Faculty of Agriculture
University of Banja Luka

XIII INTERNATIONAL SYMPOSIUM ON AGRICULTURAL SCIENCES

AGRORES
2024

BOOK OF ABSTRACTS

27-30 May 2024, Trebinje, Bosnia and Herzegovina

XIII International Symposium on Agricultural Sciences "AgroReS 2024"

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BOOK OF ABSTRACTS

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XIII INTERNATIONAL SYMPOSIUM ON AGRICULTURAL SCIENCES

AgroReS 2024

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and

XXIX CONFERENCE OF AGRICULTURAL ENGINEERS OF THE REPUBLIC OF SRPSKA

27-30 May 2024

Trebinje, Bosnia and Herzegovina

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Sustainable economic development and environmental protection of Areas with Natural Constraints in Bosnia and Herzegovina

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Monday, 27 May 2024

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	– 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 of Scientific and Technological Development and Higher Education of the Republic of Srpska – Mirko Ćurić, Mayor of the Trebinje City – Boris Pašalić, President of the Organizing Committee	

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Tuesday, 28 May 2024

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** This part of the Symposium program is in Serbian.*

Moderator: *Željko Vaško*, Faculty of Agriculture, University of Banja Luka

Panelists: *Aleksandar Ostojić,* vice-rector for scientific research and development, University of Banja Luka;
Goran Bursać, Assistant Minister, Department for providing professional services in agriculture, Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska;
Veselin Dutina, director, Agrarian Fund of the City of Trebinje;
Dušan Andrijašević, president, Association of breeders of Gatačko catlle

20:00 - 21:00	**CULTURAL EVENT: Concert of the City Choir *Tribunia***

Cultural centre Trebinje (venue in the center of the city)

Aleksandra Rajković, prof., conductor
Anja Đurić, performer of traditional music
Ratomir Mijanović, artistic director of the program

Wednesday, 29 May 2024

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	Novo Pržulj, Sava Vrbničanin, Biljana Kelečević, Siniša Mitrić	

** This part of the Symposium program is in Serbian.*

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10:10 - 10:20 O4_08	*Simeon Rakonjac, Snežana Bogosavljević-Bošković, Vladimir Dosković, Miloš Lukić, Zdenka Škrbić, Veselin Petričević, Milun D. Petrović* EFFECT OF REARING SYSTEM AND GENOTYPE OF LAYING HENS ON THE BREAKING STRENGTH OF TIBIA AND FEMUR	
10:20 - 10:40	Coffee break	

10:40 - 10:50 O4_09	*Neđo Stokanović, Sava Spiridonović, Lidija Perić, Mirjana Đukić Stojčić* EFFECT OF DIFFERENT PRODUCTION SYSTEMS ON QUALITY OF TABLE EGGS
10:50 - 11:00 O4_10	*Michael Oke* AN OVERVIEW OF THE FISH ISSUES FACING GWAGWALADA'S FISH FARMERS AND TRADERS NIGERIA'S ABUJA
11:00 - 11:10 O4_11	*Slađana Preradović, Biljana Rogić, Božo Važić, Milica Ćutković* INFLUENCE OF LIPIZZAN STALLIONS ON BODY MEASUREMENTS OF FOALS
11:10 - 11:20 O4_12	*Matúš Džima, Miroslav Juráček, Branislav Gálik, Milan Šimko, Michal Rolinec, Ondrej Hanušovský, Mária Kapusniaková* FATTY ACID PROFILE OF COMMERCIAL DRY DOG FOODS WITH AND WITHOUT INSECT
11:20 - 11:40	POSTER PRESENTATIONS: P4_01 – P4_16
11:40 - 12:00	Discussion
14:00 - 16:00	Lunch break

XXIX CONFERENCE OF AGRICULTURAL ENGINEERS OF THE REPUBLIC OF SRPSKA: Youth in Agriculture *

XXIX САВЈЕТОВАЊЕ ИНЖЕЊЕРА ПОЉОПРИВРЕДЕ РЕПУБЛИКЕ СРПСКЕ: Млади у пољопривреди

Large Salon

** This part of the Symposium program is in Serbian.*

14:30 - 14:45	Уводно обраћање	*Opening address*
14:45 - 15:00	*Бојан Ћикић* Пројектно позиционирање младих у пољопривреди	*Bojan Ćikić* Project Positioning of Young People in Agriculture
15:00 - 15:15	*Ђорђе Грујчић* Активизам младих у служби руралног развоја	*Đorđe Grujčić* Youth Activism in the Service of Rural Development
15:15 - 15:55	Панел 1: Изазови и прилике за младе у агробизнису Модератор: *Маринко Векић*, Учесници: *Мара Пупчевић, Лука Врачар, Игор Дабић, Немања Јалић, Бојана Петровић, Драгана Дувњак Крндија, Милош Галић*	Panel 1: Challenges and Opportunities for Youth in Agribusiness Moderator: *Marinko Vekić*, Participants: *Mara Pupčević, Luka Vračar, Igor Dabić, Nemanja Jalić, Bojana Petrović, Dragana Duvnjak Krndija, Miloš Galić*
15:55 - 16:15	Пауза за кафу	Coffee break
16:15 - 16:30	*Виолета Лемић* Исходи I фазе кампање Млади у пољопривреди	*Violeta Lemić* Outcomes of Phase I of the Youth in Agriculture Campaign

16:30 - 17:15	Панел 2: Институционална подршка младима у пољопривреди Модератор: *Петар Николић*, Учесници: *Саша Лалић, Драган Вучковић, Гордана Роквић Кнежић, Драган Шепа, Радомир Вукелић, Кристина Дутина, Живан Митровић*	Panel 2: Institutional Support for Young People in Agriculture Moderator: Petar Nikolić, Participants: *Saša Lalić, Dragan Vučković, Gordana Rokvić Knežić, Dragan Šepa, Radomir Vukelić, Kritina Dutina, Živan Mitrović*
17:15 - 17:30	*Петар Николић* Млади и пољоприведа – поглед у будућност	*Petar Nikolić* Youth and agriculture - a look into the future

20:00	Gala evening	Hotel *Leotar*, Restaurant

Thursday, 30 May 2024

09:00 – 13:00 **EXCURSION: Visit to Vjetrenica Cave and Monastery Tvrdoš**

LIST OF THE POSTER PRESENTATIONS

SESSION 1: HORTICULTURE LARGE HALL

P1_01	*Ivana Radović, Aleksandar Radović, Slađana Savić, Milena Marjanović, Milica Miletić, Jelica Novaković, Zorica Jovanović* BIOCHEMICAL AND MORPHOLOGICAL ANALYSIS OF FRUIT QUALITY TRAITS OF DIFFERENT TRADITIONAL APPLE GENOTYPES FROM WESTERN SERBIA
P1_02	*Miroslav Lisjak, Jelena Ravlić, Tomislav Vinković, Andrijana Rebekić, Tihana Teklić* EFFECT OF HEAT STRESS ON ANTIOXIDANT STATUS IN APPLE LEAVES GROWN IN TWO DIFFERENT MICROCLIMATES
P1_03	*Nada Zavišić, Jelena Davidović Gidas, Gordana Đurić* PRELIMINARY EVALUATION OF THE FRUIT VALUE OF SELECTED WILD PEAR (*Pyrus communis* L.) SEEDLINGS IN THE *EX SITU* COLLECTION OF THE AGRICULTURAL INSTITUTE
P1_04	*Sandra Bijelić, Borivoje Bogdanović, Draža Janković, Goran Jaćimović* PLANT PRODUCTION OF NEW CLONES OF HAZELNUT CULTIVARS BY GRAFTING ONTO TURKISH FILBERT ROOTSTOCK
P1_05	*Marina Mačukanović Jocić, Dragana Rančić* THE MORPHOLOGICAL FEATURES OF CORNELIAN CHERRY (*Cornus mas* L., Cornaceae) POLLEN GRAINS
P1_06	*Dragana Rančić, Marina Mačukanović Jocić, Radenko Radošević* THE POSITION, MORPHOLOGY, AND STRUCTURE OF FLORAL NECTAR-SECRETING GLAND IN *Cornus mas* L. (Cornaceae)
P1_07	*Božana Odžaković, Vanja Ćupina, Slavica Grujić, Staniša Latinović, Zoran Kukrić* DEVELOPMENT, QUALITY AND ANTIOXIDANT ACTIVITY OF CORNELIAN CHERRY FRUIT GELS
P1_08	*Danilo Vidović, Boris Pašalić* IMPACT OF BIOFUNGICIDES IN POSTHARVEST AND STORAGE OF CHERRY FRUITS

P1_09	*Snežana Stevanović, Ana Plećić, Tanja Petrović, Simo Stevanović, Aleksandar Leposavić, Milena Otović, Uroš Milovančević* THE EFFECT OF FREEZING AND FROZEN STORAGE ON THE QUALITY AND ANTIOXIDANT ACTIVITY OF RASPBERRY AND BLACKBERRY FRUITS
P1_10	*Ivanka Ćirić, Dragana Dabić Zagorac, Milica Sredojević, Milica Fotirić Akšić, Biljana Rabrenović, Stevan Blagojević, Maja Natić* VALORIZATION OF RASPBERRY SEEDS IN COSMETIC INDUSTRY
P1_11	*Maja Natić, Milica Fotirić Akšić, Lazar Pejić, Ivanka Ćirić, Dragana Dabić Zagorac, Milica Sredojević, Biljana Rabrenović* BIOACTIVE COMPOUNDS OF COLD-PRESSED RASPBERRY SEED OIL AND FUNCTIONAL PROPERTIES OF THE REMAINING OIL CAKE
P1_12	*Dragana Dabić Zagorac, Ivanka Ćirić, Milica Sredojević, Milica Fotirić Akšić, Biljana Rabrenović, Aleksandra Pavlović, Maja Natić* UTILIZATION OF AGRICULTURAL WASTE IN BIOSORPTION OF ANTHOCYANINS
P1_13	*Zoran Maličević, Milan Jugović* STATUS OF PESTICIDE APPLICATION EQUIPMENT AND THE POSSIBILITY OF APPLYING EUROPEAN STANDARDS AND REGULATIONS
P1_14	*Vojislav Trkulja, Gordana Babić, Bojana Ćurković, Bojana Vuković, Jovana Prijić, Bogdan Nedić, Aleksandra Dobričanin* SURVEY ON THE PRESENCE OF *Alternaria mali*, THE CAUSAL AGENT OF APPLE ALTERNARIA BLOTCH, IN REPUBLIC OF SRPSKA DURING 2019-2023
P1_15	*Nadja Milutinović, Uroš Vojinović, Aleksandra Bešlić, Nataša Duduk, Ivana Vico, Milan Stević* IN VITRO TOXICITY OF FLUDIOXONIL TO *Penicillium expansum* AND *Penicillium crustosum* ISOLATES FROM DECAYED APPLE FRUIT
P1_16	*Slavica Vuković, Antonije Žunić, Dragana Šunjka, Sanja Lazić, Aleksandra Šušnjar, Dragana Bošković, Jelena Ećimović* CONTROL OF *Cacopsylla pyri* L. IN A PEAR ORCHARD USING INSECTICIDES
P1_17	*Tamara Popović, Jelena Adamović, Anđelka Prokić, Milan Ivanović, Aleksa Obradović* ETIOLOGY OF HAZELNUT (*Corylus avellana*) BACTERIAL BLIGHT IN MONTENEGRO
P1_18	*Biljana Lolić, Stefani Tepić, Sonja Umićević, Marina Antić* DETECTION OF PHYTOPHTHORA IN STRAWBERRY PLANTS BY POLYMERASE CHAIN REACTION
P1_19	*Dragoslava Bjelošević, Duška Delić* THE INFLUENCE OF DIFFERENT WEED CONTROL APPROACHES ON THE YIELD OF STRAWBERRY (*Fragaria ananassa* D.)
P1_20	*Danijela Ristić, Ivan Vučurović, Jovana Blagojević, Vukašin Keserović, Mira Starović, Nenad Trkulja, Goran Aleksić* EFFICACY EVALUATION OF SYNTHETIC FUNGICIDES AND BIOFUNGICIDES AGAINST FUSARIUM WILT IN BLUEBERRY
P1_21	*Marina Dervišević, Dejana Stanić, Draga Graora* DIVERSITY OF COCCINELLIDAE IN COLONIES OF SOFT SCALES (HEMIPTERA: COCCIDAE)
P1_22	*Dušanka Jerinić-Prodanović, Dragica Smiljanić* A CONTRIBUTION TO THE KNOWLEDGE OF TRUE FRUIT FLIES (DIPTERA: TEPHRITIDAE) IN SERBIA
P1_23	*Stefani Tepić, Anica Maksić, Nikola Grujić, Branimir Nježić* LEARNING AND MEMORY IN NEMATODES
P1_24	*Borut Bosančić* META-ANALYSIS IN THE HIERARCHY SCIENTIFIC RESEARCH LOGIC
P1_25	*Dunja Sotonica, Marija Ćosić, Ružica Stričević, Miloš Pajić, Mirjam Vujadinović Mandić, Jelena Ivanović, Željko Dželetović, Aleksa Lipovac* REMOTE SENSING ASSESSMENT OF IRRIGATION IMPACT ON VINEYARD WATER STATUS

P1_26	*Radmila Ilić, Mirjana Radovanović, Gorica Paunović, Ivan Glišić, Vesna Đurović, Tomo Milošević* FRUIT CHARACTERISTICS OF SOME WALNUT CULTIVARS (*Juglans regia* L.)
P1_27	*Darko Jaksic, Ivan Bradic, Jelena Rodic, Milan Beader, Mladen Petrovic, Zana Jaksic, Radoslav Milic* THE INFLUENCE OF METEOROLOGICAL CONDITIONS ON THE PHYTOSANITARY STATE OF VINEYARDS IN THE ŽUPA WINE-GROWING DISTRICT (SERBIA)
P1_28	*Tatjana Jovanović Cvetković, Srđan Bojbaša, Rada Grbić* CHARACTERISTICS OF TABLE GRAPE VARIETIES GROWN IN THE HERZEGOVINA REGION
P1_29	*Zoran Pržić, Nebojša Marković, Đorđe Živadinović* COMPARISON OF THE TECHNOLOGICAL AND OENOLOGICAL CHARACTERISTICS OF THE WINE GRAPE VARIETIES JAGODA AND MUSKAT RUŽA
P1_30	*Tatjana Popović, Danijela Raičević, Radmila Pajović Šćepanović, Saša Matijašević* AGROBIOLOGICAL, ECONOMICAL, AND TECHNOLOGICAL CHARACTERISTICS OF THE RIBIER VARIETY DEPENDING ON THE DIFFERENT VINE LOAD WITH FERTILE BUDS
P1_31	*Ivana Stanković, Danijela Ristić, Ivan Vučurović, Dušica Kovačević, Branka Krstić, Katarina Zečević* MOLECULAR CHARACTERIZATION OF GRAPEVINE RUPESTRIS STEM PITTING-ASSOCIATED VIRUS ISOLATES INFECTING GRAPEVINES IN SERBIA
P1_32	*Biljana Korunoska, Vladan Pešić, Krum Boškov, Nenad Bunjac* ANALYSIS AND COMPARISON OF METAPHASE CHROMOSOMES IN SOME VARIETIES AND CROSSING COMBINATION OF GRAPEVINE
P1_33	*Mladen Kalajdžić, Dragoslav Ivanišević, Predrag Božović, Sara Todorić* BERRY PHYSICAL PROPERTIES OF GRAPEVINE CULTIVARS MUSCAT HAMBURG AND NADA DURING RIPENING AND STORAGE
P1_34	*Nikolina Zivkovic, Danka Mitrovic, Ivana Sredovic Ignjatovic, Aleksandar Petrovic* EXTRACTION OF INDIVIDUAL PHENOLIC ACIDS DURING VINIFICATION OF CABERNET SAUVIGNON GRAPE VARIETY
P1_35	*Darko Jaksic, Ivan Bradic, Stefana Utvic, Milan Beader, Mladen Petrovic, Milos Ristic, Ivana Mosic* COLOR INTENSITY AND TONALITY OF WINES FROM SELECTED PROKUPAC GRAPEVINE VARIETY GENOTYPES IN THE ŽUPA WINE-GROWING DISTRICT (SERBIA)
P1_36	*Violeta Dimovska, Fidanka Ilieva, Emilija Arsov, Aleksandar Piperevski, Biljana Balabanova, Biljana Vitanovska* PHYSICAL AND CHEMICAL PROPERTIES OF GRAPE MOLASSES PRODUCED FROM VRANEC GRAPE VARIETY BY TRADITIONAL AND INDUSTRIAL TECHNIQUES
P1_37	*Milica Stojanović, Dragica Milosavljević, Jelena Dragišić Maksimović, Vuk Maksimović, Aleksandra Govedarica-Lučić, Radomir Bodiroga* SELECTION OF THE OPTIMAL LETTUCE CULTIVAR TO AGRONOMIC TRAITS IN SUMMER PRODUCTION USING MULTICRITERIA DECISION-MAKING MABAC METHOD
P1_38	*Aleksandra Rakonjac, Slađan Adžić, Vladimir Perišić, Dejan Cvikić, Kamenko Bratković, Jasmina Balijagić, Kristina Luković* THE EFFECTS OF WHITE AND BLUE LIGHT EXPOSURE ON WINTER LETTUCE SEEDLINGS
P1_39	*Vida Todorović, Nikolina Đekić, Đorđe Moravčević* EFFECTS OF MULCHING ON THE PRODUCTIVITY OF LETTUCE (*Lactuca sativa* L.) IN OPEN FIELD SUMMER PRODUCTION
P1_40	*Boris Adamović, Janko Červenski, Đorđe Vojnović, Žarko Ilin* EFFECT OF MULCHING AND FERTILIZING ON YIELD AND QUALITY OF KOHLRABI (*Brassica oleracea* var. *gongylodes* L.)

P1_41	*Ivan Tupajić, Nenad Đurić, Vladimir Miladinović, Veselinka Zečević, Radiša Đorđević, Marija Bajagić, Milan Ugrinović* INFLUENCE TWO DIFFERENT TYPES OF FERTILIZER ON LETTUCE (*Lactuca sativa* L.) IN A HYDROPONIC SYSTEM
P1_42	*Jelena Golijan Pantović, Stefan Gordanić* YIELD OF FOREIGN SPINACH HYBRIDS IN GREENHOUSE PRODUCTION
P1_43	*Sonja Umićević, David Ducanović, Stefani Tepić, Zlatan Ristić, Biljana Lolić, Borut Bosančić, Marina Antić* TOTAL PHENOLIC CONTENT IN FRUITS OF PEPPER ACCESSIONS FROM THE GENE BANK OF THE REPUBLIC OF SRPSKA
P1_44	*Mirela Kajkut Zeljković, Tanja Krmpot, Marina Antić, Predrag Ilić, Sonja Umićević, Jelena Nikitović, Vida Todorović, Mirjana Jankulovska* MUTATION BREEDING OF COMMON BEAN ACCESSION NISKA BORANIJA (*Phaseolus vulgaris* L.) FROM THE GENE BANK OF REPUBLIKA SRPSKA
P1_45	*Stefan Gordanić, Dragoja Radanović, Snežana Mrđan, Jelena Golijan-Pantović, Sara Mikić, Željana Prijić, Tatjana Marković* SIGNIFICANCE AND REASON FOR THE ESTABLISHED PLANTATION PRODUCTION OF SREMUŠ (*Allium ursinum* L.) IN THE REPUBLIC OF SERBIA
P1_46	*Sandra Vuković, Jelica Gvozdanović Varga, Đorđe Moravčević* GROWING TECHNOLOGY OF ALLIUM SPECIES WIDESPREAD IN THE SERBIA
P1_47	*Lovro Sinkovič, Mojca Škof, Vladimir Meglič, Barbara Pipan* MORPHOMETRIC AND COLOUR CHARACTERISTICS OF GARLIC ACCESSIONS (*Allium sativum* L.) IN THE AGRICULTURAL INSTITUTE OF SLOVENIA
P1_48	*Ivan Vučurović, Ana Vučurović, Danijela Ristić, Jovana Blagojević, Jelena Đukanović, Katarina Zečević, Ivana Stanković* INCIDENCE AND GENETIC DIVERSITY OF GARLIC COMMON LATENT VIRUS INFECTING GARLIC IN SERBIA
P1_49	*Lovro Sinkovič, Hourieh Tavakoli Hasanaklou, Barbara Pipan, Vladimir Meglič, Aleksandra Ilić, Ana Uhlarik, Andrey Sinjushin, Maja Ignjatov, Nevena Nagl* EFFECT OF DIFFERENT EXTRACTION METHODS ON THE CONTENT OF TRYPSIN INHIBITORS IN COMMON BEAN PODS
P1_50	*Slađana Savić, Marina Dervišević, Biljana Šević, Jelena Maksimović, Magdalena Knežević, Zoran Dinić, Ivana Radović* THE EFFECT OF *Bacillus* spp. ISOLATES AND CALENDULA EXTRACT ON TOMATO YIELD
P1_51	*Vojislav Trkulja, Gordana Babić, Bojana Ćurković, Bojana Vuković, Jovana Prijić, Aleksandra Dobričanin, Bogdan Nedić* SURVEY ON THE PRESENCE OF PEPINO MOSAIC VIRUS IN REPUBLIC OF SRPSKA 2019-2023
P1_52	*Uroš Vojinović, Nađa Milutinović, Vladimir Ljubičić, Milan Stević* EFFICACY OF OSBPI FUNGICIDES (FLUOXAPIPROLIN AND OXATHIAPIPROLIN) IN THE CONTROL OF CUCUMBER DOWNY MILDEW (*Pseudoperonospora cubensis*)
P1_53	*Emilija Arsov, Sasa Mitrev* PRESENT STATUS OF *Acidovorax citrulli* - CAUSING BACTERIAL FRUIT BLOTCH OF WATERMELON FRUITS IN NORTH MACEDONIA
P1_54	*Dušanka Jerinić Prodanović, Aleksandar Stojanović, Dragica Smiljanić* NATURAL ENEMIES OF *Bactericera trigonica* (Hodkinson) (Hemiptera, Psylloidea, Triozidae)
P1_55	*Ilinka Pećinar, Dragana Rančić, Maja Terzić, Marina Mačukanović Jocić* CHEMICAL ANALYSIS OF POLLEN OF SELECTED TREE SPECIES BY RAMAN SPECTROSCOPY
P1_56	*Stefan Gordanić, Dragoja Radanović, Snežana Mrđan, Jelena Golijan-Pantović, Sara Mikić, Željana Prijić, Tatjana Marković* INFLUENCE OF AGROTEXTIL FOIL ON *Arnica montana* FLOWER YIELD

P1_57	*Marko Burić, Vera Popović, Aleksandar Filipović, Ivana Iličković, Saša Vujović* MEDICINAL PROPERTIES OF ESSENTIAL OILS LAVENDER AND BENEFIT FOR HUMAN HEALTH
P1_58	*Vladimir Filipović, Ljubica Šarčević-Todosijević, Vladan Ugrenović, Snežana Dimitrijević, Marko Popović, Snežana Mrđan, Vera Popović* APPLICATION OF YARROW BROTH IN ORDER TO REDUCE THE INTENSITY OF INFECTION OF POT MARIGOLD LEAF POWDERY MILDEW (*Podosphaera xanthii* (Castagne) U. Braun & Shishkoff.)
P1_59	*Zlatan Kovačević, Biljana Kelečević, Siniša Mitrić, Sandra Petković* WILD MEDICINAL AND AROMATIC PLANTS IN THE MANJAČA REGION
P1_60	*Gligor Bojkov, Sasa Mitrev, Emilija Arsov* *FOLIAR SYMPTOMS OF ESCA AS A SIGN OF VINE MORTALITY: A BINARY LOGISTIC REGRESSION APPROACH*
P1_61	*Aleksandar Radović, Ivana Radović, Dragan Nikolić, Dejan Đurović, Ivana Bakić, Slađana Savić, Milena Marjanović* FRUIT CHARACTERISTICS OF SOME APPLE CULTIVARS AND THEIR CLONES

