100} \times F_{50}$ (22.0 cm) and the shortest in combination $I_{100} \times F_{100}$ (13.4 cm). It can be concluded that infestation and damage level of European corn borer on corn depends on the year (climatic conditions) which than influence effect of irrigation and fertilization.

Key words: European corn borer, Republic of Srpska, corn, insect management

Acknowledgment: The study was funded by SMARTWATER project.

PI_31

Application of the insecticide tefluthrin for the control of Elateridae and Scarabaeidae in maize crops

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Abstract

Achieving high and stable yields with high nutritional value, that are economically profitable and at the same time safe for health is the primary goal of maize production. Soil pests (Elateridae and Scarabaeidae) are among the economically important pests of maize. To control these pests, field trials were conducted in 2021 in the region of Vojvodina province in the localities of Kovilj and Čurug on mercantile maize crops (hybrid NS 3022 (FAO group 360)), according to standard EPPO methods. Products based on the active ingredient tefluthrin (5 g a.i./kg, GR) at the rate of 15 kg/ha and (15 g a.i./kg, GR) at the rate of 7 and 10 kg/ha, were applied simultaneously with sowing with depositors. The experiment was laid out in four replications. Immediately before sowing, soil analyzes were carried out to determine the number of pests. In the first evaluation, the effects of the applied insecticides were derived from the number of sprouted plants at a distance of 10 m and the number of plants damaged by Elateridae and Scarabaeidae larvae. In the second assessment, the mass (g) and height (cm) of 25 plants per replication were evaluated. Results are presented as average values and significance of differences (LSD 5%) at ANOVA. Before sowing, at the locality Kovilj only Elateridae larvae (2.1/m²) were determined, while at the locality Čurug larvae of Elateridae (1.8/m²) and Scarabaeidae (1.3/m²), were found. The analyzed tefluthrin based products significantly increased the number of sprouted plants, decreased the number of damaged plants and increased the mass and height of maize plants. The results indicate that populations of Elateridae and Scarabaeidae are sensitive to the insecticide tefluthrin.

Key words: maize, Elateridae, Scarabaeidae, tefluthrin, efficacy

Acknowledgement: This study was part of the project 451-03-47/2023-01/200117 funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

PI_32

Laboratory investigation on insecticidal efficacy of alternative compounds against rice weevil

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Abstract

In this study, we studied the insecticidal activity of powders of four different invasive alien plant species in combination with wood ash and diatomaceous earth under laboratory conditions, namely: 1) false indigo (*Amorpha fruticosa*), 2) tree of heaven (*Ailanthus altissima*), 3) Canada goldenrod (*Solidago canadensis*) and 4) staghorn sumac (*Rhus typhina*). The aim of the research of the task was to study the effectiveness of powders of four invasive alien plant species in combinations with wood ash and diatomaceous earth for the control of rice weevil (*Sitophilus oryzae*) at different temperatures and different air humidity values. The insecticidal action of the selected powder formulations and the effect of the prepared formulations were studied at two different temperatures (20 and 25°C) and at two values of relative air humidity (Rh) (55 and 75%). Wheat was mixed in various combinations in larger flasks. In research the best insecticidal effect was achieved with combination at 25°C and 55% Rh. Diatomaceous earth showed high efficacy when used alone, but when we reduced the concentration in the combinations with plant powders, the efficacy dropped. This means that there is not enough synergy between plant dusts and diatomaceous earth. On the other hand, we found satisfactory efficiency in the use of wood ash, both in single use and in combinations with plant powders, against rice weevil. We confirmed the highest mortality in treatment positive control - diatomaceous earth (100%), followed by mixtures false indigo and wood ash (97%), Canadian goldenrod and wood ash (97%), staghorn sumac and wood ash (94%).

Key words: rice weevil, *Sitophilus oryzae*, storage pests, diatomaceous earth

PI_33

First testing of horse-drawn roller-cutter for green-manure crops management in Croatia

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Abstract

Green manuring (GM) for raising the soil fertility becomes increasingly important due to environmental and other sustainability issues. However, GM is unavoidably associated with additional agrotechnical operations and energy consumption required for establishment of GM crops and their termination or incorporation of a GM herbage into soil, depending on the soil tillage system. Horse powered agriculture could be an option to decrease or avoid the consumption of fossil energy, as well as CO₂ emissions from powering the cultivation of arable crops. However, some operations in GM management might be challenging by using solely the living horse power, namely the chopping of GM's herbage before its incorporation into soil. An entirely CAD-designed retroinnovation developed in Schaff mat Paerd asbl. of Luxembourg has given a horse-drawn alternative to tractor powered choppers and mulchers. The horse-drawn roller-cutter showed a good performance on crimson clover (*Trifolium incarnatum* L.) GM crop at the experimental site near Požega. However, the broad acceptance of horse-powered farming might be challenging due to decrease of human labor efficiency when compared to modern tractorized farming. Raising the consciousness about sustainability issues and need for improved resilience to changing climate, as well as personal inner transformation of people might be needed to improve the image of such a labor-intensive agriculture.

Key words: green manuring, fossil energy consumption, sustainability, CO₂ emissions, low-input farming, inner transformation

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Section: HORTICULTURE

Oral Presentations

02_01

Soil management in organic fruit production: an agroecological approach

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Abstract

Agroecology is defined as a holistic and integrated approach that simultaneously applies ecological and social concepts and principles to design and manage sustainably agriculture and food systems. The agroecological approach aims at optimizing the interactions between plants, animals, humans and the environment, in a socially and economically sustainable manner. Living mulches, flower strips, microbial and organic fertilisers and biopesticides are among the practices and tools that support agroecology. The establishment of living mulches in orchards improves the orchard biodiversity and, when specific plant species are selected, can provide additional eco-services and functions, including adequate weed management. For examples, living mulches with herbs can contribute to weed control and at the same time support biodiversity, both above and below ground, and have the potential to provide an additional income to the farmer, without impairing the tree root development and nutrient status. Flower strips are introduced to increase the overall biodiversity, but can host natural enemies as well as provide feed to them when the prey population is not sufficient as food source. However, flower strips can also be integrated in it as living mulches. Several microbial products are available as biofertilisers and can be used to reduce the input of mineral fertilisers, positively impacting on soil biodiversity and its ecosystem services and functions. Several organic fertilisers can be used instead of mineral ones, and they can function as probiotics or postbiotics toward the native soil microbiome, increasing its biological functions and not only directly providing nutrients for the crops. Biopesticides can be combined to other tools (e.g. physical control or mass trapping) to selectively and effectively reduce the risk of damage from soil-borne pathogens and pests. All these aspects will be presented with particular reference to organic production, a method that is included among the agroecological practices.

Key words: cover crops, flower strips, living mulches, microbial products, organic farming

02_02

Open issues of knowledge transfer in fruit growing in Bosnia and Herzegovina

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Abstract

The development of agricultural science in countries in transition is mostly under the influence of a reductionist paradigm that looks at the elements of the system and not the system as a whole. Only a systemic approach (functionally integrated approach) can lead to the optimal use of knowledge in the development of agriculture and to the connection of science and practice. As a basis for considering the application of new technologies in fruit production in Bosnia and Herzegovina (BiH), the trends in apple production in Germany in the last 40 years were analyzed. From 1970 to 2010, an increase in yield per unit of production area by $\approx 80\%$ leads to a decrease in the selling price on market by $\approx 60\%$, as well as a decrease in the producer's gross earnings by $\approx 30\%$. Producers can overcome the decline in gross earnings by applying knowledge: new technologies, changing the assortment and reducing production costs, or increasing production areas if they remain at the same technological level of production. Everything else leads to the fact that they become uneconomical and cannot generate the necessary earnings for a long period of time. Apple growing systems, realistically available to producers in BiH, give average sustainable yields of 80 to 100 t/ha. Only a few individuals in BiH achieve average apple yields of 50-60 t/ha, and a group of leading producers (larger production areas) achieve average yields of 20-40 t/ha. The paper presents a comparative structure of variable costs in apple production in Germany and BiH with an argument for solving open questions of knowledge transfer in the field of fruit growing in BiH: greater engineering knowledge \rightarrow lower production costs \rightarrow higher earnings.

Key words: integrated knowledge, productivity, new technologies, apple

02_03

Challenges in apple planting material production and export in Bosnia and Herzegovina

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Abstract

Based on Regulation (EU) 2016/203 ("Plant Health Law") European Commission adopted two Implementing Regulations. The first one, (EU) 2018/2019 establishes, on the basis of a preliminary assessment, a list of high risk plants, plant products and other objects with 34 genera and one species of plants for planting originating from third countries as high risk plants, inter alia the genera *Malus*. The second one, (EU) 2018/2018, lays down specific rules concerning the procedure to be followed in order to carry out the risk assessment. All third countries are obliged to carry out a risk assessment for commodities if they want to export them to the EU. This paper presents main characteristics of apple planting material production in BiH, detailed description of production for the period 2016-2020 and export for the period 2018-2020, as well as the risk assessment analyses for apple young plants. The planting material production in BiH is regulated by several laws and rulebooks at the level of entities and the whole country. The regulatory framework is harmonized with the EU regulations. Certification program has started in 2009, and since then has been mandatory for all producers, which had a great impact on production size and quality. The most commonly produced apple cultivars are Idared, Golden Delicious, Granny Smith, Gala and Jonagold. The volume of production reached its peak in 2018. In the whole territory, regular control of plant quality and health status by authorized institutions and phytosanitary inspection are in force every year. Three actionable pests, as pests of regulatory significance associated with the commodity, are confirmed. The total production of apple plants in the period 2016-2020 in BiH was 3.868.779, produced by 19 registered nurseries. The total export in the period 2018-2020 was 1.127.502 apple plants, majority by nurseries located in the Republic of Srpska.

Key words: risk-assessment, certification program, apple young plants, phytosanitary-status, actionable pests

02_04

Influence of plum variety on the mechanized pruning efficiency

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Abstract

Plum (*Prunus domestica* L.) is the most abundant, but also the most extensive fruit species in Bosnia and Herzegovina. The level of application of pomotechnical and agrotechnical measures is relatively low, especially in traditional plantations. New plum plantations are characterized by higher degrees of intensity, in which pruning represents labor-intensive work operation. The persistent labor shortage imposes the need to mechanize this work operation. Mechanized pruning represent the possibility of more efficient implementation of this measure. The paper presents the preliminary results of the analysis of the influence of varietal specifics on the efficiency and quality of mechanized pruning. The research was performed in the orchard of the company “Agrovoće” Laktaši (Bosnia and Herzegovina) on the varieties Stanley, Čačanska lepotica and Čačanska rodna. All varieties were grafted on seedlings *Prunus cerasifera* Ehr. and trained in a spindle system with a planting distance of 4.0×1.8 m. Pruning was done by hedging both sides with a saw bar, while the tops were trimmed by hand from the platform. The quality of mechanical pruning was largely conditioned by the varietal specifics of the tree architecture. The Stanley variety, with its open canopy architecture, has the best predispositions for mechanized pruning. The upright growth of the Čačanska lepotica variety and the pendulous form of the Čačanska rodna variety reduce the efficiency of mechanized pruning. Mechanical pruning must be combined with manual pruning, which is necessary for regulating the top parts of the canopy as well as growth in the in-row space.

Key words: labor, tree, architecture, cuts

Acknowledgment: This research was funded by the Ministry of Scientific and Technological Development, Higher Education, and the Information Society of the Republic of Srpska through the program SINERGIJA (grant number 19.032/961-69/19 from 13.12.2019).

02_05

The effect of irrigation during flower initiation and flowering time on blackcurrant

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Abstract

Blackcurrant (*Ribes nigrum* L.) is an important berry fruit crop due to its very high value of antioxidants and ascorbic acid. Global climate change is gradually limiting its production, as weather conditions are becoming more extreme, with longer dry periods, milder winters and warmer summers, which have a negative impact on the productivity and sustainability of blackcurrants. Genotypic differences in tolerance to abiotic stress, primarily to drought, was investigated in greenhouse conditions at Aarhus University (Denmark) and at the James Hutton Institute (Scotland) within the Interreg project "ClimaFruit". The most important blackcurrant varieties for these areas were studied during the period of flower initiation and flowering time, with the main aim of understanding the physiological, molecular and growth responses of blackcurrant to limited water availability. Stomatal closure was the most direct response to drought stress resulting in reduced transpiration. Drought stress inhibited the development and vegetative growth of plants, as well as reproductive growth, which resulted in reduced flower initiation and flower abortion. Some genotypic differences in drought tolerance and speed of recovery following drought stress were observed. The research demonstrated negative impact of drought stress at key developmental stages for blackcurrant. The results of this work are of great importance for future blackcurrant irrigation planning, as dry periods followed by higher temperature during the flower initiation and flowering time are expected to become more frequent.

Key words: irrigation, blackcurrant, drought, plant growth, flower initiation, flowering time

02_06

IoT based digital farm management for orchards

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Abstract

The Internet of Things (IoT) is one of the most attractive areas for research and implementation within the application of information and communication technologies in various areas, including fruit production. IoT helps in the process of designing smart orchards in which every process can be monitored, with the aim of reducing costs and increasing productivity. In this way, stable yields are ensured while reducing input costs, i.e., consumption of fuel, working hours of people and machines, raw materials, and other costs in the production process. By applying the IoT system, work is facilitated, and the time required for decision-making is reduced, which has the effect of speeding up the process of realization of works. The paper presents an overview of IoT devices that are used in fruit production within the experimental educational center of the Faculty of Agriculture, as well as the possibilities of their application. A meteorological station with associated sensors, a crop-view camera for monitoring the dynamics of fruit growth, a digital meteorological trap for insects, a digital irrigation device provides timely information that contributes to making appropriate decisions. The information is used for forecasting the occurrence of plant diseases, harmful insects, determining the dynamics of fruit growth, the orientation moment of harvesting and the optimal moment of irrigation.

Key words: fruit, efficiency, decision making process

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02_07

Development of automatic pest trap based on IoT (Internet of Things) technologies

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Abstract

Pheromone Traps are regularly used in pest monitoring providing information on insect occurrence and flight dynamics. This information is used by agricultural advisors and growers in order to facilitate decision making considering timing and choice of control measures. However, the information from common pheromone trap is obtained by regular in-field inspection, which is often non-practical, time and fuel-demanding operation. The scope of this work was to develop automatic pest trap which would remotely provide information on pest status in the trap, same time being reliable and affordable for growers in Bosnia and Herzegovina. Trap consists of three hardware modules: camera module, communication module and power supply module. Camera provides regular images of trap sticky plate which are sent to server via Wi-Fi or GSM network. Acquired images are integrated into cloud-based web application which allows user to remotely check pest status, filter and sort images. Trap is currently at Technology Readiness Level of 7 (System prototype demonstration in operation environment) and final tests are expected to be done in 2023.

Key words: pest trap, camera module, communication module, power supply, web application

02_09

The application of advanced technologies in the research of *terroir* factors in viticulture and oenology

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Abstract

Faced with a very picky market and strong competition from high-quality imported wines, it is necessary to shed light on the *terroir* characteristics of local wine-growing areas and the typicality of local wines, as this represents an opportunity to enhance the wine sector through geographical indications and the protection of small appellations. A necessary step in this complex process is the application of advanced technologies, i.e. new techniques and different modelling methods, accompanied by a spatial analysis of different parameters through the geographic information system (GIS).

This paper presents several examples of application of advanced technologies and development of innovative modelling methods in viticulture and winemaking in the Oplenac wine-growing district (Serbia), all of which have the potential for wider application and adaptation of developed methods to conditions in other wine-growing areas of the region. With the aim of studying the *terroir* factors, this paper presents modelling performed by applying the Analytical Hierarchy Process (AHP) method, which was used for modelling and classification of the studied abiotic *terroir* factors in hierarchical levels. The modelling and classification of the abiotic *terroir* factors in hierarchical levels was performed using the Geographical Detector Method (GDM). Modelling with TOPSIS method was used in this work to present an example of modelling and ranking of analysed anthropogenic *terroir* factors. The

application of the GIS technology was used in this paper to present examples of mapping favorability classes of abiotic and anthropogenic *terroir* factors and small appellations in particular absolute, elite, historic and organic vineyards, i.e. viticultural parcels. The Random Forest Clustering (RFC) method was used to present examples of wine quality and typicality prediction. Through this modelling, a link is established between the *terroir* factors studied and wine quality and typicality, which forms the basis for the protection of geographical indications in the EU PDO/PGI system. Finally, a comprehensive classification of viticultural micro-areas was made based on all the viticultural-oenological models developed.

Key words: abiotic and anthropogenic *terroir* factors, modelling, multicriteria analysis, GIS

02_10

High-throughput sequencing and multiplex RT-PCR for diagnostics of grapevine viral pathogens

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Abstract

One of the most important limiting factors for sustainable viticulture worldwide are diseases caused by viral pathogens. Therefore, rapid and accurate diagnosis and identification is crucial. In order to investigate the occurrence of grapevine viral pathogens from the Ampelographic collection Kromberk in Slovenia, we used high-throughput sequencing (HTS) of virus- and viroid-derived small RNAs. The used method revealed the presence of: grapevine leafroll-associated virus 1 (GLRaV-1), grapevine leafroll-associated virus 2 (GLRaV-2), grapevine leafroll-associated virus 3 (GLRaV-3), grapevine rupestris stem pitting-associated virus (GRSPaV), grapevine fanleaf virus (GFLV) and its satellite RNA (satGFLV), grapevine fleck virus (GFkV), grapevine rupestris vein feathering virus (GRVfV), grapevine Pinot gris virus (GPGV), grapevine satellite virus (GV-Sat), hop stunt viroid (HSVd), and grapevine yellow speckle viroid 1 (GYSVd-1). GV-Sat was detected for the first time in Slovenia. Multiplex reverse transcription-polymerase chain reaction (mRT-PCR) was developed for validation of HTS predicted infections. mRT-PCR enables rapid, time-saving, and cost-effective molecular diagnosis including widespread, emerging, and seemingly rare viruses, as well as viroids which testing is usually overlooked.

Key words: *Vitis vinifera* L., virome, HTS, mRT-PCR

02_11

The influence of raw materials and the production process on the quality of rosé wine

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Abstract

The influence of raw materials and the production process on the quality of Rosé wine Serbia is rich in vines. Serbian vineyards are fruitful and they are characterized by different varieties of grapes. The vines and the tradition of producing this divine drink are present in the south of Serbia, and the Čegar vineyards are famous, located near the city of Niš. Wine has been produced in this area for centuries and, therefore, many traditional methods have been retained in the production process, which were used in the process of obtaining the wine referred to in this paper. This paper examines the influence of raw materials, locality and technological production process on the quality of produced rosé wine. The usual physical and chemical analyses were applied in the analysis of the wine, as well as the evaluation of the sensory characteristics of the wine (color, clarity, smell, taste). The characterization of the produced rosé wine involved determining the content of the most important ingredients: relative density at 20/20°C 0.9936; alcohol 12.0% v/v; total extract 23.7 g/L; total acids 4.9 g/L; volatile acids 0.21 g/L; reducing sugars 7.3 g/L (semi-dry wine); total sulfur dioxide 23.7mg/L; ash 1.51 g/L; pH 3.4. The wine is light red in color, it is clear, and it has a distinctive aroma and a harmonious taste. The established chemical and sensory characteristics of the examined wine indicate that the grape varieties Prokupac, which is the most dominant, Beogradska rana and Smederevka, as well as Afuz ali, can be considered good raw materials for the production of rosé wine.

Key words: wine, production, quality, sensory characteristics

02_12

Examination of the influence of soil type on the yield and morphological parameters of *Mellisa officinalis*

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Abstract

Mellisa officinalis is a medicinal and spice plant known for centuries and is used in cooking and pharmacy. Although *M. officinalis* is easily adaptable to different habitat conditions, finding the most adequate agroecological conditions, primarily soil conditions, where this plant species can show the best productivity is important. In this regard, an experimental, potted production of *M. officinalis* was carried out in four different types of soil (arenosol, fluvisol, cambisol, chernozem) to examine which of the types best favors the yield of this plant species. A significant difference in the leaf yield of *M. officinalis* grown in different soil types was observed ($P < 0.05$). The best leaf yield per plant was recorded in heavier soils (cambisol and chernozem) (1.56; 1.57 g), while in lighter soils (arenosol and fluvisol), the yield was significantly lower (0.92; 0.98 g). The research showed that of the tested soils, heavier soils (cambisol and chernozem), due to their favorable physical and chemical properties, have the most favorable effect on the growth and yield of *M. officinalis*.

Key words: arenosol, fluvisol, cambisol, chernozem, lemon balm

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02_13

Inventarisation of the woody plants in Novi Sad (Serbia)

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Abstract

The paper presents the results of the inventarisation of woody plants in the Novi Sad settlement – Liman 1. The fieldwork has been performed in 2022, and the processing of gathered data has been done using the QGIS and the R program. The research included processing the basic data related to woody plants, and calculating biodiversity indices. The results show that the ratio between angiosperms and gymnosperms is equal to 87.8% versus 12.2%, respectively. The total number of woody species is high and equal to 156, with a total of 3,367 individuals. The most dominant species are *Tilia tomentosa* Moench., *Populus x euramericana*, *Celtis australis* L., *Celtis occidentalis* L. and *Platanus x acerifolia* (Aiton) Willd. The value of the Shannon index is equal to 3.554, while the value of the Simpon index is 0.894. Both indices prove a good richness and evenness of woody species in the Liman settlement. The field inventory has shown that approximately 1/3 of plants have some kind of mechanical damage. These damages are caused by abiotic or biotic factors. The biotic factors are linked with the presence of the fungi *Erysiphe platani* causing damages on the plane trees, as well as with the presence *Cameraria ohridella* affecting the horse-chestnut trees. The research is part of the activities under project "Enhancing vitality and functions of greenery in the modified climate and environmental conditions", financed by City Office for Environmental Protection, City of Novi Sad.

Key words: biodiversity index, R program, biotic factors, mechanical damage

02_14

Remodeling horticultural plants' breeding to meet sustainable development goals

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Abstract

Aligning with the European Green Deal breeding goals of horticultural plants and their application have significantly changed in the last decade. Former breeding goals were focused on the basic pomological, physiological, biochemical and phenotypic characteristics of ornamental and fruit species. Answering to the contemporary urges for nature incorporation into everyday urban life and activities, as well as increase in integrative and organic fruit production in rural areas, breeding goals were redefined. According to 21st century challenges, research interest has shifted towards the sustainable usage of plant genetic resources (autochthonous terrestrial orchids, roses, wild fruit species, sweet and sour cherry ecotypes, and allochthonous oil-rich species) in both urban and rural gardening, as well as sustainable practices and nature-based solutions (biodiesel, rain gardens, green roofs and walls). Research concentrated on the higher yields and fruit quality, rapid plant propagation and higher ornamental value meeting the market and profitability requirements, did not include the sustainability issues. Due to the rapid social, environmental and economic pressures, this paper aims to present novel research streamline: (1) the selection of disease- and pest-resistant fruit and rose cultivars with a reduced chemical treatment, characterized by high-quality flowers and/or fruits, suitable for edible gardening; (2) the selection of wild flowering species tolerant to stressful urban environments; (3) the selection of water-efficient and cost-effective low-vigorous rootstocks to allow both pedestrian rural and urban gardening; (4) utilization possibilities, rather than the eradication of invasive and allergenic woody and shrub species; (5) the investigation of nature-based solutions to mitigate adverse climate factors; and (6) the mitigation of drought-induced stress in flowering plants. Behind all listed activities lies the sustainable usage of plant genetic resources and/or sustainable practices to support them, contributing to the globally defined goals for sustainable development.

Key words: circular economy; nature-based solutions; plant selection; sustainability; urban greenery

02_15

Effect of weed control in a poplar plantation clone *Populus x euramericana* 'I-214'

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Abstract

The aim of this work is to show the effect of weed control in a *Populus x euramericana* clone 'I-214' poplar plantation, in Banat in the Tamish river valley. The research was conducted in the period from 2011-2021. There are rows of treated and control plots with four replicates on the test plot. Weed control was carried out using a total herbicide based on (glyphosate) as an active substance, on a circular area of 1 m around the seedling, during the first three years of the seedling's age. From the point of view of ecology, this method of treatment with herbicides is acceptable, because only 9% of the total area of the plantation was treated. The diameters of the poplar seedlings on the treated areas are significantly larger compared to the control area by 6.1 cm at eleven years of age.

Key words: poplar plantation, herbicide, diameter

02_16

Dietary risk assessment of diamide insecticides in peach fruits

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Abstract

In this study long-term and short-term dietary risk assessment of peach fruits treated with diamide insecticides, chlorantraniliprole and cyantraniliprole, was conducted. The evaluation was done by calculating the dietary risk quotient (HQ) and International Estimated Short-Term Intake (IESTI). In order to obtain estimated daily intake (EDI), residue data in treated fruits were generated from dissipation experiments. Plant protection products based on these two insecticides were applied at the rate recommended for the control of *Grapholita molesta*, at two localities in the Republic of Serbia, in peach orchards with the Royal gem cultivar. Fruit sampling was performed immediately after application till the end of the pre-harvest interval (PHI), and for the residue analysis, the QuEChERS-based method followed by HPLC was used. The chlorantraniliprole and cyantraniliprole residues in peach fruits dissipated with a half-life of 2.50 and 3.15 days. The amount of chlorantraniliprole in the peach fruits at the EU maximum residue level (1 mg/kg) was achieved seven days after the application (0.95 mg/kg), while cyantraniliprole was at the MRL (1.5 mg/kg), immediately after the drying of the deposit. For the EDI value of chlorantraniliprole and cyantraniliprole, results obtained from the field experiments were multiplied by the average consumption rate (16.7 g/day) and divided by the mean weight of an adult (70.8 kg). Finally, obtained results indicate low risk from chlorantraniliprole and cyantraniliprole residues in the peach, thus fruits can be safely consumed.

Key words: risk assessment, chlorantraniliprole, cyantraniliprole, peach fruits

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02_17

Evaluation of efficacy of some plant extracts for the control of *Fusarium wilt* (*Fusarium oxysporum*) and *Alternaria* leaf spot (*Alternaria alternata*)

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Abstract

In this study, *Fusarium oxysporum* isolate deriving from potato field and *Alternaria alternata* isolated from tomato were assigned in the present research planned to evaluate the effect of plant based phyto-extracts against these fungi. In vitro studies were conducted to evaluate the efficacy of hemp solvent (*Canabis sativa* L.) extracts and medicinal, aromatic, fruit and vegetable oil. The evaluated concentrations were 1% and 0.5% for hemp extract and 1% and 2% for oil solvent. The given plant extracts were tested by the poison food technique with slight modifications. The in vitro results showed that each plant extract inhibited significantly the mycelia growth whereas the best results were obtained with extract made of industrial hemp in the concentration of 1%. The concentration of the hemp extracts exhibited the best inhibitory effect considering the percentage mycelial growth it recorded. The major compounds in the extract were the CBD, CBDA, canabidiol and canabidivarin using HPLC-UV/DAD. The results have provided new perspectives for the use of inorganic fungicides in managing plant diseases.

Key words: plant pathogens, bio-fungicide, plant protection, hemp, plant oil

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02_18

Use of antibiotics in crop protection: yes or no?

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Abstract

Plant pathogenic bacteria can devastate number of crops in a short time under conditions favorable for the infection and disease development. In majority of pathosystems antibacterial strategy relays on application of copper-based treatments. However, their effectiveness is limited due to restricted application during dormancy, phytotoxicity, emergence of bacterial resistance and accumulation of residues. In some countries, antibiotics are also used to control phytopathogenic bacteria. However, use of antibiotics in plant protection is followed by many controversies and misunderstandings. Some of the reasonable fears associated with the use of antibiotics in crop protection are: bacterial resistance development; resistance gene transfer from agricultural to clinical microbiome; impact on non-target or beneficial microorganisms; reduction of microbial diversity; and potential residues of antibiotics in plant products. However, one of the biggest misconceptions is that antibiotics are widely used in plant protection. In the USA, out of total use of antibiotics in agriculture only 0.26% goes to plant protection. The remaining 99.74% is used in livestock production. In Serbia, antibiotics have no permit to be used in crop protection. However, off the record, they are used illegally in some crops. Possible models of controlled use of antibiotics, safe for the producers, consumers and environment are discussed, as well as their current and future role in crop protection.

Key words: plant pathogenic bacteria, antibiotics, streptomycin, resistance

Effects of ionizing radiation on food

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Abstract

The application of ionizing radiation on food does not make it radioactive, does not endanger the quality of nutrition, nor does it significantly change the taste, texture or appearance of the food. All the changes made by radiation are so minimal that it is not easy to tell if the food has been irradiated. Food irradiation is a technology that improves storage safety and extends the shelf life of food by reducing or eliminating microorganisms and insects, i.e. irradiation can make food safer for the consumer. There are three radiation sources approved and used for food irradiation; 1) Gamma rays emitted from radioactive sources of Cobalt-60 or Cesium-137; 2) X-rays produced by bouncing a high-energy stream of electrons of the target element into the food; 3) The electron beam represents current of high-energy electrons that are pushed from the electron accelerator into food. Radiation can be used for conservation, i.e. destruction or deactivation of organisms that cause spoilage and decomposition and extend the shelf life of foodstuffs. Radiation breaks chemical bonds and thus destroys pathogenic microorganisms, i.e. decontamination is performed on: spices and spice mixtures, fresh, dehydrated and ground fruits and vegetables, vegan products, mushrooms, tea and powdered tea extracts, etc. Irradiation can also be used to prevent food with effective elimination of organisms that cause food borne diseases, such as *Salmonella* and *Escherichia coli*. Also, it should be added that the food is exposed to gamma rays to prevent germination, i.e. to delay sprouting and ripening (onions, potatoes, ginger, garlic), disinsection of insects (cereals, legumes, dried fruit), extension of shelf life (chicken, meat, fish). It is also important to note that radiation can be used to sterilize foods, which can then be stored for years without refrigeration.

Key words: ionizing radiation; food; gamma-ray

Section: HORTICULTURE

Poster Presentations

P2_01

Fruit set of traditional apple cultivars in the conditions of Banja Luka

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Abstract

Traditional fruit cultivars are suppressed from production, even their nutritional and biodiversity values are extremely high, and are more resistant to harmful organisms and other abiotic factors. These cultivars are sporadically maintained in-situ as individual trees in homesteads and gardens and mainly use for home consumption or processing. They are usually maintains in ex-situ field collections for long-term preservation as well as pre-breeding material. One of the directions of fruit crops breeding is the selection of later flowering species and cultivars, which is of particular importance due to the increasingly frequent occurrence of warmer winters and late spring frosts. The paper presents fruit set data of 167 apple accessions during three years of monitoring in the field collection of the Institute for Genetic Resources, University of Banja Luka. The collection was built in the period from 2008 to 2013. In 2019, fruit set was registered with 16 accessions, from 8th to 19th April. In 2021, fruit set was registered with a total of 82 accessions, between April 27th and May 4th. In 2022, fruit set was confirmed in 83 accessions, between April 21st and May 4th. Negative temperatures occurred in all spring months except May in all three years and April in 2019. In 2021, an absolute minimum of -2.8 °C was recorded in April, and -6.4 and -7.9 °C in March 2021 and 2022, respectively. For further work, accessions with a later flowering time that set fruits, such as: 'Petrovača' (PKB-J-79), 'Kolačara Danilo' (PKB-J-80) 'Bobovec' (PKB-J-64), 'Petrovača' (PKB-J-295), 'Gospoinjača' (PKB-J-338), 'Budalača' (PKB-J-88), 'Ananas Reinette Apple' (PKB-J-84), and 'Fukača' (PKB- J-95), are interesting. It is necessary to continue the phenological monitoring of these accessions, and to determine possible damages from late spring frosts, the degree of fruit set, the regularity of fruiting and fruit quality.

Key words: ex-situ collection, negative temperatures, late flowering

P2_02

Morphological and quality attributes of selected autochthonous apple genotypes from Serbia

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Abstract

Apple is one of the most grown fruits in the world. Traditional apple genotypes represent an important resource that ensures the sustainability of apple production and high diversity of available genotypes. The aim of this study was to analyze the fruit quality and sensory characteristics of 5 autochthonous apple genotypes from Serbia, in order to determine their potential on the market for fresh consumption and processing industry. In order to determine the fruit visual characteristics, morphological traits were studied (fruit ground and over color, percentage and pattern of over color, greasiness of the skin, fruit weight, length and height and fruit shape). In addition, length of the fruit stalk and fruit firmness were determined, as important characteristics for fruit storability. Among the biochemical parameters, total soluble solids and titratable acidity were determined. Sensory analysis was performed for the following traits: attractiveness, taste, aroma, juiciness and astringency. The highest potential for fresh consumption showed 'Šećeruša' and 'Čegarača' genotypes. Genotype 'Đeregarka' is more suitable for processing industry due to its high content of organic acid. 'Crvena Debelokorka' had low taste and aroma ratings (partially due to high astringency), but also the highest fruit firmness, which can result in good storability. The analyzed genotypes showed diverse quality traits and could find their place in the market and in the economy of the small farmers, but also in breeding programs focused on quality and diversity. They should be preserved as an important genetic resource for the sustainability of agriculture.

Key words: apple, traditional genotype, morphological traits, soluble solids, sensory analysis

Acknowledgements: This study was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Grants No. 451-03-47/2023-01/200116 and 451-03-47/2023-01/200216).

P2_03

The influence of the combination of rootstock and interstock on the initial growth of three sweet cherry cultivars

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Abstract

One of the main characteristics of cherry trees is generally increased growth habit. The use of dwarf rootstock under certain growing conditions, vigorous rootstock with dwarf interstock is one solution. This paper presents how the combinations of rootstock/interstock influence on the sweet cherry growth in the first years of cultivation. Three cultivars ('Burlat', 'Regina', and 'Kordia') were grafted on two rootstocks (seedlings of *Prunus avium* and *Prunus mahaleb*) with an interstock ('GiSela 5' with 40 cm of length). Experimental orchard, located in Ortiješ (Mostar), was planted in autumn 2011 with planting distance 1.4×3.5 m, and trained in the form of a spindle-shaped pyramid. On five randomly selected trees of each combination of cultivar / interstock / rootstock (in total 30 trees) during two years (2014 and 2015) the growth parameters was measured: total length of growth, number of buds, diameter of the rootstock, interrootstocks and shoots at the middle of their length. Based on the measurements, the vegetative potential of each combination was calculated, expressed as the number of vegetative buds per length of the skeleton and unit of the average cross-sectional area of the trunk. The comparison was performed using general linear models, and the level of significance of the differences was set at the level of significance $p < 0.05$. The results showed a significant influence of the combination of rootstock/interstock for the studied characteristics. Cultivar 'Burlat' grafted on a mahaleb seedling is the most vigorous in terms of the length of the skeleton. Cultivar 'Regina' had the highest number of vegetative buds on combination wild cherry seedlings/' GiSela 5', while cv. 'Kordia' had the lowest of vegetative buds on combination mahaleb seedlings/' GiSela 5'.

Key words: Burlat, Regina, Kordia, mahaleb and wild cherry, GiSela 5

P2_04

Positive effect of gibberellic acid treatment on fruit colour in two cherry varieties ‘New Star’ and ‘Bing’

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Abstract

Modern technologies of cherry production aim to improve the quality of the fruit while extending the shelf life. This is achieved by influencing the growing and storage conditions in the way to control the occurrence of physiological and microbiological causes, while at the same time it is necessary to minimise the pesticide residues. Primary goal of the research was to study the influence of treatment with gibberellic acid on the fruit colour in two cherry varieties ‘New Star’ and ‘Bing’. The experiment was set in a cherry orchard in the locality of Jablanica, Gradiška, Republic of Srpska. Timely treatment with ‘Gibberellin’, main ingredient gibberellic acid, was performed on three cherry trees of each studied variety. At designated harvesting time, timed to the full fruit ripeness, fruit was picked in way that random samples of 30 fully ripe fruit per three were taken from both treated and control trees. The fruit samples were taken to the laboratory where the colour analysis took place. Fruit skin colour was measured for each fruit with a colorimeter model i1Pro3 in the ‘Lab’ colorimetric system. Colour analysis of the studied varieties indicates a significant influence of the ‘Gibberellin’, i.e. gibberellic acid, on the fruit skin colour. It was notable that the variety ‘New Star’ control sample indicated higher intensity in red spectra (L: 9.49, a: 20.70, b: 11.18), compared to the treatment (L: 17.60, a: 25.04, b: 9.3). The analysis of variety ‘Bing’ also indicates a higher intensity of the red colour spectrum of the fruit skin in the control sample, compared to the treatment. As a conclusion it is indicative that the application of gibberellic acid by slowing metabolic processes in the fruit consequentially slows down the ripening which positively impacts the maintenance of the fruit colour.

Key words: cherry, gibberellic acid, cherry fruit color

P2_05

Primary effects of gamma radiation (Cz137) on the content of some nutritive and bioactive matters in the leaves of selected cherry plants

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Abstract

A study has been conducted on the influence of gamma radiation on the content of macro and micro elements (N, P, K, Ca, Mg, Fe, Cu, Zn, Mn, B) and bioactive compounds (chlorophyll „a“, „b“ and β – carotene) in the leaves of 32 decreased vigorousness plants, selected as a primary effect product from cherry varieties Bigareau Burlat, Pobeda Krimiska and Kozerska, being exposed to radiation with dosages of 25Gy, 35Gy, and 45Gy of Cz137. The analyses were performed using Kjeldal method, UV/VIS spectroscopy and atomic absorption spectrometry. The content of macro and micro elements in the leaves from the selected plants are generally lower compared to not treated control plants, with an exemption to phosphorus. Its content is 43% higher than the control variant. The highest value was noticed in the plants obtained by the radiation with dosage of 35 Gy. The ionizing radiation can have a certain influence on the increasing of root system activity, which allows additional usage of the insoluble forms of phosphorus from the soil. The contents of Fe, Cu, Zn and Mn are statistically insignificant lower than control at all radiation doses (from 2% for Fe up to 10% for Zn). Significant difference is noticed only for B content, which is 7% lower than the control. The highest difference is present with the plants obtained by doses of 25 and 35Gy. The content of chlorophyll "a" (1.33 mg/g), "b"(1.06 mg/g) and β -carotene (0.25 mg/g), are insignificant lower compared to the average values of the control.

Key words: Prunus avium, ionizing radiation, macro and micro elements, chlorophyll, β – carotene

P2_06

Influences of *Bacillus subtilis* and *Trichoderma harzianum* to productivity and fruits quality of strawberry cultivar 'Clery'

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Abstract

In the study were examined an influence of different microorganisms to improve yield and quality of fruits strawberry cultivar 'Clery'. The microbiological preparations were applied by drip irrigation system in doses of 5 l/ha, two and four weeks after planting, and also, next spring four and two weeks from the expected beginning of blooming. The following properties of productivity were analyzed: the number of crowns per plant, diameter of crowns, the number of inflorescences per crowns, the number of fruits per inflorescence, the total number of fruits per plants and the yield per plants (total and separately per harvesting in kg). According UPOV Code for strawberry the following phenological properties were studied. Plants treated with *T. harzianum* had significantly higher and numbers of inflorescences per crowns. A percentage of harvested fruits in first harvest, in regard to total fruits per plants, were between 19.5% (control plants) to 25.3% (*B. subtilis*). In the second harvest, to all treatments were recorded an increased yield of harvested fruits compared to first harvest. A total yield of marketable fruits per plants ranged between 0.38 kg (control) to 0.56 kg (*T. harzianum*). The highest content of TSS had fruits from plant treated with *T. harzianum* (10.7%), while the lowest had fruits treated with *B. subtilis* (10.2%). In the first harvest values of ascorbic acids in fruits ranged between 32.6 mg to 35.2 mg. Fruits from control plants had significantly higher values of AA. Generally, fruits from the second harvest had a decreased of contents of chemical properties.

Key words: strawberry, microorganisms, fruits quality, yield

Acknowledgment: This study was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia and Faculty of Agriculture, e.n. 451-03-47/2023-01/200116.

P2_07

Biological and production characteristics of the raspberry (*Rubus idaeus* L.) of willamete and fertodi zamatos cultivars in the period of full fruiting

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Abstract

This paper presents the results of monitoring and testing of biological and producing characteristics of raspberries of Willamete and Fertódi Zamatos cultivars in the period of full fruiting under Ivanjica climatic conditions. The chemical analysis of fruits of Willamet and Fertódi Zamatos was also carried out. As for the biological characteristics of the two cultivars, the following parameters were examined: beginning of budding phase, beginning and end of flowering phase and beginning and end of ripening. During vegetation the number of tied canes, the length of tied canes before cutting (cm), the thickness of canes (mm), the number of fruiting brunches per cane, the length of fruiting brunches (cm), and the yield (t/ha) were measured. At the raspberry technological maturity stage, fruit mass (g), fruit dimensions - length and width (cm), total soluble solids (%), total organic acids (%), vitamin C (mg/100 g), total phenols (mg/GAE/100 g), total flavonoids (mg QE/100 g) and fruit antioxidant capacity ($\mu\text{g MAA}/100\text{ g}$) were measured. The obtained results show that the cultivars differ from each other in all the mentioned and measured parameters.

Key words: biological characteristics, producing characteristics, chemical analysis, raspberry

P2_08

The influence of nitrogen fertilizer application on soil changes and raspberry fruit quality

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Abstract

This paper presents the results of the application of KAN nitrogen fertilizer (27% N) on soil changes and raspberry fruit quality in two orchards of Willamette and Tulameen cultivars in trials established during two growing seasons, 2020 and 2022. The experiment was laid out in six variants, with three replicates. Soil samples for agrochemical analysis were taken in both raspberry orchards before and after the trial was laid out to determine the effects of applying increasing doses of KAN on soil fertility parameters. At the raspberrie technological maturity stage, fruit physical and chemical properties were measured. For physical properties, the following were measured: fruit weight (g), fruit length and width (cm), and for chemical properties: total soluble solids (%), total organic acids (%), vitamin C (mg/100g), total phenols (mg GAE/100g), total flavonoids (mg QE/100g) and total antioxidant capacity of the fruit ($\mu\text{g AA/1 g}$). The obtained results indicate that raspberry nutrition with NPK compound fertilizers and KAN had a positive effect on changing in the agrochemical properties of the soil. The content of primary and secondary chemical compounds increased with the application of increasing doses of nitrogen. Under the agro-ecological conditions of Ivanjica, Willamette showed better fruit quality.

Key words: soil, KAN, raspberry, Willamette, Tulameen

P2_09

Effects of freeze-thawing on biochemical parameters of plum fruit quality

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Abstract

During storage, frozen-thawed fruits may be damaged in their texture due to formation of ice crystals, which cause irreversible disruption of parenchymatic cell structures. Resulting cell damages condition the interaction of released cell metabolites and physical-chemical properties that significantly reduce fruit quality. Two local plum cultivars (*Prunus domestica* L.) „Savka“ and „Čačanska leptica“ were selected for this research. Fruit samples have been collected randomly from five different plum trees (for each cultivar) at the time of optimal fruit ripeness and transported to the laboratory. After storing at -18°C over five months the samples were thawed in three different ways: at ambient temperature, cold temperature (4°C) and microwave oven. Fruit samples were used for the analyses of the content of anthocyanins, phenolic compounds, sugars, vitamin C, as well as total titratable acidity and antioxidant activity. The obtained results indicate that each thawing method significantly increase total titratable acidity, monosaccharide content as well as anthocyanin degradation. Among all tested thawing methods, microwave using was found as the most effective way to retain anthocyanin content, total titratable acidity and concentration of monosaccharides and total soluble solids

Key words: plum, thawing, fruit quality, biochemical parameters

P2_10

Development of gels from cornelian cherry fruit with use of different gelling agents

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Abstract

The main goal of this research was to develop a new product - cornelian cherry fruit gel with defined quality and purpose. Fruit gel, which can be used as a filling in bakery and confectionery products, was obtained by pasteurization of cornelian cherry pulp with addition water, sugar and agar or pectin as selected gelling agents. A series of 4 gel samples with agar and 3 gel samples with pectin were prepared under laboratory conditions. The quality of each sample was examined by descriptive sensory analysis and physico-chemical analysis. The ratio and amount of basic ingredients were modified, the acidity and dry matter of the samples were corrected in order to obtain a product of defined quality and purpose. During the preparation, the selected product quality parameters had to be in accordance with the optimal gelling conditions of agar or pectin in the filling in order to achieve a moderately firm, elastic and stable consistency of gels. The addition of 30% of fruit pulp, 47% of sugar, 31% of water and 1.4% of agar created sample with moderately firm, elastic, homogeneous consistency and moderately sweet and refreshingly sour taste and a pleasant fruit aroma. Homogeneous, moderately firm gel without air bubbles with a shiny surface and an intense, full and clear red color; pleasant, pronounced and characteristic aroma; full refreshing taste with balanced acidity and sweetness was obtained with 25% of fruit pulp, 54% of sugar, 30% of water and 1.2% of pectin.