SESSION 2: AGRICULTURAL ECONOMICS AND RURAL DEVELOPMENT RED SALLON

P2_01	*Ljiljana Drinić, Gordana Rokvić Knežić, Ema Jovičić* INDICATORS OF THE STATE OF SMALL AND MEDIUM ENTERPRISES IN THE REPUBLIC OF SRPSKA
P2_02	*Miha Curk, Matjaž Glavan* MODELING THE LONG-TERM ECONOMIC AND ENVIRONMENTAL EFFICIENCY OF AGRICULTURAL MEASURES WITH THE SWAT MODEL
P2_03	*Tamara Stojanović* CONTROLLER'S PERFORMANCE ANALYSIS OF THE LARGEST STONE FRUIT PRODUCER IN BOSNIA AND HERZEGOVINA IN LIGHT OF COVID-19 PANDEMIC
P2_04	*Miroslav Nedeljković, Milivoje Ćosić, Radivoj Prodanović* THEORETICAL ASPECTS OF THE SUPPLY CHAIN IN FOOD PRODUCTION
P2_05	*Đorđe Kotarac* ANALYSIS OF RICARDO'S DEVELOPMENT MODEL IN THE DIRECTION OF PRODUCTION FACTORS FROM THE PRIMARY TO THE INDUSTRIAL SECTOR
P2_06	*Dragana Vidojevic, Darko Konjevic, Pandi Zdruli, Ilir Salillari, Hamdija Civic, Mihajlo Markovic, Afrim Sharku, Mirko Knezevic, Dushko Mukaetov, Stanko Milic* ADVANCING SUSTAINABLE SOIL MANAGEMENT IN WESTERN BALKANS THROUGH PARTNERSHIP
P2_07	*Nemanja Jalić, Ivo Zdrahal, Aleksandar Ostojić, Željko Vaško* REGIONAL TRADE INTENSITY OF FOOD PRODUCTS AMONG WESTERN BALKAN COUNTRIES DURING PERIODS OF CRISIS
P2_08	*Vesna Mrdalj, Marija Gjosheva Kovachevikj, Despina Popovska Stojanov, Lazo Dimitrov* FOREIGN TRADE AND TRADE COMPETITIVENESS IN AGRI-FOOD PRODUCTS BETWEEN REPUBLIC OF SRPSKA (BOSNIA AND HERZEGOVINA) AND NORTH MACEDONIA
P2_09	*Nikolina Radaković, Vesna Mrdalj, Aleksandar Ostojić, Željko Vaško* IMPACT OF CEFTA AGREEMENTS IMPLEMENTATION ON FOREIGN TRADE IN AGRI-FOOD PRODUCTS OF THE REPUBLIC OF SRPSKA
P2_10	*Anastasija Grgić, Milana Šešum, Borut Bosančić* QUALITY OF LOCAL PRODUCTION OF FRUIT DISTILLATES IN WESTERN REPUBLIC OF SRPSKA – CURRENT STATE AND PROSPECTS

P2_11	*Angelina Petković* ANALYSIS AND FORECASTING OF THE VOLUME OF TOMATO PRODUCTION IN THE REPUBLIC OF SERBIA USING THE ARIMA MODEL
P2_12	*Simo Stevanović, Snežana Stevanović, Radovan Živković* ECONOMIC CHARACTERISTICS OF SOLAR ENERGY PRODUCTION AND UTILIZATION
P2_13	*Ana Plećić, Ana Salević-Jelić, Snežana Stevanović, Senka Popović, Tanja Petrović* BIODEGRADABLE PACKAGING MATERIALS FOR SUSTANAIBLE FUTURE

SESSION 3: CROP SCIENCE LARGE SALON

P3_01	*Sanja Antić, Pavel Benka, Nikola Santrač, Boško Blagojević, Milica Stajić, Jovana Bezdan* AN EXAMPLE OF SELECTING A PROPER LOCATION FOR CONSTRUCTED WETLANDS INSTALLATION IN SOUTH BAČKA DISTRICT, SERBIA
P3_02	*Lazar Kaluđerović, Rada Đurović-Pejčev, Svjetlana Radmanović* ORGANIC MODIFICATION OF CLAY FRACTION USING HUMIC ACIDS AND PREPARATION OF CLAY–HUMIC ACID (HA) COMPOSITES
P3_03	*Radoš Zemunac, Andrea Salvai, Boško Blagojević, Milica Vranešević, Sanja Antić, Milica Stajić* CHANGES IN THE VALUES OF CLIMATIC ELEMENTS IN THE AREA OF THE SOUTH BAČKA DISTRICT (SERBIA)
P3_04	*Tihomir Predic, Stefan Jovanovic* LAND COVER/LAND USE OF LIJEVCE POLJE IN THE FUNCTION OF AGRICULTURAL LAND PROTECTION
P3_05	*Dragan Radovanović, Vladimir Ćirić, Bojan Vojnov, Dragana Marinković* SOIL QUALITY AS A BASIS FOR SUSTAINABLE INTENSIFICATION OF AGRICULTURAL PRODUCTION
P3_06	*Jelena Golijan Pantović, Aleksandar Ž. Kostić, Danijel D. Milinčić, Slavoljub Lekić* CONTENT OF PHYTOSTEROLS IN ORGANIC AND CONVENTIONAL PRODUCED MAIZE AND SPELT SEED
P3_07	*Jelena Golijan Pantović, Danijel Milinčić, Slavoljub Lekić, Aleksandar Kostić* CONTENT OF FREE POLYPHENOLS AND FLAVONOIDS IN ORGANIC AND CONVENTIONALLY PRODUCED BUCKWHEAT SEED
P3_08	*Jelena Golijan Pantović, Bojan Dimitrijević* ORGANIC SUNFLOWER PRODUCTION IN SERBIA
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Plenary session

PL_01

Organic agriculture for territorial development: The experience of organic districts

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Abstract

Based on principles and values of organic farming, the concept of *biodistrict* or *ecoregion* emerged back in the first half of the 2000s with pioneer initiatives in Austria, France, and Italy. Over the past two decades the concept has been tested and adopted by a growing number of territories in Europe as well as all over the world, with different names, thanks to the passionate promotion of national and international networks created by pioneers. Organic districts are now a well-established global phenomenon and a reference model for territorial development. Networks support experience sharing, scaling-out and joint work on topics of common interest to further develop the concept and associated practices. Codification and harmonization efforts (e.g. guidelines) are in place to foster dialogue and increase recognition while acknowledging the value of diversity of the model applications in context-specific settings. Mentioned in the EU Organic Action Plan and in the European Commission Long-term vision for rural areas, organic districts are also praised in UN SDGs framework as a concrete example of Sustainable Food Systems. Italy is a leading country behind the development of biodistrict concept and practice: a high, and increasingly higher, number of biodistrict initiatives are operating across the country covering almost 31% of the national territory; private and public actors are extensively committed to the biodistrict cause at different levels; important efforts, including regulatory & support measures, have been made in the last years to institutionalise, mainstream the 'biodistrict idea & process' to fully express its multifaceted potential. Being an inherently polyhedric concept, 'the organic district' has been investigated by scholars through the lens of various conceptual frames, including 'neo-endogeneous' development and food systems transformation approaches. A growing body of knowledge is emerging with stimulating insights, including critical reflections: an expanding arena for hybridization calling for multidisciplinary and interdisciplinary efforts.

Key words: biodistricts, ecoregions, organic districts, territorial development

PL_02

Agriculture 4.0 in Livestock Production Systems

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Abstract

The influence of the Fourth Industrial Revolution on agriculture, often termed Agriculture 4.0 or Smart Agriculture, extends deeply into livestock production systems, reshaping them significantly. This ongoing transformative wave builds upon the foundations laid by the First, Second, and Third Industrial Revolutions. The Fourth Industrial Revolution ushers in a new era, introducing a plethora of cutting-edge technologies that fundamentally alter livestock production systems. Artificial intelligence (AI), machine learning, cloud computing, and smart sensors have seamlessly integrated into managing and enhancing these systems. Moreover, location detection, spatial engineering, augmented reality, and the remarkable surge in data play pivotal roles in propelling advancements in this domain. Big Data Analytics, in particular, emerges as a crucial player, facilitating the interpretation and utilization of the immense data volumes generated by these systems. In intensive livestock production systems like dairy, pork, poultry, and cattle farming, digital and AI-monitored automated milking and feeding systems, estrus detection equipment, and animal behavior monitors have gained prominence. These innovations allow for precise assessments of animal behavior and vital activities, leading to heightened production efficiency and enhanced animal welfare. Additionally, "Smart" technology and equipment regulate environmental conditions encompassing ventilation, temperature, humidity, and lighting, thus ensuring optimal production conditions within manageable parameters. Especially in poultry husbandry, automated systems for egg collection and sorting, as well as AI-driven monitoring of flock health and behavior, are revolutionizing the industry. Pig farming benefits from automated feeding systems and AI-powered disease detection, contributing to improved productivity and animal well-being. In summary, Agriculture 4.0, with its array of AI technologies and other cutting-edge advancements, has revolutionized livestock production across various sectors. By embracing and harnessing the power of Agriculture 4.0, the industry can pave the way for a future that is not only more productive and sustainable but also more conducive to the welfare of animals.

Key words: artificial intelligence, smart farming, precision technologies

PL_03

Challenges and opportunities for production system in berry crops

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Abstract

On the global market, berries are steadily growing in demand, mainly for the fresh consumption. Same trend can be observed in terms of growing areas, for instance, in the last eight years the blueberry cultivated areas increased more than double at the worldwide scale. Nevertheless, the last years have been impacted by a higher inflation for the whole berry growing inputs that has not been followed by an increase in fruits price. This negatively affect the grower's margin. In this respect, there is a compulsory need to produce more and with a higher quality. A market demand is also related to introduction of new varieties that better match the consumers and retail expectations. Looking from the farmers eyes, at the farm level, several key factors put pressure on the present and long-term management measures to be taken. These challenges could be clustered in five groups: climate changes, the need to be sustainable, water, soil and carbon fingerprint, organic growing solutions, labor issues and profitability. Along with these considerations, the crop protection and harvest become immediate issues to be addressed. For all these ecosystem berry production problems we have to timely, reliable and cost-effective respond with concrete solutions. To do so, advances in research and technological innovations, digitalization and multidisciplinary co-creation working groups are the flagship for a sustainable future of berry crop production and consumption.

Key words: sustainable, digitalization, climate change, innovation

Session 1: Horticulture

Oral Presentations

O1_01

Regionization – an open issue of development and sustainable intensification of fruit production

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Abstract

The regionalization of fruit production has been an open question for the scientific, professional, administrative and economic institutions of most Western Balkans countries for more than 120 years. The issue of regionalization was raised periodically on several occasions, and at different levels, but the realization was absent due to several different causes. Today, the issue of regionalization of fruit production is topical again, especially due to the possible consequences of climate change. In this paper, the open issues of regionalization in the previous periods of fruit growing development, as well as the analysis of relevant factors for the regionalization of fruit production in Bosnia and Herzegovina, are analyzed, according to the challenges facing fruit production today. Regionalization of fruit production should represent a basic determinant of sustainable fruit production, which in the given agro-ecological conditions has an acceptable relationship to climatic conditions as a limiting factor of this production. The fact is that this project has not been realized so far, regardless of all the scientific and professional discussions and historical circumstances that influenced the possibility of consistently developing the regionalization project. However, in the conditions of evident climate changes, the first step towards effective discussions on the sustainable development of fruit production is the creation of a scientifically and expertly argued regionalization project, which can only then be adequately discussed.

Key words: limiting factors, climate change, cultivars, nurseries, center maps

O1_02

Evaluation of the internal quality of contemporary apple varieties suitable for organic production

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Abstract

Research aimed at evaluating the internal quality of new modern apple cultivars: Gaia, Gemini®, Modì®Civg198, Renè®Civren, and Smeralda® was conducted at the experimental station of the Faculty of Agrobiotechnical Sciences Osijek (FAZOS) during 2023. The content of phenols, total antioxidant activity, vitamin C, total anthocyanins, and fruit color were analyzed. The collected data were analyzed using ANOVA, and differences between the mean values were examined using Fisher's LSD test. Significant differences were found for all tested parameters. The highest phenol content was found in the Renè®Civren variety (4.76 mg/g), while the lowest was in the Smeralda® variety (2.58 mg/g), which also resulted in the lowest total antioxidant activity (32.06 mg/g) compared to all other cultivars. The highest values of vitamin C content were found in the Gaia (38.55 mg/g) and Gemini® (32.33 mg/g) variety, while the lowest values were in the Modì®Civg198 (13.40 mg/g) and Smeralda® (15.34 mg/g) variety. The Modi variety had the highest values of anthocyanin content (1.01 mg/100 g FW) compared to all other cultivars. According to the CIE L*a*b* system, the highest L* and b* values were found in the Smeralda® variety (71.14 and 44.05), while the highest a* value was found in the Modì®Civg198 variety (32.56). All varieties in the study met the expected standards of internal fruit quality. Based on the multi-year monitoring of the mentioned assortment, potential variability in quality levels is not expected, especially in the regime of intensively controlled production (protection, fertilization, irrigation, etc.). In conclusion, the observed variety demonstrates good potential for expansion and use in commercial and professional apple production, particularly in ecological regimes in the eastern Croatian region.

Key words: internal quality, apple fruits, variety

O1_03

Varietal specificities of dormant pruning of two-dimensional training systems of European plum (*Prunus domestica* L.)

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Abstract

The evaluation of varietal specificities of dormant pruning of two-dimensional training systems was realized during 2023-2024, in the experimental orchard of the Faculty of Agriculture in Aleksandrovac (Laktaši). Orchard was established in 2019. The paper analyzes the varietal specificities of dormant pruning in varieties with short (Stanley, Čačanska lepotica) and long (Grossa di Felisio - Empress) fruiting shoots. All varieties are grafted on a cherry plum rootstock (*Prunus cerasifera* Ehr.). The research was carried out on two-leader and multi-leader (UFO) training systems, and the plum spindle training system was used as a standard. The paper presents the varietal specificities of pruning two-dimensional training systems, the time required for pruning per unit area and the amount of discarded wood material during dormant pruning. Pruning in the multi and two-leader training systems is simplified compared to the spindle, but it requires a higher number of precise cuts per tree, which affects the total time needed for pruning per unit area. The amount of discarded wood material in pruning is primarily a varietal specificity, on which the training system has a significant influence. Variety Grossa di Felisio requires the most effort in winter pruning, while the difference between the Stanley and Čačanska lepotica varieties is due primarily to their vigor.

Key words: variety, multileader training system

O1_04

The use of 1-methylcyclopropene (1-mcp) in nectarine storage

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Abstract

The influence of 1-MCP application on the length of storage of nectarine fruits (Morsian flowers) in a controlled atmosphere cold storage was investigated. The fruits were analyzed at different times depending on the examined parameters: before storage Ø, 7, 20 and 30 days after storage and shelf life 3 days of aging at room temperature (20° C). The content of K (2043.6 mg • kg^{-1}) and Mg (41.0 mg • kg^{-1}) is high in relation to the content of Ca (17.0 mg • kg^{-1}), which contributed to a very high value of the ratio K + Mg/Ca (122.6). The application of 1-MCP affected the preservation of fruit firmness in storage for up to 30 days, with a slightly smaller effect on shelf life at room temperature. The effect of treatment on the viability of fruit weight is noticeable, while the content of soluble solids content (SSC) is lower, with some variation due to unequal fruit ripeness. Biochemical analyses show an increased content of titratable acidity (TA) on the treated fruits, and the pH value, total sugars (TS) and invert sugars (IS) do not show the influence of the application of 1-MCP. The content of macroelements and their ratio, as well as fruit ripeness before storage, indicate partial effects of 1-MCP application, so it is necessary to ensure greater absorption of Ca into nectarine fruits during vegetation and to continue testing firmness and other biochemical parameters before and during ethylene blocker application.

Key words: 1-methylcyclopropene, shelf-life quality, nectarine

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O1_05

Establishment of *in vitro* accessions of two Galician monumental chestnut trees

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Abstract

In 2007, the Galician Government created a catalogue of monumental trees, including several centenarian chestnut trees of high value from the ecological, genetic, and cultural point of view. As mature chestnuts are recalcitrant to vegetative propagation, in vitro techniques are the most appropriate for establishing a germplasm bank of these materials. In this paper, we combined micropropagation and micrografting to obtain in vitro accessions of the monumental chestnut 'Ramil' (more than 800 years old), and of a representative (clone 'Rubial 2') of a unique chestnut grove. Explants were obtained from branch segments removed from the tree crown in winter, which were cut (20-25 cm long, 1.0-3.0 cm diameter), thoroughly washed, treated with fungicide solution, and placed upright in jars with tap water. The jars were introduced in a growth chamber for sprouting of axillary shoots, which provided axillary explants introduced in vitro in medium WPM (Lloyd & McCown, 1981) + 30 g/l sucrose + 7 g/l Bacto®-agar (basal medium) + 1.0 mg/l BAP, and transferred to fresh medium at days 1, 4, 7 and 15. After 30 days, half of the reactive, non-contaminated explants were micrografted on axillary segments of a juvenile clone (Xuv-3) and the other half was subcultured directly. Both types of explants were introduced in basal medium containing 0.1 mg/l BAP (multiplication medium). Thirty days later, scions were reisolated and subcultured. Only the micrografted explants survived after the first subculture in clone 'Ramil', while in clone "Rubial 2" both grafted and ungrafted explants could be multiplied. In clone 'Rubial 2', rooting experiments showed that this clone expresses a relatively high rooting ability after eight subcultures (65.5% in control explants). First results obtained along the stabilization phase have shown that the protocol used may be useful for the establishment of accessions of very old chestnut trees.

Key words: micropropagation, micrografting, chestnut

O1_06

Evaluation of *Pimpinella anisum* essential oils on egg-laying behavior of *Drosophila suzukii*: A multiple-choice test approach

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Abstract

Drosophila suzukii, spotted wing drosophila, is recognized as an economically significant new invasive pest of stone and, especially berry fruits. This pest registered on the EPPO-A2 quarantine list. Due to the limited presence of natural predators on the European continent, this pest quickly proliferates, posing a significant threat to the agricultural economy by causing substantial losses in fruit production. As *D. suzukii* infestations commonly occur during the ripening stage, the main obstacle with chemical control methods is the risk of high residue in fruits. To face this issue, it is crucial to explore alternative control strategies. One of the possible effective methods involves the use of plant-derived bioactive compounds. Currently, there is ongoing research to identify essential oils with potential insecticidal properties for combating this challenge. The objective of this study was to assess the insecticidal and behavioral impacts of anise (*Pimpinella anisum* L.) essential oils on *D. suzukii* adults in a multiple-choice test using blueberries treated with three concentrations of the anise essential oil. Additionally, the study monitored the emergence of adults from the treated berries. Using GC-MC chromatography, the chemical composition of anise essential oil was determined, in order to understand the possible mode of action. The essential oil of anise showed high efficacy in the multiple-choice test, since at all three application concentrations (1%, 5% and 10%), a lower number of laid eggs was recorded compared to the control (water and acetone). Our findings suggest that anise essential oil can serve as an alternative to chemical insecticides, which would enable the use of bioinsecticides based on this oil, in conventional, integrated and organic crop production.

Key words: Drosophila suzukii, essential oil, oviposition, bioinsecticide, ecofriendly

O1_07

Intensity of spread and economic importance of esca disease in Montenegro

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Abstract

Esca is the most important grapevine trunk disease in Montenegro and it is caused by a complex of fungi. It manifests as apoplectic or gradual decay of grapevine. Leaf symptoms are displayed as necrotic tissue, clearly defined with a characteristic purple line. In addition to visible symptoms, esca manifests in xylem vessels' decay. In order to examine the spread of esca and its impact on yield reduction, its symptoms were monitored in three years (2009, 2021, 2023). The research was conducted in the vineyard of Biotechnical Faculty in Podgorica, where 3,615 vines of the Vranac variety were planted on an area of 1.15 ha. During the inspection in 2009 (6 years old), symptoms of esca disease were observed on 6 vines, which represents 0.16% of the total number of vines. By comparing the yield of healthy plants and plants with symptoms, a decrease in yield of 0.07% was found. During 2021, the number of symptomatic plants was 295, which compared to healthy plants is 9.76%. Moreover, 591 empty planting sites, or 16.35%, were recorded in the vineyard caused by the vines' drying, probably as a result of the esca disease. In 2023, the number of plants with symptoms increased to 865 (29.83%), and 716 plants (19.81%) were missing. The number of healthy vines was 2036. During the harvest in 2023, the average yield on symptomatic plants was 1.36 kg, compared to 4.15 kg per healthy plant. An analysis of the yield loss both from the missing plants and symptomatic plants, revealed a yield reduction of 35.98%. The market price of grapes in 2023 was EUR 1.10/kg. Based on this price, it is concluded that the financial loss in this year was around 5,936 EUR. The obtained results indicate that esca causes significant financial losses in the viticultural production of Montenegro.

Key words: grapevine, esca disease, yield

O1_08

Determination of free hydrocyanic acid in homemade produced fruit brandies

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Abstract

Fruit brandy is a traditional alcoholic drink in the Republic of N. Macedonia, but also in other Balkan countries, which are produced by distillation of fermented fruits (plum, apricot, peach, apple, etc), traditionally (homemade) or industrially. In this study, the content of free hydrocyanic acid was determined in 24 homemade samples of fruit brandy in order to determine safety for consumption. Hydrocyanic acid (HCN), called hydrogen cyanide, is formed in the brandy during alcoholic fermentation, as a result of enzymatic hydrolysis of cyanogenic glycosides that are present in the seed of the fruit from which the brandy is produced. The free HCN content was determined spectrophotometrically using a pyridine-pyrazolone reagent. From the obtained results it can be observed that the content of free hydrocyanic acid depends on the type of fruit (stone fruit or seed fruit), the type of fermentation as well as the contact time between the seed and the pulp during the fermentation. The highest content of free HCN was determined in brandies produced from apricot and ranged from 1.012 µg/L to 9.372 µg/L, compared to brandies obtained from apples in which the content of free hydrocyanic acid was the lowest and ranged from 0.010 µg/L to 0.098 µg/L. It was also observed that all brandies contained free hydrocyanic acid below the maximum allowed limit (< 70 µg/L) and were safe for consumption.