Key words: cornelian cherry fruit, fruit gel development, pectin, agar, quality

P2_11

Functional responses of immature stages of *Cryptolaemus montrouzieri* to the cactus pear specific scale pest *Dactylopius opuntiae*

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Abstract

Cryptolaemus montrouzieri Mulsant (Coleoptera: Coccinellidae) is native to Australia and commonly known as ‘cochineal destroyer’. This predator has been introduced in many countries worldwide for biological control of many scale pest species including the harmful specific cochineal of cactus pear *Dactylopius opuntiae* (Cockerell) (Hemiptera: Dactylopiidae). The functional responses of immature stages of *C. montrouzieri* on *D. opuntiae* (Cockerell) adult females was evaluated under laboratory conditions at 26°C and 12:12 (L:D) h. All larval stages of the predator were starved for 12 h prior then placed individually in Petri dishes (14.5 in diameter) with different density (5, 10, 15, 20, 25) of *D. opuntiae* female for 24 h. The logistic regression for immature stages of the predator had a negative and significant linear parameter indicating a type II functional response. Attack rates (0.010, 0.028, 0.042 and 0.052) and handling times (11.945, 6.834, 4.878 and 3.971 hours) for first to fourth instar larvae, respectively, were estimated using Holling’s disc equation.

Key words: Cryptolaemus montrouzieri, Dactylopius opuntiae, coccinellidae, predator-prey interaction, functional response

P2_12

***Ceroplastes rusci* (L.) (Hemiptera: Coccidae), a new soft scale species in Serbia**

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Abstract

At the end of March 2016, the species *Ceroplastes rusci* was found for the first time in Serbia on a fig (*Ficus carica* L.) in the locality of Belgrade (Ledine). This species is polyphagous and causes significant damage to figs by feeding on plant juices from all above-ground parts. After the first finding, it was studied in more detail. The presence, intensity of attacks and development cycle of *C. rusci* was studied during 2016 and 2017 in the area of Belgrade. The intensity of attack was evaluated according to the scale of Borchsenius (1963). Sampling of plant material with scale insects was carried out throughout the year, and the life cycle was followed by the method of cultivation in the laboratory. The identification of the species was carried out using the morphological characteristics of the female and using the keys for the determination by Gill (1988). In the area of Belgrade, the species was found on *Ficus carica* L. (fam. Moraceae) in a private yard at the Ledine location. All above-ground parts of the plant were covered with numerous colonies of scales, so the intensity of the attack was rated as 4. This degree of infestation caused the physiological weakening of the plants and the drying of individual branches. *C. rusci* reproduces by gamogenesis, develops one generation per year, and overwinter as fertilized female on fig branches. In the spring, at the end of May, oviposition begins. One female lays an average of about 1200 eggs. First-stage larvae hatch in the second half of June. They actively move towards the leaves of the host plant, where they feed during the summer months. The second-stage larvae are formed in mid-August, after which females are formed during September that overwinter.

Key words: Ceroplastes rusci, fig, damage, life cycle

Acknowledgment: This work was supported by the Ministry of Science, Technological Development and Innovation Republic of Serbia under Contracts No. 451-03-47/2023- 01/200216.

P2_13

Walnut fly *Rhagoletis completa* (Cresson, 1929) (Diptera: Tephritidae) - flight dynamics, distribution and harmfulness in Serbia

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Abstract

The walnut fly, *Rhagoletis completa*, is one of the most important pests of the fruit of the walnut (*Juglans regia*). It originated in North America and was first registered in Europe in 1991 in Switzerland. In Serbia, it was registered for the first time in 2020 in several locations in western Srem, when fruit damage was up to 100% in some locations. To monitor the occurrence and activation of the imago in 2021 and 2022, sticky traps with feeding baits were placed at five sites in Serbia (Ilinci (Šid), Zemun, OPD Radmilovac, Dobanovci, and Nemenikuće). The traps were placed in mid-July 2021, slightly earlier in 2022, on 3 July, and reading once a week until the first decade of October. Feeding baits were changed every second week. At the same time, in the insectarium of the Faculty of Agriculture, larvae from the last year's fruits were placed in pots with soil for overwintering and the beginning of the flight of the fly was monitored. In the 2021, the first imago on the traps was caught on 24 July, with two peaks on 15 August and 12 September. The last imago was caught on 3 October. In 2022, the first imago of walnut fly on the traps was caught on 24 July, and the last were observed on 18 September, with only one peak on 21 August. In the insectarium, in 2021, the first caught walnut fly imago was recorded on 25 July, and the last on 15 August, with two peaks on 28 July and 13 August. In 2022, the first caught imago of walnut fly was recorded on 8 July, and the last recorded imago were on 11 August, with two peaks, the first smaller on 20 July and the second larger on 4 August.

Key words: Rhagoletis completa, Tephritidae, walnut, fly, Serbia

P2_14

***Geosmithia morbida* and *Pityophthorus juglandis* surveys, the causal agent of thousand cankers disease of walnut in Republic of Srpska**

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Abstract

According to Commission Implementing Regulation 2019/2072, *Geosmithia morbida* and its vector *Pityophthorus juglandis* are listed in Annex II part B in EU. Considering restricted distribution in the EU, risk potential analysis, high phytosanitary risk, and widely present *Juglans* species, as host plants in Republic of Srpska, *G. morbida* and *P. juglandis* surveys started in 2021. Due to economic value of host plants, present in many agricultural and forest areas in our country, monitoring was financed and approved by the Ministry of agriculture, forestry, and water management of Republic of Srpska. During 2021 and 2022 survey was performed in 6 regional units: Prijedor, Banja Luka, Gradiška, Bijeljina, Trebinje, and Istočno Sarajevo. Total 35 samples of host plants, were analyzed for the presence of *G. morbida*, followed by the inspection of 36 traps for the presence of *P. juglandis* in 2021. In 2022, 30 units of single tree host plants and 30 units of single traps were analyzed for the presence of mentioned plant pests. Laboratory analysis for *G. morbida* included isolation and morphological identification by colony characteristics and microscopy. Protocols includes also the molecular assay with the *G. morbida*-specific primers GmF3 and GmR13, while the identification of vector was performed with the standard key according Seybold et al. (2013). In both year negative results were obtained, however considering that external symptoms may become visible only after several years of infestation and a low number of tested samples, further survey is necessary for excluding a likelihood of entry and their establishment in Republic of Srpska.

Key words: *Geosmithia morbida*, *Pityophthorus juglandis*, quarantine pests, survey, Republic of Srpska

P2_15

Bacterial dieback of peach and nectarinae caused by the quarantine pathogen, *Pseudomonas syringae* pv. *persicae* in the Republic of Srpska

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Abstract

Pseudomonas syringae is economically important and a widespread plant pathogen, on a number of hosts: fruit trees, field crops, vegetables and ornamental plants. There are three stone fruit diseases caused by *P. syringae* pathovars: *syringae*, *morsprunorum* and *persicae*. *Pseudomonas syringae* pathovars from stone fruits can easily be misidentified due to similar symptomatology and many common characteristics. The pathovars *syringae* and *morsprunorum* are widely spread, while the pathovar *persicae* is regulated as quarantine pathogen in the European Union and the European and Mediterranean Plant Protection Organization (EPPO, A2 list). This quarantine pathogens is regulated on the national A2 list in our country. Nectarine and peach as a host plant of bacterial decline caused by *P.s. pv. persicae* (Psp) make the symptoms of shoot dieback, leaf spots and fruit lesions, on the end which can results with the death of the tree. Leaves, twigs and branches of hosts (peach and nectarine) were inspected and samples were taken for laboratory analysis. Detection and identification were done according to EPPO diagnostic protocols PM 7/100 (1), with slight modifications. As a reference material it was used freeze dried bacteria CFBP 1573 (producer CIRM, France). In 2022, out of 55 analyzed samples, 6 samples confirmed as positive and originated from orchards and 2 samples confirmed as positive and originated from nurseries. Further studies on *Pseudomonas syringae* pv. *persicae* are planned to be conducted in 2023.

Key words: quarantine bacterium, stone fruits, orchards, nurseries

Acknowledgement: The results of this work was supported by Ministry of Agriculture, waters and forestry through Special surveillance program for the presence of quarantine pest organisms in stone fruits on territory of the Republic of Srpska in 2022.

P2_16

Current status of the Mediterranean fruit fly *Ceratitis capitata* (Wiedemann, 1824) (Diptera: Tephritidae) in Serbia

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Abstract

Polyphagous species the Mediterranean fruit fly *Ceratitis capitata* is one of the most economically important pests in the world. It has been found on over 250 different plant species, causes most damage to citrus, but is also commonly reported as a pest of peaches, persimmons, figs, apricots, and apples. In the Mediterranean region, it is particularly harmful to peaches and citrus. *C. capitata* is widespread in tropical and subtropical areas and in a limited area of temperate climate. It was first reported in Serbia in 2021; although there is evidence that, the species was detected a decade earlier. During the summer and autumn of 2021 and 2022, VARs+ traps containing pheromones to attract males were used to monitor the presence of *C. capitata*. The traps were placed on 22 July 2021, and 7 July 2022, respectively, at various locations in peach, vineyard peach, fig, and persimmon orchards in the Belgrade area. One trap was placed at the Kvantaška market in Belgrade and one in the vineyard peach orchard in Ilinci (west of Srem). Readings were taken once a week, and the pheromone was changed every three weeks (according to the manufacturer's instructions). To determine the possible presence of larvae, fallen fruit was collected during the reading of the traps and delivered to the laboratory for further analysis. The Mediterranean fruit fly *C. capitata* was caught three times in traps at three different locations in the Belgrade area (Kvantaška market and vineyard peach orchards) in 2021, while the presence of larvae in fig fruits was determined. In 2022, *C. capitata* was found only once at one site in a peach orchard. Two years of monitoring suggests that *C. capitata* is present in the wider Belgrade area and is not currently of economic importance to crops.

Key words: Ceratitis capitata, Tephritidae, Mediterranean fruit fly, monitoring, peach, Serbia

P2_17

New records of *Oscheius* spp. in region of Banja Luka

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Abstract

Entomopathogenic nematodes (EPNs) have proven to be highly effective biological agents in the control of numerous insect pests. Recently, *Oscheius* spp. have been added to the group of EPNs, in addition to *Steinernema* and *Heterorhabditis* spp. As part of the broader EPN survey, 10 soil samples were collected in the Banja Luka region (Čelinac) from different natural habitats at a depth of 15 cm, five subsamples per sample. Then, drilled Eppendorf tubes containing larvae of the greater wax moth (*Galleria mellonella*) were added to the collected soil samples. EPNs were extracted from dead larvae using a White trap, and then re-inoculation was performed to test pathogenicity in new wax moth larvae. Genomic DNA was extracted from two infectious juveniles (IJ). The ribosomal ITS region was successfully amplified in two EPN populations. Amplified DNA fragments were directly sequenced. The result of BLAST search in NCBI Genbank showed that there is a high concordance between the sequences of these two populations and the deposited sequences of *Oscheius* spp. These results indicate new detections of *Oscheius* spp. in the Republic of Srpska.

Key words: entomopathogenic nematode, biological control agents, soil samples

P2_18

The effect of paclobutrazol application on the growth length of five sweet cherry cultivars

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Abstract

The effect of the paclobutrazol hormone (PBZ) ((2RS, 3RS)-1-(4-chlorophenyl)-4,4-dimethyl-2-(1H-1,2,4-triazol-1-yl)-pentan-3-ol) application was studied to investigate its impact on growth length in five cherry varieties (Vera, Aida, Carmen, Giant Red, and Firm Red). PBZ was soil-surface applied at the rate of 1g per tree grafted onto the Mahaleb seedlings. One-year research was conducted on the 5-year-old commercial orchard located on the south slope of Fruska Gora mountain (45°07' N 19°53' E; 191 m altitude). For all tested varieties, the length of all branches was measured on 10 tested trees per treatment. The length of branches in the control treatment was the highest in the Giant Red and Vera, while the shortest branch length was recorded in the Aida cultivar. In all varieties, shoot length was significantly reduced compared to control treatments, with a 27.51% to 48.3% reduction in growth. The Vera, Aida, and Giant Red cultivars experienced the greatest decrease in growth length, whereas the Carmen and Firm Red cultivars had a significantly smaller reduction.

Key words: paclobutrazol, *P. avium* L., growth length

P2_19

Analysis of meiosis in the flowers of some vine varieties using the method of chiasma frequency and normal crossingover

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Abstract

This paper analyzes meiosis parameters in maternal and paternal sex cells in grapevine flowers. Varieties that have morphologically and functionally hermaphrodite flowers and those that have functionally female flowers in the population were examined. Cartilage with eggs and anthers with pollen were analyzed. Because the flowers in grapevine inflorescences are small, the analysis of meiotic divisions is very difficult. Meiosis has been observed in varieties - Chaush, Konchanka, Kadarka and other varieties that have functionally female flowers and where anomalies in meiosis have been observed. The Vranec variety was taken as a standard, which has hermaphrodite flowers and good formation of sex cells (good pollen viability and no anomalies in meiosis). Standard methods were used for isolating the flowers, keeping them in a fixative to capture meiosis at the right time, dyes for staining the tissue and cells, and necessary means for making preparations and observing under a microscope. To prove irregularities (anomalies) in meiotic divisions, the chiasma frequency method, which has been used several times in other cultures, was used. The method of examination is by counting the changes of material between the non-homologous and homologous chromatids, which is, calculating the degree and frequency of the chiasm in relation to the normal crossing over. The purpose of the examination is to detect and control the irregularities in meiosis - sex division even in the cells of the flower before fertilization in order to see the causes of further irregularities in the germination of pollen, fertilization and the formation of embryo and fruit. Irregularities in the flower have a negative impact on the further formation of the cluster and grain, which may be scattered and unevenly shaped. These analyzes are especially important for table varieties that should be distinguished by a beautiful grain and cluster.

Key words: meiosis, anomalies, chiasma frequency, crossing over, homologous chromatids, grapevine

P2_20

Microsatellite analysis of paternities of grapevines after cross-pollination

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Abstract

The autochthonous grapevine cultivar of Herzegovina, Blatina, has all the good characteristics in terms of fertility, grape quality and wine quality, but has a biological flaw reflected in the female flowers, which requires cross-pollination for successful fruit set. Therefore, the main objective of crossing and selection is to maintain all the good characteristics of Blatina, but to eliminate the biological weakness by donating a gene for inducing trait for hermaphroditic flower that allows self-pollination. However, a certain percentage of seedlings with functionally female flowers is maintained among the progeny even after crossing varieties with female flowers with a variety with hermaphrodite flowers. In 2017 and 2018, the cultivar Blatina was crossed with several autochthonous (old) cultivars that have hermaphrodite flowers and produce high quality wines. The male parents used in this study were: Vranac, Trnjak, Žilavka, Alicante bouschet and Cardinal. In 2018, a different number of seedlings were obtained from seed from the listed combinations of potential crosses. Since the performed crosses cannot be 100% controlled and open pollination is not controlled at all, we used molecular markers to determine and/or confirm the male parent for all performed crosses. In this paper, the preliminary results of the determination of the male parent of crosses with the Blatina variety are presented.

Key words: grapevine cultivar, fertility, molecular markers

Acknowledgment: The abstract was prepared thanks to participation in the project: "Microsatellite analysis of paternities of grapevines after cross-pollination", which is supported by the agreement on co-financing scientific and technological cooperation between Bosnia and Herzegovina and the Republic of Slovenia for 2021/2022 (project number 19.032/966-19/20).

P2_21

Influence of altitude on the ampelometric characteristics of Vranec variety leaves

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Abstract

The aim of the study was the influence of the altitude on the ampelometric characteristics of the leaf of the variety Vranec. It has been established that the terroir factors (soil climatic conditions) related to the altitude of the vineyard have a mathematically proven influence on the ampelometric descriptors of the leaf, which is expressed in an increase of the values of all descriptors in the vineyard located in Skopje. In the vineyards around Gevgelija and Veles, they are characterized by relatively similar values and a noticeable tendency of growth in the vineyard located on higher altitude. According to the comparative statistical analysis, the absolute values of the indicators length of vein N1, vein N2, vein N3, and length of vein N4 in the vineyard located around Skopje, have higher value compared to the same parameters of the vineyards in Veles and Gevgelija. In addition, the length petiole sinus to upper lateral leaf sinus and length petiole sinus to lower lateral leaf sinus from both halves of the leaf in the vineyard located around Skopje, have higher value compared to the same parameters of the vineyards in Veles and Gevgelija. There are no significant differences between the size of the angles α and β (OIV code 607 and 608) for all vineyard locations.

Key words: ampelometric characteristics, Vranec, ampelometric descriptors.

P2_22

Comparative analysis of potential clones of the Žilavka variety in region of Herzegovina, subregions of the middle Neretva and Trebišnjica

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Abstract

In the paper, isolated clones of the autochthonous variety Žilavka in the region of Herzegovina, subregions of the middle Neretva and Trebišnjica in the vineyard of the monastery Tvrdoš were examined. Phenological characteristics, fertility, mechanical composition of grapes and berries and chemical quality were studied. The laboratory tests were carried out in the laboratory of the Department of Viticulture of the Faculty of Agriculture University of Belgrade. The coefficient of absolute fertility had the highest values in clone 10 (2.0) and the lowest in clone 9 (1.3). According to the values of the coefficient of absolute, relative and potential fertility, clone 7 stood out. Clone 8 was characterised by the largest mass of grapes (329,2 g) and berries (315,4 g), as well as one of the largest mass of 100 seeds (3,0 g). The most sugar in grape juice was accumulated by clone 10 (22.7%), and the least by clone 7 (16.2%) and the population (16.5%). Clone 3 was characterised by high content of total acids (5.7 g/l), while clones 5 and 8 had very low content.

Key words: Žilavka, clone, fertility, mechanical composition of grapes, grape juice

Acknowledgements: The research was funded by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia under project number 451-03-47/2023-01/200116.

P2_23

Certain characteristics of grapes and grape must of the local vine variety Bagrina

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Abstract

Bagrina is a local white vine variety characterized by reddish grapes and belongs to the so-called "minor varieties", as it occurs only on 5.11 ha in Serbian commercial vineyards. Its traditional cultivation is mainly connected with the PDO Negotinska Krajina. With the aim of affirming the Bargina variety within the framework of the project "Exploration of the oenological potential and revival of the local autochthonous vine variety Bargina", evaluation of all vineyards planted with this variety was carried out in 2022. As a result, a total of 29 genotypes of different vine varieties with positive production and utilization values were selected. This paper presents some results of the research of the mechanical composition of grape clusters and berries and the analysis of quality parameters of the selected Bagrina variety genotypes. The sugar content in grape must ranged from 15.2 to 26.9%, with 21 Bagrina genotypes having a sugar content higher than 20%. Among the first 10 genotypes with the highest sugar content, there were 3 genotypes from the group of top 5 genotypes with the highest total acidity. In this group of 10 genotypes with the most favorable sugar content were 3 genotypes from the group of 5 genotypes with the lowest grape mass and 2 genotypes from the group of 5 genotypes with the lowest grape stem mass. The performed analyzes led to the conclusion that the group of 10 genotypes with the highest grape

mass had a significant number of genotypes with favorable grape must quality parameters. Namely, in this group of genotypes with largest grapes, 3 were from the group of top 5 genotypes with the highest sugar content in grape must, 4 were from the group of top 5 with the highest acidic content, and 2 were from the group of top 5 genotypes with the most favorable grape must pH value.

Key words: Bagrina, PDO Negotinska Krajina, grape clusters, berries, grape must

P2_24

Influence of altitude on the fertility of the vine variety Vranec

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Abstract

The influence of altitude on the fertility of the green shoots of the variety Vranec grown in three micro regions has been studied during three years period. It was found that in the vineyards located in Gevgelija and Skopje the percentage of developed winter buds is high, and in Veles relatively lower. The values of the fertility rates in most cases are very similar and the differences between them are insignificant. There are some proven differences between the average values of the analyzed indicators: percentage of developed winter buds and fruiting shoots in the investigated vineyards. The altitude has a certain influence on the percentage of developed winter buds and fruiting shoots mainly in the vineyard around Veles, but does not significantly change the analyzed coefficients of fertility of the green shoots in all three regions. There is an unproven mathematical tendency for reduction of the value of this indicator in the vineyard located near Skopje.

Key words: fertility, variety Vranec, influence of the altitude, three micro-regions

P2_25

Effect of foliar calcium and nitrogen treatments on yield and fruit quality of table grapes

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Abstract

The foliar fertilization has been used as an important agrotechnical measure to avoid deficiencies and to improve quality. During the three consecutive years, a study has been performed on *Vitis vinifera* L. (cv. 'Cardinal') to examine whether a yield and grape berry quality has been affected by the foliar application of Ca and N fertilizers. A liquid mineral fertilizer containing 40% Ca(NO₃)₂ as Variant I and 31% N with 0.015 % Fe-chelate; 0.01 % Mg – chelate as Variant II (in text), has been sprayed four times during the growing period (before and after blooming, buckshot berries and veraison). Results showed that, calcium and nitrogen when applied foliary, increases the yield of table grapes in all three years of research, in comparison with control variant. The highest yields of grapes in all three years of investigations, were achieved in Variant II – 4.57 kg/vine (14.85 kg/ha). During the tree years of investigations, the largest mass of grape bunch and berries were recorded in Variant II (382g and 368.68g) while the lowest yields was in control variant (344g and 330.92g). With a reference to the mechanical properties of the grape grains, the highest resistance to pressure (2229.70g) and breaking resistance (364.52g) were revealed at Variant I, treated with Ca fertilizer. The foliar application significantly affected the mechanical properties (resistance of berry pressure and breaking of resistance), especially at variant I. Application of different types of foliar fertilizers did not have a significant effect on sugar content and total acids, compared with the control variant.

Key words: foliar fertilization, nitrogen, calcium, table grapes, yields

P2_26

Characteristics of the newly created table grapevine variety Simona

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Abstract

During the period (2016-2018), the main ampelographic and production characteristics of the newly created table grapevine variety Simona, derived from the cross combination Sejanac 113 x Muscat Hamburg, were studied. In terms of the studied characteristics, it was compared with the standard variety Muscat Hamburg. Regarding the ampelographic characteristics, the Simona variety represents a unique genotype and has a half-open tip of a young shoot, five lobes in the mature leaf, a hermaphroditic flower type, a medium-loose bunch, a broad ellipsoidal berry shape, a dark red violet color of the skin and a neutral flavor. Statistically significant differences of production traits between Simona variety and standard variety were found for ripening time and berry width. Grape yield, bunch weight, bunch length, berry length, berry width and sugar content in must were higher for this variety than for the standard variety. On average, the Simona variety had a later ripening time (September 27) than the standard variety (September 18). The Simona variety had a yield of 2.25 kg/m², a bunch weight of 341.0 g and a berry weight of 3.07 g, while Muscat Hamburg variety had a yield of 1.78 kg/m², a bunch weight of 312.5 g and a berry weight of 3.61 g. The sugar and total acids content in the must of Simona variety was 18.6%, i.e. 6.1 g/l, and that of Muscat Hamburg variety was 17.2%, i.e. 6.3 g/l. The Simona variety showed a very high resistance to the main fungal diseases (*Plasmopara viticola*; *Uncinula necator*; *Botrytis cinerea*). Due to a number of positive characteristics, especially beautiful and attractive appearance of bunches and berries, as well as disease resistance, Simona variety is expected to spread in production vineyards.