Key words: fruit brandies, free hydrocyanic acid, spectrophotometry

O1_09

Vanillic acid mediated disease tolerance in mung bean against *Macrophomina phaseolina* through the enhancement of plant antioxidant defense gene

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Abstract

Mung bean (*Vigna radiata*) is a leguminous crop vulnerable to different pathogens including *Marcophomina phaseolina*, a notorious fungal pathogen causing charcoal rot disease. During this investigation, anti-mycotic potential of vanillic acid was studied. To unravel the underlined mechanisms, impact of different concentrations of vanillic acid (VA) viz., 0.045%, 0.050, 0.055, and 0.060% was analyzed. *In vitro*, VA caused complete inhibition in fungal growth at concentration of 0.055%. Also, during the *in vivo* assay, the same concentrations (0.055%) managed maximum charcoal rot disease in mung bean and improved growth and biomass in the plants. Polyphenol oxidase (PPO) was also targeted using the same four concentrations and 0.055% is the significant concentration for the increased levels of PPO showing that this gene might play a pivotal role in mitigating the oxidative stress which is the common response triggered by pathogen invasion. The findings highlight the promising role of VA in bolstering mung bean's innate defense mechanism against pathogen by augmenting plant's antioxidant defense system. This research not only enhances knowledge of molecular mechanisms related to the disease tolerance in mung beans but also lays the foundation of creating sustainable environment friendly approaches to handle charcoal rot disease and enhance crop yield.

Key words: charcoal rot, gene expression, vanillic acid, antioxidant

O1_10

Botanical description and chemical profile of *Opuntia* spp. (Cactaceae)

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Abstract

Opuntia species, commonly known as prickly pears, belong to the cactus family and are found predominantly in the Americas, Mediterranean regions and South Africa, with Mexico having the greatest diversity of wild species. These plants represent a significant economic value as fruit crops and serving various purposes, including human consumption, therapeutic and cosmetic applications, as well as fodder for animals. Several phytochemical researches have been devoted to the different parts of this plant (cladodes, fruits, seeds, oil, mucilage), which are a valuable source of bioactive substances, including polyphenols, vitamins, minerals, unsaturated fatty acids, etc., conferring them a wide range of therapeutic and preventive properties. The aim of this paper is to provide a comprehensive review of the botanical description and the chemical profile of Opuntia spp. in Morocco and worldwide.

Key words: Opuntia species (spp.), Botanical description, Chemical Composition

Session 1: Horticulture

Poster Presentations

P1_01

Biochemical and morphological analysis of fruit quality traits of different traditional apple genotypes from western Serbia

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Abstract

Market demands for apple fruits are increasing. Beside fruits for fresh consumption and processing, in the last few years is also increasing the need for fresh-cut fruits. The aim of this work was to evaluate the fruit quality of 6 traditional apple genotypes from Western Serbia ('Slatkača', 'Đulabija', 'Zelenika', 'Prstenka', 'Šumatovka' and 'Žutica') through the analysis of various morphological and biochemical characteristics and to propose the potential use that will respond to the market demands. Morphological parameters of quality were measured: fruit weight, height and width, shape index, fruit firmness and fruit stalk length. Among biochemical components of quality, total soluble solids and titratable acidity were measured and used to calculate flavour index. Sensory analysis included parameters: fruit appearance, taste and aroma. Based on results, fruits of selected apple genotypes were divided into three clusters, which reflect their best potential to use for a different purpose. Genotypes 'Đulabija' and 'Prstenka' were the best rated by sensory analysis. It shows their potential as apples for fresh consumption, which are grouped in Cluster I. In Cluster II are grouped genotypes suitable for processing - 'Šumatovka' and 'Žutica'. These genotypes have good soluble solids content, but low rating of appearance and taste, due to higher sourness or sweetness. Genotypes 'Slatkača' and 'Zelenika' had lower ratings regarding the appearance, but have good aroma and taste, which makes them suitable for Cluster III. Fruits from this cluster are suitable for fresh-cut apples. This research showed great diversity and the potential of traditional varieties of apples for different uses. Further research should evaluate their fruit quality in detail, especially regarding different climate conditions and pomotechnical measures that can improve quality of fruits.

Key words: Malus domestica, fruit quality, sensory analysis, soluble solids, titratable acidity

P1_02

Effect of heat stress on antioxidant status in apple leaves grown in two different microclimates

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Abstract

Long-term high temperatures alongside with insufficient amounts and unfavorable distribution of precipitation, affect negatively the assimilation processes what reduces apple production. Initiating the antioxidant response in leaves through the synthesis of phenols and flavonoids is one of the defense strategies. The aim of this research was to examine the physiological response in the leaves of 33 apple varieties to heat stress in two microclimatically different localities in Croatia, Tenja (eastern region) and Donja Zelina (north-western region). The leaves were sampled after a long-term hot period, at the end of June and in the middle of the July during growing season 2021 and 2022. In average for both years the locality significantly influenced all the examined parameters. In 2021, in the second sampling period at Donja Zelina location, an increase in the phenol content was determined as compared to the first sampling period, while at the Tenja location there was a slight decrease in the phenol content, which was accompanied by a decrease of total antioxidant activity. In all other sampling periods at both localities, the average antioxidant activity in the leaf did not change significantly. A significant influence of the variety on the accumulation of phenols, flavonoids and antioxidant activity was established, which points to the genetic specificity in the response to high temperatures. Further research should be directed towards the linking of oxidative stress indicators in the leaf with different parameters of fruit quality, aiming to help producers to choose the most stable variety for particular growing conditions.

Key words: adaptation, apple varieties, heat stress, microclimatic conditions, oxidative stress

P1_03

Preliminary evaluation of the fruit value of selected wild pear (*Pyrus communis* L.) seedlings in the *ex situ* collection of the Agricultural Institute of the Republic of Srpska

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Abstract

Natural population of wild pear (*Pyrus communis* L.), as an element of total biodiversity and a genetic source for variety and rootstock selection and breeding, is significantly endangered, which can be mitigated by establishing ex situ collections. In 2009, free fertilized seedlings were produced from nine wild pear accessions, previously inventoried in natural populations of wider Banja Luka region and planted in ex situ collection of the Agricultural Institute. Based on positive morphological characteristics, 54 seedlings were selected for further observation. During 2009-2021, a preliminary evaluation of fruit value from fruit bearing seedlings was conducted. Evaluation included fruit description (position of maximum diameter, fruit section symmetry, skin color and appearance of rust), as well as measurement of fruit quantitative parameters (stalk length and thickness, mass, height, width and fruit shape index). Out of 54 seedlings, 27 of them bore fruit in the observed period. Two seedlings began to bear fruit in fifth year, while the majority began to bear fruit from 8th to 10th year. In most seedlings, the fruit maximum diameter position is in the middle (i.e. fruits are symmetrical). Fruit skin color is green to green-yellow, with a small or medium appearance of rust, except for one seedling with pronounced skin rust. Fruits are medium sized in most cultivars (8 to 15 g), while two cultivars had larger fruits (45.10 g and 37.99 g). The fruit shape index of majority of seedlings is less than 1, two seedlings have an elongated fruit shape, and one seedling has red fruit flesh. Based on the pomological analysis of the wild pear seedlings, significant differences were observed, both between seedlings and in relation to their parents, so this ex situ collection significantly contributes to diversity preservation of the wild pear population in the Banja Luka region.

Key words: genetic sources, natural population, fruiting, pomological analyses

P1_04

Plant production of new clones of hazelnut cultivars by grafting onto Turkish filbert rootstock

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Abstract

The latest trends in hazelnut production are moving in the direction of selection and breeding of more productive cultivars and isolation of native clones, aimed at enhancing the agronomic performance of plants. Serbia stands out in the production of quality planting material by grafting on Turkish filbert (*Corylus colurna* L.), which does not form shoots and develops in the form of a tree. The aim of this research was to investigate the success achieved by grafting leading Italian cultivars and their clones on Turkish filbert seedlings using technology developed at the Faculty of Agriculture, Novi Sad, as well as determine possible differences in the quality and variability of the obtained planting material. For this purpose, during the spring of 2021 and 2022, two-year-old C. colurna were grafted by the whip and tongue method. After the plants entered the dormant period, they were taken out of the soil and classified. The obtained results revealed that the chosen hazel cultivars (Tonda di Giffoni, Tonda Gentile delle Langhe and Tonda Gentile Romana) and their clones (Tombesi; AD17; Clon 3) exhibited excellent grafting success rate. In both analyzed years, as well as throughout the entire study period, greater grafting success was achieved using clones relative to the main cultivars. Over the two-year study period in average the highest grafting success was achieved by clones AD17 and Tombesi (88,7% and 88,8%, respectively). Class I grafted plants were obtained in 82,7% in average, especially with Tombesi (92,5%) and AD17 (89,9%) clones, while significantly fewer class I grafted plants were produced by grafting basic cultivars. All clones exhibited superior uniformity (i.e., a more stable grafting success) relative to their basic cultivars.

Key words: hazelnut, grafting, cultivar, clone, rootstock

P1_05

The morphological features of Cornelian cherry (*Cornus mas* L., Cornaceae) pollen grains

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Abstract

Cornelian cherry is an ornamental early-blooming shrub or small tree providing a great source of nectar and pollen for bees at a time when not much food is available. Yellow flowers appear in February before the leaves emerge, in dense, showy, rounded clusters. Pollen morphology investigation was carried out using both light and scanning electron microscopy in order to contribute the taxonomic and melissopalynological studies. Measurements and description of basic micromorphological parameters such as aperture, ornamentation, shape, size, polarity and symmetry, including polar axis (P), equatorial axis (E), the length of the colpi and structural elements of the exine, were performed on pollen samples obtained from fully opened flowers in the peak flowering phase. After gold sputtering (BAL-TEC SCD 005 Sputter Coater, 100 seconds at 30 mA), the pollen samples were analyzed using a SEM JEOL JSM-6390 LV at 20 kV, and photographed in two characteristic positions - polar and equatorial. The pollen grains are monads, isopolar, radially symmetrical, with scabrate exine ornamentation and medium in size. The length of the polar axis (P) is 34 ± 1.1 µm in average, while the mean length of the equatorial axis (E) is 22.9 ± 1.5 µm. Pollen shape is prolate, given that the P/E ratio amounts to 1.5 ± 0.1. Viewed equatorially, the outline was mostly elliptic, whereas viewed polarly it was triangular, with flattened or concave sides and quite prominent apices. The aperture type is tricolporate. The length of the colpi is 29.5 ± 1.3 µm. In general, typical depression occurs in the central part of mesocolpia. The analyzed palynomorphological characteristics may be of special importance for determining the botanical and geographical origin of honey, also contributing to the pollen atlas of Serbia and the region.

Key words: Cornus, pollen morphology, SEM

P1_06

The position, morphology, and structure of floral nectar-secreting gland in *Cornus mas* L. (Cornaceae)

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Abstract

Cornus mas, usually used as decorative, medicinal or culinary plant, is also important because of its melliferous potential. Blooming at at the very end of winter, it produces nectar and pollen abundantly. The micromorphology and anatomical structure of floral nectary was examined under both, light (LM) and scanning electron microscope (SEM), in order to contribute taxonomic, ecological and pollination aspects of this genus. Flower has a four small triangle-shaped sepals, four free yellow petals alternating with four stamens, and syncarpous gynoecium composed of two carpels. With regard to inferior position of ovary, the flower is epigynous. The nectary gland is annular, completely surrounds the base of the long style and freely exposed to pollinating insects. For LM study flowers were fixed in FAA and permanent microslides were prepared by standard paraffin method. Serial transverse and longitudinal sections of the ovary at bloom were made using a sliding microtome followed by staining in Alcian blue and Safranine. For SEM study, fresh flowers were covered with gold (in BAL-TEC SCD 005 Sputter Coater, 100 seconds in 30 mA) and observed using JEOL JSM- 6390 LV electron microscope. LM analysis revealed that the epidermis is single-layered, subtended by nectariferous tissue composed of multiple layers of cells containing starch and chlorophyll grains. The outer walls of epidermal cells are covered by a thin cuticle. Beneath the secretory tissue are larger and more loosely arranged non-secretory parenchyma cells. No conducting tissue was distinguished in the nectariferous tissue. The nectar is secreted through modified stomata which have a reduced substomatic chamber. SEM study indicated that guard cells of modified stomata are at the same level as the adjacent epidermal cells. These stomata are anomocytic and evenly distributed on the nectary surface.

Key words: anatomy, micromorphology, SEM, LM, Cornelian cherry

P1_07

Development, quality and antioxidant activity of cornelian cherry fruit gels

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Abstract

The aim of this research was to: a) examine the possibility of producing fruit gel from cornelian cherry fruit of defined quality with addition of different gelling agents, b) to determine the nutritive and sensory quality of the selected fruit gels, c) to determine phenolic composition and antioxidant activity of the selected fruit gels. In order to obtain fruit gels of defined quality, sensory properties and quality parameters of produced samples were monitored and based on the obtained data, the initial recipe was modified. Agar and pectin were used as gelling agents suitable for consistency modification. Basic chemical composition (moisture, dry matter, total sugars, total ash, total acidity and pH value), sensory quality (appearance, color, consistency, aroma and taste) and the content of total phenols, flavonoids, flavonols and flavan-3-ol, monomeric and total anthocyanins and antioxidant activity (DPPH and ABTS tests) of selected samples were analyzed. The results showed that a fruit gel of defined quality can be obtained from cornelian cherry fruit with the addition of agar or pectin by precisely balancing certain parameters in the recipe. Samples GA4 with 1.4% agar and GP3 with 1.2% pectin were evaluated as samples of the best, expected quality. Moderately firm and homogeneous consistency of fruit gels was achieved, which determined the use of these products for filling and decoration in the bakery and confectionery industry. Cornelian cherry fruit gel of defined quality, can be obtained with a lower content of sugar and a higher content of fruit by using agar as a gelling agent. Withal, the fruit gel with agar has a higher ($P<0.05$) content of total polyphenol, total flavonoid, total flavan-3-ol, and monomeric and total anthocyanins, as well as higher antioxidant activity ($P<0.05$) comparing to the fruit gel with pectin.

Key words: cornelian cherry, gelling agents, nutritive quality, sensory analysis, antioxidant activity

P1_08

Impact of biofungicides in postharvest and storage of cherry fruits

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Abstract

Cherry is one of the most intensively grown fruit species, the fruits are used mainly for consumption, and to lesser extent for processing. Cherry fruit is one of the characteristic climacteric fruits i.e., are prone to rapid decay, which has an impact on the economy, handling and ultimately the producer's profit. This paper presents the results of the effects of two biofungicides (bacillus) and one commercial preparation (tubecanazol) on the storage of cherry fruits after harvest. The fruits of the varieties used for the analysis (Sabrina and Ferovia) were taken from the experimental plot of the EECT (Experimental Educational Center) of the Faculty of Agriculture, University of Banja Luka. After harvesting, the fruits were immersed in a solution of the recommended doses of the preparation, which were used for the experiment. The fruit was stored in plastic baskets with lids weighing 1 kg. Each container is also marked with the appropriate label (T1-skladix, T2-Timorex gold, T3-Accord, K-Knobination T1 and T2 and Control). After 20 days at a temperature of 3-50°C, the weighting and analysis procedure was carried out. Before storage, basic analyses were performed on 30 randomly taken fruits: fruit mass, hardness and brix, and the same were repeated after the fruits were taken out of the refrigerator. The variety/treatment Sabrina/K had the most negatively affected fruits, and Ferovia/T3 had the least damage. The variety/treatment Sabrina/Control had the highest average fruit weight, and Ferovia/T1 had the lowest. The variety/treatment Sabrina/T1 had the highest fruit hardness, and Ferovia/K had the lowest. The variety/treatment Ferovia/Kontrol had the highest brix, and Sabrina/T1 had the lowest.

Key words: harvesting, storage, biofungicides, Sabrina, Ferovia

P1_09

The effect of freezing and frozen storage on the quality and antioxidant activity of raspberry and blackberry fruits

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Abstract

Freezing is the most commonly used method for long-term preservation of berry fruits. This study was conducted to investigate the effects of freezing and frozen storage on the quality changes of raspberries and blackberries. The maintenance of antioxidant activity and their initial property after air-blast freezing, as well as frozen storage (4 and 8 months) at –20°C was examined. A range of fruit characteristics (dry matter content, pH, soluble solids, titratable acidity, quality index, vitamin C) were determined before and after freezing and long-term frozen storage. Raspberries and blackberries are known as rich sources of bioactive compounds; therefore, the antioxidant activity of the fresh and frozen samples was assessed by DPPH assay. After thawing, the fruits were evaluated by sensory analysis based on four sensory attributes: color, taste/flavor, texture/firmness, and overall acceptance, and the results were compared with the physicochemical properties. The results showed that freezing did not significantly affect the physicochemical parameters and vitamin C content; moreover, the values of the antioxidant activity were higher in the frozen raspberries and blackberries than in the fresh fruit. However, during storage at –20°C, the quality properties gradually decreased and became more pronounced with increasing storage time; however, frozen storage up to 4 months had no significant effect on the analyzed compounds and the antioxidant activity of the samples. Freezing had a significant effect on the sensory properties of the raspberry and blackberry fruits; the most considerable changes were observed in texture/firmness and consequently in the loss of overall acceptance. From all the observed results it can be concluded that air-blast freezing is a suitable method to preserve the physicochemical properties and antioxidant activity of raspberry and blackberry fruits.

Key words: freezing, raspberry, blackberry, quality, antioxidant activity.

P1_10

Valorization of raspberry seeds in cosmetic industry

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Abstract

Processing of fruit juices generates large quantities of waste, mainly in the form of a mixture of pulp, peel, seeds and stems. These by-products contain large amounts of bioactive compounds and are therefore considered as valuable sources of nutraceuticals. In addition to the nutritional properties, bio-waste is frequently attributed with beneficial effects on human health, highly valued in pharmaceutical and cosmetic industries. In this work, we have developed a strategy to valorize raspberry seeds in order to obtain active ingredients with potential application in cosmetics. For this purpose, defatted raspberry seed cake was used to obtain a fraction rich in polyphenols. The extraction process was based on a deep eutectic mixture of two solvents, proline and citric acid. The extract was characterized by free and total ellagic acid content, Total phenolic content and Radical scavenging activity. The hand care cream was tested after the addition of seed extracts, by direct mixing into the cream, and as an encapsulated supplement after mixing with starch as a carrier. To evaluate the improvement of the cosmetic product properties, Zein test of irritation potential (harshness), Transepidermal water loss (TEWL), Red blood cell test (RBC), and DPPH antioxidant assay were performed. Based on the results, we concluded that the raspberry seed extract has significant potential for use in the cosmetics industry. The extract can be used as an emulsion as well as a microemulsion, it has low skin irritation effect, leads to a lower TEWL and has a higher antioxidant potential in comparison to the reference hand cream. This work represents the efficient utilization of natural resources and the minimization of food waste ending up in landfills, and is in line with the principles of the circular economy standards adopted by European Union and the United Nations Sustainable Development Goals (SDG).

Key words: bio-waste, encapsulation, bioactive compounds, circular economy

P1_11

Bioactive compounds of cold-pressed raspberry seed oil and functional properties of the remaining oil cake

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Abstract

Raspberry seeds contain a considerable amount of oil (10-23%) and are used for oil extraction by cold pressing. After extraction of the oil, an oil cake remains, which is a rich source of various bioactive compounds and is used for animal feed and the production of formulations that serve as functional foods. Some publications indicate that flour obtained from pressed oil cake of berry seeds has a high antioxidant potential and contains a considerable number of polyphenolic compounds. The objective of this work was to characterize the cold-pressed oil from raspberry seed and the defatted cake. The composition of fatty acids was studied by gas chromatography, the tocopherols were determined by normal phase HPLC-DAD, and the oxidative stability of the extracted oil was assessed by using the Oxitest device. The oil cake flour was characterized in terms of moisture content and techno-functional properties, such as swelling capacity, water holding capacity and oil holding capacity. Linoleic acid (ω-6 fatty acid) was dominant, with a content of 62.94%, followed by the monounsaturated fatty acid oleic acid (16.89%) and the omega-3 fatty acid, α-linolenic (13.95%). Palmitic acid (4.15%) and stearic acid (1.79%) were the most abundant saturated fatty acids. The predominant tocopherol isomer in the oil was γ-tocopherol with a content of 200.39 mg/100 g oil, followed by α-tocopherol (69.26 mg/100 g) and δ-tocopherol (28.82 mg/100 g), while β-tocopherol was not detected. To conclude, the studied oil is nutritionally extremely valuable and the high content of γ-tocopherol and α-tocopherol certainly expands potential applications for pharmaceutical and cosmetic purposes. Due to techno-functional properties, the tested oil cake flour could improve the texture and sensory properties of confectionery and bakery products, as a partial substitute of wheat flour.

Key words: cold-pressed oil, fatty acids, tocopherols, defatted seed cake, techno-functional properties

P1_12

Utilization of agricultural waste in biosorption of anthocyanins

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Abstract

Natural biosorbents made of agricultural by-products and waste are increasingly being studied and are mainly used for heavy and toxic metals removal from waste water. Such biosorbents have large surface area and capacity for various compounds. Our research puts sustainability in the spotlight, as there are tons of seed and pomace left behind during the processing of fruit in juice industry. Even after the oil pressing, 90% of biomass is still available for recycling. Besides, conventional extraction methods used to recover phytochemicals from food waste are time-consuming, expensive and unsustainable, so novel technologies are encouraged. Therefore, we designed the experiment to study two by-products, raspberry seed biomass and liquid by-phase rich in anthocyanins, with the aim to investigate a biosorption potential of seed material in recovery of natural pigments. Two seed materials were prepared to serve as biosorbents, raw seed and defatted seed material. Liquid by-phase was initially collected during depulping of the raspberry seed material, and was subjected to biosorption. Seed material was characterized by Fourier Transform Infrared Spectroscopy (FTIR). Major bands were related to complex polymeric structure of seed, mainly consisting of lignin, as well as cellulose, hemicellulose and other less abundant compounds. FTIR profile of raw and defatted seed pointed to functional groups involved in biosorption. Total anthocyanin content (TAC) before and after biosorption was determined, while individual anthocyanins were assessed by liquid chromatography with mass spectrometry (LC MS). In seed material, cyanidins predominate, followed by pelargonidins and peonidins. Efficiency of the biosrption was examined by comparing the recovery of specific compound. Developed strategy to valorise raspberry seeds and to obtain natural colorants could have applications in the food industry, especially anthocyanins which are considered to be safe and healthy in comparison to commonly used artificial food colorants

Key words: biowaste, anthocyanins, LC MS, FTIR

P1_13

Status of pesticide application equipment and the possibility of applying european standards and regulations

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Abstract

The research in this paper was conducted in the western part of Republic of Srpska, located in the northwest of Bosnia and Herzegovina. This region is characterized by intensive agricultural production, with increasing investments in viticulture and fruit growing in recent years. As a candidate country for accession to the European Union, Bosnia and Herzegovina must harmonize its legal regulations with European standards. Compliance with these standards includes the introduction of legal inspection of machinery and equipment for pesticide application. The aim of the research was to collect data (brand, model, age, technical condition, etc.) on machinery and equipment for pesticide application, as well as to gather basic data on the operators of these machines (education, basic knowledge, attendance at training for safe and proper adjustment of these machines, etc.). The study was conducted as part of the regular activities of inspection, certification, and calibration of pesticide application equipment, which the Faculty of Agriculture performs every year before the start of the protection season. The research involved the inspection and examination of 76 pesticide application devices - sprayers. Of the total number of inspected devices, the largest deviations were recorded during the inspection of sprayers (34%), pressure gauges (16%), and pump capacity (9%).