Key words: grapevine, new variety, ampelographic characteristics, quality, resistance

P2_27

The impact of the irrigation regimes on the Ravaz index in vineyard plavinci under climate change

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Abstract

With increasing aridity and the frequency of extreme events predicted in the near future according to global climate models, soil water availability may become a more important limiting factor in wine production and quality. Wine quality and yield are strongly influenced by climatic conditions and depend on a complex interaction between temperature, water availability, plant material, and viticultural techniques. The aim of this research is to determine the differences between different watering regimes on yield components, with a focus on the value of the Ravaz index. The experiment was conducted during the growing season of 2022 in an organic vineyard called Plavinci (Serbia). The grapevine variety is Panonia and the vines are trained using Smart-Dyson system. The drip irrigation method was applied in three regimes as a percentage of crop evapotranspiration (ET_c): full irrigation, F (100% ET_c); deficit irrigation, D (50% ET_c); and rainfed, R (0% ET_c), treatment without irrigation. The watering turn was 7 days, and the watering norm was 15 mm for D and 30 mm for F treatment. The obtained results show that the average weight of bunches are 2.92 kg·plant⁻¹, 3.18 kg·plant⁻¹, and 2.83 kg·plant⁻¹ for F, D, and R, respectively. The Ravaz Index (RI) was calculated by expressing the ratio between the yield and pruning weight. The values of the RI by treatment are 8.3, 7.5, and 6.3 for F, D, and R, respectively. These results confirm the influence of irrigation on yield and severity of pruning, which caused differences in RI between treatments as it increased with the amount of irrigation water applied. Since the RI values in our experiment range from 5 to 10, it indicates a good balance between vegetative growth and productivity in the Pannonia grapevine.

Key words: grapevine, quality, yield, Ravaz index, irrigation

P2_28

Content and corelation of organic compounds in some autochthonous grapevine varieties (*Vitis vinifera* L.)

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Abstract

Various organic acids (citric, malic, lactic and tartaric), as well as glucose and fructose, in some autochthonous grapevine varieties (*Vitis vinifera* L.) from R.N. Macedonia were determined. Stanushina from Tikvesh vineyard and Valandovski crn drenok, Valandovski crven drenok and Belo zimsko from Gevgelija-Valandovo vineyard were taken as samples for investigation. The same analysis of Palieri as standard grapevine variety were performed. For this examination, spectrophotometric methods of analysis, with enzymatic assay kit, were carried out. The obtained results show that tartaric acid has the highest content in all varieties (over 3 g/L) and lactic acid content is represented in traces. The content of citric acid in investigated samples is between 0.798 g/L in Valandovski crn drenok and 0.956 g/L in Belo zimsko. The obtained results for malic acid are in interval from 0.455 g/L in Belo zimsko to 1.110 g/L in Stanushina. The higher concentration of glucose and fructose in Stanushina grape variety was determined (209.93 g/L) and the lowest one in Valandovski crven drenok (179.63 g/L).

Key words: organic acids, glucose, fructose, Stanushina, Drenok, Belo zimsko

P2_29

Reduction of the content of heavy metals in white wines of the Italian riesling variety by certain treatments USED in R.N. Macedonia

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Abstract

In our study, the Italian Riesling variety was taken, which, together with its clones, was introduced into the collection plantations at the Agricultural Institute in Skopje, where its study was carried out. From the collection plantations, it has spread to other regions in the Republic of North Macedonia, where it is grown on separate areas that have a slightly cooler climate. Since the collection plantations happen to be close to the industrial area in the Skopje region (close to a factory, harmful gases, waste water), a research was done on the content of heavy metals (Cu, Fe, Ni, As, Cd, Pb and Zn) in the wine obtained from the Italian Riesling variety, grown in the Skopje vineyards that are near this area. The aim of our analysis was to determine which treatments we used reduce highly toxic heavy metal contents in wine and what is the impact of those treatments on wine quality - chemical composition, sensory evaluation of wine. Skimmed milk clarification, tannin and gelatin clarification, blue clarification, centrifugation and filtration were the treatments applied to the wine. Heavy metal analysis was performed with Varian atomic absorption spectrometry, model Spectra AA 880 with a deuterium corrector. The instrument was equipped with flame technique supplies, with a GTA 100 graphite furnace and an autosampler. The greatest impact on the reduction of the content of heavy metals was determined in the blue clarification of the wine, which was due to the addition of a 0.5% solution of K₄[Fe(CN)₆], indicating that the content of heavy metals was significantly lower in comparison with the control sample (the standard).

Key words: Italian Riesling, heavy metals, blueclarification, tannin, gelatin, spectrometry

P2_30

Control effects of various fungicides against powdery mildew of grapevine

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Abstract

Powdery mildew of grapevine, *Erysiphe necator*, is a very destructive grapevine disease, causing great economic losses to the production. Therefore, regular fungicide applications are required during the growing season. The main goal of this experiment was to observe the efficiency of various fungicidal treatments on different grapevine varieties against powdery mildew of grapevine. The treatments were performed with two fungicides: PROSPER (a.i. spiroxamine) and LUNA EXPERIENCE (a.i. fluopyram + tebuconazole). The experiment was conducted during 2019 in two vineyard regions in the Republic of North Macedonia (Demir Kapija and Negotino), on four wine grape varieties (Kardinal, Merlot, Riesling and Vranec). The destructive potential of powdery mildew of grapevine was confirmed in the control (untreated) variants of all four varieties, where the disease severity ranged between 3.6% - 57.6% on bunches. Both tested fungicides showed very high level of efficacy. On bunches, the fungicides efficacy varied from 88.88% to total of 100% for LUNA EXPERIENCE and from 93.05% to 100% (maximal protection) for PROSPER. The results showed that regardless the grapevine variety, both tested fungicides showed remarkable level of protection of grapevine against powdery mildew. However, the novel active ingredient spiroxamine provided better protection in all four grape varieties in comparison with the well-known combination of a.i. fluopyram and tebuconazole against the powdery mildew.

Key words: spiroxamine, fluopyram + tebuconazole, powdery mildew, control, grapevine

P2_31

Control of *Plasmopara viticola* with the novel class of fungicides

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Abstract

Plasmopara viticola, the causal agent of downy mildew of grapevine, is one of the most devastating and economically most important grapevine pathogens worldwide. In the Republic of North Macedonia, control of downy mildew in grapevine is mainly achieved by application of synthetic fungicides. The goal of this trial was to study the efficiency of a novel combination of two active ingredients: oxathiapiprolin + zoxamid (ZORVEC VINABEL). The efficacy of the novel combination was compared to the effectiveness of list of well-known active ingredients: mankozeb + cymoxanil, cyazofamid + dipotassium phosphonate, cymoxanil + famoxadon and dithianon + potassium phosphonate. The trials were conducted during 2019 on three different grape varieties, in the region of Demir Kapija (Merlo and Riesling variety) and in the region of Negotino (Vranec variety), grown on low-cordon trellises. In the untreated variants in both regions, a high level of disease severity varying from 27 to 38.33% on leaves and from 8.6 to 24.6% on bunches was observed, leading to destructive damage on grape vine. The tested novel fungicide combination provided high level of efficacy in the control of downy mildew. In both regions, the fungicide efficacy varied from 95.19 to 98.29% on the leaves and was total of 100% on bunches for all tested varieties. This shows that the active ingredients oxathiapiprolin + zoxamid (ZORVEC VINABEL) are extremely efficient in controlling of downy mildew of grapevine, with preventive and curative mode of action.

Key words: Plasmopara viticola, oxathiapiprolin + zoxamid, novel fungicide combination.

P2_32

Chemical composition of wine produced from the newly introduced variety rebo (*Vitis vinifera* L.)

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Abstract

Grapevine variety Rebo, originates from Trentino – Alto Adige (former Agricultural Institute of San Michelle all' Adige, IASMA), North Italy, was taken as sample for this investigation. It is obtained as a result of crossing the varieties Merlot and Teroldego, by the researcher Rebo Rigotti. The scope of the research is to give an expert opinion on the quality of grapes and wine of the Rebo variety, grown in Macedonian's agro -ecological conditions. The vineyard for this investigation is located in the north part of Macedonia on the mountain German, near the town of Kriva Palanka area, typical for growing frost resistant varieties. The comparison of commercial lactic acid bacteria of the species *Oenococcus oeni* (Lavin PN4) and *Lactobacillus plantarum* (Lavin ML – PRIME) was the field of interests. Different chemical parameters, that influence on the quality of wine, as alcohol strength, specific gravity, total extract, total acids, volatile acids, pH, free and total SO₂ in wine received from the newly introduced variety Rebo (*Vitis vinifera* L.) were determined. In addition, the quantity of total phenols, total anthocyanins, wine color and total flavan-3-ols were analyzed by spectrophotometric methods.

Key words: Rebo, Oenococcus oeni, Lactobacillus plantarum, phenols, anthocyanins, flavan-3-ols

P2_33

Management of dissolved gases during winemaking and their effect on wine quality and typicity of the aroma

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Abstract

In the winemaking process the management and control of dissolved gases are important practices. Oxygen analysis is monitored at every winemaking stage because oxygen has a decisive influence both on aroma profile and on the shelf life of the product. Knowing the concentration of dissolved oxygen in the wine, it is also possible to control with extreme precision the amount of sulfur dioxide to be used during vinification. Similarly, CO₂ control and analysis have a vital role during maturation and during pre-bottling by monitoring the sensory impact on wines. Both gases are also essential for checking the legal limits in dry, sparkling, and semi-sparkling wines. The aim of this study is to analyze the impact of membrane contactor technology, used to control dissolved gases, on the aromatic fraction of wine. Two samples of each wine (Sauvignon Blanc, Ortrugo and Gutturmo), taken before and after treatment, and the three respective water samples taken during the process, were analyzed by GC-MS for the determination of volatile compounds to evaluate the impact of the treatment on the overall aroma of the wine. The volatile component of each sample was isolated by solid phase extraction (SPE) and analyzed using standard gas chromatography-mass spectrometry (GC-MS) techniques to evaluate the aromatic compounds related either to the fermentation or to the varietal origin of the wines. The aromatic composition of the wines before and after treatment did not undergo significant modifications. Some light molecules, especially malodorous disulfides, were eliminated by the treatment, as shown by the analysis of the water collected after the treatment. Interesting indications, which need further investigation, were highlighted during the sensory analysis of the wines, showing that the treated wines were more aromatic and had generally fruitier and more intense flavors than the wines tasted before treatment.

Key words: oxygen analysis, carbon dioxide, gas chromatography-mass spectrometry, aromatic compounds, disulfides

P2_34

Effect duration of maceration and temperature on characteristics of red wine

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Abstract

Wine is an alcoholic beverage obtained by alcoholic fermentation of grape must or grape juice, and moreover. The chemical composition and quality of wine largely depend on the variety, type of wine, production and storage. Maceration is an essential part of red wine production. It is considered, that temperature and length of maceration are the most important factors that affect the quality of red wines. The aim of this work was to determine the influence of different maceration regimes on the quality of red wines of Vranac and Merlot. The vinification was carried out in 2021 in Microbiological Laboratory of the Faculty of Technology in Banja Luka, where maceration regimes of 6 and 12 days, at temperatures of 16 and 25°C were applied. Analysis of wine quality were done in the Laboratory of Ampelography and Oenologie of the Faculty of Agriculture in Banja Luka. Differences in wine quality were observed depending on the maceration method. The highest alcohol content was during maceration for 6 days at 25°C, while prolonged maceration had an effect on reduced alcohol content. The increased temperature had a positive effect on the content of the total extract, as well as on the chromatic characteristics of the wine of both varieties. The wines of the Merlo had less acidity with longer maceration, while the wines of the Vranac had less acidity with shorter maceration. All analyzed wines had satisfactory values of volatile acids, as well as pH. The Merlot wines had the highest ash content after a 12-day maceration at 25°C, and the Vranac wines after a 6-day maceration at 25°C.

Key words: Vranac, Merlot, maceration, wine quality

Acknowledgment: The research presented in this article is part of the project: “Influence of localities on the phenolic composition and antioxidant properties of grape and wine of Blatina variety”, funded by the Ministry of Scientific and

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P2_35

Effects of winemaking technique of newly created cv. Vladun on total phenolic content and anti-DPPH radical activity of wine

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Abstract

The aim of this study was to investigate influence of grape maceration with addition of grape stalk on total phenolic content and antiradical activity of derived wines. The experiments included three different winemaking protocols: maceration without stalk addition, addition of 30% grape stalk and addition of 50% grape stalk. After grape crushing and destemming, K₂S₂O₅ in amount of 10g per 100kg was added in all of three winemaking trials. All samples were inoculated by *Saccharomyces cerevisiae* yeast strain, BDX (Lallemand, Canada). Maceration lasted 14 days with pomace punching down twice a day. Total phenolic content in wine samples was determined by the Folin–Ciocalteu's (FC) method using gallic acid as a standard. Antioxidant capacity of wine was measured as anti-DPPH radical activity. The highest total phenolic content was obtained in wine sample which was enriched with 30% of grape stalks (1725 mg/L GAE), because of better extraction of phenolic compound from the grape solids. In terms of anti-DPPH radical activity, wine sample which macerated with adding grape stalks in 50%, was showed the best results. According to this, it could be concluded that addition of grape stalks during prolonged maceration up to 14 days caused higher total phenolic content and anti-DPPH radical activity of wine.

Key words: winemaking, grape stalk, total phenolic content, antioxidant capacity.

P2_36

Dendrofond of the park architecture monument „University City” - some elements of the bio-ecological evaluation of existing green areas

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Abstract

This paper presents research results of floristic composition and some elements of dendrofond in the Park architecture monument ‘University City’ complex. It was created as an Austro-Hungarian military facility with trees planted during different periods. The research was conducted in 2013 and 2014, and an assessment of the condition was performed in 2021. The analysis of dendrofond parameters was represented by the elements of the bioecological basis for the valorization of existing green areas. Plant nomenclature follows Flora Europaea (Tutin et al., 1964-1986), Atlas of Trees and Shrubs (Šilić, 1990) and Ornamental Trees and Shrubs (Šilić, 1990). A total of 1219 individuals were recorded, of which 45.53% were conifers and 54.47% were deciduous trees. A total of 102 taxa were recorded: 24 conifers and 78 deciduous trees. Of all the recorded taxa, 45 were autochthonous and 57 allochthonous. A total of 62 genera were recorded and the most numerous genus was *Picea* (21.66%). Of the deciduous trees, *Acer* was the most numerous (9.60%), and a total of 28 families were recorded. The largest number of coniferous species belonged to the family Pinaceae (16 species), with the largest number of deciduous species belonging to the family Rosaceae (15 species). During 2013 and 2014 the following species were introduced: *Sorbus domestica*, *Corylus colurna*, *Celtis occidentalis*, *Alnus glutinosa*, *Carpinus betulus*, *Fagus sylvatica* and *Populus tremula*, etc. According to the research conducted in 2014, 34.86% of the trees were rated as ‘satisfactory’, 31.13% as ‘good’, 16.68% as ‘very good’, 2.89% as ‘excellent’, and 14.45% were rated as ‘bad.’ According to the research conducted in 2021, 26.41% were rated as ‘satisfactory’, 25.77% as ‘good’, 25.24% as ‘very good’, 4.47% as ‘excellent’, and 18,10% were rated as bad.

Key words: nature protection, urban green areas, sustainable use of natural resources

P2_37

Plant collection in the Botanical garden of the University of Banja Luka

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Abstract

This paper is an overview of the long-term introduction of plant species in the Botanical garden of the University of Banja Luka. The botanical garden is a part of the protected area Park Architecture Monument “University city”, occupying an area of 5.17 ha. The introduction of plant species started in 2008, and the intensive development and introduction of a larger number of new species was recorded from 2017 to 2022. The nomenclature of the plants follows the modern taxonomic bases of Euro+Med (Euro+Med, 2006), World Flora Online (WFO, 2021) and Ornamental trees and shrubs (Šilić, 1990). A total of 594 individuals were recorded, of which 85 (14.31%) were conifers and 509 (85.69%) were deciduous trees. A total of 246 taxa were recorded: 32 (13.01%) conifers and 214 (86.99%) deciduous. Of the total number of individuals, 372 were trees and 222 were shrubs. A total of 119 genera were recorded, and the genus *Picea* has the largest number of individuals (22). The most numerous genus of deciduous species was *Prunus*, with 34 individuals represented by 13 taxa. A total of 54 families were recorded. The largest number of coniferous species belonged to the Pinaceae family (14 species), with the largest number of deciduous species belonging to the Rosaceae family (34 species). Of the total number of taxa, 77 are autochthonous and 169 are allochthonous. The global importance of botanical gardens is listed in the Convention on Biological Diversity (CBD), which emphasizes the importance of ex-situ conservation of native flora, with the introduction and cultivation of autochthonous taxa. The introduction of species into botanical gardens is a long-term process, which requires constant monitoring of individual species and correction of the floristic composition of individual collections.

Key words: ex-situ conservation, botanical garden, taxa

P2_38

Perceptions of the ornamental value and application of selected weeds for flower beds

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Abstract

Weeds hinder growth and development of plants for cultivation that are different categories of plants in anthropogenic ecosystems. It is believed that there are more than 650 plant species belonging to the group of weeds in Europe. Weeds can be useful in decorative, in improving areas abandoned by humans (ruins, garbage dumps, etc.) or in arranging public and private green areas. Some weed species can be used for flower beds in landscaping public and private green areas: *Matricaria camommila*, *Taraxacum officinale*, *Calystegia sepium*, *Papaver rhoeas*, *Plantago lanceolata*, *Portulaca oleracea* and *Viola arvensis*. Furthermore, such species require smaller amounts of nutrients and water and are suitable for sustainable gardens. The aim of this paper is to investigate the respondents' perceptions of the decorative value and application of selected weeds for flower beds. The research was conducted in first half of 2022. The results of the research showed that respondents very good perceived the decorative characteristics and application of a larger number of weed species, except for the species *P. lanceolata*, which they assigned with average rating. The best rated species was *V. arvensis*. The difficulty of cultivation and maintenance for the vast majority of species is estimated to be mostly light.

Key words: weeds, flower beds, perception, decorative characteristics, application.

P2_39

Influence of microbiological preparation Bacillomix on the germination of *Challistephus chinensis* L.

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Abstract

The use of biostimulant create better conditions for the growth and development of the germ and germination. Bacillomix is 100% natural biostimulant and soil improver with increased content of live bacterial cells obtained from 12 powerful *Bacillus* sp. strains. The use of this preparation has many positive effects: stimulate of germination, rooting and growth of plants; improve the microbiological structure of the soil; keep the plants healthy through the growing season; increases the plants resistant to stress; supplies the plant with nitrogen, phosphorus, potassium and sulfur. The aim of this study was to examine the impact of microbiological preparation Bacillomix on the germination and germination energy of the seeds *Challistephus chinensis* L. In the experiment were totally 480 seeds of this species. The experiment was set up in the laboratory on Faculty of Agriculture, University of Banja Luka and consisted of control (K) and treatment with microbiological preparation Bacillomix in two concentrations (T1 100% and T2 10%). After 7 days germination energy and after 14 days germination of the seeds were tested. The highest average values of the germination energy were recorded in the treatment plants (73.75% T1, 64.38% T2), while the lowest values were recorded in control plants (60%). The highest average germination values were also recorded in treatment (78.755% T1, 73.75% T2), and the lowest in the control group (70%). The highest average values of hypocotyl height, root length and fresh weight were recorded also in the treatment plants (1.47 cm T1 and 1.01 cm T2; 4.59 cm T1 and 3.28 cm T2; 0.91 g T1 and 0.65 g T2) while the lowest values were recorded in control plants (0.99 cm; 2.87 cm; 0.61 g). It can be concluded that the use of a natural biostimulant is recommended for better germination and better morphological development of plants

Key words: Bacillomix, germination, flower

P2_40

Use of LED lights in micropropagation of rosemary (*Rosmarinus officinalis* L.)

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Abstract

This paper presents preliminary results of research on the influence of LED lights with different wavelengths on the growth and development of rosemary (*Rosmarinus officinalis* L.) in in vitro conditions. Previous research has shown that LEDs can be used for steering plant development in in vitro conditions. Material for in vitro multiplication was obtained from seedlings of rosemary grown in vitro, and the experiment was conducted in the In vitro laboratory of the Faculty of Agriculture (UNIBL). Explants were grown on standard Murashige and Skoog growth medium, with the addition of 0.5, 1.0 and 1.5 mg/l 6-Benzylaminopurine (6-BAP) or meta-Toplin (mT) and 0.1 mg/l 1-Naphthaleneacetic acid (NAA), in 100 ml glass flasks, under 16h light/8h dark regime, and temperature of 20±1°C. The treatment consisted of three chambers with LED lights of different wavelengths (blue, red, and blue+red [1:1]), while standard fluorescent lights were used as control. Three flasks containing five explants were used for each treatment and the control. During the multiplication phase, the length and number of new shoots were recorded, as well as the fresh and dry weights of explants. The results showed that red LED light and fluorescent light had the greatest influence on formation of new shoots (144 and 141 new shoots formed, respectively), and on the average number of new shoots per explant (7). Blue LED light had the greatest influence on shoot length, with an average of 11.78 mm. Combination of blue and red LED light had the greatest influence on average fresh and dry weight of explants (907.83 mg and 105.97 mg, respectively). As these are preliminary results, further research is needed to confirm the positive effect of LED lights on the micropropagation of rosemary.

Key words: in vitro, multiplication, shoot length, fresh and dry weight

Acknowledgment: This research was partly funded by the Ministry of Scientific and Technological Development, Higher Education and Information Society of the Republic of Srpska (grant no. 19/6-020/961-147/18).

P2_41

Applicability of different methods for disinfection of herbaceous peony seeds native to Serbia

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Abstract

Herbaceous peonies belong to an endangered species native to Eurasia. They have high ornamental, edible, medicinal, economic, and ecological values. Although they have many important features, they are not well studied. Growing these valuable plant species from seed is one way to preserve them. Disinfection of seeds is the first step in the process of germination. Compared to other ornamental plants, there is little information about seed diseases and their control. For this reason, the aim of this study was to find the best disinfection method(s) that have a beneficial effect on protecting peony seeds from diseases. The seeds were surface-disinfected using several methods: in 70% ethanol; 4% sodium hypochlorite (NaClO), and in a combination of mentioned treatments 4% NaClO + 70% ethanol for 5 min without/with treated with fungicides (Metconazole, Captan, Quadris and Previcur in recommended concentrations). Seeds were rinsed in sterile distilled water (SDW) for 2 min after each treatment, and dried on sterile filter paper. The control was performed on SDW without any treatment. Disease incidence was evaluated for 7 days. Isolation of pathogen was done on potato dextrose agar (PDA) medium. After 7 days, the grayish-brown, white, and olive-gray colonies appeared on the surface of the seeds. Based on macromorphological and micromorphological characteristics, the isolates identified as *Alternaria* sp., *Fusarium* sp., and *Penicillium* sp. The percentage of infected seeds was approximately 5%. The best effects have achieved after treatments with 4% NaClO + 70% ethanol + Captan or Metconazole, while the treatments without fungicides were not effective enough.

Key words: seed health, fungicides, *Alternaria* sp., *Fusarium* sp. and *Penicillium* sp.

Acknowledgment: The research was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (451-03-

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P2_42

Seed weight and optimal imbibition period for some herbaceous peony (*Paeonia* spp.) species native to Serbia

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Abstract

Herbaceous peonies are plant species with high ornamental and medicinal value. Due to their endangerment, wild peonies are protected by law in Serbia. Possible ways to protect them are propagation and/or cultivation. Peonies can be propagated vegetatively (by rhizome division) or generatively (with seeds). As peony seeds have a double dormancy and their germination is a long-term process, it is important to determine which seed characteristics and pre-treatments have a positive effect on germination. Since peony seed weight is an important seed characteristic, and imbibition period is an effective pre-treatment, the aim of this study was to evaluate the peony species native to Serbia, and to determine seed mass, seed imbibition capacity, the influence of seed weight on imbibition and the influence of habitat on the studied parameters, as the mentioned parameters have hardly been studied for the tested species. The research was conducted in 2021. on three peony species native to Serbia (*Paeonia tenuifolia* L.-fern leaf peony or steppe peony; *Paeonia peregrina* Mill.-Balkan peony or Kosovo peony and *Paeonia daurica* Andrews). According to our one-year research, there was no statistically significant difference in seed weight depending on the natural habitat within the species and also not between *P. peregrina* and *P. daurica*. A significant difference was found in seed weight between steppe peonies and the other two studied species. In agreement with our results, the optimal imbibition time is two to three days for *P. peregrina* and one to two days for *P. tenuifolia* and *P. daurica*. The findings can be used as preliminary research for future peony germination studies.

Key words: *Paeonia peregrina* Mill., *Paeonia tenuifolia* L., *Paeonia daurica* Andrews, seed mass, soaking time

Acknowledgment: The research was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (451-03-47/2023-01/200003 and 451-03-68/2022-14/20007)

P2_43

Spider mite control on medical cannabis mother plants

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Abstract

The use of cannabis for medicinal purposes can be found in records dating back thousands of years ago. The new legal regulation for the use of cannabis for medicinal purposes is followed by a strict regulation for the non-use of synthetic pesticides during its cultivation. The two-spotted spider mite (*Tetranychus urticae* Koch.) is one of the most significant pests of medicinal cannabis and can completely compromise its production, especially in greenhouses and indoor production facilities. The trial was conducted in a cannabis indoor production facility in the Skopje region, from November 2022 until February 2023. The purpose of the trial was to determine the effectiveness of the predatory spider mite *Phytoseiulus persimilis* in mother plants for the production of medical cannabis clones. Temperatures in the cultivation area where the experiment was performed ranged from 24° to 26°C, relative humidity varied from 65 to 85% and 18 hours daylight. During the test, it was established that the application of the predatory spider mite *Phytoseiulus persimilis* gave better results than the use of citrus oil. In addition, it was determined that the place of implementation of the predatory spider mites on the plant plays a significant role on their efficiency.

Key words: medical cannabis, biological protection, *Phytoseiulus persimilis*, *Tetranychus urticae*, indoor cultivation.

P2_44

Fruit characteristics of pepper accessions (*Capsicum annuum* L.) from the Gene Bank of the Republic of Srpska

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Abstract

Landraces are considered to have better resistance to local biotic and abiotic stress factors, fruit quality and taste compared to commercial varieties. Through the Program for conservation of plant genetic resources of the Republic of Srpska and the Working group for vegetables, 13 pepper landraces have been collected. To utilize the collected material in a sustainable way and to determine if there are duplicate accessions present, fruit evaluation is done. The aim of the research was to evaluate 13 pepper accessions: GB00026, GB00028, GB00863, GB00869, GB01091, GB01093, GB01111, GB01112, GB01115, GB001130, GB01133, GB01350 and GB01351 using IPGRI morphological descriptors (1995) for pepper (*Capsicum* spp.). Plant material was produced in 2022 in greenhouse from seedlings. In total, 15 fruit characteristics were scored on 10 fruits per accession. The results showed that the highest fruit weight (58.53 g) and the highest fruit width (62.8 mm) was recorded for accession GB01111. The highest fruit length (122.8 mm) was recorded for accession GB00869. On the other hand, accession GB01350 had the lowest recorded fruit weight (2.74 g) and length (26.1 mm) while the accession GB00026 had the lowest width (10.5 mm). Most accessions had elongated fruit shape (53.85 %), while other accessions were triangular (23.08 %), almost round (15.38 %) and campanulate (7.69 %). Most accessions had dark red fruit color at the mature stage (46.15 %), while other accessions had red color (15.38 %), orange color (15.38 %) and orange-yellow color (23.09 %). It can be concluded that investigated pepper collection possesses high fruit diversity.

Key words: Landraces, IPGRI, diversity

P2_45

Morphological diversity of onion genetic resources at the Agricultural Institute of Slovenia

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Abstract

Onion is an important vegetable crop grown for its pungent bulbs and aromatic leaves. Onion genetic resources collected in the Slovenian Plant Gene Bank at the Agricultural Institute of Slovenia were evaluated for the first time using various morphometric traits. Using the prescribed descriptors (UPOV, CPVO) for *Allium cepa* spp., a collection of 61 onion accessions and varieties grown in the experimental fields of the Infrastructure Centre Jابلje in 2022 was described. For each onion genetic resource, a total of thirteen quantitative (numerical) and qualitative descriptors were evaluated on the bulbs: bulb size, bulb height, bulb diameter, ratio height/diameter, position of maximum diameter, width of neck, shape in longitudinal section, shape of stem end, shape of root end, base color of dry skin, intensity of base color of dry skin, coloration of epidermis of fleshy scales and dry matter content. The results showed significant differences between onions in the collection in terms of bulb size (73.7 ± 26.0 g), bulb height (46.3 ± 14.2 mm), bulb diameter (36.7 ± 6.8 mm), bulb shape (predominant transverse medium elliptic) and color of dry skin (brown, pink, red, purple). The highest coefficients of variation were observed for bulb size (35.3%) and height/diameter ratio (32.6%) and the lowest for dry matter content (8.6%). The data obtained and the variability of the traits studied indicate that these onion accessions require further genetic analysis to identify the best candidates for future breeding programs.

Key words: accession, *Allium cepa*, CPVO, descriptors, dry matter, UPOV

P2_46

Molecular characterization of leafy kale genetic resources (*Brassica oleracea* var. *acephala* L.)

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Abstract

Leafy kale (*Brassica oleracea* var. *acephala* L.) is one of the most important Brassicaceae species with health-promoting properties and high diversity. To investigate variability within and between accessions, 12 accessions (each accession comprised four individuals/genotypes) from the Balkan area was genotyped at 12 SSR (Simple Sequence Repeats) loci. DNA was extracted from seeds, cotyledons, shoots, or young leaves, depending on the germination energy of each seed, using the MagMax (Applied Biosystems) magnetic extraction method with the BioSprint Plant Kit (Qiagen). Genetic analysis included 8 accessions from Serbia (24 genotypes), 2 accessions from Bosnia and Herzegovina (8 genotypes) and one accession from Croatia and Montenegro (with 4 genotypes each). The SSR markers originated from the genomes of *B. oleracea* (8), *B. rapa* (2) and *B. napus* (2). Accession-specific polymorphism was found at the OI12-FO2 and OI10-F11a loci, where genotypes were qualitatively distinguished by horizontal agarose gel electrophoresis (binary detection). However, the overall molecular variability among accessions was higher than 71% (AMOVA), which explains the diversity of native leafy kale germplasm in the Balkans. In order to exploit the genetic diversity, it is would be prudent to evaluate these accessions at phenotypic level and use their potential in breeding programs.

Key words: leafy kale, accession, genetic analysis, SSR, genotyping

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P2_47

Response of two tomato lines to drought stress based on the proline content in fruits and yield

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Abstract

Drought is one of the factors that most reduces crop productivity. Water deficit affects the morphological and physiological parameters of the plant, and some of them can be used as indicators of plant tolerance to drought. The aim of this experiment was to evaluate the effects of water deficit on proline content in fruits, as well as yield parameters of two tomato lines (M7 and R83), that in previous research showed a contrasting response in vegetative phase. Tomato plants were grown in a glasshouse in pots during three months after planting of seedlings. Two water regimes were applied (optimal field capacity and water deficit - reduction of water for 30% compared to control). The content of proline was significantly higher in the fruits of both tomato lines exposed to water stress. The increase in proline content under stress conditions compared to control was higher in fruits of line M7 (81.0%) compared to line R83 (35.4%). Our results showed that water deficit significantly affected fruit diameter, length and biomass of the fruit, but did not affect the number of fruits per plant in both tested tomato lines. The reduction of fruit yield in water deficit conditions was higher for line M7 (31.5%) in comparison to line R83 (20.7%). Based on the obtained results, the R83 line showed a potentially better response to drought stress at fruit level, which is in accordance with our research results conducted on the same lines in the vegetative phase.

Key words: tomato, drought, fruit, proline content, lipid peroxidation, yield

Acknowledgment: This work was supported by the Ministry of Science, Technological Development and Innovation Republic of Serbia under Contracts No. 451-03-47/2023-01/200216 and 451-03-47/2023-01/200116.

P2_48

The effect of different systems of growing tomatoes in a protected area on morphological properties and business results

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Abstract

We are witnessing negative consequences caused by the use of synthetic crop protection products and fertilizers in food production. Interest in the indoor farming of certain plant species has grown significantly. Organic and integrated farming imply the use of natural products, while limiting or completely eliminating the use of synthetic resources. The goal of the research is to study different farming systems in two types of tomatoes and their effect on the variability of certain tomato properties (the number of formed flower trusses, number of fruits per flower truss and tomato yield). Furthermore, the gross margin of tomato production was calculated. Factor A comprised of different systems of agricultural production: integrated and organic. Factor B comprised two types of tomatoes (cherry and beef). The experiment was set up in a modern indoor space, in controlled microclimate conditions in randomized block design in four replications. The organic system of farming highly significantly affected the studied parameters. The reason for this was the use of a modern growing technology and the approach of the farming itself.

Key words: organic and integrated, safe food, plastic greenhouse, tomato, gross margin.

P2_49

Increasing climate resilience in pepper seed production through *Trichoderma harzianum* and soil fertilizer treatments in North Macedonia

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Abstract

Pepper is one of the most important vegetable crops in the Republic of North Macedonia, and its production is vulnerable to the effects of climate change. This study aimed to evaluate agro-technical measures for increasing resilience to climate change in pepper production, specifically for the Sivrija variety. Multiplication trials were conducted in two locations, Skopje and Kochani, to assess the effects of *Trichoderma harzianum* treatment and various fertilization schemes on yield and seed quality. The trials consisted of two factors: *Trichoderma* treatment (half treated, half untreated) and fertilization (mixed, organic-only, and mineral-only). The highest fruit yields were obtained from plots treated with *Trichoderma* and mixed fertilizers, with 36.57 t/ha in Skopje and 39.20 t/ha in Kochani. *Trichoderma* treatment also resulted in fewer dry plants and less rotting and unmarketable fruits. Seed quality was highest in seeds obtained from plants treated with mixed fertilizers, indicating the importance of appropriate fertilization in promoting seed quality. The results of this study demonstrate the potential of *Trichoderma* treatment and mixed fertilizers to increase the resilience of pepper production to climate change. Further research should investigate the mechanisms by which *Trichoderma* promotes stress resilience and the long-term effects of these agro-technical measures on soil health and crop sustainability. Overall, this study highlights the importance of implementing sustainable agricultural practices to adapt to changing environmental conditions and ensure food security. The findings can also inform the development of policies and programs to support small-scale farmers in the Republic of North Macedonia and other regions facing similar challenges.

Key words: pepper seed production, climate change resilience, *Trichoderma harzianum*, fertilization treatments

P2_50

Quality of cucumber seedlings grown in different substrate volumes

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Abstract

The production of vegetable seedlings is a part of horticultural production that is very intensive and requires a number of horticultural practices and measures. The standards of quality seedlings are not well defined, but mostly refer to the following facts: without infections of diseases or pests, ability to survive in unfavorable environments after transplanting, well developed root system, adequate root:shoot ratio, and well developed leaf area without visible physiological defects of leaves. In this study cucumber seedlings (*Cucumis sativus* L.) were grown in five different substrate volumes (100, 200, 300, 500 and 1000 cm³) with aim to determine which substrate volume ensured production of seedlings with the highest quality in the shortest time. Research was conducted in controlled conditions (growing chambers) at the Faculty of Agriculture in Belgrade. The quality of the seedlings was monitored through the following growth parameters: plant height (cm), stem height (cm), stem diameter (cm), number of leaves, plant fresh weight (g), and leaf area per plant (cm²). The results obtained show that the increase in substrate volume resulted in a linear increase in the values of all measured quality parameters of the seedlings. However, the seedlings grown in a smaller substrate volume (especially 200 and 300 cm³) also had growth parameters that met the standards for high-quality seedlings, which is economically justified from several aspects: lower substrate consumption, greater number of pots per unit.

Key words: cucumber, seedlings, substrate volume, plant height

Acknowledgment: This research was supported by the Ministry of Education, Technological Development and Innovation of the Republic of Serbia, grant numbers 451-03-47/2023-01/200116 and 451-03-47/2023-01/200054.

P2_51

Influence of photosynthesis inhibitors on chlorophyll content in redroot pigweed and lettuce

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Abstract

The aim of this study was to determine the effect of different concentrations of herbicides inhibitors of photosynthesis, , on the chlorophyll content two test plants: redroot pigweed (*Amaranthus retroflexus* L.) and lettuce (*Lactuca sativa* L.). Two herbicides Dancor 70 WG (a. s. metribuzin 700 g/kg) and Goltix 70 SC (a. s. metamitron 700 g/L) were applied. Five different concentrations were used and compared with the untreated control. The relative content of chlorophyll in the leaves of the treated plants was measured by chlorophyllometer SPAD 502. In both test plants, significant phytotoxic reactions were observed 7 days after herbicides application. Phytotoxicity on redroot pigweed manifested in the form of burning of the edge of the leaf and twisting towards the reverse side, depigmentation and drying of smaller leaves. On the lettuce, necrosis appeared from the top to the base of the leaf. The regression relationship between the percentage content of chlorophyll in the leaves of redroot pigweed and the applied concentration of both herbicides corresponds to a linear regression function (decreasing function), and for lettuce this relationship corresponds to an exponential function of the first order (decreasing function). Applied effective doses of metribuzin and metamitron showed that lettuce is more sensible than redroot pigweed. Also, a.s. metribuzin is more effective than a.s. metamitron in the reduction of chlorophyll content, for both researched species.

Key words: metribuzin, metamitron, redroot pigweed (*Amaranthus retroflexus* L.), lettuce (*Lactuca sativa* L.), chlorophyll content

Could Raman microspectroscopy confirm differences of two *Allium* species grown under different selenium treatments?

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Abstract

In this paper, the potential difference in the chemical composition of edible parts of two *Allium* species – *A. sativum* L. (AS) and *A. schoenoprasum* L. (SS) was investigated. Selected alliums were grown in open field conditions and foliar treated with different doses of Se fertilizer (control-0, 10, 20 and 30 g ha⁻¹). The Raman spectroscopy of AS and SS samples was done using an XploRA Raman spectrometer. The Raman spectra showed the highest intensity band at 1437 cm⁻¹, associated with the glucosidic structure. The medium-intensity band in the region from 1568-1578 cm⁻¹, following by the band at 1633 cm⁻¹, are directed to the occurrence of chlorophyll a and b, while a lower-intensity band at ~1519 cm⁻¹, most prominent for all SS samples, originated from the carotenes. According to PCA, score plot suggests the clear existence of two groups of objects along the PC1 axis, all AS and SS samples clearly differ. The highest positive-intensity loadings along PC1 at 1564 cm⁻¹ and 1425 cm⁻¹ mostly responsible for the differentiation of SS and AS samples are attributed to chlorophyll a and b. The higher negative-intensity loadings of PC1 placed at 1057, 814, and 528 cm⁻¹ are mostly responsible for the differentiation of AS and SS, mainly depend on pectin and amino acids, respectively. The PC2 gave a good separation between AS treatments, mainly coming from loadings attributed to chlorophylls and carbohydrates. Application of Raman spectroscopy gave more detailed information concerning the nutritional composition and differences among investigated *Allium* species grown under selenium treatment.

Key words: A. sativum, A. schoenoprasum, spectroscopy, multivariate analysis

P2_53

Onion production characteristics depending on the size of onion sets and planting time during the production in the open field

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Abstract

The influence of the size of the planting material and the date of planting on the parameters of onions is very important for the proper planning of onion production. Srebrnjak onions are produced for use as young onions, young bulbs, and mature bulbs. Therefore, the aim of this study was to determine the influence of the size of the onion sets and planting period on the production characteristics of onions in the open-field production of mature onion bulbs. The experiment was conducted during three planting periods (1st was 3/15/2022, the 2nd was 3/25/2022 and the 3rd planting period was 4/4/2022). Harvesting was performed in July 2022 for all planting dates. From the production characteristics of onions (cv. Majski srebrnjak) in technological maturity, bulb height (cm), bulb diameter (cm), bulb mass (g), and vitamin C content (mg/100 g) were examined. Planted onion sets were divided into those with a diameter of less than 1.5 cm and those with a diameter of more than 1.5 cm. There was no statistically significant interaction effect of the onion set size and planting period on bulb height and diameter. The average mass of the bulb (g) was higher in all three planting periods when the diameter of the onion set was larger than 1.5 cm. The vitamin C content was the highest in the third planting period, with the highest average content of vitamin C in the variant with larger onion set (diameter > 1.5 cm) in the third planting period (15.81 mg/ 100 g).

Key words: bulb, onion, planting period, production characteristics, vitamin C

P2_54

Yield and quality of directly seeded onion cultivars

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Abstract

Fresh onions bulbs are important component in different salads. Depending on the cultivars, the color and taste of the bulbs differ. From the perspective of the farmers, the most important characteristics that onion cultivars should have are the potential for high yield, tolerance to drought, and plant diseases. Therefore, the objective of this study is to examine the yield and quality of five onion cultivars from direct sowing in temperate climate conditions. Open field trials with onion cultivars were conducted in 2022 in the village of Gospođinci, Province of Vojvodina (Serbia). The experiments were setup in a completely randomized design with three replication per treatment. The tested onion cultivars are as follows: 1. Elenka (standard as control), 2. Magika, 3. KNS 314, 4. Lisa, and 5. Zelda. The highest of total yield was recorded at Zelda, while KNS 315 had the lowest yield. The percentage of the first class yield in examined onions ranged from 96.6% in cultivar KNS 315 to 98.4% in Lisa. Regarding the height of the bulbs, the highest value was recorded for Magika (6.3 cm), while the lowest bulb height was recorded for Elenka (5.6 cm). The diameter of the bulbs ranged from 5.8 cm (KNS 315) to 7.5 cm for Lisa. Depending on the cultivars, the average number of external (freshly) leaves ranged from 5.4 to 6.8, while the average of number internal (freshly) leaves varied from 1 to 1.4. Meanwhile, this study demonstrates that each cultivar has a different reaction to field conditions under direct seeded methods of cultivation.

Key words: onion, genotype, yield, quality

P2_55

Analyzing the impact of foliar spraying of selenium on some yield and biochemical parameters on the lettuce (*Lactuca sativa* L.)

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Abstract

The trace element selenium (Se) has beneficial effects for vegetables growth and development. However, its impact on the lettuce (*Lactuca sativa* L.) yield have not been systematically investigated. In our study, the plants of an autochthonous Slovenian variety of crisp lettuce 'Ljubljanska ledenka' were foliar-sprayed with aqueous solution of Na₂SeO₄ (0-water spray as a control, 1+1; 2+2; 5+5; 10+0; 10+10 and 10+50 mg Se L⁻¹) to understand its impact on some quantitative and qualitative yield parameters. First spraying began at the third true leaf unfolded and the second five days later. The experiment was carried out in a completely randomized design in a greenhouse on laboratory field in Ljubljana. No significant differences in the shoot height, leaf number per plant and root dry matter were observed between treatments. The dry matter content in shoots was higher in plants with limited Na₂SeO₄ supply. The growth analysis revealed that 5+5, 10+0 and 10+10 mg Se L⁻¹ increased the weight of shoots. The shoots yield was reduced with foliar application of strong enlarged doses of selenium (10+10 mg Se L⁻¹). Se concentration in shoots increased in proportion to the level of the concentration of Na₂SeO₄ and the highest values were recorded from the plants in which 10+10 mg Se L⁻¹ was applied. The portion of photosynthetic pigments decreased from the control group to treatment with high Na₂SeO₄ solution (10 +50 mg Se L⁻¹). The contents of chlorophyll, as well as carotenoids were good indicators of severe stress caused by Na₂SeO₄.

Key words: selenium, lettuce, *Lactuca sativa*, yield components, pigments

Iceberg lettuce in different cropping systems

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Abstract

Production of iceberg lettuce requires above-average skills, which is why it is not produced in Serbia, but mostly imported for market needs. In order to improve its production, researches on cultivation techniques and systems were conducted. The trials were carried out in the company Salat Iceberg Centar from Belgrade in the period from the end of September to the end of October. The variety used was Umbrinas RZ, grown on dams, with and without mulch, in greenhouse (GH) and in open field (OF). The period from sowing to harvest was 51 days (greenhouse) and 63 days (OF). The largest and the smallest mass of the aboveground part were obtained by the plants on the mulch film in the greenhouse (784.4 and 695.4 g, respectively), and the difference was statistically very significant. Head weight (553.6 and 520.8 g) and yield (44.7 and 41.3 t/ha) were also similar. The number of rosette leaves ranged from 8.4 (OF) to 11.8 (GH) and the number of head leaves ranged from 24.1 (OF) to 22.5 (GH). The cultivation system had a significant effect on these parameters, while mulching showed positive results only under greenhouse conditions in lettuce cultivation. Based on the obtained results, it can be concluded that the production of iceberg lettuce in early fall can be successfully carried out both at OF and in the greenhouse, with a better result obtained under greenhouse conditions.