Key words: sprayers, inspection, standard, service life, technical correctness

P1_14

Survey on the presence of *Alternaria mali*, the causal agent of apple alternaria blotch, in Republic of Srpska during 2019-2023

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Abstract

According to B&H the list of quarantine organisms *Alternaria mali* Roberts is categorizatied in II/A1 list as *Alternaria alternata*, non-European isolates pathogenic to Malus. Considering that apple, as main host, is the most predominantly and commercially grown fruit in our country, presenting direct phytosanitary risk to the main cultivated crop, survey in Republic of Srpska (RS) started in 2019. From 2019 until 2023 survey was performed in 6 regional units, as well from import. In 2019 total 135 samples of host plants were analyzed for the presence of *A. mali*, 119 in 2020, 60 in 2021, 50 in 2022, while in 2023 total 95 samples of host plants were analyzed. All samples were analyzed in a laboratory in PI Agricultural institute of Republic of Srpska, Banja Luka, in accordance with international standards. As the initial test, the conventional tissue isolation method was used for the isolation of pathogenic fungi. The samples were cleaned, cut into 5 mm × 5 mm pieces, disinfected with 75% alcohol for 30 s, followed by 1.5% NaClO3 for 3 min, and rinsed 3–5 times with sterile water. The disinfected leaf pieces were gently placed on potato dextrose medium containing streptomycin, using 5 leaf pieces per dish, and incubated in the dark at a constant temperature of 28°C for 3–5 days. Morphological characteristics of fully grown single colony were recorded under an Olympus microscope BX51. Protocols included also the molecular assay, extraction from diseased leaf pieces, amplification by PCR, and detectection by 1.5% agarose gel electrophoresis. During a survey from 2019 to 2023 negative results for the presence of *A. mali* were obtained. However, considering other species within *A. alternata* species-group, present in our area, further survey is neccesary for prevent the introduction of this fungus into the territory of the RS.

Key words: Alternaria mali, quarantine pests, survey, Republic of Srpska

P1_15

In vitro toxicity of fludioxonil to *Penicillium expansum* and *Penicillium crustosum* isolates from decayed apple fruit

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Abstract

One of the most important postharvest diseases in apple fruit production worldwide is blue mold, which is caused by Penicillium spp. Numerous species of the genus Penicillium have been described as blue mold pathogens, of which *P. expansum* and *P. crustosum* are the most common. The production losses are quantitative, as the fruit is severely damaged, but also qualitative, as infected fruit can be contaminated with mycotoxins. Therefore, it is crucial to reduce the infection of apple fruit. Various phytosanitary, mechanical, agrotechnical and chemical measures are particularly important to prevent the occurrence of fruit disease during storage. Although not many active substances are available for this purpose, the main method of controlling *Penicillium spp*. is the application of synthetic fungicides before harvest. Fungicides registered in Serbia against Penicillium species include trifloxystrobin and boscalid+pyraclostrobin, fluopyram+tebuconazole and cyprodinil+fludioxonil mixtures. The aim of this study was to determine the sensitivity of two Penicillum species to fludioxonil in vitro. Isolates of *P. expansum* and *P. crustosum* from the collection of the Laboratory of Postharvest Phytopathology, University of Belgrade - Faculty of Agriculture were tested. The commercial formulation of fludioxonil (Flux®, 225 g L-1 fludioxonil, Galenika-Fitofarmacija a.d.) was used for the sensitivity test. The mycelial growth assay method was performed to investigate the sensitivity of the isolates to fludioxonil. The tested isolates (22 in total) showed high sensitivity to fludioxonil with average EC50 values of 0.056±0.008 and 0.085±0.015 µg ml-1 for the isolates of *P. expansum* and *P. crustosum*, respectively. This research has shown that isolates of *P. expansum* are more sensitive to fludioxonil than isolates of *P. crustosum* in vitro.

Key words: fungicide sensitivity, blue mold, fludioxonil

P1_16

Control of *Cacopsylla pyri* L. in a pear orchard using insecticides

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Abstract

Insecticides are intensively used to increase the yield and quality of agricultural products and achieve the best possible results. The pear psylla (Cacopsylla pyri L.) is an economically significant pest regularly appears in pear orchards and poses a major problem in control due to the larger number of generations that can overlap, as well as the secretion of honeydew which is an obstacle to the action of insecticides. During 2023, in pear orchards (varieties Williams, Carmen, and Santa Maria) at the localities Kovilj and Kula (R. Serbia), insecticides based on acetamiprid (200 g/kg, SG), lambda-cyhalothrin (25 g/l, EC) and acetamiprid+lambda-cyhalothrin (32 g/l+30 g/l, EC) were applied in the control of C. pyri, at a concentration/quantity of 0.05%, 0.5 l/ha and 0.75 l/ha, respectively. The experiments were set up according to standard EPPO methods in four replications. The treatment was performed foliar, with a backpack sprayer, and water consumption of 1000 l/ha. At the moment of treatment, the pears were in the BBCH 73-74 phenophase. The achieved results were processed using one-way ANOVA and LSD test, while the efficacy was determined according to Henderson and Tilton. The efficacy of the applied insecticides two days after the treatment in controlling larvae of the pear psylla (ages L1-L3 and L4-L5) ranged from 88.5 to 94.5% at the location of Kovilj, while at the location Kula, it ranged from 80.3 to 85.5%, compared to the control. Ten or twelve days after treatment, the efficacy was 83-95.1%, also depending on the insecticide, location, and insect larval age. The number of larvae of the C. pyri, at both locations and in both assessments, when applying the tested insecticides was significantly lower compared to the control, indicating the sensitivity of the populations of the pear psylla to the applied insecticides in the tested localities.

Key words: pear, *C. pyri*, insecticides, efficacy

P1_17

Etiology of hazelnut (*Corylus avellana*) bacterial blight in Montenegro

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Abstract

In Montenegro, production of hazelnuts is continually increasing due to market demands and favorable climate. However, the production is occasionally affected by occurrence of hazelnut diseases. Bacterial blight is one of the most damaging worldwide. In June 2021, leaf spot, bud and twig necrosis were observed on young hazelnut plants (*Corylus avellana*) cultivar Hall's Giant, near Cetinje, Montenegro. From the symptomatic samples, fourteen bacterial strains, forming yellow, convex and mucoid bacterial colonies, were isolated. Pathogenicity of the strains was preliminary tested by their hypersensitivity in pelargonium, and by spraying young leaves of potted hazelnut plants with the bacterial suspension (108 CFU/mL SDW). The reference strain *Xanthomonas arboricola pv. corylina* (Xac) NCPPB 3037 and sterile distilled water (SDW) were used as positive and negative control, respectively. Small, irregular lesions appeared on the leaves of all inoculated plants within 5 to 6 weeks after inoculation, while the leaves sprayed with SDW remained symptomless. All the strains were Gram-negative, catalase positive, oxidase negative, obligate aerobic, hydrolyzed starch, gelatin and esculin, did not reduce nitrate and did not grow at 37°C and in the presence of 5% NaCl, showing the same characteristics as the reference Xac strain. PCR with XarbQ-F/XarbQ-R primers produced a fragment of 402 bp in 14 strains and the reference Xac, confirming their affiliation to X. arboricola species. Additionally, PCR analysis with primers XapY17-F/ XapY17-R produced a single band of 943 bp. Amplification and sequencing of the partial rpoD gene of two selected strains (GenBank Nos. OQ271224 and OQ271225), showed that they share 99.47% to 99.92% rpoD sequence identity with Xac strains CP076619.1 and HG992342.1 isolated from hazelnut in France and HG992341.1 in USA. According to the results, *Xanthomonas arboricola pv. corylina* was identified as the causal agent of hazelnut bacterial blight in Montenegro.

Key words: X a pv *corylina*, leafspot, necrosis, identification, RpoD

P1_18

Detection of *Phytophthora* in strawberry plants by Polymerase Chain Reaction

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Abstract

Commercial production of fresh fruit like strawberry (*Fragaria* L.) and raspberry (*Rubus idaeus* L.) showed significant development in the Republic of Srpska territory. *Phytophthora fragariae* Hickman is a quarantine organism and is as well pathogenic on strawberry as on raspberry. Root rot caused by the fungus-like pathogen in genus Phytophthora continues to be one of the serious and an economically important diseases of strawberry in the Republic of Srpska. During the period 2019-2023 in the laboratories of the Institute for Genetic Resources of the University of Banja Luka, as a part of regular annual health control, strawberry samples were analyzed for the presence of *Phytophthora fargariae* var. *rubi*. That is a soil-borne pathogen listed by EPPO as an A2 quarantine pest for which specific and sensitive detection methods are required to be tested. In the Republic of Srpska, in the last 5 years, 65 samples from nursery and commercial production were analyzed, and six infected plants from the production in 2 different locations were confirmed. DNA was extracted directly from root samples. Diluted DNA extracts were amplified by nested PCR (ITS4 and DC6 for the first round, DC1 and DC5 for the second round) and then visualized on 1% agarose gel. Nested PCR is sensitive and less time-consuming, and therefore recommended as a routine control method. This report indicates that human activity might be the most important factor in spreading of this disease. The importance of this aspect is increasing due to the attention to the presence and research on the control of the spread of quarantine harmful organisms.

Key words: quarantine organism, *Phytophthora fragariae* var. *rubi*, nested PCR

P1_19

The influence of different weed control approaches on the yield of strawberry (*Fragaria ananassa* D.)

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Abstract

Modern plant protection today is based on the principles of integral plant protection. For many years, scientific research in the field of plant protection has been oriented towards the study of the scientific foundations that are absolutely necessary for the successful implementation of integral protection of plants from various harmful organisms. In this paper, using examples of good practice and the results of scientific research, it is shown how certain principles of integral plant protection can be successfully integrated into the integral protection of strawberries from weeds. In the Brcko District of BiH, in the village of Popovo Polje, research was conducted in several varieties of strawberry production for three years (2021, 2022, 2023): plots where the soil is covered with synthetic material, i.e. with black plastic film, plots where the soil is covered with organic material, in this case with straw, plots on which weed control will be carried out with herbicides, and plots on which no soil covering or weed control will be carried out. The aim of the experiment is to determine whether there is a significant difference in the final yield of strawberries, depending on the effect of soil cover in relation to the presence of weeds, as well as to determine the interaction observed over the years. The data that was used as a method to calculate the data of interest are the yields that were achieved per bush of strawberries shown in grams. The collection of fruits from different test plots and the formation of representative samples using the methods of inferential statistical processing led to results that represent a key indicator of the success of weed control and, ultimately, the success of the agricultural process.

Key words: strawberry, protection, integral, weeds

P1_20

Efficacy evaluation of synthetic fungicides and biofungicides against Fusarium wilt in blueberry

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Abstract

Fusarium wilt poses a significant challenge to blueberry production worldwide and recent reports suggest it is posing a threat to sustainability and expansion of this crop in Serbia. During the survey in 2019 in Sopot, Serbia, symptoms of leaf wilting, reduced plant growth, decreased yield and fruit quality of blueberries were observed. Subsequent morphological and molecular analysis identified *Fusarium sporotrichoides* as the causal agent of the disease. Addressing this threat, this study aims to evaluate the effectiveness of the widely used synthetic fungicides, trifloxystrobin, metalaxyl+fluazinam, and difenoconazole alongside innovative biological agents comprising of three combinations of lactic acid bacteria (*Lactobacillus plantarum*, *Lactobacillus rhamnosus* >103CFU/g), phototrophic bacteria (*Rhodopseudomonas palustris* >103CFU/g) and yeast sugar molasses (*Saccharomyces cerevisiae* >103CFU/g), marked as: EM1, EM5 and EM AGRO, using in vitro methods. Minimum inhibitory concentrations (MIC) were determined via microdilution tests in 96-well plates, with spore suspensions adjusted to 5x104 in 100 µl per well, incubated at 25°C for 5 days. MIC values were analyzed using STATISTICA v.7, with Duncan's multiple range tests to differentiate the means at $p<0.05$. The highest degree of inhibition for *F. sporotrichoides* was demonstrated by difenoconazole (MIC: 0.13 µg/ml) and a combination of metalaxyl and fluazinam (MIC: 3.63 µg/ml). Trifloxystrobin showed a moderate inhibition (MIC: 15.00 µg/ml). All three combinations of lactic acid, phototrophic bacteria and yeast sugar molasses showed a significant antifungal effect against *F. sporotrichoides* (MIC<50.00 µg/ml). The microbial mixture EM5 demonstrated the highest potency (MIC: 38.80 µg/ml). This study not only validates the effectiveness of these antifungal strategies against Fusarium wilt in blueberries, but also encourages a balanced approach to combating this disease. Combining chemical and biological treatments contributes to the preservation of ecosystems and human health by reducing the effect of chemicals and enhancing food safety.

Key words: blueberry, *Fusarium sporotrichoides*, synthetic fungicides, biological agents

P1_21

Diversity of Coccinellidae in colonies of soft scales (Hemiptera: Coccidae)

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Abstract

The ladybird beetles (*Coleoptera: Coccinellidae*) is one of the most important predatory groups in biological control of soft scales, which are significant pests of many horticultural and agricultural crops. *Coccinellidae* in nature can provide successful control of these pests, especially in environments where chemical control measures are not applied. This study was carried out to determine the *Coccinellidae* species and their preys (*Hemiptera*: *Coccidae*) in Serbia. The samples were collected from perennial plants, including fruit trees, vines, forest trees, shrubs, and ornamental woody plants. Predator larvae collected with scales were reared individually in petri dishes in order to prevent cannibalism. Eclosed ladybugs adults were mounted on cards, and identified using the Bieńkowski (2018) key. Total of 163 individuals were collected and 8 species belonging to 7 genera were identified. The most common species of predator were *Exochomus quadripustulatus* L. that was reared from 16 species of soft scale species and *Harmonia axyridis* Pallas, which has been identified on nine *Coccidae* species. Also, these two species were the most numerous in the soft scale colonies. A total of 117 individuals *E. quadripustulatus* and 22 individuals of *H. axyridis* were reared. Other species, *Chilocorus bipustulatus* (L.), *Chilocorus renipustulatus* (Scriba), *Coccinella septempunctata* L., *Hippodamia variegata* (Goeze), *Propylea quatuordecimpunctata* (L.) and *Scymnus abietis* Paykull, were represented individually in soft scale colonies. Ladybirds were present in *Coccidae* colonies throughout the year, with young larvae feeding on eggs or first instar nymphs of *Coccidae*, and older larvae and adults feeding on all developmental stages of the host. The future research should be focused on the study of individual Coccinellidae species and their role in the reduction of harmful *Coccidae*.

Key words: Coccinellidae, natural enemies, *Coccidae*, Serbia

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P1_22

A contribution to the knowledge of true fruit flies (Diptera: Tephritidae) in Serbia

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Abstract

The Tephritidae (true fruit flies or peacock flies) is a very large family with more than 4500 currently recognized species, and the larvae of numerous species are economically important plant pests. Their larvae develop in the fruit of various fruit varieties, causing rapid rotting and complete decay. They can also be leaf miners, borers on stems and flower heads of plants. Adults feed on nectar, honeydew and plant juices. In addition to the three species recorded in Serbia: *Rhagoletis cerasi* (Linnaeus, 1758) (European cherry fruit fly), *R. completa* (Cresson) (walnut husk fly) and *Ceratitis capitata* (Weidemann, 1824) (polyphagous), two more were recently recorded *Anomoia purmunda* Harris, 1780 on *Crataegus monogyna* and *Carpomya (Carpomya) chineri* (Loew, 1856) on *Rosa canina*. Damaged fruits of rose hips and hawthorn were collected during the autumn together with the larvae and brought to the laboratory for examination, photography and further rearing. The fruits were placed together with the larvae in pots with soil in which the larvae pupated. These pots were covered with transparent nets and left in the insectarium until the following year, where the time of eclosion of the imago was monitored. Eclosion of the imago of *C. (C.) chineri* began in early May, that of *A. purmunda* in early June. These flies have one generation per year. The larvae develop inside the fruit and feed on their pulp. After reaching maturity at the end of the summer, the larvae leave the fruit, pupate and overwinter in the soil. The new adults appear the following year. With these research, *C. (C.) chineri* and *A. purmunda* were found for the first time in Serbia.

Key words: Tephritidae, fruit flies, Anomoia, Carpomya, Serbia

P1_23

Learning and memory in nematodes

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Abstract

This literature review examines the methods used to study the learning process in nematodes. Recognizing that the learning process is important for all living beings we wanted to understand how nematodes learn and memorize information. We conducted a systematic review of research, starting with early research conducted in the 1970s, and followed the changes in research methods until 2021, when this topic was also investigated at the molecular level. Since learning is a complex process involving a number of psychological processes (acquisition, retention, memory extinction, and transfer), the study itself requires complexity. Various conditional stimuli such as temperature, oxygen, odor and taste were used in these methods. Using these methods, it was shown that nematodes can learn to avoid odors, tastes and temperatures that do not indicate the presence of food, while at the same time they are able to migrate towards certain odors, tastes or temperatures when they associate these stimuli with the presence of food. Nematodes are not only able to make positive associations with stimuli, but also negative associations, allowing them to avoid potentially dangerous foods. Due to their capacity for associative learning, nematodes are able to acquire knowledge without direct stimulus association, known as non-associative learning. The model organism used in almost all of these methods was the nematode *Caenorhabditis elegans*. Given the effectiveness of all the methods used in the research, we believe that there is an excellent base that can be built upon in future studies, possibly by including other species, like entomopathogenic nematodes, which are increasingly being used as biological control agents and model systems.

Key words: Caenorhabditis elegans, non-associative learning, stimuli, psychological processes

P1_24

Meta-analysis in the hierarchy scientific research logic

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Abstract

Scientific research in horticultural sciences has a specific logic which is necessary to apply in case when researcher intends to achieve a valid results and conclusions. The strength of the scientific argument and evidence depends on both the applied method and method of application. The concept of meta-analysis and the meta-analysis' itself are not widely conducted and are thus scarce in horticultural research. This study is undertaken with the aim to establish meta-analysis and its proper place among other types of research in terms of scientific evidence strength and validity. A review of conducted practical and literature studies was done in order to reach this specified research goal. It resulted in establishing methodologically different study types with regard to the research in horticultural sciences. It also established the hierarchy of the evidential strength of each of the research types. The conclusions were clear in terms of the fact that meta-analysis as the ultimate formal review methodology represents the crown evidence with the highest strength of evidence. This is however still not applied widely in horticultural sciences due to a number of identified factors influencing the decision-making process in the research and practice, and hence that part remains as a subject matter for future studies.

Key words: systematic review, formal systematic analysis, hierarchy of scientific evidence

P1_25

Remote sensing assessment of irrigation impact on vineyard water status

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Abstract

The composition of grapes for wine production is intricately linked to the water status of vineyards during the vegetative period, with water stress significantly impacting grape yield and quality. Current vineyard water status monitoring primarily relies on a variety of soil moisture sensors and remote thermal sensors. This study aims to present spatial vegetation index values derived from a handheld multispectral camera, specifically the Plant-O-Meter (POM), concerning diverse irrigation regimes within an organic vineyard near Belgrade, Serbia. Conducted in 2022, a year-long experiment involved four recordings using POM during different phenophases of the Panonia grape variety. POM utilizes a multispectral source emitting pulse trains of various wavelengths for plant analysis. Three irrigation treatments were applied based on the percentage of crop evapotranspiration (ETc): full irrigation (F - 100% ETc), deficit irrigation (D - 50% ETc), and rainfed (R - 0% ETc), with irrigation norms set at 30 mm for F and 15 mm for D. Soil moisture, measured through standard gravimetric and TDR methods, exhibited the highest values in the F treatment and the lowest in the R treatment. Vegetation indices NDVI (Normalized Difference Vegetation Index) and GNDVI (Green Vegetation Index Normalized Difference) displayed varying values across treatments. NDVI values were 0.68 (F), 0.74 (D), and 0.75 (R), while GNDVI values were 0.63 (F), 0.68 (D), and 0.70 (R). The results highlight the significant impact of irrigation regimes on soil moisture, coupled with unexpected vegetation index values per treatment. The study concludes that the Panonia grape variety demonstrates remarkable tolerance to water deficits, suggesting that some irrigation events during the experiment were unnecessary for the specific terroir conditions. However, considering the potential impacts of climate change, the obtained results may undergo alterations in the future.

Key words: remote sensing, grapevine, irrigation regimes, vegetation indices, soil moisture

P1_26

Fruit characteristics of some walnut cultivars (*Juglans regia* L.)

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Abstract

This study conducted in 2022 evaluated eight walnut cultivars (Chandler, Pieral Lara, Tulare, Champion, Rasna, Šejnovo, Gazenheim 139, and Ovčar) grown in Serbia, revealing variations in fruit and kernel attributes. Fruit weight ranged from 11.27 g (Šejnovo) to 15.13 g (Šampion), while kernel weight varied between 5.16 g (Ovčar) and 7.81 g (Tulare). Additionally, kernel yield ranged from 44.26% (Rasna) to 53.88% (Tulare). Fruit dimensions exhibited diversity, with lengths ranging from 36.55 mm (Šejnovo) to 48.92 mm (Šampion), widths from 29.17 mm (Šejnovo) to 36.37 mm (Tulare), and thicknesses from 31.23 mm (Šejnovo) to 37.79 mm (Pieral Lara). Chandler, Pieral Lara, and Ovčar showcased a light shell color, with all cultivars displaying moderately rough shells except Pieral Lara. Notably, Tulare, Šejnovo, and Gazenhajm 139 were identified as cultivars with easily breakable shells. Kernel characteristics, including fullness and color, varied among cultivars, with Chandler, Pieral Lara, Tulare, and Ovčar exhibiting lighter kernel hues. Kernel removal ease ranged from easy for Chandler and Tulare to medium for other cultivars. Gazenhajm 139 recorded the highest oil content at 68.17%, while Chandler had the lowest at 56.8%. Gazenhajm 139 also yielded the highest quantity of cold-pressed oil at 54%. Iodine values of cold-pressed walnut oils ranged from 134.5 to 145.6 g J2 per 100 g of oil, while refractive indexes fell between 1.4740 and 1.4750. Acidic values (AV) were generally below 1 mg KOH/1 g of oil, indicating minimal hydrolytic changes, except for Rasna walnut oil (3.7 mg KOH/1 g of oil), which approached the maximum allowed value.

Key words: fruit characteristics, sensory properties, cold-pressed oil

P1_27

The influence of meteorological conditions on the phytosanitary state of vineyards in the Župa wine-growing district (Serbia)

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Abstract

There are 1,054 grape producers and 66 wineries in the Župa wine-growing district. However, no less than 40 wineries have a small annual wine production of up to 20,000 liters and vineyards have an average surface of 0.1235 ha. Such a structure of grape producers and winemakers signifies an economically sensitive group of producers susceptible to the influence of various factors, in particular changing meteorological conditions. This paper presents studies on the number of chemical treatments of vineyards, the incidence of predominant fungal diseases and the extent of the Botrytis cinerea attack. For the years 2021, 2022 and 2023, surveys were conducted among all grape producers in the Župa wine-growing district, namely for 2496 vineyards. The largest share of the number of chemical treatments in 2021 and 2022 was 5 to 6 (76.42% and 61.97%, respectively). The structure of the number of treatments in 2023 showed an equal proportion of 5 and 6 treatments (32.25%) and 7 and 8 treatments (32.24%). However, in 2023, there was also a large proportion of 9 and more treatments in the vineyard (21.44%). Regarding the predominant fungal diseases in 2021 and 2022, there was no significant attack by the pathogens. However, in the rainy year 2023, 85.33% of the vineyards had an extremely strong attack of downy mildew. As far as the occurrence of Botrytis is concerned, there was no significant attack in 2021 (87.62% of vineyards without symptoms), while in 2022 it rained in the second part of the harvest period, and in addition to vineyards without the Botrytis infestation (47.27%), there was a large proportion of vineyards with significant (19.6%) and minor Botrytis infestations (23.44%). In 2023, as many as 26.12% of the vineyards had extremely severe Botrytis attacks, while there was no Botrytis infestation on the grapes in healthy vineyards (56.94%).