Key words: iceberg lettuce, cultivation system, yield

P2_57

The influence of mulching and bioregulators on the production characteristics of endives

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Abstract

Endive (*Cichorium endivia* L.) is a leafy vegetable with excellent nutritional composition and bitter taste. Unlike in Southern and Western Europe, the vegetable is little known in Serbia. In an experiment conducted in the greenhouse in the fall of 2022 (August-October), the influence of mulch and bioregulators on the production characteristics of the narrow-leaved curly endive cultivar "Cigal" (*C.e.* var. *crispum*) was studied. An extract of the seaweed *Ecklonia maxima*, trade name Kelpak, was used as a bioregulator. Endive was grown on raised beds with and without PE mulch film. The bioregulator was applied in several ways, from watering the seedlings to foliar treatment. The best results were obtained with the combination in which the seedlings were irrigated with bioregulator before planting and then treated with it for 10 days. The total weight of the endive leaf rosette was 658.1 g for this combination, while it was 550.7 g for the control. The plants grown on the mulch film showed a statistically very significant increase in the total weight of the leaf rosette. All other parameters studied behaved similarly: the number of leaves in the rosette, the height and width of the leaf rosette, and the mass of the tree. The commercial yield of endive after removal of the oldest leaves ranged from 32.7 to 40.4 t/ha. Based on these studies, it can be recommended for production practice to grow endive on dams and with mulch film, and to treat the plants with natural bioregulators from planting to preharvest.

Key words: endive, mulching, bioregulators, leaf, yield

P2_58

Survey on the presence of quarantine bacteria of potatoes *Ralstonia solanacearum* and *Clavibacter sepedonicus* in Republic of Srpska 2011-2022

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Abstract

In Republic of Srpska (RS), survey on the presence of quarantine bacteria *Ralstonia solanacearum* (Smith) Yabuuchi et al. - the cause of brown rot and bacterial wilt of potatoes and *Clavibacter sepedonicus* (Spieckermann & Kotthoff) Li et al. - the cause of potato ring rot has been carried out since 2011. Due to the economic importance of potatoes in our area, as well as the export into the European Union market, a survey was financed and approved by the Ministry of agriculture, forestry, and water management of RS. Mercantile and seed potato (*Solanum tuberosum* L.) samples from domestic production in RS, as well as imported mercantile and seed potato samples, were analyzed in a laboratory for plant protection and biotechnology, in PI Agricultural institute of Republic of Srpska, Banja Luka. All analyses were carried out in accordance with EU directives (98/57/EC and 69/464/EEC) and diagnostic laboratories protocols stated in the Official Gazette of RS (81/17 and 71/20). These included screening tests, IF as the first one, isolation from symptomatic or asymptomatic samples, conventional PCR test, and pathogenicity test. During a survey from 2011 to 2022, 15 samples of imported mercantile potatoes were positive for the presence of quarantine phytopathogenic bacteria *Ralstonia solanacearum*. In 2011 three positive samples were from Egypt, in 2012 two positive samples were from Serbia, as well as one in 2014 and nine in 2020. Regarding potential risks and protection of domestic production of potatoes and other host plants, timely detected infected shipments played a key role in preventing entry of these quarantine bacteria in RS.

Key words: *Ralstonia solanacearum*, *Clavibacter sepedonicus*, quarantine bacteria, potato, survey, Republic of Srpska

P2_59

Evaluation of several Romanian geographical provenances of silver fir (*Abies alba*) based on reproductive traits, in order to identify suitable seed sources

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Abstract

The evaluation of the diversity of silver fir (*Abies alba* Mill.) populations and the reproductive traits of the trees is of great importance for the conservation of genetic resources and forest management. Therefore, the reproductive characteristics of seven Romanian provenances of *A. alba*, considered as different geographical populations, were evaluated. Significant differences between provenances were observed for the investigated traits associated with female cones and seed morphology, such as cone length, cone diameter, number of seeds per cone, seed length and seed weight. Due to the relatively low germination of silver fir seeds, germination tests were conducted to identify treatments that can stimulate germination capacity. Thus, seed germination capacity was determined using four different stimulation treatments compared to untreated seeds as a control. Considerable differences were recorded in seed germination depending on the origin, but also on the treatments applied to the seeds. With the exception of one population (namely Bistrei Valley), seed treatment with Atonik biostimulator induced the best germination capacity and had the best results for the rest of the provenances studied, from 40% to 60%. In addition, the Garda Seaca provenance had the highest germination percentage for all applied treatments. The results could be relevant to the conservation of valuable genetic resources and local populations, as well as their use in silver fir reforestation programs.

Key words: Abies alba; genetic resource; germination capacity; provenances; silver fir

P2_60

First results in insects detection using AI and Deep Neural Networks

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Abstract

It is known that some insects have a negative influence on the yield of agricultural crops but also on the quality of the product itself. Therefore, it is reasonable to consider insect traps as a solution to monitor their population in order to optimize timing and choice of control strategies. In this work, Artificial Intelligence (AI) is used in order to detect Apple Codling Moth (*Carpocapsa pomonella* L.) on pheromone “delta type”, camera-enabled, sticky trap. Model is tested using tensorflow models and CUDA Deep Neural Networks (cuDNN). The model was trained on data set of 100 insect images using above mentioned techniques. It resulted in Mean Average Precision (mAP) of around 70% and localization loss of less than 10%. The results reveal that model allows autonomous insect counting, reducing the need for physical trap inspection. The prototype model will be developed in the future with the aim of achieving the highest possible precision and efficacy.

Key words: insects detection, artificial intelligence, tensorflow, cuDNN, Mean Average Precision

P2_61

Effect of different intensity of late summer pruning on vigor, yield, and fruit quality of sweet cherry 'Black Star'

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Abstract

Seven-year-old sweet cherry trees of 'Black Star' (*Prunus avium* L.) grafted on Gisela 6 rootstock were summer pruned during the first week of September 2021. Pruning consisted of three treatments of high and low intensity, as well as control untreated treatment (66, 33, and 0% of the sum of the length of annual shoots was removed, respectively). Late summer pruning influenced vegetative growth by measuring trunk cross-section area (TCSA) compared to the control treatment, as well as yield and fruit quality. The fruit set was the lowest on the trees with high-intensity pruning treatment (6.51%) and was significantly different from the control treatment (25.02%), which also correlates with the yield and yield efficiency. High-intensity pruning influenced the increase in fruit weight and larger fruits, as well as the length of the stem which was significantly different from the control treatment, but decreased the fruit firmness and cracking index. The fruit shape index wasn't influenced by pruning methods. Pruning methods did influence the chemical properties of fruits considering total soluble solids (TSS) and total acid content (TAC), such that high-intensity pruning reduced TSS and increased TAC compared with the control treatment. From the productive and qualitative point of view, including the agroecological conditions of the cherry production area, as well as with the current market and quality of cherry fruits, in this case, moderate pruning proved to give the best results with this variety of sweet cherries.

Key words: sweet cherry, summer pruning, fruit quality

**Section: AGRICULTURAL ECONOMICS
AND RURAL DEVELOPMENT**

Oral Presentations

03_01

About the good governance of Bulgarian agriculture

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Abstract

A new evolving concept of “Good Governance” has been increasingly debated in academic, governmental, business etc., circles. This paper tries to fill the existing gap suggesting a holistic framework for assessing the quality (goodness) of agrarian governance and estimating its level in Bulgaria. The assessment framework includes: defining the content and components of the agrarian governance system (Institutional Environment, Mechanisms and Forms of Governance, Process of Governing, Agents, and Systemic); formulating the principles of good agrarian governance (Good Legislation, Respectful Informal Rules, Good Working Public Sector, Good Working Private Sector, Good Working Markets, High Transparency, Good Involvement, High Efficiency, Good Leadership, Equity and Solidarity, and High Synergy); specifying the assessment aspects for each principle; identifying the best indicators for each aspect; selecting the criteria and reference values for assessing the quality of agrarian governance for each indicators; and deriving the good governance assessment score. The initial assessment using statistical and expert data found out that the Integral Governance Index of Bulgarian agriculture is at moderate level having in mind the EU perspective. The highest performance is attained under the principles of Equity and Solidarity and the Good Working Public Sector while in terms of the Working Private Sector and the Stakeholders Involvements it is the lowest.

Key words: good governance, assessment, agriculture, Bulgaria

Acknowledgements: This study has been funded by the Bulgarian Science Fund, the project “The Mechanisms and the Modes of Agrarian Governance in Bulgaria”, Contract № KII-06-H56/5 from 11.11.2021

03_02

Farm sustainable development of the EU new member states

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Abstract

The main concept of every agricultural policy is aiming to support the farm sustainability beyond the aspects defined in a single definition, but a contemporary state policy could not escape from the focus of economic efficiency, social responsibility or environmental compatibility. The European Union regulations are reorganizing the holdings in the entire Community and this reflects crucially on the economic size and furthermore the agricultural sustainability of the farms. This paper aims to find out how the agricultural holdings are affected and how the connection between farm economic size and sustainability is developed within the three sustainability pillars. The scientific approach uses an assessment that modifies the Farm Accountancy Data Network set of variables in comparison of predefined criteria used as a sustainability scoring system. The results are determined for each economic size class to the benchmarking frame received by a previous research on a EU level which reports the Balkan farms as a part of the EU vulnerable agricultural units.

Key words: Agricultural Holdings, Farm Sustainability, Economic Size

03_03

Economics and innovations in milk production and processing in Germany up to 2030 - prospects and challenges

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Abstract

German milk production is already undergoing a massive transformation process. The study systematically analyzes influencing factors from six areas. The aim of this study is to analyze the prospects for German milk production both on the producer side and on the processor side. The factors selected for influence are husbandry, nutrient and health management, as well as climate, food retailing and alternative proteins. The methodology of a scenario analysis under consideration of the influencing factors is used. The analysis focuses on the parameters dairy farms, dairy cows and milk volume. A probable development of the dairy sector in Germany is thereby illustrated. With the help of a trend extrapolation, a scenario is set up for the respective measured variables. The results in the area of nutrient management show a monetary impact of 0 to 460 €/ha for 25 analyzed farms due to the entry into force of the amended Fertilizer Ordinance. The additional burden on the individual farm is strongly dependent on the farm conditions, such as location, farm type or farming method. There are huge differences in production emissions and carbon opportunity costs in a global comparison. Due to the land use of milk production, the world misses out on a carbon sequestration of 6.2 kg CO₂ per year per kg of milk on a global average. In contrast, for milk production in Germany, these carbon opportunity costs amount to only about 1.8 kg CO₂ per year. The factors of nutrient management and health management will influence the further development of German milk production in the short term. The factors alternative proteins and climate change will have a significant impact on milk production in the long term. In the sum of the factors, a downward trend is shown for all three measured variables in the scenario analysis.

Key words: transformation process, milk production, influencing factors, perspectives

03_04

Analysis of indicators of rural development of selected municipalities in the Republic of Srpska

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Abstract

The aim of this research is to determine the degree of development of rural areas in the Republic of Srpska on the example of selected municipalities, and to provide answers to the following questions: how important is the agricultural sector for the rural economy of the mentioned municipalities, what is the demographic situation and quality of life in the rural area, what is the income structure of rural households, and what is the assessment of the level of resource use and the ecological situation in the rural area. For the purposes of the research, the OECD methodology was used to select indicators of rural development grouped into four thematic areas: population and migration, economic structure and performance, social welfare and environmental protection. The selection of municipalities was carried out in accordance with the ongoing project Supporting local agricultural and rural development planning (TCP/BiH/3804) financed by the Food and Agriculture Organization (FAO), which includes the following municipalities: Osmaci, Zvornik, Visegrad, Rudo, Rogatica, Gacko, Foca. The analysis of rural development indicators revealed that agriculture is still the dominant source of income for rural areas, but that it is accompanied by additional income coming from employment in the public or private sector and income from pensions. A bad demographic situation was also determined, expressed through the reduction of the total number of inhabitants, negative natural growth and migration balance, a high aging index. In terms of quality of life, a different degree of development of rural infrastructure and availability of public services has been determined. Environmental aspects of rural development were addressed through the segments of land, water and waste management, where numerous problems were identified. At the end, recommendations were given for the improvement of rural development in the Republic of Srpska.

Key words: indicators of rural development, the Republic of Srpska, agriculture, rural households

03_05

Modelling of additional ranking of areas with natural constraints in Bosnia and Herzegovina

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Abstract

The goal of the research was to perform an additional ranking of municipalities in BiH previously classified as areas with natural constraints (ANC) for agricultural production. Starting from that result of ANC BiH project, additional ranking of 108 municipalities classified as ANC area in BiH was performed. Since there was no adequate ready-made model for the aforementioned ranking, the authors created an EDEO model (that operates with 12 variables. The variables were selected under three sub-criteria from each of the four groups of criteria: ecological (agricultural land, ratio of arable and agricultural land, number of LSU), demographic (population density, migration, average age), economic (municipal budget, average salaries, ratio of unemployment and employment) and organisational (number of agricultural producers associations, cooperatives, and registered farms). The model aims to maximize the function with twelve variables based on determining the distance from the value of each criterion for a specific municipality in relation to the municipality that records the maximum or minimum value of the same criterion. The results of the application of the EDEO model is a list of all municipalities according to each of twelve sub-criteria and a final rank list which showed a significant difference between the municipalities, which were all classified in the ANC according to the biophysical criteria. The difference between the best and worst ranked municipalities in the Republic of Srpska is 73.2%, and in the Federation of BiH 152.5%. The conclusion is that this additional ranking enables the further selection of ANC municipalities for certain interventions in case of lack of funding, as well as the objective gradation of the level of support between municipalities. Also, EDEO model, in its original or modified form, can be used for other classifications of rural areas with the possibility of adjusting the weight of individual criteria to a specific ranking purpose.

Key words: areas with natural constraints, ranking, modelling, Bosnia and Herzegovina

03_06

Economic indicators for the sustainability of tobacco production in the Republic of North Macedonia

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Abstract

Tobacco production in the Republic of North Macedonia has a long tradition and is a strategic crop in the industrial crops sector, occupying a significant place in the structure of Macedonian agriculture and implying significant economic and social effects in the national economy. The overall goal of this research is to show the economic elements of sustainability of tobacco production as an indispensable industrial crop with equivalent economic benefits. Through this paper, the need to study this issue will be shown due to the fact that tobacco production plays a key role both for the development of certain municipalities and for the entire national economy. The studies will mainly be based on secondary sources of data, and the set goal is dictated by several methods: method of indices, comparative inductive, deductive and other mathematical-statistical methods characteristic of agro-economic research. In Macedonia, tobacco production is organized on an average area of 16.260 ha, that is, 78.8% of industrial areas. About 22.000 producers are engaged in tobacco production, or rather, tobacco is a source of basic and additional income for a population of about 80.000 people. Tobacco production has a strong social component due to its labor-intensive nature, but it should also be emphasized that all stages of the production process are contractually regulated by a separate legal solution. Macedonia is among the top 30 tobacco producing countries in the world and among the 20 exporters of raw tobacco. Most of the tobacco produced in Macedonia, i.e. 90%, is exported. The fact is that Macedonia exported more than it imported in the analyzed seven-year period. Today, when the areas under tobacco maintain a stable level, the state support for the income of agricultural holdings engaged in tobacco production must continue, by encouraging balanced and sustainable development in the tobacco-producing regions, as well as support in the formation of producer organizations in accordance with European experiences.

Key words: tobacco, unprocessed tobacco, tobacco production, sustainability, economic indicators, agricultural policy

03_07

Economics of irrigation in north-eastern Slovenia

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Abstract

The irrigation is gaining on importance due to more frequent drought occurrence related to climate change. Furthermore, some crops cannot be grown without irrigation. North eastern Slovenia has great potential for irrigation due to existence of 2 derivative hydro electric power plants (HE Zlatoličje and HE Formin) on Drava river. Despite favorable conditions the building of irrigation systems is slow hindered by complicated legal bureaucratic procedure. In this paper we present 1) drought occurrence in NE Slovenia and general information on importance of crop irrigation 2) existing irrigation systems 3) economics of main crops and expected gross margin values with the use of decision trees.

Key words: irrigation, crops, economics, gross margin

03_08

Managerial capacities of milk producers in Titel municipality

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Abstract

Farmer managerial capacities can be defined as "possessing appropriate personal characteristics and ability to cope with certain problems and opportunities, in the right way and at the right time." In order to have successful and competitive production, farmers must devote more time and attention to their managerial capacities than their predecessors. Since managerial capacities are not getting deserved attention, also bad situation in milk production sector and the necessity of improving its competitiveness, the subject of research is the managerial capacities of milk producers in the municipality of Titel, AP Vojvodina. The survey was conducted during 2021 and 60 milk producers were interviewed. Considering that farmer is mostly the manager as well, the aim in this paper is to evaluate the managerial capacities of milk producers (their personal characteristics and abilities, as well as the decision-making process) and after establishing their managerial profile, certain recommendations will be given in order to improve the managerial capacities of producers, and thus increase the competitiveness of milk production. According to obtain results, it can be concluded that in addition to the necessity to take adequate measures to increase the milk yield and the application of new biotechnologies in the production process, it is also crucial to improve managerial capacities, especially the aspect of the decision-making process. Moreover, it is important for milk producers to plan production for a longer period of time, to keep records and analyze achieved result of technical and economic efficiency, as well as to improve their managerial skills through various professional trainings, through the exchange of experiences with other producers, cooperation with advisory services, etc.

Key words: managerial capacities, milk production, Titel municipality

03_09

The significance of the fiscal relief of wheat and corn production in the function of protecting the food market in the Republic of Croatia

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Abstract

The production of a sufficient amount of quality food is one of the world's biggest problems. Statistics record a significant increase in the human population, with a particularly pronounced trend in the underdeveloped countries of the world, which are also the weakest food producers, which contributes to an uneven ratio in the production of components of everyday food products. The aim of this paper is to carry out a market analysis of the production of wheat and corn for the Croatian market as inputs from which ready-made food is produced and to show the importance of a sustainable production management policy with the aim of reducing production costs. The emphasis of research is focused on models of reducing the fiscal burden of business in order to increase market competitiveness. A supply and demand curve for wheat and corn will be formed based on current prices and production volumes and will show changes when the tax burden is reduced. Adequate management of the production process must be put into the function of protecting the domestic market, which enables the satisfaction of domestic needs and creates conditions for increasing food production.

Key words: wheat, corn, fiscal burden, market, supply and demand

Foreign trade of wine in the Republic of Serbia

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Abstract

The paper analyzes the foreign trade of wine in the Republic of Serbia. The period investigated in the research is 2018-2022. Wine export from the Republic of Serbia averaged 11.5 million liters with a slightly decreasing trend at a rate of 0.78% per annum. The average export value was 18.7 million USD. Wine was exported to 36 countries in the world. The Republic of Serbia accounted for 0.13% of the European export, taking 21st place. The most important export market was the Russian Federation, with an average of 5.9 million liters per annum, which accounted for more than half (51.3%) of the total export. It was followed by the CEFTA countries with 3.9 million liters (33.9%), while on average only one million liters (8.7%) was exported to the European Union market. The average import amounted to 22.3 million liters with a slightly increasing trend at an average annual rate of 0.21%. The value of import was 31 million USD. Analyzed at the regional level, the largest import was from the CEFTA countries in the amount of 19.3 million liters (86.5%), while from the European Union the average import was 2.8 million liters (12.5%). Analyzed by countries, the largest import was from North Macedonia, with an average of 15.4 million liters, accounting for more than two thirds of the total import (69.1%). On average, the Republic of Serbia had negative foreign trade balance of wine in the amount of 10.8 million liters, i.e. the value of 12.3 million USD. The negative balance had a slightly increasing trend at a rate of 1.30% per annum.

Key words: wine, foreign trade change, export, import, Republic of Serbia

03_11

Consumer attitudes about purchasing and consuming vegetables

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Abstract

The main goal of this research was to investigate the attitudes of consumers when buying and consuming vegetables. Primary data collection was carried out in the second half of 2022. A survey of 100 people was conducted with a structured questionnaire that included socio-demographic questions and questions that were directly related to attitudes when buying and consuming vegetables. Data processing was performed in Microsoft Office Excel and in the statistical program IBM SPSS Statistics 22. Basic descriptive statistical indicators e.g. mean, median, mode, range, frequency were used to describe the sex, age, number of members and household income, and place of residence. In order to calculate and determine the relationship between certain characteristics of the sample, the Chi-Square (χ^2) test was also applied. The results showed that vegetable is most often bought in supermarkets, in 49% of cases and in green markets (25%). According to the results, less than 100 BAM per month for vegetables allocates 70% of sample and 30% more than 100 BAM. The most important factors when buying vegetables are freshness, quality, smell and taste and origin of the product. The size and appearance of vegetables in selling places and the nearness of the selling place are lower important factors. The respondents with a lower income spend less on vegetables on a monthly basis. The allocations for vegetables on a monthly level and the frequency of purchases are interconnected. Respondents whose households spend less on vegetables buy more often in mini and supermarkets, while those who spend more buy more often at the green market. Males respondents think that their households spend less on vegetables compared to the opinion of females who think that spend more.

Key words: consumer behavior, attitudes, vegetables, purchase place, money allocation

03_12

Z generation attitudes and opinions about beer

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Abstract

The aim of this research was to identify the key attitudes of Generation Z that influence the purchase, consumption and preference for domestic or foreign beers. The research was conducted in the second half of 2022. Primary data were collected online, using a structured survey questionnaire. The model is based on the opinions of 25 adult members of the Z generation who are beer consumers. The consistency of the received answers is within the range of acceptable limits. Quality and market characteristics of beer were selected as the two main criteria that influence consumer attitudes about beer. The term quality of beer includes the criteria of color, taste, smell, alcohol content and bitterness, and within the criteria of market characteristics sub-criteria are price, availability, awareness and packaging. Based on the Analytical Hierarchy Process method applied using the Expert Choice program, it was concluded that beer quality factors are more important than market characteristics factors. The most important factor when buying beer is taste, which influences the purchase with 28%, followed by bitterness at 16%, alcohol content at 13% and smell at 12% influence the purchase. Price affects 9%, color 8%, availability 6% and finally familiarity and packaging 4% each. Preferences of young beer consumers were calculated based on the weighted sub-criteria obtained on the basis of the attitudes of the respondents. Based on all the factors, young consumers are more committed to foreign beers compared to domestic beers in a ratio of 52:48%.

Key words: beer, attitudes, opinions, Z generation, AHP

03_13

Gender trends in modern agriculture: the case of female farmers in Europe

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Abstract

This article examines the extent to which women entering a male occupation threatens the current gender structure by focusing on women farmers who are formally equal to men. The current data demonstrates that young female farmers signal a shift toward a new job role for women in agriculture. In many significant aspects of farming, such as professional training, technological know-how, and union participation, they have become more similar to men farmers; nonetheless, significant elements of the current gender system are still intact. In recent years, there has been a modest rise in the proportion of women farmers. According to the most recent data (Eurostat 2016), 29% of farms in the EU are reportedly run by women on average. Yet, these figures conceal some sizable nation-to-nation variations. This issue is particularly serious because recruiting Europe's upcoming generation of farmers is proving to be a significant obstacle. Only 4.2% of female farmers in Europe are under the age of 35, according to recent data, indicating that the farming business is dominated by an older generation. The gender disparity in farming could worsen in the future given that 42% of women who work in agriculture are over 65 (as opposed to just 29.2% of men). For young women who want to work in agriculture, assistance is available. The EU can offer rural development grants to assist young women in starting farms in addition to its standard system of income support for new farmers. The common agricultural policy (CAP), which mandates that EU nations take into account the situation for women in rural areas when planning their rural development programs, embodies this commitment to closing the gender gap in the EU.

Key words: women, European Union, agriculture, gender, farm manager

03_14

Evaluating of environmental impact in cost benefit analysis of investment projects in agriculture

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Abstract

The aim of research is to identify the most suitable method that can be applied for estimating the monetary value of changes in non-market goods in agriculture projects. Research is motivated by fact that investment projects in agriculture have exceptional influence on environment i.e. decrease or increase in the quality or quantity of environmental goods and services with consequential changes, gains and losses, in social benefit. In this context, choice of method for economic evaluation of environment is of essential significance for proper evaluation of investment projects in agriculture, i.e. calculation of aggregate Cost Benefit Analysis indicators of net benefit as a base for optimal investment decisions. Research method used in this paper is comparative analysis of original studies/projects available in GEVAD database set up to facilitate BT. BT method can be defined as use of unit value for a non-market good estimated in an original study as a proxy (after some adjustments) for values of the same good in another study. Searching studies in the GEVAD database by defining General environment good as a first category of information, and Agriculture and Agriculture landscape as a second different categories of information we have found that in five of seven studies valuation method was Contingent valuation and willingness to pay (WTP) as economic measure. In one of this five study/project alongside of Contingent valuation, Analytic hierarchy process and Choice experiment methods were used, and in a one study BT method was used. Thus, according to the GEVAD database the most used method of evaluating of environmental impact of investment project in agriculture is Contingent valuation method.

Key words: evaluating methods, environment, agriculture projects

03_15

Challenges for the further development of the organic sector in Western Balkan countries/territories

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Abstract

Over the past fifteen years, consumer preferences and behavior have changed significantly. An important role in this change has been played by consumers' increasing interest in the impact of food production on the environment. They now also prefer food produced without the use of chemical pesticides, more nutritious food with fewer additives, and food with less saturated fat. Promoting better or healthier eating habits is becoming increasingly important to consumers around the world. Although Western Balkan countries/territories have relatively good conditions for organic farming, according to the Standing Working Group for Regional Rural Development in South Eastern Europe study, the development of this sector is at an early stage due to the many challenges still facing agriculture in the region. Organic farming is a good tool for competitiveness, especially for small farms to survive in the extremely demanding food market, and it opens up the possibility of reducing population out-migration from rural areas, promoting the development of local economies, and preserving rural communities. In general, organic production in the Western Balkan region is highly export-oriented and dominated by primary products, including wild plant collections, or semi-finished products with minimal processing stages, with very little export of final products destined for the end consumer. There is a relatively limited but steadily growing demand for organic products in the region, and the obstacles to overcome are more typical of young markets, such as establishing critical production volumes, organizing producers, professionalizing, scaling up production, and informing and communicating with consumers. These are the main weak points today.

Key words: habits, organic, growth, market

03_16

Selecting socio-environmental indicators to understand the effects of drought on Ramsar sites

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Abstract

Ecosystems of Ramsar sites are characterized by diversified flora and fauna; accordingly, the ecological assets of these wetlands need to be additionally protected. Wetlands are under numerous pressures such as climate change, pollution, unauthorized urban infrastructure development, overexploitation of natural resources, land use changes, invasive species, etc. Identification and assessment of these threats are essential for developing efficient management strategies to preserve the good status of wetlands. The Driver-Pressure-State-Impact-Response (DPSIR) methodology comprehensively analyzes threats to water resources from social, economic, and human activities and it can be implemented in any given wetland. The information gathered by the DPSIR can be used for different analyses, among them to link stages of droughts with the effects outcomes of drought. This research aims to select a set of indicators to understand intricate drought effects on the Ramsar sites. Based on the DPSIR, a total of 39 drought-related social and environmental indicators were identified for the Ramsar site "Koviljsko-Petrovaradinski rit" in the floodplain of the Danube River near Novi Sad, Serbia. These indicators are clustered into five groups as Driver-Pressure-State-Impact-Response. Drivers of climate change and human activities that trigger altered patterns of rainfall distribution and reduction in freshwater flow are identified, and ten pressures as well. Nine states and ten impacts caused by drivers and pressures are also recognized. Six responses were identified by the DPSIR, including stakeholder participation in decision-making, developing conservation strategies, ecosystem restoration, etc. The authors agree that these responses could enhance the state and reduce drought impacts on Ramsar sites.

Key words: drought mitigation, DPSIR, Ramsar, wetland management

03_17

Tool for Agroecology Performance Evaluation testing in Bosnia and Herzegovina

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Abstract

Tool for Agroecology Performance Evaluation - TAPE is developed by UN Food and Agriculture Organization (FAO) to support local development toward sustainability in different ways to identify farmer's needs in the transition process. TAPE represents an opportunity to show that the region is open for agroecology and that actions from public institutions would be welcomed. The tool has 4 steps. Step 0 describe the production systems, type of farms, agroecological zones, existing policy and environment. In step 1 a survey of farms describes the current status based on Characterization of Agroecological Transition (CAET). Step 2 provides the measure progress and quantify the impact and analyze the time and cost constraints. Based on participatory approach at community level, step 3 review CAET result and analyses their contribution to Sustainable Development Goals (SDGs). The pilot testing of TAPE was conducted in small-scale family farms in a selected territory in BIH (Trebinje and Ljubinje). The interviewed farms have been divided in two groups: market oriented with 1-2 main products, and ecological mixed production mainly for self-consumption based on domestic and autochthonous species including beekeeping. The main characteristics of the selected area are a very strong tradition and culture of local cuisine, pronounced depopulation and aging of households, lack of connection between the area and infrastructures (internet, somewhere GSM signal), roads, schools, kindergartens, health centers, etc. The region still has an active rural population represent by family farms, supportive communities, agrarian fund supporting farmers, organizing local selling of products and advisory services. The agriculture is mainly traditional and small-scale. Youth migration in town and abroad is a major problem, although in this lively region a great part of the youth population wishes to stay and make a living out of agriculture.

Key words: agrobiodiversity, TAPE, youth, tradition, small-scale farm

**Section: AGRICULTURAL ECONOMICS
AND RURAL DEVELOPMENT**

Poster Presentations

P3_01

Associating in Serbian agriculture: cooperatives and clusters

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Abstract

Agriculture is an essential branch of the economy, and ways to improve its contribution to the overall economy should be constantly sought. One of the ways and methods to achieve this is by associating in different forms. The main objective of the paper is to analyse the importance of different connection models and the need for the improvement of clustering in agriculture. However, there are different connection models, for more detailed consideration in this paper, cooperatives and clusters were chosen. The focus of the analysis is on Serbia because there are natural preconditions for the development of agricultural production as an economic activity. The interpretive content analysis of secondary sources was used in this article to achieve the paper's objective. The paper presents a theoretical analysis of the cooperatives and clusters in agriculture. The paper consulted a rich literature review. The research was conducted based on the analysis of available sources of literature. The motive of the research and analysis in this paper is the more profound understanding of the benefits brought by the association in clusters and cooperatives. The results of the analysis showed that cooperatives and farmer organisations can provide added value to agribusiness firms, which is a kind of benefit for everyone. The results of the analysis also showed that the clusters can combine local and global perspectives, which can be crucial for the development of agricultural activity in general, and, consequently, the entire economy. The conclusion could be combined for both types of mergers. By joining either in cooperatives or in clusters, resource strength is increased and synergistic effects are achieved that could not be achieved by individuals as members.

Key words: agriculture, associating, cooperatives, clusters, Serbia

P3_02

Structure of income diversification of rural households in Macedonia: A case study in Polog and Pelagonija

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Abstract

The contemporary trends in rural economic development go beyond the concept that agriculture and food production are the only functions of the rural economy and move towards a broader concept that covers all resources in the rural area, including non-agricultural activities. Thus, the paper aims to analyze rural households' economic diversification with a particular focus on rural income structure and its influence on households' well-being. The paper is based on a questionnaire survey performed in the year 2018, through direct visits and interviews of 140 randomly selected rural households from two statistical regions in Macedonia, Pelagonija and Polog. The household income structure is measured as net incomes from all on-farm and off-farm activities and other financial transfers, for one calendar year. The analysis shows that the households group, which have only one type of income source (I. households with on-farm incomes only from agricultural activities, II. households with on-farm incomes only from non-agricultural activities, and III. households with only off-farm incomes) have much lower financial success than one with mixed income sources, while non-agricultural rural households achieve the least success. In addition, households with mixed income sources, including incomes from agriculture, have better financial results than other households with mixed income sources, which do not comprise farming incomes. Hence, the challenge for policymakers is to identify the best mechanism to promote rural households' economic portfolio, with a well-balanced synergy between agricultural and non-agricultural activities, based on agriculture at the center of rural development, as complementary engines for rural poverty and food security.

Key words: diversification, rural resources, rural economy, on-farm incomes, off-farm incomes

P3_03

The analysis of vegetable and fruits export competitiveness of the Republic of Srpska

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Abstract

The aim of this research is an analysis of export competitiveness in vegetables and fruits of the Republic of Srpska on international markets. Two main evaluation indices are used; the trade competitiveness (TC) index and the revealed comparative advantage (RCA) index, to measure and analyze the international position of vegetables and fruits during 2015 – 2022. Both indicators are calculated based on statistical data on foreign trade in vegetables and fruits between the Republic of Srpska and the World, EU and CEFTA countries, and analyzed using descriptive statistics. Vegetables and fruits participate with 7.17% and 15.41% in the total export of agri –food sector of the Republic of Srpska. Analysis of the export structure of agri–the food sector of the Republic of Srpska, showed an average share of vegetables and fruits of 12.04% and 9.43% in the EU market, i.e. 1.63% and 9.65% in the CEFTA market. The results indicate the strong export competitiveness of the Republic of Srpska in vegetables in relation to world and EU markets, but weak export competitiveness related to CEFTA countries. The Republic of Srpska recorded strong export competitiveness in fruits on the world and CEFTA market, while in the EU market poor export competitiveness. Within these two product groups, in the world market, strong export competitive are cucumber, apple, pear and plum. On the EU market cucumber and plum are two leading products regarding strong export competitiveness, while apple and pear are on the CEFTA market. Considering the favorable agroecological conditions for the production of vegetables and fruits, the Republic of Srpska should continue to promote production for export of these products and use apply policy measures to improve their competitiveness in international markets.

Key words: vegetables, fruits, export competitiveness, Republic of Srpska, foreign trade

P3_04

Advancing medium and long-term adaptation planning in the Republic of Serbia

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Abstract

Climate change impacts threaten Serbia's development, particularly agriculture and water management, forestry, energy, transport and infrastructure sectors. In line with the United Nations Framework Convention on Climate Change, Paris Agreement for Climate Change, and within the EU accession progress, Serbia has committed to adapt to changing climate conditions. Serbia has made much progress in establishing an effective institutional and legal framework to combat climate change, though significant gaps and needs remain. These include insufficient information flow among relevant institutions, as well as uncoordinated and ad hoc planning and lack of funding for further integration of climate change adaptation measures into strategies and policies on national and subnational level. The success of adaptation depends on the involvement of stakeholders and their active engagement in developing and implementing adaptation measures. The efficiency of adaptation, on the other hand, depends also on the quality and detail of vulnerability assessments which, in turn, requires available, high-quality and long sets of data, as well as capacities for vulnerability assessment now and in the future. In principle, delaying interventions contributing to adaptation make adaptation more costly and more difficult to achieve. The UN Framework Convention on Climate Change and the Paris Agreement define adaptation as a global challenge, which requires integration of socio-economic and environmental policies. Ministry of Agriculture, Forestry and Water Management implements the project „Advancing medium and long-term adaptation planning in the Republic of Serbia“ with the aim to improve Serbia's legal framework for addressing climate change vulnerabilities and strengthen institutional capacities for integrating climate change adaptation measures into decision making and investment planning. The preparation of the National Adaptation Programme to Climate Change is underway in order

to identify all adaptation measures in the sectors and define the dynamics of their implementation.

Key words: climate change, adaptation measures, agricultural, policies

P3_05

Rural development policies towards empowering of young farmers: a case study in southeastern North Macedonia

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Abstract

Farm inheritance from generation to generation is crucial for rural development and modernization of agriculture. Motivating rural youth to engage themselves in the agricultural sector and stay in rural areas is one of the biggest challenges for policy makers worldwide. According to statistics, the percentage of young farmers is only 5% at EU level. In North Macedonia, rural youth account for approximately 35% of the total population on one hand, while the average age of a Macedonian farmer is 56 on the other, confirming the country's low level of engagement of young farmers. As a result, one of the goals of the EU CAP and national agricultural policies is the economic empowerment of young farmers. Similarly, North Macedonia has foreseen series of mechanisms for support of young farmers in its national strategies and programs, such as direct financial support in agriculture and rural development measures. The focus of this paper is investigating the effects of rural development policy on young farmers in North Macedonia, as well as the mechanisms for their implementation. Data was collected using a survey questionnaire distributed to 45 young farmers in the southeastern region of Macedonia. Descriptive statistics and correlation were applied for the data processing and analysis. The results revealed that about 50% of the young farmers receive state support through rural development measures designed specifically for young farmers, and confirmed that these measures have a positive impact on farm management decisions. However, the support provided to young farmers is insufficient, and in the future, other complementary support measures for young farmers should be developed in addition to the existing measures.

Key words: young farmers, agricultural policy, support measures, rural development

P3_06

Gender differences in characteristics of quality, loyalty, recognition and association with the brand „Valjevsko pivo“

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Abstract

The aim of this empirical research was to determine gender differences in the subjective perceptions of consumers about the most important variables of the „Valjevsko pivo“ brand (quality, loyalty, recognition and associations with the brand) with regard to their socio-demographic characteristics (gender, education and place of residence). The sample of respondents (N = 181) included 134 men and 62 women, ages 18 to 70, average age 46.24±9.71 years. The research instruments are Aaker's brand variables and a survey questionnaire on the socio-demographic characteristics of the respondents. Determined relations between groups in the examined variables were defined by Mann-Whitney (U) and Kruskal-Wallis and (K-W) non-parametric tests at the level of statistical significance ($p \leq .05$, $p \leq .01$). The calculated values of the Cronbach Alpha coefficients of internal reliability show that the variables used had satisfactory psychometric characteristics, and that they are a valid measuring instrument that can be recommended for examining the population in Serbia. Depending on the gender, the results of the U and K-W tests show that men have a higher arithmetic mean of ranks in relation to the perception of the variables quality, loyalty, recognition and association with the brand. Also, significant differences were manifested between social-demographic variables (lowest and highest level of education) and measured Aaker variables. However, the statistical analysis indicates that no statistically significant differences were found for the parameters place of residence and attitudes about the „Valjevsko pivo“ brand, because the sums of the ranks are approximately equal. The results obtained in this study point to the importance of learning about statistically relevant differences between respondents in the

variables of the „Valjevsko pivo" brand, considering their socio-demographic characteristics.

Key words: Aaker's variables, beer, consumers, men, women

P3_07

Analysis of the representation of nonforest greenery in the territory of Vojvodina

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Abstract

The territory of Vojvodina is a predominantly agricultural area, where the share of forests is only 6%. Forested areas are unevenly distributed, mainly in the territory of Fruška Gora and in the inundation areas of large rivers, while the share of afforestation where arable land dominates is only 1.5%. The small percentage of nonforest greenery in Vojvodina is one of the reasons for aeolian erosion. The structure, percentage of connectivity, and distribution were analyzed by the plugin of QGIS. One of the tools used in spatial analysis is the LecoS QGIS plugin. Input data are Corine Land Cover 2018. Landscape matrices were calculated using LecoS plugins, which enable converting classified raster layers into arrays using a powerful bio-library. Land cover in the territory of Vojvodina is divided into four classes depending on the impact on the environment. The first class consists of urban green areas, vineyards, orchards, and inland waters with a share of 2.7%, the second class - are agricultural areas that are not cultivated every year (pastures and meadows), as well as areas with low vegetation (shrubs) with a total of 11%. The third class - forest areas cover 8.1%. The fourth class represents surfaces that do not have a significant impact on the environment. Conducted spatial analyzes show low representation and uneven distribution of nonforest greenery in a highly agricultural area. The analysis highlights areas where there is a small share of nonforest greenery. These analyzes could represent a good basis for an afforestation plan. It would be achieved by the formation of a network of green corridors in the area threatened by large homogenous areas with intensive agricultural production. This could improve the protection of soil from aeolian erosion, provide habitat for flora and fauna, preserve biodiversity, landscape diversification, etc.

Key words: Quantum GIS Plugin LecoS, Land use/cover, Forest landscape, Vojvodina

P3_08

Economic impact of biostimulants in raspberry production

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Abstract

Poland is one of the world leaders in raspberry production. The nature of production is mainly export-oriented, so producers need as large harvest as possible to be as profitable as possible. This is becoming increasingly difficult each year, due to unfavourable weather conditions. Agricultural producers have developed new preparations that are in line with the principles of integrated farming - biostimulants. In the event of stress factors, such as frost or long periods of drought, they strengthen the plants and help them survive difficult times. Raspberries recover faster. In periods of good weather, they make the plants grow faster and they also make the root system stronger and deeper. From an economic perspective, another positive effect of biostimulants is the increase in the number of fruits on the bushes. Among the biostimulators accessible on the Polish market, preparations with various substances in the formulation are offered, including those containing seaweed extracts, such as Kinactiv Initial or Shigeki. The Available research related to the use of biostimulants in raspberry production shows that they increase yield (e.g. Kinactiv Initial increased yield by 5.6 tonnes per ha). The aim of this study is to determine the importance of biostimulants and to show the cost-effectiveness of their use in raspberry production. To collect the data, a documentary analysis was used. A descriptive method and a financial calculation method were used to develop the results. The calculations show that the use of biostimulants in raspberry production is cost-effective and increases the value of production.

Key words: biostimulant, raspberry production, agribusiness calculation, profitability

P3_09

Structural changes and competitiveness of Serbian farms

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Abstract

The main goal of this research is to examine structural changes of farms in Serbia and competitiveness among different types. In first stage we explore farm structure changes, according to EU farm typology, based on Agriculture Census 2012 and Farm structure survey 2018 data. Total decrease in farm number by 10% originate mainly from livestock farm types, that decreased much strongly, while number of crop farms even increased. Several reasons causing structural changes can be grouped in two categories: demographic and economics. Continuity in ageing of farmer population, especially in group 65 and older force farmers to quit farm business, or at least livestock enterprises, retaining crop enterprises. At second stage analysis is focused on several dimension of farms competitiveness: profitability, productivity, and efficiency. FADN data set, also based on EU farm typology in period 2017 – 2021 were used for analysis of dynamics in farm types competitiveness. Additionally, competitiveness of farms from FADN Serbia system were analysed in two regions: north and south, following differences in production systems.

Key words: farm type, profitability, efficiency, productivity, Serbia

P3_10

Actions related to the strategy of protection of pollinating insects in Natura 2000 areas in Poland

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Abstract

Pollinating insects play an important role in the natural environment and food economy. Their significant impact on ecosystems is associated with ensuring biodiversity. In the case of the agribusiness sector, the yield of various plants and the related economic results of farms depend on their activity. Pollinating insects are involved in the pollination of plants due to the transfer of pollen from anthers (it is estimated that about 80% of flowering plants are pollinated by these insects). Thanks to the activity of these insects, the number and quality of food increases. Unfortunately, there is a significant decline in the abundance and diversity of wild pollinating insect species, largely due to the intensification of agricultural production and the inappropriate or excessive use of pesticides and fertilisers. A particularly high economic threat due to the smaller number of pollinating insects occurs in the case of fruit, vegetable and nut production, which in turn may limit the amount of available food for humans and reduce its quality and nutritional value of the diet. Therefore, in order to protect pollinating insects, various initiatives, strategies and programs are being created - both at the global and national level. The study is based on secondary data obtained by the method of critical analysis of the literature and the documentation method. The aim of the study is to disseminate knowledge about the importance of pollinating insects and to present activities resulting from the protection of pollinating insects implemented in Natura 2000 areas in Poland. The study presents initiatives undertaken by the Polish Ministries of Climate and Environment and the General Directorate for Environmental Protection, including: species protection programs, creation of ecological corridors, protection of habitats, promotion of ecological agricultural practices, as well as education and information activities related to the importance of pollinating insects and their security.

Key words: pollinating insects, biodiversity, food safety, fod security, Natura 2000, agribusiness

SECTION: ANIMAL SCIENCES
Oral Presentations

04_01

The importance of education in the field of agriculture in terms of changes of climate

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Abstract

The changes in climate become one of the most pronounced problems in overall agricultural production. Accordingly, to various reports and research, these changes will result in increasingly adverse climatic conditions for all sectors of food production, especially the sector of animal production. Since these changes are unquestionable if we want to ensure food security for the human population and to enable sustainable food production it is necessary to adopt and implement efficient mitigation methods. Therefore, there is a growing need for adequate education in order to enable transformative changes in production practices as well as in individual mindsets of stakeholders ensuring future climate-friendly agricultural production.

Key words: education, agriculture, animal production, climate change

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04_02

The influence of geographical area on morphometric parameters of honey bee in Serbia

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Abstract

During the evolutionary development of bees, in different parts of the world, under the influence of various environmental factors, different races with specific biometric characteristics appeared. In this study, morphological characteristics were measured on worker bee samples collected from seven different locations covering the territory of Republic Serbia. Three samples were taken from the territory of AP Vojvodina, namely from the Southern Banat district (Vršac; I), South Bačka district (Bač; II) and West Bačka district (Crvenka; III). From the central Serbia worker bees were originated from different sites namely Rasina district (Aleksandrovac; IV), Zlatibor district (Lučani; V), Pešter (Sjenica; VI) and Bor district (Negotin; VII). The measurement included a total of 14 parameters, 11 of which were the angles on the forewing, while the other analyzed parameters were the length and width of the forewing and the cubital index. The results showed that there is a high statistically significant difference between the localities in the examined characteristics. From a total of 11 angles analyzed, statistical significance ($p < 0.01$) of average values between localities was determined for the following angles: A4, J16, K19, L13, N23, G18 and O26. The analysis of the results of the length of the front wings and the cubital index showed a significant difference between the groups of bees.