Key words: phytosanitary state of vineyards, Župa wine-growing district

P1_28

Characteristics of table grape varieties grown in the Herzegovina region

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Abstract

In recent decades, global production and consumption of table grapes have experienced significant expansion. While grape production for the wine industry still dominates the overall grape production, there is a trend of decreasing demand for wine in the market, accompanied by an increase in interest in fresh grapes and non-fermented grape products. The aim of this study was to investigate the ampelographic characteristics and quality of table grape varieties grown in the Herzegovina region (Mostar). The study included the following varieties: Prima, Cardinal, Supernova, Italia, Victoria, and Matilda. Based on the results of the analysis, inter-varietal differences were observed, as well as variations in the investigated parameters in different years of the study. Minor or major variations were found in several parameters, such as cluster weight, berry count, length and width of berries, total sugar and acidity content, and other parameters. Based on the overall assessment of weather conditions during the study period (2019-2020), it is assumed that weather conditions were one of the main causes of the observed variability in the physicochemical characteristics of the studied varieties. The studied table grape varieties in the Herzegovina region exhibited varietal characteristics that can be considered standard. The question of the success of their cultivation, as well as achieving optimal yields with satisfactory quality, requires the implementation of appropriate agro-technical and ampelotechnical measures.

Key words: ampelographic characteristics of grapes, quality, climate

P1_29

Comparison of the technological and oenological characteristics of the wine grape varieties Jagoda and Muskat ruža

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Abstract

The aim of the research was to present the comparative results of research for the varieties of Jagoda and Muskat ruža grown in the conditions of the Župa vineyard, Serbia. The research included the study of phenological observation, yield, mechanical (ampelographic) characteristics of bunch and berries, qualitative parameters of grape juice-must, physico-chemical analysis and sensory evaluation of wine. For the Muskat ruža variety, a later date was determined for the start of the bleeding phenophase, flowering and berry growth, while the Jagoda variety entered the phenophase of budburst and shoot growth later. In addition, the Muskat ruža variety was characterized by higher fertility with an average of more developed reproductive shoots per trunk (9.2) compared to the Jagoda variety (7.4). When examining the mechanical (ampelographic) properties of the bunch and berry, the Muskat ruža variety had a higher number of developed berries, the average weight of bunch, the average length of bunch and a higher number of seeds in 100 berries. In addition, Muskat ruža variety also had a higher proportion of the bunch stem, the proportion of berry skin, proportion of the seeds and the skeleton of the bunch. The Jagoda variety had a higher average mass of bunch and mass of all berries in a bunch, a higher average width and length of a bunch, a higher average width of a berry. A higher sugar content (21.3%) was found in the grape juice of the Muscat ruža. As far as the physico-chemical analysis of the wine is concerned, the wine of both varieties meets the criteria for the production of wines with protected geographical origin. The wine of the Jagoda variety received a sensory score of 19 points, while the Muscat ruža variety received 17 points.

Key words: Jagoda, Muskat ruža, comparison, grape, vine

P1_30

Agrobiological, economical, and technological characteristics of the Ribier variety depending on the different vine load with fertile buds

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Abstract

The study of the impact of different vine load on the agrobiological, economical and technological characteristics of the Ribier variety was carried out in 2020 and 2021 with the aim of determining the optimal load for this variety. The tests were carried out in the experimental vineyard of the Biotechnical Faculty in Podgorica. Four different vine loads with fertile buds were applied: 8, 12, 16 and 18 buds. The results of this study showed that the applied loads had a significant impact on the examined parameters of the Ribier variety. The obtained results on the average yield of grapes show that the lowest value of this parameter was the variant with a load of 8 buds - 4.2 kg/vine, while the highest grape yield was recorded for the variant with a load of 18 buds (7.0 kg/vine). V1 had the highest average cluster weight (396 g), while V4 had the lowest cluster weight (325 g). The content of sugar in grape juice also varied significantly under the influence of the load on the vines. The highest sugar content was recorded in the variant with a load of 8 buds - 16.1%, and the lowest in the variant with 18 buds - 14.7%. The acid content did not differ significantly between the tested varieties.

Key words: Ribier, yield, cluster weight, sugar, acids

P1_31

Molecular characterization of grapevine rupestris stem pitting-associated virus isolates infecting grapevines in Serbia

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Abstract

Grapevine rupestris stem pitting-associated virus (GRSPaV) occurs worldwide and is often considered to be one of the most prevalent grapevine viruses. It is involved in the graft-transmissible disease rupestris stem pitting of the rugose wood complex, as well as in the vein necrosis and Syrah decline, although its role in all diseases is not yet clear. In addition, GRSPaV is also found in grapevine cultivars in a latent state. After the first detection, two-year survey (2021-2022) was carried out to determine the presence and distribution of the virus in Serbia and to examine its genetic diversity. A total of 55 samples were collected and analyzed by the multiplex reverse transcription-polymerase chain reaction (mRT-PCR) using primers for nine viruses that commonly infect grapevine: arabis mosaic virus (ArMV), grapevine fanleaf virus (GFV), grapevine virus A (GVA) and B (GVB), GRSPaV, grapevine fleck virus (GFkV), grapevine leafroll-associated virus-1 (GLRaV-1), -2 (GLRaV-2), and -3 (GLRaV-3). The presence of GRSPaV was detected in 66.6% of the samples tested in single or mixed infections with GVA, GLRaV-1, -3, GFkV and/or ArMV. For further GRSPaV molecular characterization, seven mRT-PCR positive isolates were selected and a fragment of the coat protein (CP) gene was partially sequenced. Multiple alignments of the sequences revealed nucleotide identities from 83.9% to 97.9%, indicating variability of the GRSPaV population in Serbia. Phylogenetic analysis revealed that genetic variability of GRSPaV comprising three molecular variants is present in Serbian grapevine genotypes. Although GRSPaV is considered a virus of minor importance, the virus may pose a risk for severe decline symptoms caused by either single or complex infections with other viruses. This study has also shown that the virus is highly prevalent in Serbia and that enhanced phytosanitary measures are needed to exclude GRSPaV in vines used for vineyard propagation and planting.

Key words: grapevine, grapevine rupestris stem pitting-associated virus, CP gene, phylogentic analysis

P1_32

Analysis and comparison of metaphase chromosomes in some varieties and crossing combination of grapevine

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Abstract

In R. N. Macedonia has a large number of autochthonous and introduced cultivars of grapevine that represent precious genetic resources, especially with positive properties, for obtaining new cultivars of grapevine. Our research results are presented from the analysis of metaphase chromosomes of four grapevine cultivars (dattier, drenok, vranec and smederevka) and one crossing combination (dattier x vranec). Investigations were performed during the period of 2018-2020 year, in Skopje vineyard region. Examined cultivars and crossing combination of grapevine are mainly characterized with 2n = 38 chromosomes. Determination of the chromosome number was conducted during mitoses-cyclus. For analysis of somatic chromosomes were used meristems of small roots (5-10 mm) from the seed on examined cultivars. Investigation and observation of grapevine chromosomes is difficult. They are small and do not scatter well through the cell surface during squashing, because of the density in the cytoplasm. The examined materials were treated with the method of Thio and Levan, and standard “Squash” method of Battaglia. The method is suitable for accurate counting but not for investigation morphological differences between chromosomes. The aim of the researches was only determination of the chromosome number and ascertainment possible differences between the examined cultivars and the crossing combination.

Key words: chromosomes, number, metaphase, determination, crossing combination

P1_33

Berry physical properties of grapevine cultivars Muscat Hamburg and Nada during ripening and storage

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Abstract

In the last 20 years, table grape global production has increased by 70%. Physical properties such as berry size, color and firmness are important traits for successful display of table grapes on the market. Two table grapevine cultivars were examined in this experiment: i) Nada - seedless and fungus tolerant cultivar released in Sremski Karlovci and ii) Muscat hamburg. Following parameters were weekly monitored during ripening (season 2023), harvest, cold storage and after shelf life: berry weight, berry size, berry firmness, color and total soluble solids. The sample (during the ripening period and harvest) was composed of 30 randomly selected berries. Berries were stored 6, 12, and 18 days in cold storage with a normal atmosphere (temperature 2±1°C, relative humidity 70±5%) before individual berry analyses. Subsequently, after 6, 12, and 18 days, additional berries were taken out from cold storage and exposed for three days to shelf life at room temperature (24 ± 2°C) before individual berry analyses. Berry weight increased during ripening in both cultivars. At harvest Muscat Hamburg had higher average berry weight compared to Nada (4,4 and 2,8 g, respectively). During storage and shelf-life Nada berry weight was significantly lower compared to harvest in almost all measurement point dates (5 out of 6). Change in berry firmness during ripening was similar in both cultivars. The berry firmness of Nada was higher compared to Muscat hamburg. Total soluble solids in both cultivars increased during the examined period from verasion (15,6% Muscat hamburg; 15,4% Nada) to later sampling point dates (24,5% Muscat hamburg – after 18 days cold storage; 26,3% Nada - after 12 days cold storage + additional three days at room temperature).

Key words: table grapes, ripening, berry physical properties, storage, shelf life

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P1_34

Extraction of individual phenolic acids during vinification of Cabernet Sauvignon grape variety

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Abstract

During winemaking, different classes of phenolic compounds are extracted from the solid parts of the grapes and processed into wine. Various factors can affect the extraction and final content in the wine, e.g. grape variety, temperature, vinification technique, maceration, yeast and enzyme addition, etc. In this study, the focus was on certain phenolic acids (caffeic acid, vanillic acid, p-hydroxybenzoic acid, protocatechuic acid and ellagic acid), which are among the most important non-flavonoids of grape berries. The wine was obtained after prolonged maceration during the spontaneous and inoculated fermentation of Cabernet grapes. Two fermentations were carried out, one spontaneous and one inoculated, and the maceration lasted 0, 3, 5, 7, 14 and 21 days respectively. The grape must be inoculated with the yeast strain Saccharomyces cerevisiae (BDX, Lallemand, Canada) and K2S2O5 (10 g per 100 kg) was added in both vinifications. The wine samples were prepared for LC-MS/MS analysis by solid phase extraction. An exponential increase was observed for all phenolic acids measured. Among these compounds, p-hydroxybenzoic acid required only 3 days for its maximum extraction (1.0485 mg/l) during BDX vinification. In contrast, spontaneous vinification required 8 days of maceration for maximum extraction. The highest extraction value for caffeic acid was achieved on the 12th day of maceration at 5.831 mg/l in spontaneous fermentation. Inoculated vinification contributed to higher extraction values for vanillic and protocatechuic acid than spontaneous vinification. For ellagic acid, maximum extraction was observed at the end of the maceration period (day 21). This study offers a perspective for future research and practical application in the wine industry with the aim of obtaining wine with high phenolic content.

Key words: phenolic acids, vinification, maceration, red wine

P1_35

Color intensity and tonality of wines from selected Prokupac grapevine variety genotypes in the Župa wine-growing district (Serbia)

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Abstract

Due to the genetic characteristics of autochthonous Serbian red wine variety Prokupac, which yields light red wines, improvement of color intensity through addition of small quantities of colored wine produced from grapes of other grapevine varieties is a common oenological practice. Precisely with the aim of selecting prospective genotypes of this variety with more favorable wine color intensity, wines from which could be marketed in the future as monovarietal wines, research was carried out on 16 previously selected genotypes of the Prokupac wine variety from the Župa wine-growing district (PDO Tri Morave, Serbia), in particular, eight genotypes from the Latkovac locality (mark: L) and eight genotypes from the Drenča locality (mark: D). This paper presents the results of the analysis of color intensity (A420, A520, A620 and total color intensity) and tonality of wines produced from selected genotypes of the Prokupac wine variety from the 2019 and 2021 vintages. The analyzed wines were produced by microvinification in the Centre for Viticulture and Oenology in Niš. Color intensity and wine tonality of all samples from both vintages were analyzed in 2024, through application of the WineScan™ SO2 interferometer. Taking into consideration that values of individual and total color intensity, as well as wine tonality from grapes of the 16 selected genotypes of the Prokupac variety covered a wide range, certain genotypes were selected as particularly positive, especially the genotypes with marks 10 D, 12 D, and others from the Drenča locality, as well as genotype 2 L, and others from the Latkovac locality. These genotypes could be characterized as prospective and could be used for further research with the intention of future production of monovarietal wines with better coloration, without the need for coupage with more intensely colored wines produced from grapes of other grapevine varieties.

Key words: Prokupac, wine, color intensity, wine tonality

P1_36

Physical and chemical properties of grape molasses produced from Vranec grape variety by traditional and industrial techniques

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Abstract

Grape molasses is one of the popular and traditional food in the North Macedonia for the last 10 years. It is mostly produced in a traditional way under the name "Madžun". In this study, some physical and chemical properties of grape molasses (Madžun) from Vranec grape variety, produced using traditional (four samples) and industrial (one sample) techniques were investigated. The water-soluble dray mater contents of the samples were determined to be 61.67% (V5) to 75.17% (V2). The mean total sugar contents of the grape molasses (Madžun) samples were determined to be 47.27% (V5) and 72.42% (V3). Sucrose content in all samples was at the detection threshold (<0.1%). This indicates that no sugar was added in the production of grape molasses (Madžun). The total phenols (gallic acid) were identified in five samples and significant differences were observed between samples. Sensory analysis of the samples was carried out by a committee consisting of 7 members. All members are women with experience in sensory evaluation of plant-based foods. The following elements were evaluated: color, smell, taste, sweetness, acidity, texture and aftertaste. The maximum number of points is 20 (modified hedonic test). Based on the results of the sensory evaluation, we concluded that the highest score of 17.92 points is sample V3- the best grape molasses (madžun) produced using traditional technique.

Key words: grape molasses, sugar, total phenols, total acids, sensory evaluation

P1_37

Selection of the optimal lettuce cultivar to agronomic traits in summer production using multicriteria decision-making MABAC method

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Abstract

Five lettuce cultivars ('Kiribati', 'Tourbillon', 'Carmesi', 'Lianabel', and 'Biondonna') were grown in the open-field experiment during the summer of 2018. The aim was to find the optimal summer lettuce cultivar according to morphological and production parameters, suitable for the fresh market and food industry processing by applying the MABAC (Multi-Attributive Border Approximation Area Comparison) method. The correlation analysis was carried out to reduce the number of criteria that have high coefficient values and a double influence on the ranking results. The study involved five alternatives (cultivars) and five different criteria regarding morphological parameters (rosette height, rosette diameter, rosette fresh weight, number of leaves, and stem height). Weight coefficients were determined using the AHP (Analytic Hierarchy Process) method while the stability of the obtained ranking list was determined by applying sensitive analysis through six scenarios. According to the selected criteria, the obtained results showed that the green cultivar A2 - 'Tourbillon' has the best results, while the least favorable results were obtained by the red cultivar A4 - 'Carmesi'. Furthermore, this study tends to facilitate cultivar selection by farmers to avoid economic losses and sustain the required quantity and quality standard demands for the fresh product and food industry market.

Key words: lettuce, summer, MABAC, morphology, biomass

P1_38

The Effects of White and Blue Light Exposure on Winter Lettuce Seedlings

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Abstract

Green leaf lettuce (*Lactuca sativa* L.) is the most widely cultivated plant globally and one of the most consumed vegetables in the human diet. However, lettuce growth can be slow under low-light greenhouse conditions, such as those found in the Balkans winter. With the aim to study the effects of monochromatic blue (MBL) and multispectral white lighting (MWL) on Genesis and Jukebox lettuce cultivars seedlings development, we used light-emitting diodes (LEDs). The cultivation in a greenhouse under only natural lighting served as the control. The research was conducted at the Institute for Vegetable Crops Smederevska Palanka, Serbia. In the phase of three leaves, plants were placed in plant growth chambers (three containers per LED), while three containers were kept in the greenhouse. Plants were cultured in plant growth chambers for 25 days with a 9/15h and 10/14h (day/night) photoperiod, to simulate outdoor conditions. Morphological growth parameters were measured on the 11th and 25th days. Chlorophyll content was measured on the 4th, 11th, 18th, and 25th days after plant removal to plant growth chambers. Based on the results, Genesis lettuce seedlings acclimated to MBL by increasing biomass production and number of leaves after 11 days, while after 25 days, growth parameters and chlorophyll content were significantly increased compared to control. Under MWL, biomass production was lower compared to MBL, and higher compared to greenhouse. Jukebox lettuce seedlings grown under MBL produced higher biomass than those grown under MWL and standard greenhouse conditions. Chlorophyll content was significantly higher under MWL compared to MBL and greenhouse after 25 days. However, plants grown under MBL started to elongate and deform after 10 days. Therefore, we recommend exposing Genesis and Jukebox seedlings to MBL for no more than 10 days to produce quality seedlings. At MWL, plants can be held for 25 days.

Key words: genesis cultivar, jukebox cultivar, led light, plant development, chlorophyll content

P1_39

Effects of mulching on the productivity of lettuce (*Lactuca sativa* L.) in open field summer production

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Abstract

The production of lettuce in the open field during summer is still much lower than that during spring and winter. Given that there are lettuce cultivars that are resistant to sprouting and form heads even at higher temperatures, this type of production is a good basis for the presence of fresh lettuce in the market during summer period as well. At the same time, the use of mulch in field production has become standard practice. Therefore, this study aimed to examine whether mulch influences the productive characteristics of lettuce grown in open fields. Plastic mulch, wheat straw, and two lettuce cultivars (Radian F1 and Vignola F1), intended for summer production, were used. The plant (rosette) weight, relative leaf water content, leaf chlorophyll content and average nitrate content were examined. Statistically significant differences were observed between the cultivars, and mulch treatments for all tested parameters. The highest average rosette weight was measured for black foil, whereas the lowest average weight was measured for wheat straw. The relative water content (RWC) was the lowest in the control (74.091%), whereas the highest average RWC was recorded in wheat straw and black foil (96.86%). In addition, Radian F1 plants on black foil had the highest average total chlorophyll (40.65 SPAD), whereas the lowest average chlorophyll values were recorded for Vignola F1 in the control (25.723 SPAD). The average nitrate content in the lettuce leaves ranged from 140 to 860 ppm.

Key words: lettuce, mulch, chlorophyll content, RWC, nitrate, rosette weight

P1_40

Effect of mulching and fertilizing on yield and quality of kohlrabi (*Brassica oleracea* var. *gongylodes* L.)

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Abstract

Kohlrabi is a short vegetation vegetable species from Brassicaceae family. In 2010 was examined influence of soil mulching with black polyethylene film and fertilizing on yield and quality of kohlrabi. The trial was carried out during May and June on the experimental field of Agricultural Extension Service Sombor at the Toplana location. The two-factor experiment was set up in split-plot method in four replications. The main plots (factor A) include experiment without mulching (control) and experiment with mulching with a black polyethylene film. The sub plots (factor B) were fertilization treatments: 1. control - without fertilization (K); 2. mature cattle manure (CM), 3. composted pig manure (PM), 4. NPK fertilizer. Soil mulching with black polyethylene film significantly increased kohlrabi total yield (20.8%) compared to unmalched control. In average, all fertilization treatments achieved higher swollen stem weight compared to the control without fertilization. Average swollen stem weight on mulched plots was 310.8 g and 18.4% higher than control without mulch. All fertilization treatments achieved higher dry matter content compared to the control without fertilization. Based on the obtained results black polyethylene mulch should be used in mid early kohlrabi production.

Key words: kohlrabi, black polyethylene film, total yield, stem weight, organic fertilizers

P1_41

Influence two different types of fertilizer on Lettuce (*Lactuca sativa* L.) in a hydroponic system

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Abstract

Lettuce (*Lactuca sativa* L.) is one of the most popular leafy vegetables used in human nutrition. Owing to its nutrient and mineral content, and high concentrations of vitamins and fibers, lettuce is considered as beneficial for human health. The short growing season makes lettuce convenient for growth in hydroponic greenhouses. This paper aimed to study the effects of different mineral fertilizers on development and chlorophyll content in lettuce cultivated in controlled hydroponic systems. The research was carried out during January-February 2024 at the Institute for Vegetable Crops Smederevska Palanka, Serbia. The commercial lettuce cultivar "Jukebox" was cultivated for 30 days in a peat substrate, in a hydroponic system with artificial illumination. For lighting, we used light-emitting diodes (LEDs). Plants were illuminated with 40% multispectral white light (350-700 nm) at the temperature of 23 ± 2ºC and photoperiod of 8/16h (day/night). The experiment was set up in three replicates. The treatments were: Commercial fertilizer (CHF) intended for hydroponic production and soluble mineral fertilizer (SMF) which was alternative fertilizing treatment, were used. For the first 15 days, the experiment was watered every day for 15 minutes, later watering was done twice a day for 15 minutes at intervals of ten hours. After 30 days of cultivation in a hydroponic system, growth parameters (biomass and number of leaves) and chlorophyll content were measured. The CHF treatment significantly ($p \leq 0.01$) increased the mass of the plant (13.94g) comparing to SMF treatment (9.79g). The values of leaf chlorophyll content were significantly higher on the CHF treatment (26.43 SPAD) comparing to SMF treatment (22.18 SPAD) on the lower level of probability ($p \leq 0.05$). Nevertheless, the differences in mass and chlorophyll content indicate that the nutrients in CHF are better used compared to the SMF treatment.

Key words: lettuce, fertilizer, treatments, hydroponic

P1_42

Yield of foreign spinach hybrids in greenhouse production

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Abstract

Spinach (*Spinacia oleracea*) belongs to the group of leafy vegetables very important in human nutrition. It is a rich source of vitamins, minerals, fiber, and phytonutrients. In recent years, foreign varieties of vegetables that have not yet been sufficiently tested for cultivation in the climatic conditions of the production regions of our country have been rapidly entering Serbia. It is dominantly grown in protected areas. The aim of this work was to perform a comparative examination of some introduced hybrids of spinach indoors, from the aspect of yield, as well as adaptability and the possibility of cultivation in greenhouse production in the agro-ecological conditions of Raška (Panojeviće). The area of the experimental field was 112 m^2. Solomon F1 and Rembour F1 hybrids originating from the Netherlands were tested in the experiment. Experiments were carried out during 2021 on vertisol soil type according to the principle of a random block system in four repetitions. Different amounts (0, 5, 10, 15 g m^{-2}) of nitrogen in the form of urea were applied as top dressing, different amounts of chicken manure (0, 3, 6, 9 kg m^{-2}), as well as combinations of chicken and cow manure. (0, 5, 10, 15 kg m^{-2}). Standard agricultural techniques were applied, as for regular spinach production, as well as micro-fertilization. The highest yield (3.6 kg m^{-2}) was achieved in the treatment of the combination of application of 9 kg m-2 of chicken manure and 15 kg m^{-2} of cow manure in the Solomon variety. The obtained results show a significant increase in the yield of spinach with the use of suitable hybrids as well as with the use of the optimal amount of fertilizer. In addition, the good adaptability of the hybrid for indoor production in the investigated area was also determined.

Key words: spinach, hybrids, feeding, nitrogen

P1_43

Total phenolic content in fruits of pepper accessions from the Gene Bank of the Republic of Srpska

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Abstract

Pepper *(Capsicum annuum* L. 1753) is considered one of the most popular and useful vegetables worldwide, native to tropical America and belonging to the nightshade family Solanaceae. It has impressive nutritional profile containing numerous vitamins, mineral and antioxidants. The aim of this research was to determine diversity of pepper collection from Republic of Srpska according to fruit total phenolic content. The seeds of 13 pepper accessions were acquired from the Gene Bank of the Republic of Srpska and the experiment was established in the field at the Institute of genetic resources using standard agricultural practices. Samples containing total of 10 fully ripe fruits from 10 plants within one accession were collected, homogenized and stored at -20°C until analyses. The determination of total phenolic content was performed according to Singleton and Rossi (1965) spectrophotometric method based on the reaction of phenols with the Folin-Ciocalteu reagent, by measuring the absorbance at a wavelength of 765 nm. The results showed that accession GB00863 was identified to have the highest content of total phenolics, while the accession GB01130 had the lowest content of total phenolics. Average phenolics of pepper collection amounted 11.64 mgGAE/gFW. Based on these preliminary results, a significant diversity within the pepper collection from the Gene Bank of Republic of Srpska is evident regarding the fruit total phenolics. The next step in biochemical characterization of this pepper collection should be determination of the antioxidant activity.

Key words: collection, biochemical characterization, spectrophotometry

Acknowledgement: This research was financially supported by Ministry of Scientific and Technological Development, Higher Education and Information Society of Republic of Srpska trough the project "Characterization of pepper genetic resources from Gene Bank of Republic of Srpska" (contract number: 19.032/961-82/23 (29.12.2023.)).

P1_44

Mutation breeding of common bean accession Niska Boranija (*Phaseolus vulgaris* L.) from the Gene Bank of Republic of Srpska

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Abstract

Agricultural production faces many challenges due to climate, environmental and technological changes which negatively effects on quantity, quality and availability of agricultural products. The scientific community strives to contribute reduction of these phenomena thought the application of genetic and biotechnological methods as well as using genetic resources in the breeding programs. Within the Institute of Genetic Resources of University of Banja Luka, there is a Gene Bank of Republic of Srpska with very diverse and valuable genetic material for the breeding programs especially for mutation breeding. In this research, total of 6000 seeds of Niska Boranija (two groups x 3000 seeds) accessions were selected from the Gene Bank of the Republic of Srpska and irradiated in the Plant Breeding and Genetic Laboratory in Seibersdorf (International Atomic Energy Agency - IAEA) with two gamma ray doses (80 and 200 Gy). Obtained mutant seeds (M1) were sown in the spring of 2023 in the field and order to obtain first mutant plants. Screening of germination was done and according to the irradiation treatments results were: 11.66% (irradiation with 80Gy) and 0.47% (irradiation with 200Gy). Harvesting of first mutant plants were conducted in the summer of 2023. Seeds irradiated with 80Gy gave an 11.742 seeds and seeds irradiated with 200Gy gave a 1.715 seeds. Obtained mutant seeds (M2) were stored in the Gene Bank and they will be basic material in the next breeding steps. These results present first steps in the mutation breeding in the Republic of Srpska and Bosnia and Herzegovina. Further research will contribute development of mutant lines to ensure the sustainability of the food crop improvement. These results are part of the project RER5024 - Enhancing Productivity and Resilience to Climate Change of Major Food Crops in Europe and Central Asia supported by International Atomic Energy Agency).

Key words: mutants, irradiations, lines, germplasm

P1_45

Significance and reason for the established plantation production of sremuš (*Allium ursinum* L.) in the Republic of Serbia

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Abstract

Plants of the genus Allium from the family Alliaceae have occupied an important place in nutrition, traditional, and modern medicine since ancient times. In addition to the well-known cultivated species of garlic and onion, the genus Allium also includes other species: spring onion (*Allium ursinum* L.), winter onion (*Allium fistulosum* L.), leek (*Allium ampeloprasum* L.), chives (*Allium schoenoprasum* L.), Chinese chives (*Allium tuberosum* L.). In the Republic of Serbia, out of about 4,000 species present in the flora, about 70 are used as cultivated and wild vegetables. Of the wild onions, only bear's onion or sremuš (*Allium ursinum* represented here only with the subspecies ucrainicum) is used in the diet. Sremuš is a native wild species and requires special growing conditions. The objective of this study was to point out the importance and potential of sremuš production in the Republic of Serbia, especially in organic agriculture. For food purposes, the fresh or dried above-ground part (leaf) of sremuš or bulbs is most often used as an addition to salads or stews. Biological activities in sremuš related to the content of sulfur compounds. Alin and its derivatives are responsible for the characteristic taste and smell of sremuš and the manifestation of anticancer activities. According to the data of the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia, organic sremuš production covers only 0.001 ha, specifically in the Južnobački district of the province of Vojvodina. Taking into account the legal regulations that limit the exploitation of this raw material in natural habitats, there is a great demand for sremuš, which has a good market price. There is an assumption that the need for plantation cultivation of sremuš in the future on the territory of the Republic of Serbia will be increasing.

Key words: sremuš, areas, organic production

P1_46

Growing technology of *Allium* species widespread in the Serbia

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Abstract

The genus Allium belongs to the Amaryllidaceae family and represent the biggest genus of monocotyledonous plants. The genus includes a large number (over 1000) of species that are widely used as vegetables, spices, medicinal and ornamental plants. Regardless of the variety of species, their use and cultivation are mainly of a local character, except in the case of onion (*Allium cepa* L.) and garlic (*Allium sativum* L.), which are globally known and have a use in the diet all over the world. In addition to onions and garlic, the following species are grown in the Serbia: leek (*Allium ampeloprasum* L.), Welsh onion (*Allium fistulosum* L.), chives (*Allium schoenoprasum* L.), shallot (*Allium ascolanicum* L.) but on smaller surfaces compared to onion and garlic, or at backyards and hobby gardens. Depending on the selected species, cultivation begins in autumn (October) or in spring (February-March). Cultivation of onion and garlic, as the most abundant Allium species, for production of dry bulbs, primarily start in spring. In the case of onion, growers prefer to produce commercial onion crops from little bulbs, rather than seed. On the other side, garlic are propagated only vegetative, by planting cloves, because, and today garlic varieties are completely sterile and they don't produce seeds. Leek, Welsh onion and chives are produced by transplants while field seeding is not recommended. Shallot, as a perennial Allium species produces a cluster of small, pointed bulbs from a single planted bulb. In general, alliums require fertile, well-drained, slightly acid (pH 6.0-6.8) soils. In addition, crop rotation is very important in Allium cultivation. Currently, the topical issue in Allium cultivation is related to the establishment of growing technologies that ensure high yield, good quality and high nutritional value of alliums, among which biofortification stands out.

Key words: Alliums, cultivation, growing technologies, Serbia

P1_47

Morphometric and color characteristics of garlic accessions (*Allium sativum* L.) in the Agricultural Institute of Slovenia

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Abstract

Garlic from the Alliaceae family is a vegetatively propagated bulbous crop with great morphological diversity. It is used worldwide as an important spice in the culinary and in traditional medicine. The garlic accessions managed in the Slovenian Plant Gene Bank at the Agricultural Institute of Slovenia were studied based on various morphometric and color characteristics of the bulbs and cloves. A total of 49 garlic accessions were grown and evaluated in the experimental fields of Infrastructure Centre Jablje in 2023. Numerical descriptors included bulb weight, height and diameter, height/diameter ratio, number of cloves and clove size. Qualitative descriptors included ten UPOV descriptors related to the pseudo stem (flowering stem), bulb (size, ground color of dry external scales, anthocyanin stripes on dry external scales, number of cloves) and clove (size, color of scales, intensity of color of scales, anthocyanin stripes on scales, color of flesh). Results showed significant differences between the accessions in terms of bulb size and color parameters. Bulb weight ranged from 8.6–54.1 g, bulb height from 26.5–45.8 mm and bulb diameter from 31.4–58.9 mm. The average number of cloves was 10 ± 3 and the weight of the cloves was 3.0 ± 1.2 g. The predominant bulb ground colors of the dry external scales were white and yellowish white, 31 and 18 accessions, respectively. The clove colors of the scales were predominantly pink/purple, pink/purple/brown, brown, cream/pink or cream, with anthocyanin stripes on the scales present in nearly 75% of the accessions. The highest coefficients of variation were observed for bulb size (49.6%) and clove size (39.6%) and the lowest for height/diameter ratio (6.2%). The data obtained and the variability of the traits studied indicate that garlic accessions require further in-depth agromorphological, nutritional and genetic analyses to identify the best candidates for future breeding proposals.

Key words: accession, *Allium sativum*, garlic, morphometric descriptor, color parameter

P1_48

Incidence and genetic diversity of garlic common latent virus infecting garlic in Serbia

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Abstract

Garlic (*Allium sativum* L.) has been cultivated as a vegetable for over 5000 years. In Serbia, garlic farming occurs across various geographic regions, with the main cultivation area being the Vojvodina province. Viruses pose a significant threat to garlic crops, especially due to ability to spread easily through vegetative propagation. Garlic plants are susceptible to infection by viruses from three main families: Potyviridae (genus Potyvirus), Betaflexiviridae (genus Carlavirus), and Alphaflexiviridae (genus Allexivirus). Among them, garlic common latent virus (GarCLV) stands out as one of the most prevalent viruses affecting garlic. Despite often showing no visible symptoms, GarCLV plays a crucial role as a synergistic agent, particularly when combined with other plant viruses, notably potyviruses. The first report of GarCLV infecting garlic in Serbia was reported in 2011, but the extent of its incidence and genetic diversity remained unclear. In this study, 130 garlic plants were collected and tested for the presence of GarCLV by double-antibody sandwich (DAS)-ELISA using commercial diagnostic kit (Bioreba, AG, Reinach, Switzerland). After detection of GarCLV presence through ELISA, further confirmation, and molecular characterization two selected samples was carried out using RT-PCR with GarCLV-specific primer pair, 1-GCLV and 2-GCLV, which amplified a 960-bp fragment of the entire coat protein (CP) gene. The amplified products were purified, sequenced in both directions using the same primer pair, and deposited in GenBank (Acc. No. KP208802 and MK814828). The serological results showed a high prevalence of GarCLV in garlic crops in Serbia, and the phylogenetic studies showed that GarCLV isolates exhibited significant genetic similarity and were grouped in the same cluster. Considering that GarCLV is mainly transmitted through propagation material and the risk of a synergistic effect due to mixed infections with other garlic viruses, special measures should be taken to control impact of this virus on garlic production.

Key words: garlic, garlic common latent virus, RT-PCR, ELISA, phylogenetic analysis

P1_49

Effect of different extraction methods on the content of trypsin inhibitors in common bean pods

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Abstract

The common bean (*Phaseolus vulgaris* L.) is an excellent source of protein, calories and essential micronutrients. However, the absorption of these nutrients is subject to many variables, including the presence of antinutrients such as trypsin inhibitors (TIs), which can interfere with nutrient absorption. TIs may also serve as a natural plant defense mechanism against various pests, so determining their content in pods could lead to a better understanding of their distribution and their potential impact on disease resistance. Common beans, which are grown not only for their dried seeds but also for their edible, immature and tender pods, are known as snap beans (syn. French beans, green beans, string beans). Different methods for extracting TIs from the fresh pods of five common bean genetic resources (three breeding lines, two varieties) were investigated to accurately measure trypsin inhibitor activity (TIA) and related traits such as percentage of trypsin inhibition (%TIn), Trypsin Units Inhibited (TUI), TUI/mg sample and µg Trypsin Inhibited/mg sample (µg TId/mg sample). Four extraction methods were used: (i) ultrasonic-assisted extraction (UAE) for 15 min and (ii) for 30 min, and (iii) shaking-assisted extraction for 60 min and (iv) for 180 min. The results showed a significant increase in TIA-related traits in UAE compared to shaking extraction, with the 15-min ultrasonic procedure showing better efficacy than the 30-min ultrasonic procedure. Breeding line 228_4aa_ca showed the highest TUI and TUI/mg sample after 15-minute extraction by UAE. In addition, significant correlations were observed between TUI, TUI/mg sample and %TIn. The results provide valuable insights into the relationship between bean genetic resources, extraction methods and trypsin inhibitor content in common bean pods and serve as a basis for the refinement of extraction protocols.

Key words: bean pods, extraction method, pH maintenance, trypsin inhibitor activity

P1_50

The effect of *Bacillus spp*. isolates and calendula extract on tomato yield

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Abstract

In recent years, in order to protect the environment and food safety, intensive work has been done on the development of biological fungicides, nematicides and herbicides, as well as products based on biological agents and medicinal herbs for plant protection. The aim of this research was to evaluate the effect of the application of *Bacillus spp*. and calendula extract on tomato yield. The experiment was carried out during the 2023 growing season in the field conditions using SP - 109 genotype of tomato, selected at the Institute for Vegetable Crops Smederevska Palanka. Tomato seedlings were produced in a greenhouse and were planted in the field at the end of May. The experiment was laid out in a random block system, with four replications. The number of plants per main plot was 36. The distance between the rows was 50 cm and between the plants in the row 25 cm. Five treatments were applied three times during the vegetable season (T1 - *Bacillus spp*. isolate 1, T2 - *Bacillus spp*. isolate 2, T3 - Calendula extract, T4 - Fungicide, T5 - Control). The number of fruits per plant in treatments T1 and T4 was 29. It was statistically significantly higher compared to the number of fruits per plant in treatments T2, T3 and T5 (20, 21, 20). Also, the fresh weight of fruits per plant was significantly higher in treatments T1 and T4 (847.7 and 868.5) compared to treatments T2, T3 and T5 (686.7, 680.4 and 634.4). Results of this investigation indicate that the application of biological agents, specifically selected *Bacillus spp*. isolate 1 (T1), can have effects comparable to fungicides, as evidenced by the achieved tomato yield. The future research will include investigations of the impact of *Bacillus spp*. isolates and calendula extract on the nutritional characteristics of tomato fruits.

Key words: tomato, yield, biological protection, *Bacillus spp*., Calendula extract

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P1_51

Survey on the presence of pepino mosaic virus in Republic of Srpska 2019-2023

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Abstract

Pepino mosaic virus (PepMV) is categorizatied in EPPO A2 list no. 369 according regulated pest in the Eueopean Union (EU) based on emergency decision 2004/200/EC. Like most other potexviruses, PepMV has a fairly narrow natural host range among Solanaceous species. Originaly it was described on pepino (*Solanum muricatum*), while mainly affects glasshouse tomatoes (Lycopersicon esculentum). However, considering his distribution in the EU, risk potential analysis, high phytosanitary risk, and widely present Solanaceous species, as main and experimental hosts in Republic of Srpska, PepMV surveys started in 2019. From 2019 until 2023 survey was performed in 6 regional units: Prijedor, Banja Luka, Doboj, Bijeljina, Trebinje, and Istočno Sarajevo, as well from import. In 2019 total 127 samples of host plants were analyzed for the presence of PepMV, in 2020 108, in 2021 99, in 2022 64, while in 2023 total 96 samples of host plants were analyzed. All field- and glasshouse-grown plants, and tomato seeds samples were analyzed in a laboratory for plant protection and biotechnology, in PI Agricultural institute of Republic of Srpska, Banja Luka, in accordance with EPPO protocol: Diagnostic PM 7/113 (1) Pepino mosaic virus Bulletin OEPP/EPPO Bulletin (2013) 43 (1), 94–104. For qualitative detection and identification of PepMV Double antibody sandwich enzyme-linked immunosorbent (DAS-ELISA) is recomended as the initial test of choice. This serological method is folowed by confirmation with DAS ELISA with a different antisera or molecular test, the most common nucleic acid-based tests (Real-time RT-PCR) adapted from Ling et al. (2007) and bioassay. During a survey from 2019 to 2023 negative results for the presence of PepMV were obtained. However, considering that symptoms of PepMV can be extremely variable, ranging from latent to very severe infections, further survey is necessary for excluding a likelihood of entry and their establishment in Republic of Srpska.

Key words: Pepino mosaic virus, regulated pests, survey, Republic of Srpska

P1_52

Efficacy of OSBPI fungicides (fluoxapiprolin and oxathiapiprolin) in the control of cucumber downy mildew (*Pseudoperonospora cubensis*)

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Abstract

Downy mildew, caused by *Pseudoperonospora cubensis* is a very destructive disease of *Cucurbitaceae* plants. The pathogen mainly affects the foliage, however, a reduction in photosynthetic activity in the early growth stages of cucumber leads to stunted plants and severe yield losses, both in the field and in greenhouse cultivation. Chemical measures are most important in downy mildew management. Therefore, fungicides such as inorganic copper compounds, phenylamides, benzamides, phosphonates, QiI, CAA are usually applied at 5-10 day intervals. The aim of this study was to investigate the efficacy of two newly developed OSBPI fungicides, fluoxapiprolin and oxathiapiprolin, in the control of cucumber downy mildew. The trials were conducted during 2022 and 2023 in the open field cropping system at Belosavci site (Serbia), according to EPPO method PP1/65(4). A randomized complete block system with four replicates was used and each treatment block consisted of 10 cucumber plants (hybrid Ajax F1). The efficacy of the following fungicides and their combinations was investigated: Fluoxapiprolin (FXN), oxathiapiprolin, propamocarb-hydrochloride (PCH), PCH+FXN, copper hydroxide+copper oxychloride (CH+CO), CH+CO+FXN, fluopicolide+ PCH, cyazofamid and mandipropamid. A total of four fungicide applications were carried out in each growing season. Disease severity in the untreated plots was severe in both years, 18-71% (2022) and 16-84% (2023). High efficacy was achieved with the application of FXN (92-100%), oxathiapiprolin (94-100%) and PCH (90-100%). Each of the tested combinations of FXN+PCH, CH+CO+FXN and fluopicolide+PCH showed high efficacy in the control of downy mildew (92-100%). Cyazofamid showed slightly lower efficacy in 2023 (79-91%) than in 2022 (92-100%). Significantly higher efficacy of mandipropamid was observed in 2022 (> 89%) than in 2023 (34-61.5%). The efficacy of CH+CO in downy mildew control was low (44-89%). The results obtained in this study indicate that both OSBPI (fluoxapiprolin and oxathiapiprolin) fungicides have a great potential in cucumber downy mildew control.

Key words: Pseudoperonospora cubensis, cucumber, fluoxapiprolin, oxathiapiprolin, fungicide efficacy

P1_53

Present status of *Acidovorax citrulli* - causing Bacterial Fruit Blotch of watermelon fruits in North Macedonia

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Abstract

Acidovorax citrulli is the causal agent of Bacterial Fruit Blotch (BFB) of cucurbit plants. So far, *A. citrulli* has been added to the EPPO A1 List version 2023-09. Despite the economic importance of the disease, little is known about the basic aspects of *A. citrulli* pathogenesis. In the late spring months of 2020 to 2022, the appearance of fruit blotch symptoms on fully ripened watermelon crops, attributed to *A. citrulli* was documented. In our research, we conducted a comprehensive analysis utilizing various methods including observation of fruit symptoms, pathogenicity assessment on young watermelon fruit and seedlings, as well as biochemical tests, ELISA test, and Real-time PCR analyses, all compared with positive controls. As a result of this thorough examination done for the first time, we have conclusively identified the pathogen responsible for the observed symptoms as *A. citrulli*, the causal agent of BFB in watermelon fruits. The bacterium was isolated from fruit tissue and colonies were visible after a few days, such as wet mount formed smooth, round, small cream-coloured, non-fluorescent colonies on King's B medium with basic characteristics such as gram-negative, rod-shaped, aerobic, and oxidase-positive. A total of 20 isolates were subjected to characterization through physiological, biochemical, and pathogenicity tests. For identification and comparison, PCR analyses were conducted using *A. citrulli*-specific primer pairs. In the area under investigation, it was determined that there were substantial economic losses, reaching up to 70%. Because of the costly lawsuits and lack of efficient management, BFB represents a serious threat to the cucurbit industry. As this pathogen is on the EPPO A1 List, we already informed our Ministry of Agriculture, and all the farmers that grow watermelon, about *A. citrulli* that it is very important to implement eradication measures to prevent the further spread of this bacterium across the region.

Key words: fruit blotch symptoms, watermelon fruit, biochemical tests, PCR analyses

P1_54

Natural enemies of *Bactericera trigonica* (Hodkinson) (Hemiptera, Psylloidea, Triozidae)

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Abstract

The carrot psyllid, *Bactericera trigonica* (Hemiptera: Triozidae) is a pest of carrots. It was first found in Spain in 1981. Since then, it has been found in carrot crops in almost all southern European countries. *B. trigonica* has also been confirmed as a vector of *Ca. Liberibacter solanacearum* on carrot and celery plants in Europe. One focus of integrated pest management is the use of sustainable methods of pest control. In order to develop efficient solutions through biological control, it is important to understand the important role that natural enemies play. So far, *Tamarixia pronomus* (Walker, 1839) and Syrphophagus sp. have been found to be parasitoids of *B. trigonica*. The aim of these studies was to find natural enemies of *B. trigonica* that can be used for biological control. The studies were conducted from 2017 to 2021 in carrot crops in Serbia. The carrot plants and the larvae of *B. trigonica* were collected together and brought to the laboratory. Mummified and non-mummified nymphs were divided with a binocular and reared under laboratory conditions until eclosion. Three parasitoids, one hiperparasitoid and one predator species were reared and identified: *T. pronomus*, *Tamarixia upis* (Walker, 1839) (Eulophidae), Syrphophagus sp. (Encyrtidae), *Marietta picta* (Andre, 1878) (Aphelinidae) (as a hiperparasitoid) and *Orius (Orius) niger* (Wolff, 1811) (Anthocoridae). *T. upis*, *M. picta* and *O. niger* were recorded for the first time in association with *B. trigonica*.

Key words: Bactericera trigonica, carrot, natural enemies, parasitoid, Serbia

P1_55

Chemical analysis of pollen of selected tree species by Raman spectroscopy

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Abstract

Palynological information is of taxonomic importance and the use of microscopy is a standard method in pollen analysis. Pollen of different species differ in the chemical composition of the cell wall, so Raman microspectroscopy (RS) may be suitable for pollen identification as a rapid and non-destructive tool for chemical characterization. The aim of this study was to perform chemical analysis of pollen using RS in distinguishing pollen of seven taxa (*Acer sp., Fraxinus sp., Sorbus sp., Salix sp., Quercus sp., Betula sp., Pinus sp*.). RS of pollen was recorded at 532 nm using an XploRA Raman spectrometer. The spectra were pre-processed and subjected to PCA. The obtained Raman spectra in the "fingerprint region" contain information about lipids, proteins as well as the biopolymers of the pollen wall, sporopollenins and cellulose. The signals in the 1630-1560 cm^{-1} range are correlated with phenyl ring vibrations indicating the presence of sporopollenins, which mark the exine of the pollen. The second higher intensity band at ~1440 cm^{-1} along with 1304 and 1162 cm^{-1} indicates the CH2/CH3 vibrations in lipids, while the medium intensity band at 1653 cm^{-1} could indicate proteins. The bands at 1627 and 1547 cm^{-1}, which differ in *Pinus sp*. from other samples, could be from sporopollenins and proteins. According to PC1 and PC2, *Betula sp*. and *Fraxinus sp*. pollen differ from the other samples mainly in terms of sporopolenins (at 1564 cm^{-1}) and lipids (at 1164 cm^{-1}). In the lower range of differences, polysaccharides with loadings below 1000 cm^{-1} have an effect, such as the band at 540 cm^{-1} corresponding to C−C and C−O vibrations. Vibrational spectroscopy enabled the biochemical characterization of pollen and the potential detection of differences between tree pollen samples in combination with PCA.