Key words: honey bee, morphometry, angle, cubital index, Serbia

04_03

Change in pulse frequency in horses as an indicator of stress caused by loading

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Abstract

Transport, and above all loading into vehicle, can cause stress in horses, which can consequently damage the concept of the animal's well-being. Loading a horse into vehicle involves the inability to exhibit a natural model of behavior. The aim of the study was to determine the existence of stress in horses during the loading into vehicle, expressed through a change in pulse frequency. The study included 25 horses between the ages of 4 and 20 ($\bar{X}= 9.04\pm 5.623$). On the first measurement, when the horses were resting in the stalls, a pulse frequency of 29 to 40 rpm ($\bar{X}= 35.12\pm 2.505$) was found. The second measurement was made at the moment of loading, when the horses stepped onto the loading ramp of the transport trailer for two horses, and the values of pulse frequency from 42 to 72 rpm ($\bar{X}=52.28\pm 5.512$) were found. The results of the t-test indicate that there is a statistically significant difference ($p=0.00$; $t = -15.174$; $df = 24$) in the obtained pulse frequency values. Results of this study indicate that loading into vehicle that can cause stress in horses, which is manifested by an increase in pulse frequency. The tendency of horses to easily form habits allows proper training of horses to reduce the level of stress during loading into vehicles, which contribute to improving the well-being of horses and at the same time contribute to reducing stress and the risk of injury to horses and staff.

Key words: horse, loading stress, pulse frequency

04_04

Variability of mastitis occurrence in dairy Simmentals due to recording time

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Abstract

The aim of this research was to determine the mastitis occurrence in dairy Simmental cows regarding the year, month and season of milk recording. Therefore, test-day records were collected during regular milk recording on dairy cattle farms in the period from January / 2004 – December / 2022 were analysed. After logical control, the processed dataset contained 4,922,751 test-day records. The obtained results indicated the effect of the time of recording (year, month, and season) on mastitis occurrence in dairy Simmental cows. The highest occurrence of cows with mastitis was determined in the year 2020 (25.76%); in August (21.89%) and during the Summer season (20.89%). During the analysed period (2005 – 2022), 35% of cows experienced health problems caused by mastitis occurrence. Therefore, it is necessary to put into practice a system for monitoring and prevention of mastitis occurrence in order to ensure successful management and minimize the environmental impact of dairy farms.

Key words: dairy Simmentals, test-day records, mastitis, occurrence

Acknowledgements: Research and dissemination were supported by the Fund for Bilateral Relations within the Financial Mechanism of the European Economic Area and Norwegian Financial Mechanism for the period 2014-2021 (Grant number: 04-UBS-U-0031/23-14).

SECTION: ANIMAL SCIENCES
Poster Presentations

P4_01

State and perspectives of aquaculture development in Bosnia and Herzegovina

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Abstract

The goal of the research was to review the state and perspectives of the development of aquaculture in Bosnia and Herzegovina. Statistical data on aquaculture in B&H (2010 - 2021) was used to analyze the situation. B&H is characterized by a wealth of water resources; river networks 20918.68 km, natural and artificial lakes and part of the Adriatic Sea (1400 ha). B&H has a tradition of farming fish that goes back over 100 years. The freshwater fish species that are predominantly farmed are: rainbow trout and carp, to a lesser extent brown trout and brook trout, fingerlings native salmonids huchen, softmouth trout and marble trout. In the sea, seabream and seabass are grown, dentex and meagre have been farmed a trial basis, also shellfish flat oysters and mussels are farmed. The area of trout ponds varied between 85367.3 - 141250 m², carp ponds 2042.2 - 2462 ha and cage volume 75163 - 127106 m³. The produced quantities of trout varied between 2381.8 - 3502.6 tons, carp 218 - 1355.8 tons, other freshwater fish 12.6 - 379.6 tons, sea bass 40 - 81 tons, sea bream 60 - 100 tons, oysters 1 - 5 tons and mussels 10 - 40 tons. Although the area of trout fish farms increased slightly (0.53%) in 2021 compared to 2010, the growth of produced trout was higher (13.96%). The area of carp ponds was smaller by 17.01%, and the drop in production is 73.73%. The number of employees in the aquaculture sector varied between 293 - 457. The opportunities for the development of aquaculture in B&H are great in terms of increasing production in the existing ones and building new capacities, which should be accompanied by the application of new technologies and the education of fish farmers.

Key words: state, perspectives, aquaculture, Bosnia and Herzegovina

Animal welfare in cattle breeding

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Abstract

The paper aimed to define the basic elements and the importance of welfare as well as the subsidy system for welfare in animal production in Croatia. The importance of animal welfare is reflected in the commitment of various organizations and policies that deal with this area. Therefore, it's not surprising that animal welfare is the subject of agricultural policy in the European Union which through a system of subsidies in agriculture strives to increase the welfare of animals. The importance of welfare is confirmed by International Organization for the Control of domestic animal productivity - ICAR, which develops specific models and calculates the welfare index of individual farms, and based on that data is concluded that greater animal welfare leads to higher milk yields of cows, and higher satisfaction and health of the farmers, but also a better financial result of the farms.

Key words: welfare, welfare assessment, dairy cows, legislation

P4_03

An analysis of breeding methods applied on the territory of the nišava district

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Abstract

The main breeding objectives include increasing productivity, improving racial composition, and preventing the decrease in numbers when it comes to cattle breeding by genetically improving a breed, and honouring principles and regulations relating to animal welfare and environmental protection. The implementation of the main breeding programme for the Simmental breed which has been carried out for years on the territory of the Nišava District is in the function of improving cattle breeding by achieving breeding objectives and controlling production characteristics, as well as by breeding animals with desirable genetic potential from the standpoint of functional and physical development, with the preservation of the genetic variability of populations, reproductive and other traits of quality breeding animals. In the area of the Nišava District, there is a large number of heads that have not been assessed and they are not regarded as purebred regardless of their genetic potential. Production results that were monitored over a period of five years showed a continuous increase in the amount of milk by 14.23% compared to the initial year. Other parameters, proteins, milk fat, remained at the same level. After analysing the implementation of the breeding programme and selection measures in the period between 2015 and 2019 in quality breeding Simmental cattle that are under the supervision of the basic breeding organisation Veterinary Station Niš, Ltd. the following measures have been introduced: selection measures, linear assessment of first-calf heifers, and the control of milk yield in purebred cows. Bearing in mind that one of the important preconditions for a successful selection is the control of production traits of cattle heads, the research objective was to analysis implement zootechnical measures and possibilities increase the number of the herds under control in order to form the largest possible population of breeding cattle.

Key words: selection, breeding programme, selection roundup, linear assessment, milk yield control

P4_04

Comparative analysis of the production results of the Svrljig and Pirot sheep strains

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Abstract

The research presented in this paper aimed to determine which strain of Pramenka sheep achieved better production results under the same conditions of keeping, housing, care, and nutrition. In our country, the type of sheep with triple production capacities is the most widespread. Apart from the Pramenka breed originating from Svrljig, the Pirot Pramenka strain is represented in significant numbers as well, and it is mostly encountered in eastern and south-eastern Serbia, and found in the highest numbers in the highland region. The analysis of the comparative results of the two strains, the Svrljig and Pirot Pramenka strains, was carried out resorting to an experimental method on the Djordjević family farm in semi-extensive growing conditions. The heads of two strains were used as samples for the experiment: two-year-old Svrljig and Pirot sheep. The total number at the beginning of the experiment was: 243 heads of the Svrljig sheep strain, and 247 heads of the Pirot sheep strain. The results of the analysis showed that the Svrljig strain of Pramenka showed better results compared to the Pirot strain of Pramenka in terms of milk production, exceeding it by 1.08%, as well as in terms of the growth of lambs by 6.9%, and the amount of sheared wool by 2.3%.

Key words: sheep, Svrljig strain, Pirot strain, production, results.

P4_05

Effect of terminal sire genotype on the carcass characteristics of the fattening pigs

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Abstract

The purpose of this study was to measure some of the carcass characteristics as meatiness, thickness of MLD and back fat in three different types of crossbred fatteners. Some of the characteristics of meat as color and pH_i and pH_u were also measured. All dams were the Yorkshire x Landrace and three different types of terminal sire (Duroc, Pietrain, Pietrain x Duroc). Immediately after farrowing, piglets were marked according to the crossbred which belonged. In total it was marked 188 (Yorkshire x Landrace x Duroc), 86 (Yorkshire x Landrace x Pietrain) and 443 (Yorkshire x Landrace x x Duroc) piglets. All piglets were reared on the same farm in the same condition. At the end of the fattening period the pigs were slaughtered at the local abattoir. In total 120 carcasses were measured. The results showed that the highest value of meatiness had the fatteners crossbred Yorkshire x Landrace x Pietrain on average 60.19%, while other two types of crossbred had the meatiness 59,06% and 58,61% (Yorkshire x Landrace x Duroc; Yorkshire x Landrace x Pietrain x Duroc) . The pH_i, pH_u and color of the meat derived from three types of crossbreed were very similar and there were no statistically significant differences.

Key words: terminal sire, carcass characteristics, fatteners

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P4_06

The significance of the introduction of controlled bee queen selection in the Republic of Srpska

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Abstract

In the agricultural sector of the Republic of Srpska, beekeeping, as a traditional profession, takes an important place because it represents a basic or supplementary source of income for a large number of rural households. Profitable beekeeping is conditional by healthy and strong bee societies, as well as good beekeeping and veterinary practice, which includes use of healthy queens from controlled reproductive centers. In the Republic of Srpska, 15 reproductive centers are registered, which are rearing queens of the autochthonous Carniolan bee - *Apis mellifera carnica*. The Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska has recognized the importance of controlled selection of queens and for the last two years has been financing the Plan for Monitoring Breeding and Selection Work in Beekeeping implemented by the Institute of Genetic Resources in partnership with the Faculty of Agriculture of the University of Banja Luka. Monitoring is based on taking samples of worker bees from queen bee hives of which there are 8 lines per each reproductive center. A morphometric analysis was performed on the collected worker bees, which includes the measurement of tongue length, cubital index, corbicula surface, length of hairs on the fifth segment of the abdomen and width of the tomentum. The analyzed samples so far show the belonging of the selection lines to the Carniolan bee - *Apis mellifera carnica*, with the fact that there is a need to supplement these measurements with digital morphometry of wing nervature, genetic characterization and a certain level of health protection in order to obtain complete results and create better selection material.

Key words: beekeeping, queen selection, reproductive center, monitoring, Republic of Srpska

P4 07

Growth characteristics of calves given milk replacements with various protein and calorie levels

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Abstract

The goal of the study was to determine how various milk substitute formulations impacted the conversion, mass, and growth of calves. 116 male Holstein calves were divided into control and experimental groups during a period of 59 days. The experimental group's calves were fed a milk substitute that contained bacteria. There were no statistically significant differences between the groups at the end of the experiment, despite the control group's higher average body mass and average daily gain figures. The conversion of the milk substitute was lower in the experimental group. The cost of the total average growth of a male calf (EUR 51.8) of the Holstein-Friesian breed in the control group, is lower compared to the cost of a male calf (EUR 58.96) of the Holstein-Friesian breed in the experimental group.

Key words: calves; production characteristics; milk substitute

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P4_08

The effects of different zeolit concentrations on hematological blood parameters in dairy cows

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Abstract

The aim of study is to examine the influence of zeolite addition to nutrition on the hematological parameters of blood of dairy cows. The research was carried out on 45 dairy cows of the domestic pied breed of the Simmental type. The animals were divided into 3 groups based on the amount of zeolite added to their feed mixtures. The first group of dairy cows (I-O group) had 4% Tufozel (the commercial name of zeolite) added to their feed mixtures during 15 months of treatment. The second experimental group of cows (II-O group) had 2% Tufozel added to their feed mixtures. The third group of dairy cows represented a control group (K-group) and did not receive Tufozel. Hematological analysis of cow blood samples was performed at the beginning and at the end of the trial, by determination the hemoglobin content, and number leukocytes, erythrocytes and thrombocytes. The statistical analysis of the obtained data did not reveal any statistically significant differences between the groups.

Key words: cow, zeolite, hemoglobin, leukocytes, erythrocytes, thrombocytes

P4_09

The influence of season on the somatic cells count in dairy goat milk

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Abstract

The somatic cells count (SCC) in goat's milk is significantly higher than in cow's milk and its number can exceed 1,000,000/ml. Extensive research on the SCC in goat's milk has not been conducted. This research examined the influence of the season, as a significant factor affecting the increase in the SCC in goat's milk. A total of 2,416 samples of Alpina goat milk from two farms in Vojvodina were analyzed. The samples were taken as part of regular DHI control. Based on the season, the samples were divided into 4 groups (spring, summer, autumn, and winter). Analyses of raw milk samples were carried out on MilcoScan FT+ and the Fossomatic FC. The average SCC was 1,975,282/ml, ranging from 76,000/ml to 27,516,000/ml. The average content of other milk components was as follows: milk fat 3.01±0,76%, protein 3.25±0,40%, lactose 4.37±0,22%, and MU 37.96±9,17 mg/dl. Statistically significant differences were found in SCC between seasons, as well as between the contents of other milk components. The SCC increased from spring (beginning of lactation) from 1,546,910/ml, during summer (1,907,100/ml) and autumn (2,496,350/ml) to winter (end of lactation) to 4,623,830/ml. Based on the obtained results, it can be seen that the average SCC in goat's milk increased during the year, that is, during lactation. Due to the seasonal character of goats and that the SCC in goat's milk is increasing during lactation, it is difficult to define a limit for SCC in goat's milk as it was done for cow's milk.

Key words: somatic cells, goat milk, season

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P4_10

The influence of the season on the milk production and composition at the dairy cow farm "MMB-INEXCOOP" Šamac

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Abstract

The aim of study was to examine the influence of season on production and composition of milk at the dairy cow farm "MMB-INEXCOOP" Šamac. Study population included monthly average of 141,92 (128-159) dairy cows (70% Simmental and 30% red and black Holstein) milked during different months 2020, with an average milk production of 3378 litres (2949,00-3986,00 l) per day for the whole period. All cows were kept in a free-stall system, and fed with TMR rations, adjusted to milk yield and annual season. During study feed and water were constantly available. The farm has a herringbone-type milking parlor with 8 milking units, equipped with the Afimilk-Afilab information system, which has the ability to monitor milk yield and all parameters of the chemical composition of milk. For the study purposes following data were monitored for each month: average air temperature, total and average milk production, number of cows milked, concentration of milk fat, protein, dry matter without fat, and lactose, and milk fat-to-protein ratio. Results of this study indicate an influence of season on variations in milk yield (22.01-26.14 L), milk fat (3.58-5.39%), protein (3.21-3.48%) and dry matter without fat (8.64- 8.98%) content in milk, and also to fat-to-protein ratio (1.09-1.63), probably caused by negative impact of high summer temperatures, but also by the seasonal variations in cows diet. Influence of season on milk production and composition on this farm is well controlled by organisational measures, which is shown by low variations in average milk yield per cow and total milk production per day.

Key words: cow, milk production and composition, season

P4-11

Positive interactions between horse and rider

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Abstract

The aim of the work was to present a way of developing positive interaction between horses and riders in training. Interactions between horse and rider that lead to a positive relationship are realized through a series of human actions towards the horse and vice versa. The interaction between horse and rider is influenced by many factors; rider's seat, training method, appropriate equipment and knowledge of the basic characteristics of horse ethology. The connection between a man and a horse is the embodiment of the greatest connection between a man and an animal, while the ultimate goal of riding is to achieve union with the horse, that is, some kind of fluidity. With proper work and training, horses show a desire and willingness to communicate with people, while coercion in working with a horse is the worst for both partners. The rider around the horse should have the qualities of a calm and reliable leader, while the horse should have confidence in its rider. Constant proper work and time dedicated to the horse will lead to a high-quality and successful creation and maintenance of a positive relationship between horse and rider.

Key words: horse, training, positive interaction

P4_12

Significance of the apiary location for the content of copper and zinc in the pollen

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Abstract

Pollen is one of the most valuable direct products of the honey bees. Bees as well as humans use the pollen in their nutrition as a high-quality supplement. Therefore, information about the mineral content of pollen is valuable. The aim of this study was to determine the amounts of copper (Cu) and zinc (Zn) in the pollen collected from the three apiary locations (Kozarska Dubica, Petrovo and Srbac). Quantification of copper and zinc content in pollen was done by atomic absorption spectrophotometry after acid digestion (HNO₃+HClO₄) of pollen. The highest contents of both elements were found in samples from Kozarska Dubica (8,41 mg Cu/kg, 29,52 mg Zn/kg). The lowest Cu content was found in the samples from Petrovo (6,19 mg/kg), while the lowest Zn content was determined in samples from Srbac (22,06 mg/kg). Additionally, statistically significant differences in the content of both elements between samples originating from different locations were found. As the location of the apiary was mainly determined by proximity to potential sources of metal contamination, botanical origin of pollen and technology of pollen collection, it is important to investigate more detailed their impact on the elemental content of pollen in the future.

Key words: bee products, pollen, copper, zinc, bee

P4_13

The potential of the use of the biomarkers as the indicators of the exposure to mycotoxins in the intensive pig production in Vojvodina, R. Serbia

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Abstract

Today's pig production is very intensive. The animals are reared in the large scale objects with a huge number of animals per unit. The animals are often on the very edge of their biological limits. Mycotoxins secondary metabolites of fungi are often found in animal feed in our climatic condition. The usual practice in the countries with the legislation regarding mycotoxins in feed to prevent chronic and acute mycotoxicosis is the regular analysis of feed and compound feed. The biggest problem with the analysis of mycotoxins is the nature of their distribution in any matrix. Fungal growths most often are localized in the area with the higher water activity, in hot spots, where the concentrations of mycotoxins are much higher. One of the options to measure the exposure of humans or animals to mycotoxins is the determination of biomarkers in urine or in some other biological fluids. Regarding the nature of the pig metabolism, the best choice of biofluid for the determination of mycotoxins is urine. Biomarkers in pig's urine are: for AFB1 is AFM1, for OTA is OTA, for ZEA are ZEA, α -ZOL and β -ZOL for DON are DON and DOM-1. A good correlation was observed between the ingested amount of mycotoxin and excreted biomarkers in the urine of pig. The development of the method for the detection and quantification of biomarkers in urine for some of the most important mycotoxins from the standpoint of pig production allows the opportunity to measure the exposure of mycotoxins and the effectiveness of their deactivators in use.

Key words: pigs, urine, biomarkers, mycotoxins

Assessment of contamination with heavy metals in food of animal origin

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Abstract

Heavy metals such as arsenic, cadmium, lead, and mercury are natural chemical compounds. They are present in water, soil, and the atmosphere in different amounts, but their presence has also been found in food because of contamination during production and storage, which is not desirable due to the bioaccumulation of heavy metals in the human body and its harmful effects on human health. The aim of the work is to determine the amount of heavy metals in certain types of food of animal origin that are available on the market in Republic of Srpska and Bosnia and Herzegovina in order to assess the real risks to human health based on compliance with the maximum allowed amount according to the Ordinance on the maximum allowed amounts of individual contaminants in food.

The amount of total arsenic was determined by the hydride formation method of atomic absorption spectrometry according to *BAS EN 14546*, mercury by the spectrophotometric method on the Advanced Mercury Analyzer AMA-254, and cadmium and lead by the graphite technique AAS according to *BAS EN 14084*.

Based on the test results, it was established that there were no heavy metals in the analyzed food samples that exceed the maximum allowed amounts, so based on this fact it can be concluded that the contamination in products of animal origin on the market of Republic of Srpska and Bosnia and Herzegovina with heavy metals does not pose a risk to human health. However, given the number of tests and increasing environmental contamination and heavy metal toxicity, monitoring of lead, cadmium, mercury, and arsenic must be carried out continuously to protect human health.

Key words: heavy metal, contamination of food, human health

Whey as a source of health

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Abstract

Today, all of us follow a fast lifestyle and that causes a stress. In this occasion people are paying more and more attention to proper nutrition. Milk and dairy products belong to the category of basic foods in human diet. A balanced diet has become an integral part of life and part of declaring finished products. The indigenous dairy products are of special importance within that category. It is the food that not only satisfies the basic needs for nourishment, but is at the same time a part of the material culture and tradition of a certain country. Whey has been a well-known by-product in the production of cheese. New trends in nutrition require balanced nutritional values, as a contribution to that it is important to know the same about whey. Traditional cheeses and whey have high nutritive and health benefits. The content of whey in dry residue is: fat - 0.41 g/100 g of whey, saturated fatty acids - 0.20 g, carbohydrates - 4.80 g, protein - 0.92 g and NaCl content is 0.11 g. The energy value of whey is 27 kcal or 112 kJ.

Key words: nutritional value, whey, cheese Trappist, health

P4_16

Evaluation of the microbiological suitability of drinking water on farms of domestic animals

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Abstract

The production and distribution of biological stable drinking water should be a non-negotiable goal for water utilities with the perspective of providing the same water quality to consumers than produced at the treatment facility. The microbiological quality of water is commonly defined as a maximum acceptable number or concentration of bacteria that do not constitute a health hazard. Many infectious diseases of animals and humans are transmitted by water contaminated with human and animal excrement, which becomes a source of pathogenic bacteria, viruses and parasites capable of surviving for different periods. The experiment used drinking water samples originating from farms of domestic animals from the territory of Republic of Srpska (Bosnia and Herzegovina) sampled in the Year 2021. A total of 117 samples were examined. The aim of this study is to determine the microbiological status of drinking water for animals in the Republic of Srpska (Bosnia and Herzegovina). For microbiological testing of sterilized milk were used methods BAS EN ISO 6222, BAS EN ISO 7899-2 and BAS EN ISO 9308-1/A1. The microbiological state of water on farms in Republic of Srpska shows significant variations from year to year, and is still quite unfavorable considering the large number of unsatisfactory samples. This is particularly worrying considering the fact that over a third of farms are supplied with water from wells, which are not under constant sanitary supervision. Bearing this in mind, as well as the results of conducted research, it is necessary to comprehensively, regularly and routinely examine water samples originating from farms and take preventive measures in order to prevent water contamination, especially by animals.

Key words: drinking water, domestic animals, farms, microbiology.



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