Key words: pollen grains, 532 nm, sporopolenins, lipids, proteins

P1_56

Influence of agrotextil foil on *Arnica montana* flower yield

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Abstract

Arnica montana is endemic medicinal plant species that, due to its biological activity, is widely used in medicine, pharmacy, and cosmetics, which is why it has a high commercial value. According to legal regulations prohibiting the exploitation of *A. montana* from natural habitats and the limitation of human resources in its production, there is a constant need to improve the technology of its cultivation. Therefore, this study aimed to investigate the effect of agrotextile mulch film on the flower yield of A. montana in the second year of cultivation. *A. montana* seedlings produced at the "Dr. Josif Pančić" Institute from autumn 2021 to spring 2022 were used for the experiment. In the middle of May 2022, a demonstration experiment was set up on Tara mountain (43°54'31.4"N 19°32'22.6"E) on the district cambisol on an area of 10 m^2 with and without the application of mulch at a density of 24 plants/m^2. Due to the successive flowering of *A. montana*, seven harvests were conducted out in the period from the beginning to the end of June 2023. The average flower yield per plant differed significantly in harvests and treatments (with and without agrotextiles), but the highest number of flowers (1.20; 1.18), as well as the yield (30.03; 29.58 g/m^2), was obtained during the fourth harvest. The average yield of air-dried flowers without the use of agrotextiles ranged from 97.15 g/m^2 in the first harvest to the last, whereas a slightly higher yield was achieved with the use of agrotextiles, 105.9 g/m^2.

Key words: growth, yield, mulch, harvest, distric cambisol

P1_57

Medicinal properties of essential oils lavender and benefit for human health

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Abstract

Lavender belonging to the *Lamiaceae* family. Most commonly used species of lavender include *Lavandula angustifolia*, *Lavandula latifolia*, *Lavandula stoechas*, and *Lavandula intermedia* are used for the commercial extraction of essential oil. Essential oils to have many medicinal properties and are used as a part of alternative medicine, in medicine, cosmetics, and aromatherapy. Essential oils offer a safe alternative to relatively risky pharmacological agents. Lavender essential oil is known to be rich in medicinal properties like anxiolytic, anti-inflammatory, antinociceptive, antioxidant, and antimicrobial effects. Herbal products like lavender essential oils may offer a solution to the problem of antibiotic resistance, side effects and drug addiction. These properties make lavender a very useful medicinal herb due to the advent of drug resistance. Utilization lavender essential oils will benefit the patients in many ways. Many studies indicate that lavender essential oil has a positive effect on sleep quality, anxiety relief, reduction of depression condition, influences gradual pain relief, in dentistry, preoperative treatments, obstetrics, burns, and cancer patients as an alternative or adjuvant therapy. It can also be used for treat local infections, as an alternative to antibiotics, in reducing dental anxiety, or to prevent the formation of biofilm on teeth. Due to the vast applicability of the lavender species due to its medicinal properties, there is a need for focused attention to its use in the field of medicine and to contribute to clinical practice.

Key words: herbal products, lavender esential oils, alternative to antibiotics, medicine

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P1_58

Application of yarrow broth in order to reduce the intensity of infection of pot marigold leaf powdery mildew (*Podosphaera xanthii* (Castagne) U. Braun & Shishkoff.)

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Abstract

The paper examined the influence of a plant preparation = broth based on yarrow to reduce the intensity of infection of pot marigold leaf powdery mildew (*Podosphaera xanthii* (Castagne) U. Braun & Shishkoff.). The goal of the work arose from the need for a solution to one of the most economically significant diseases of pot marigold (*Calendula officinalis* L. cv. "Domaći oranž"). This disease is caused by the fungus *Podosphaera xanthii* (Castagne) U. Braun & Shishkoff., which occurs during the cultivation of pot marigold. The location of the research was the collection of the Institute for Medicinal Plants Research "Dr. Josif Pančić" located in Pančevo (44°52'20"N; 20°42'06"E; 74 m.a.s.l.). The experiments were conducted during the growing season in 2022, on the soil of the humogley (black soil), according to a random block system in four repetitions. The size of the plot was 5.0 m^2 (2 x 2.5 m), and the effect of the broth based on yarrow was evaluated according to a scale from 1 to 5 of the presence of disease on the pot marigold leaf. The plants were treated with this preparation in three variants: The first variant - one treatment at the beginning of the disease, the second variant - at the beginning and two weeks after the disease and the third variant - at the beginning, after two weeks and four weeks after the disease. The fourth variant was a control variant, i.e. a variant without the use of broth. During the last treatment, an evaluation of the plants' infection with powdery mildew was made. In the tests, number 1 represented the least sensitivity, and number 5 the most sensitive variant of this disease. After the evaluation of the infection of plants with powdery mildew, the best results were shown by the third variant with the least presence of powdery mildew (on average 1.8 i.p.), the second variant in second place, the first in third place and the control variant in fourth place with the highest presence examined diseases (on average 4.0 i. p.).

Key words: pot marigold, *Calendula officinalis*, powdery mildew, plant preparation, broth

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P1_59

Wild medicinal and aromatic plants in the Manjača region

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Abstract

Thanks to its specific geographical position, climatic and edaphic characteristics, the Manjača region is highly conducive to the growth and development of medicinal and aromatic plants. The primary aim of the research was to conduct an inventory of such plants in the Manjača locality and to determine their abundance, coverage, life form, and flora element for each identified species. The Brown-Blanquet method (1965) was utilized to determine abundance and coverage, while life forms were classified according to Raunkiaer (1934), and flora elements were categorized following Oberdorfer (2001). Floristic research conducted between 2022 and 2023 identified a total of 67 wild plant species, with 25 of them falling under the category of medicinal and aromatic plants. Species from the genera Mentha, Galium, Achillea, and Thymus exhibited the highest abundance and coverage. Hemicryptophytes were the most prevalent in the biological spectrum. Phytogeographical analysis revealed a dominance of species with a wide geographical range.

Key words: Manjača, flora, soil

P1_60

Foliar symptoms of Esca as a sign of vine mortality: A binary logistic regression approach

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Abstract

This research aims to see how temporal dynamics affect the death of vines that previously manifested symptoms of Esca - complex of "trunk diseases" caused by different wood-infecting fungi (*Phaeomoniella chlamydospora*, *Phaeoacremonium aleophilum*, and *Fomitiporia mediterranea*). The situation with Esca disease in our country, every year is variable and depends from variety, climate changes and conditions, and measurement for grapevine protection. For this research, Vranec black grapevine variety was observed, at an experimental field in Smilica, Kavadarci, Republic of North Macedonia. Our initial assumption was to monitor the progress of the Esca disease in vines that displayed interveinal necrosis on their leaves. Due to the inconsistency and fluctuation of foliar symptoms at vines over several years, it is necessary to use a binary logistic regression analysis using IBM SPSS software to analyze and predict the percentage of vine deaths. A binary logistic regression model was chosen because the dependent variable distinguishes between chronic and acute forms of Esca disease, with values coded as 0 and 1. Esca disease is associated with the development of internal wood necroses, which are chronic and acute and discussed in the context of these findings.

Key words: Esca disease, Vranec, foliar symptoms, dead vines, wood necroses

P1_61

Fruit characteristics of some apple cultivars and their clones

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Abstract

Apple is one of the most cultivated fruit trees in the world. Consumers value high quality fruit, with desirable morphological characteristics, good aroma and taste. Given the popularity of red apple fruits, the need for its cultivation is growing. The aim of this research was to analyze the qualitative characteristics of 4 commercial apple cultivars ('Gala', 'Red Delicous', 'Jonagold' and 'Golden Delicous') and their clones ('Schnico Red Gala', 'Scarlet Spur', 'Wilton's', 'Red Jonaprince' and 'Reinders'). Research was carried out on the Radmilovac Experimental Site in a two-year period (2021 and 2022). The following morphological parameters were monitored: weight, height and width of the fruit, index of the fruit, length of the stalk, firmness of the fruit and coloration of the fruit. Also, biochemical parameters were measured: content of soluble solids, total titratable acidity and flavour index. Sensory analysis was performed by scoring fruit attractiveness, taste and aroma. Clones had higher degree of attractiveness due to intense red colour ('Schnico Red Gala', 'Scarlet Spur', 'Wilton's Red Jonaprince') or reduction of rustiness ('Reinders'), in comparison to commercial varieties.In some clones ('Wilton's Red Jonaprince' and 'Scarlet Spur') fruit size was decreased in comparison to parent cultivar. 'Wilton's Red Jonaprince' had the best parameters of biochemical quality –highest soluble solids, titratable acidity and flavor index among all analyzed genotypes. The decrease of quality (soluble solids, acidity and flavor index) is noticed in the clones 'Scarlet Spur' and 'Reinders'. 'Schnico Red Gala' showed the highest increase of sensory properties in comparison to original cultivar ('Gala'). Clone 'Wilton's Red Jonaprince' showed the best overall biochemical quality and sensory traits in comparison to all analyzed genotypes.

Key words: Malus domestica, fruit quality, morphological characteristics

Session 2: Agricultural Economics and Rural Development

Oral Presentations

O2_01

Global food security challenges: Opportunities and threats

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Abstract

Agricultural and food markets have been through other shock waves during the last few years, especially due to the impacts of COVID-19 and Conflict. Such shocks always raise concern about global food security in the near term and long term. Challenges to achieve the Sustainable Development Goals for food security face both opportunities and threats. After the last food security crisis in 2008, much attention was given to our global capacity to feed the world in 2050 and beyond. However, science has continued to bring productivity growth and promises to continue to produce enough calories for growing populations. But what about new and continuing conflicts? What about nutrition deficits? What about climate change effects? Population growth is not expected to outpace food production growth, but what are the remaining future prospects and challenges? Projections for production, trade, and prices will be analyzed along with stochastic analyses that show ranges of possible outcomes. Projections for 2050 from FAO and others are discussed in view of both food security and nutrition security. Nutritional needs are clearly the greater challenge when calorie needs remain a concern in areas of severe poverty and conflict. COVID-19 impacts caused a large setback to what had been slow but continuing progress in food security gains around the world. Conflict continues to be the most intractable near-term challenge in the most food-insecure populations. Climate change is the major challenge, both in terms of near-term episodic threats and the longer-term crop migration and resulting human migration. Policy options will be explored to mitigate prospective threats and promote promised opportunities.

Key words: food security, markets and trade, price analysis

O2_02

Barriers to participate in short food supply chains: preliminary results from the survey among farmers in Poland and the Czech Republic

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Abstract

In the light of natural resource management challenges, the links between short food supply chains and sustainable development cannot be overlooked. Short food supply chains support the economic (e.g. income, product range offered, new jobs in rural areas), social (e.g. heritage, mutual trust between consumer and producer, local quality of life, especially for disadvantaged or peripheral people) and environmental (greenhouse gas emissions, biodiversity) aspects of sustainability. Shortening food supply chains is a strategic objective of the European Union. Against this backdrop, we interrogate challenges in the functioning of short food supply chains using the results from 152 interviews with farmers already participating in SFSCs in Poland and in the Czech Republic. Descriptive statistics were used to analyse the responses. The results suggest that some of the farmers from Poland and Czech Republic do not see any barriers to participate in the short food supply chains. The rest of the farms regardless of the countryindicated the same constraints and problems related to their participation in the SFSCs. Responses differed only in frequency between Polish and Czech farms. These were time-consuming, the need to employ additional staff, the need to be available to customers at all times, and the need to find and keep customers themselves. To the least extent, farmers from both countries complained about the bureaucracy and formal requirements for participating in SFSC, the lack of infrastructure and the low financial resources and profitability of sales through SFSC. In addition, farmers from Poland were almost four times more likely than the Czech ones to emphasize the problem of participation in SFSCs was the seasonality of income.

Key words: short food supply chains, farms, participation, barriers, socio-demographic characteristics

O2_03

Navigating pressure: Corporate social responsibility in Eastern European Agriculture amid growing criticism and protests

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Abstract

The agricultural sector is one of the most criticized sectors in recent decades. In light of global crises like climate change, resource depletion, and widening social inequality farmers and farming enterprises face increased pressure to address their social and environmental impact. These pressures manifest in heightened scrutiny from regulatory bodies and criticisms from diverse stakeholders. The disagreement with these pressures has recently become visible in the nationwide farmers' protests in Germany that extended to a series of protests also in Eastern Europe, e.g. Romania. The phasing out of tax breaks for agricultural diesel served as a specific trigger to spark farmers' anger. Corporate social responsibility (CSR) is a governance mechanism enterprises adopt to address social and environmental issues as well as to exert moral responsibility. The few studies that have focused on CSR activities in these regions have highlighted activities focused on rural infrastructure, health and education services. This paper adopts an institutional theory framework to probe deeper. It aims to elucidate the importance CSR activities for agricultural enterprises in Eastern and Southeastern Europe. In a second step it explores the existence of normative and cultural expectations regarding contributions to rural development. Furthermore, the paper answers how farmers navigate their responsibility between perceived institutional voids and the complex interplay of regulatory and societal demands at both domestic and European levels. The paper builds on online interviews from the recent farmers' protests with different key informants (agricultural economists, conventional farmers, bio-farmers, activists etc.). Additional insights come from in-depth and semi-structured interviews with agricultural enterprises in Romania. Our results show where agricultural enterprises in Eastern and Southeastern Europe position themselves within the discourse on CSR of Western, transitional, and emerging economies. They shed light on CSR dynamics, regulations, and societal expectations in Eastern European agriculture, amid recent protests.

Key words: Eastern and Southeastern Europe, farmers' protests, CSR, transition economy, sustainability

O2_04

Greening agriculture from the perspective of Bosnia and Herzegovina

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Abstract

In the context of achieving SDGs and climate neutrality by 2050, the EU adopted a new growth strategy, known as the “Green Deal”. The recently used term has become "greening agriculture", which implies the application of agricultural practices that reduce the negative impact of agriculture on climate change. The countries of the Western Balkans joined the EU initiative to reduce the negative impact of climate change, adopted the Sofia Declaration on the Green Agenda for the Western Balkans (2020), and reached an agreement on the implementation of the Action Plan for the Green Agenda. The research was conducted using the method of analysis of data from secondary sources and their processing by methods of descriptive statistics, and comparison and synthesis for conclusions. The research aims is to determine where is Bosnia and Herzegovina (BiH) in the context of achieving the goals of greening its agriculture. The results based on ten-year average data indicate that in the case of BiH: (1) agricultural land occupies less than half of the total land area (43%) (2) permanent grasslands have a high share in total agricultural land (48.9%); (3) the temporary fallow land is highly present with the slow decline (42.3% of arable land) (4) the number of ruminants decreases reducing their GHG emission contribution (0.40 LU ha-1 of grassland); (5) organic farming is slowly increasing (0.05% of the total agricultural area); (6) the consumption of pesticides is increasing (1.72 kg ha-1 of cropland); (7) the use of synthetic and organic fertilizers is decreasing (126.3 kg ha-1 of cropland). The obtained results indicate the conclusion that BiH agriculture in a specific way is moving in a greening direction, whereby this transition is driven more by economic motives rather than motives to slow climate change.

Key words: climate change, greening agriculture, land use, fertilizer and pesticide consumption

O2_05

Undeniable necessity of innovative systems and nature based solution in adaptation to climate change in agricultural sector

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Abstract

Population growth and the need for food, without considering food security, certainly pose a very serious challenge to the sustainable development in agricultural sector. The aim of this paper is to present the technical framework which characterize the two methods: Innovated Systems (IS) and Nature Based Solutions (NBS), aimed to adapt the climate change in agricultural sector. The IS is defined as a network of different actors, together with supporting institutions and policies, in the agricultural and related sectors that bring existing or new products, processes, and forms of organization into social and economic use, while NBS is based on use of natural processes or elements aimed to improve ecosystem functions of environments and landscapes affected by agricultural practices, as well as to enhance livelihoods and other social and cultural functions, over various temporal and spatial scales. The paper provides a systematic review of various scientific and technical and scientific peer-reviewed journals and gray literature references in last decade. The focus of review are four functions of IS and NBS framework, i.e. sustainable practices in production, green infrastructure mainly using engineering purposes such as water, soil and slope stabilization, restoring the conditions for plants, water, soil and/or air and climate change mitigation, conservation biodiversity and ecosystem connectivity in the farmlands. In conclusion authors were recommended the required actions to facilitate such processes

Key words: nature-based solution, adaptation to climate change, sustainable agriculture

O2_06

Potential role of low-input farming in sustainable development of agriculture and modern societies

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Abstract

Aim of the research was to elucidate the potential role of low-input farming in transitions to improved sustainability. The research was based on literature review. Historically, almost entire agriculture was low-input until excessive chemization and mechanization took place in the Green Revolution, from about mid mid-20th century, which turned agriculture into a predominantly high-input one. However, with the intensification of agriculture there also arrived many challenges that gave rise to the awareness of the need to care about the sustainability of agriculture and humanity at all. Therefore, have advented many alternative options like biodynamic, organic, ecological, integrated, conservational, regenerative, precision, and low-input agriculture. Low-input farming systems aim to optimize the management and use of on-farm resources while minimizing the use of off-farm inputs, such as purchased fossil fuels, chemical fertilizers, and pesticides. Low-input farming is very similar to organic farming with single particularity - it tends to maximize the use of the on-farm resources even in powering the operations (by animal work when possible). Vast use of human labor is usually inherent to low-input farming, with associated low work efficiency which can be considered either as a drawback, or a generator of rural and countryside employment opportunities. Therefore, low-input farming may improve not only the agricultural sustainability but also the sustainability of societies at all. Namely, high labor needs would require the removal of urban people to the countryside and villages, which would be unavoidably associated with a decrease of urban waste generation and urban energy consumption. The rise in the number and spread of low-input farms would improve the biodiversity in agricultural zones. Moreover, it would enhance the resilience of societies to supply-chain disturbances because rural people do not need such a complex and vulnerable supply chain and infrastructure as urban dwellers do. If low-input farming is to be among options for the sustainability, there remains a question: how to motivate young people to do it?

Key words: agriculture, low-input farming, sustainability, biodiversity, energy, pollution

O2_07

The importance of ensuring agricultural production on the example of the Republic of Croatia

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Abstract

Agricultural producers are known to operate in high-risk environments. As a result, they often feel compelled to formalize their production processes, leading to reduced production efficiency. To ensure production stability, it is essential to educate agricultural producers on the risks involved. One effective approach to mitigate these risks is through property and plantation insurance. Agricultural insurance serves as a safeguard against everyday risks and losses that farmers may encounter. The aim of this work is to point out the importance of concluding contracts on agricultural insurance by analysing the relationship between the movement and changes of contracted and liquidated premiums. The paper therefore tried to show that despite the existence of risks in agricultural production, there is an insurance instrument that can compensate for business losses. The paper deals with paid insurance premiums and liquidated claims, and shows the values of changes in the volume of agricultural insurance, as well as the movement of the share of agricultural insurance in total insurance in the Republic of Croatia and the EU.

Key words: agricultural production, agricultural production insurance contract, risk, insurance premium

O2_08

Factors influencing rural youth migration in North Macedonia

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Abstract

The migration of young people from rural to urban areas poses a significant challenge to the sustainable development of rural communities in North Macedonia, leading to an aging population and diminished natural growth. This trend exacerbates socioeconomic inequalities, fostering social insecurity and the exclusion of rural youth. The far-reaching consequences of this migration influence both urban and rural landscapes across various developmental domains. To that end, this research aims to investigate the impact of main socioeconomic factors on rural youth migration. A survey of 550 rural residents aged 18-40 addressed was conducted using a tailored questionnaire. The data collection approach ensured nationwide diversity across all Macedonian planning regions, nationalities, genders and village types. Data processing involved the application of standard descriptive analysis and a binary logistic regression approach. Key findings show that factors such as gender, marital status, region, nationality, education, employment and having family agricultural holdings do not significantly impact rural youth migration. On the contrary, having children, household size, perceptions of employment opportunities, lifestyle preferences and overall quality of life in rural areas exhibit notable significance. These findings contribute to a greater understanding of the complexities surrounding rural youth migration. In conclusion, the logistic regression model serves as a powerful tool to pinpoint crucial factors influencing rural youth migration. These insights provide a solid foundation for shaping targeted policies, essential for retaining and supporting rural youth and fostering sustainable development in both urban and rural areas of North Macedonia.

Key words: binary logistic regression, Odds ratio, rural-urban migration, rural policies

O2_09

Enhancing ecosystems' and social resilience: Restore4Life Wetland Restoration Initiative

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Abstract

Wetlands, crucial ecosystems providing vital services and habitats, face threats from human activities and climate change. The Restore4Life project, centered in the Danube basin, aims to address these challenges through holistic wetland restoration efforts. Across the Danube basin, transformative restoration activities are underway, focusing on enhancing wetland connectivity, fostering biodiversity, unlocking carbon sequestration potential, and delivering essential ecosystem services. Implementation sites include floodplains, rivers, and lakes, where dedicated efforts encompass concrete restoration activities. Additionally, at six monitoring sites, the project team tracks the impacts of previous wetland restoration initiatives on ecosystem conditions and services. Within Serbia, the Landscape of Outstanding Features – Vlasina stands out as a valuable implementation site, boasting significant peatlands and biodiversity. Despite being protected, these habitats face threats from tourism, urbanization, agriculture, and peat extraction. Restoration efforts within Vlasina target four polygons, aiming to address degraded areas spanning 1,600 hectares. Wetlands preservation is imperative for biodiversity conservation, water security, sustainable development, and climate resilience. Restore4Life represents a significant endeavor to address wetland restoration challenges, engaging in restoration activities, community empowerment, and the promotion of sustainable practices. Moreover, the project pioneers citizen science initiatives in Serbia, fostering public involvement in environmental conservation efforts. By combining scientific expertise with citizen engagement, Restore4Life aims to pave the way for effective wetland restoration practices and deepen societal appreciation for the ecological importance of these vital habitats. Ultimately, recognizing and nurturing the values of wetlands is crucial for fostering harmonious relationships between humans and nature, ensuring the long-term well-being of both present and future generations.

Key words: wetland restoration, Danube basin, Restore4Life, Vlasina Lake, ecosystem services

O2_10

Agriculture knowledge and information system in Republika Srpska

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Abstract

We define Agriculture Knowledge and Information System – AKIS, as a system that connects people and organizations to promote mutual learning, generation, sharing and use of technology, knowledge and information related to agriculture. The AKIS includes institutions and organizations that create and disseminate knowledge and information to support agricultural production, marketing and post-harvest handling of agricultural products, and natural resource management. Most AKIS projects support agricultural research, advisory or educational activities, which are increasingly seen as components of an interconnected system. The system may include actors such as farmers, agricultural workers, agricultural educators, researchers, non-academic experts, public and private advisors, supply chain actors, and other actors in the agricultural sector. The research in this paper aimed to collect data on how much the AKIS system has an impact on the development of the agricultural sector in the territory of the Republic of Srpska and to determine the current situation regarding the use of knowledge and information in agriculture. The methods used in the research are: the content analysis method, analytical-synthetic method, description method, and survey method. The research identified a weak connection between the links in the chain, especially between scientific institutions (universities and institutes) and organizations of agricultural producers, weak capacitation of the advisory service, and a low level of application of modern technologies, especially related to digitization and automation of processes. On the other hand, the respondents confirmed the importance of the application of knowledge and innovations for improving the competitiveness of agricultural production, strengthening the market orientation of agricultural farms, and attracting young people to engage in agriculture. The improvement of functional links between the links in the system of knowledge and information in agriculture could contribute to overcoming structural limitations in the development of the agricultural sector of the Republic of Srpska.

Key words: system, knowledge, information, innovation, agriculture

O2_11

The influence of yield and price of sugar beet from current year on sowing area of sugar beet in following year

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Abstract

The subject of this research is the dependence of yield and price on the sowing area of sugar beet in the Republic of Serbia. The goal of the research is to observe the impact of the natural (yield) and economics (price) results of sugar beet from the current year on the sowing area in the following year. The analyzed period is 2005-2022 and basic tools of descriptive statistics. The average yield of sugar beet was 48.63 t/ha. The average price was 32.49 euro/t. Sugar beet yield (X_1) and price (X_2) are decreasing/growing at annual rates of -0,03% and 3.13%, while sugar beet sowing area in hectares (Y) decreases at annual rate of -3.91%. In order to establish the influence of yield and price of sugar beet on the number sowing hectares next year, a multiple linear regression model $\hat{Y} = 156919 + 1580X1 + 746X2$ is created. The statistical significance of the model is tested by ANOVA and the obtained results determine the statistical significance of the model ($p<0.05$). The estimated parameters of the regression model are also significant, and there is a positive relationship between the yield and price of sugar beet from current year on the number sowing hectares of sugar in the next year. The model demonstrates a positive significant impact of both independent variables on the sowing area of sugar beet in Serbia, but the yield of sugar beet has a greater impact than its price.

*Key words:*sugar beet, yield, price, sowing area, influence, Serbia

O2_12

Consumer preferences about fruit brandies

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Abstract

The main goal of this research was to determine the preferences of consumers in the Republic of Srpska regarding the most commonly consumed fruit brandies, for which there is a centuries-old tradition of consumption and production. The research focuses on fruit brandies from plums, apples, pears, apricots, grapes, quince, honey, and herbal ingredients. Primary data were collected through online surveys based on a structured questionnaire. Secondary data on production and consumption, as well as consumer preferences in other markets, were also utilized in the study. Basic mathematical-statistical methods such as frequencies, average, mode, median, range, and coefficient of variation were employed in MS Excel. In addition to these, the Analytical Hierarchy Process (AHP) method was selected for determining the importance of factors such as color, taste, alcohol content, brandy type, and smell. This method was applied in the Expert Choice program, where the consistency of all obtained responses was initially tested. The preferred brandy color among respondents is yellow-brown, with an alcohol content of 41-43%. The most preferred and highest-rated brandies are plum brandy and grape brandy, followed by apricot and quince brandy, while other types of fruit brandies are less desirable. Homemade brandies are significantly more desirable compared to industrially produced ones. The most crucial factors in the purchase and consumption decision-making process are taste, brandy type, and alcohol content. Less important factors are smell and color.

Key words: fruit brandies, consumer attitudes, multi-criteria assessment, AHP method

O2_13

Production of wood assortments of poplar clone *Populus deltoides* and corn yield on fluvisol

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Abstract

The paper presents the results of research on a permanent sample area of poplar plantations of the *Populus deltoides* clone in a protected area from floods, which was established on a 5x5 quadrangular planting spacing with 400 trees per ha. So far, it has been built on fluvisol with complete preparation of the terrain and soil. Plantation felling was done with a harvester when the poplar was 21 years old. Production of poplar wood assortments amounts to 473 m3/ha. The calculated profit from poplar is 17,451 eur, that is, the average profit per year is 831 eur. Corn yield research was done on fluvisol in the immediate vicinity of poplar plantations. The analysis of expenditure, income and profit on areas with corn was made from 2018-2023. The average yield of corn is 4,723 kg. The average profit per year on the areas with corn is 272 eur. Profit per year on the area with poplar is higher than the area with corn by 559 eur. The results of the research can be applied in the planning of agricultural protection belts with poplar.

Key words: poplar plantation, corn, production, yield, profit

Session 2: Agricultural Economics and Rural Development

Poster Presentations

P2_01

Indicators of the state of small and medium enterprises in the Republic of Srpska

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Abstract

The subject of research in this paper is the management of small and medium enterprises in a specific economy, aka in the business ambient. The issue in the research is the analyses of the indicators which define the success of small and medium enterprises between the years 2017. and 2022. Special attention is paid to small and medium enterprises in agribusiness. The goal of this research is to establish key factors of success in small and medium enterprises, in order to define measurements for an increase of competitiveness of this sector. The analysis includes legal entities and entrepreneurs residing in the Republic of Srpska. Methods used in this paper are: classification, comparison, analyses of magnitude and structure and the method of inference, scientific and professional literature, as well as publications of official institutions and relevant websites. Secondary research, i.e. "desk research" was also conducted. The results of the research indicate that in the period 2017-2021, an average of 40,171 small and medium-sized enterprises operated in the Republic of Srpska. Out of a total of 41,992 SMEs operating in 2021, the activity of agriculture, forestry and fishing is represented by 5.08% of participation, i.e. by 2,132 economic entities (out of which 936 are legal entities, and the rest are entrepreneurs). This represents an increase compared to the previous year by 44.64%, i.e. for 658 companies. In all the observed years, Banja Luka is the economic area with the highest concentration of small and medium enterprises. Of the total number of these companies which operated in the Republic of Srpska in 2021, 44.61% operated in the economic area of Banja Luka. Compared to the first year of the observed period, there is a decrease in the number of employees in micro (by 2,021 employees, or by 3.60%) and medium enterprises (by 2,230 employees, or by 4.98%). At the same time, small companies recorded an increase in the number of employees by 1,398 employees, or by 3.46%. The share of the number of employees in agriculture, forestry and fishing in the total number of employees in SMEs in the observed period averaged around 2.90%. It is evident that the field of agriculture in the segment of the development of small and medium enterprises is burdened with numerous problems, one of which is a particularly pronounced lack of capital, that is, obstacles in the financing of operational and development activities.

Key words: statistical indicators of small and medium enterprises, agribusiness sector, instruments and models of financial and non-financial support to the sector of small and medium enterprises, Republic of Srpska

P2_02

Modeling the long-term economic and environmental efficiency of agricultural measures with the SWAT model

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Abstract

Socio-economic-environmental sustainability of agri-environmental measures refers to how measures affect society and the economy. It is an important aspect to ensuring that measures are not only effective in protecting the environment but also fair and sustainable for society and the economy. The SWAT (Soil and Water Assessment Tool) model was set up in order to obtain data on the environmental efficiency of various water retention measures. By analyzing scenarios for modeling environmental efficiency, we wanted to find out what impact different changes in agricultural practices have on water retention and erosion prevention. For each scenario, based on this additional division, we obtained information on the environmental performance of different combinations of slopes and textural classes typical for a certain watershed. With the aim of later analysis of economic sustainability, we also simulated the effectiveness of each scenario for three different agricultural rotations – cattle breeding, pig breeding, and agriculture – thus including the influence of rotation and fertilization. In this way, we obtained a wide range of combinations for each area for further environmental and economic optimization. The optimization results showed that the effectiveness of different scenarios on different soil types and terrain slopes shows a certain degree of variability. Based on the socio-economic analyses, we can conclude that the greatest acceptability and feasibility are demonstrated by conservation treatment and the inclusion of various summer/winter greening to reduce the interval with bare soil, and the implementation of these measures must be adequately supported by the targeted measures of the CAP. When implementing the conservation tillage measure, it is important that farmers also have the opportunity to obtain support for the purchase of appropriate special machinery because the investment in appropriate special machinery for the implementation of this measure is the biggest identified weakness.

Key words: agriculture, economic, environment, measures, SWAT

P2_03

Controller's performance analysis of the largest stone fruit producer in Bosnia and Herzegovina in light of COVID-19 pandemic

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Abstract

This paper explores the possibilities of applying and the benefits of controlling tools for performance analysis of agricultural companies in Bosnia and Herzegovina. In order to obtain a clearer picture of the dynamics of business performance, particularly in the conditions of the COVID-19 pandemic, a controller's review of the largest stone fruit producer in Bosnia and Herzegovina has been conducted. The review covers three-year period (2020-2022) and includes the benchmarking of the observed company with the top three competitors in the country and the entire industry's average. Performance analysis of the largest stone fruit producer in Bosnia and Herzegovina has shown that the COVID-19 pandemic had significantly adverse effects on its business performance. Compared to the beginning of the pandemic, there was a significant decrease in total revenue, net profit, market share; activity indicators also significantly declined, and consequently, profitability ratios as well. The case study presented in this paper illustrates that no matter how strong and dominant companies may be in the market, they are also at greater risk of losing out during times of crisis and uncertainty. This study confirmed the findings of other research and demonstrated that large firms adapt to changes with more difficulty than smaller ones and that Return on Assets (ROA) is an indicator that points to deeper structural issues that further reflect on other performance metrics. Additionally, by combining controlling tools and multiple financial indicators, the case study provides a practical example of how to detect the initial signs of a business crisis early on and understand the causes of poorer performance, as well as where to seek opportunities for improvement.

Key words: controlling, performance analysis, benchmarking, financial indicators

P2_04

Theoretical aspects of the supply chain in food production

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Abstract

The aim of the paper is to provide a closer overview of the importance of the food supply chain through the conceptual definition given in the paper in the past and present time. Using the method of analysis, the topic gains particular importance today due to the interruption of supply chains of agricultural products, which undoubtedly affects the further character of the development of certain countries in the immediate and distant environment. Analyzing the importance and conceptual definition of value chains, as well as the importance of food supply chains, differences between conventional (standard) supply chains and specific (alternative) supply chains have been observed, and their character has been described. Undoubtedly, each of the analyzed types of supply chains has its own specific goals and tasks according to the end user (consumer). The future period leaves more room for the introduction of alternative ways of supply, and with eventual corrections of existing supply chains, especially in food supply and agribusiness.

Key words: supply chain, agribusiness, agriculture, food

P2_05

Analysis of Ricardo's development model in the direction of production factors from the primary to the industrial sector

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Abstract

In the past two decades of the new millennium, a significant number of European countries strive to achieve sustainable economic development. The process of industrialization becomes a priority of developing countries, which leads to the neglect of agricultural production. The subject of this research is analysis of development trends in the countries of the European Union, emphasizing the importance of the primary sector for overall economic development. Developing countries have a low-paid and unproductive labor force in agriculture, forestry, and fishing, which transits to the industrial sector. The progress of ICT sector is not implemented in the branches of the primary sector, which further weakens the position of agricultural producers. This research aim si to confirm the hypothesis that the industrial revolution is not achievable, if there is no support through the improvement of the primary sector. In the literature, this situation is defined as „Ricardo's trap“ or „Ricardo's development model“. If agricultural production stagnates, employees in other sectors face a decline in annual yields of food products. In that case, the reduction in food supply leads to an increase in the general level of prices in the country, which is directly correlated with the decline in the purchasing power of the population. To maintain the standard of living of the population, owners of capital in the industrial sector must increase the salary level of their employees. Raising the income level of the population tends to threaten the overall development of national economies. The methodological part was conducted through descriptive statistics, with a comparison of the added value of individual sectors of the European Union countries. Using the programs “Qm for Windows” and “Eviews 12”, we conducted a time series analysis and forecasting changes in the gross added value of the primary sector and the industrial sector. The key result of this research is obtained through regression analysis, based on statistical confirmation of the influence of the primary sector on the development of the industrial sector. A positive correlation was detected, which indicates that the growth of the gross added value of the primary sector causes an increase of the gross added value of the industrial sector, and vice versa. The key conclusion of this research suggests that the absence of investment in the primary sector can represent a significant limitation in the process of comprehensive development of national economies.

Key words: sustainable development, Ricardo's model, Industrialization process, primary sector

P2_06

Advancing sustainable soil management in the Western Balkans through partnership

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Abstract

The Western Balkans show a great variety of climate, soil, and geomorphological characteristics. The region was blessed by some of the most fertile soils in Europe. Nevertheless, the region is characterized also by several natural constraints that include salinity, sodicity, poor drainage and texture conditions, shallowness and stoniness, and other natural and human-induced limitations. Soil threats in the Western Balkans are complex, and although they are unevenly spread, their dimension is regional, and they are frequently interlinked. The Action Plan for the Implementation of the Sofia Declaration on the Green Agenda for the Western Balkans 2021-2030 has put forward several objectives that are in line with EU policies for soil management. To this end, the establishment of the Soil Partnership for the Western Balkans as an open forum for gathering all stakeholders in the region would be the perfect entity to discuss and exchange knowledge, data, best practices, and experiences about sustainable soil management (SSM). This process started in 2021 under the leadership of the Regional Rural Development Standing Working Group in South Eastern Europe (SWG). The partnership brings together nominated soil experts from six countries in the region (Albania, Bosnia and Herzegovina, Kosovo*, North Macedonia, Montenegro, and Serbia) to work together under the SWG platform for networking and regional cooperation. Important objectives of the Soil Partnership for Western Balkans include the strengthening of institutional and technical capacities of the region to assist the implementation of the new EU Soil Strategy for 2030 as well as work towards harmonization of the guidelines, methods, and indicators to enhance implementation of SSM practices. The results of the initial assessment of soil degradation status and trends in the region reveal that the primary processes contributing to degradation in the WB are land take, soil sealing, contamination, organic carbon loss, and erosion.

Key words: Sustainable soil management, Western Balkans, Soil Partnership

P2_07

Regional trade intensity of food products among Western Balkan countries during periods of crisis

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Abstract

The main aim of this study is to determine the intensity of food trade exchange between the Western Balkan (WB) countries (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, and Serbia) in the region. The impact of the COVID-19 and Ukrainian-Russian crisis is measured over three analyzed years: 2018, representing a reference year for comparison, then 2020 as the year affected by COVID-19, and 2022, depending on the previous as well as the Ukrainian-Russian crisis. All data collected are from the "Trade statistics for international business development database". Conclusions about the intensity of exchange of agricultural and food products within the WB region were reached through the calculation of Regional Intensity Trade of export (RITE) and Regional Intensity Trade of import (RITI). Higher values than 1 indicate intensity in trade or dominance of trade in specific products with a particular region compared to trade with the world. In the case of trade among the WB countries, the COVID-19 crisis did not affect the increase in trade volume. However, there was an increase in intra-regional trade by about 50% when comparing 2020 and 2022. RITE coefficients for all countries except Albania are greater than 1, indicating intensified export of agricultural and food products to the WB region compared to their global export. The RITI index is very important in crisis, as it somewhat answers the question of who "feeds" the country during crises. All WB countries have RITI indices greater than 1, indicating a higher intensity of food imports from the region compared to the world. According to this research, measured RIT coefficients generally declined in the years of crises, meaning that the countries shifted their export focus to other regions but still the most significant foreign and intense trade partners in agricultural and food products are countries from the region.

Key words: Western Balkans, crisis, trade, agricultural and food products

P2_08

Foreign trade and trade competitiveness in agri-food products between Republic of Srpska (Bosnia and Herzegovina) and North Macedonia

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Abstract

Foreign trade in agri-food products holds significant importance for both North Macedonia and the entity of the Republic of Srpska (Bosnia and Herzegovina), given the substantial role this sector plays in their overall trade exchange. As formal trade partners under the Central European Free Trade Agreement, understanding their trade dynamics is important. This paper aims to analyze the foreign trade exchange of agri-food products between the Republic of Srpska and North Macedonia in the period 2013-2022. It first outlines the trends of export and import of Republic of Srpska and North Macedonia in agri-food products, and then delves into the analysis of their export competitiveness. Descriptive analysis measures were employed to analyze the trade exchange involving agri-food products. The research determined the export competitiveness levels based on the trade competitiveness index for total foreign trade exchange, as well as for the agri-food sectors and its main product groups in both the Republic of Srpska and North Macedonia. The research results showed almost an equal average share of 10.91% in exports and 10.93% in imports of agri-food sector of North Macedonia, while the Republic of Srpska recorded an average share of 17.41% in agri-food imports, and 8.13% in exports. Regarding export competitiveness, the agri-food sector of North Macedonia had characteristics of "poor export competitiveness", while the Republic of Srpska recorded "very poor export competitiveness" in the analyzed period. The calculated values of the trade competitiveness index for the main product groups of the agri-food sector of the Republic of Srpska showed different levels of export competitiveness, from "not export competitiveness" to "strongest export competitiveness" compared to North Macedonia. However, North Macedonia and the Republic of Srpska exhibit room for improvement in enhancing export competitiveness to capitalize on market opportunities.

Key words: agri-food sector, foreign trade exchange, trade competitiveness, Republic of Srpska, North Macedonia

P2_09

Impact of CEFTA Agreements implementation on foreign trade in agri-food products of the Republic of Srpska

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Abstract

Considering the role of the agricultural sector in the overall economic development of Republika Srpska, trade in agricultural products is of great importance, especially with the countries of the CEFTA region. Through the conclusion of CEFTA, as a multilateral trade agreement, trade in agro-industry products was liberalized. The research in this paper aims to estimate the impact of CEFTA implementation on trade in agricultural products, based on statistical data for the period 2013 – 2021 and using the methods of descriptive analysis. The results of the research showed that the CEFTA agreement had a positive impact on the export and the total volume of exchange in agro-food products between the Republic of Srpska and CEFTA countries. The three countries of the CEFTA region leading in terms of participation in the total trade in agro-food products are Serbia, Montenegro and Macedonia. The paper analyzes the structures of both the total volume of trade, export and import, as well as individual CEFTA member countries. The export and import positions of agricultural and food product groups of the Republika Srpska on the CEFTA market are reviewed through their share and indicators of the average annual growth/decline rate and the coefficient of variation. The results of the calculated indicators indicated the potential dominance in export, import and total trade, i.e. the deficit of certain groups of products on the market of the Republic of Srpska.

Key words: agri–food industry, CEFTA, Republic of Srpska, impact

P2_10

Quality of local production of fruit distillates in Western Republic of Srpska – current state and prospects

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Abstract

Production of high-quality fruit distillates is traditional and utterly specific for the Serbian culture and tradition. This research was conducted in the region of Western Republic of Srpska. In the region of Western Republic of Srpska fruit distillates are traditionally produced, presented, and used with pride for important events. Surveyed were local producers of fruit distillates with the aim to study the views and processes related to quality characteristics of their own produce. The surveyed producers were non-commercial and the distillates are primarily made for their own use. Most of the surveyed producers (83,33%) use their own fruit which they have produced in private orchard. Over half of the surveyed producers (53,33%) poses their own distiller, while other rent the distilling device. Most produce plum distillate i.e. 90% of producers, second most produced distillate is apple 23,33%. To less extent produced are distillates of quince and apricot. Average amount of distillate which they produce on an annual basis is 150l. In 63,33% distillates, producers don't add any amplifiers of taste, smell or colour, others (36,67%) add sugar, add enzymes and yeast. Surveyed respondents store distillates in oak wooden barrels, inox barrels or glass vessels. Through research, concluded is that respondents don't have special knowledge about the completion of fermentation. Respondents commence distillation after a certain number of days, that is 40 days on average, which is far from optimum. Results indicate that the fruit selection, fermentation, distillation and ageing process requires adjustments in line with novel scientific understanding. The research also indicates that superb raw materials, i.e. home grown small production fruit and adequate distilling equipment are available to all producers. It takes further actions regarding research and dissemination of the knowledge and research findings in order to upgrade the quality to the desired state of the art fruit products.

Key words: fruit production quality, survey, rakija, traditional products

P2_11

Analysis and forecasting of the volume of tomato production in the Republic of Serbia using the ARIMA model

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Abstract

Tomato production is considered one of the most economically important branches of plant cultivation. This is why tomatoes are considered one of the most economically important types of vegetables. The average volume of tomato production in the Republic of Serbia from 2000 to 2020 was approximately 160,000 tons, exhibiting some variability and different trends in certain years. To establish realistic goals for tomato cultivation, it is essential to continuously analyze and predict the trend in average tomato yield using modern statistical methods. This paper aims to forecast the trend in tomato production volume for the upcoming five-year period (2021-2025) based on time series analysis (2000-2020) using an appropriate ARIMA model. An ARIMA model (1,1,1) was selected, employing the Box-Jenkins strategy. Official data from the Statistical Office of the Republic of Serbia was utilized for the time series analysis. Descriptive statistical analysis revealed an annual decrease in tomato production volume by 2.17%. The research results indicate a slight decrease in tomato production volume in the Republic of Serbia over the next five years, continuing the negative trend in overall tomato yield.

Key words: tomato yield, ARIMA models, time series analysis, Republic of Serbia

P2_12

Economic characteristics of solar energy production and utilization

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Abstract

Until the second half of the 20th century, energy was not considered a significant factor in economic development due to the belief in the unlimited nature of natural resources and the notion that nature is capable of neutralizing waste generated by human activity. Solar radiation energy, in the form of electromagnetic waves, reaches the Earth in the amount of 1.5x109 TWh. Approximately 1.05x109 TWh is retained on the Earth's surface, significantly more than the available reserves of coal and oil. Nevertheless, solar energy accounts for only 2-3% of the world's total energy production. Greater use of Renewable Energy Sources (RES), particularly solar energy, is important for several reasons. Solar energy production emits zero greenhouse gas emissions, ensures diversity in energy supply, and thus achieves greater stability in the electricity grid. However, solar energy production and utilization have their specificities: significant production fluctuations during the day, night, and seasons; dependence on meteorological conditions and atmospheric pollution; mismatch between production and consumption times; low conversion efficiency of photovoltaic and thermal panels into useful forms of energy; and high production and installation costs of solar panels. This paper aims to highlight the economic significance of RES, particularly solar energy, for future economic development. Solar energy, as an inexhaustible resource and cost-competitive with conventional energy sources, is increasingly becoming the focus of future economic research. The paper will specifically address the economic characteristics of converting solar energy into useful forms of energy. The paper analyzes relevant domestic and foreign literature on the economic characteristics of solar energy production and utilization. Descriptive methods were used to explain the process of converting solar energy into electrical and thermal energy. Based on a thoroughly conducted systematization, analysis, and appropriate mathematical-statistical methods, relevant conclusions about the studied issue were drawn.

Key words: RESs, solar energy, energy efficiency, photovoltaic panels, balance energy

P2_13

Biodegradable packaging materials for sustainable future

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Abstract

Plastics derived from non-renewable sources (fossil fuels) are commonly used for food packaging due to their exceptional functional properties. They are mainly intended for single use, are discharged as waste after a short period and decompose very slowly in nature. The public's growing awareness of environmental sustainability has led to a demand for eco-efficient and biodegradable materials. These requirements are putting pressure on food manufacturers to deliver their products in recyclable and/or biodegradable packaging. Biodegradation occurs when microorganisms (bacteria, fungi, algae) use biodegradable material as a nutrient by breaking chemical bonds in polymer chains with suitable enzymes. Favorable environmental conditions such as temperature, humidity, pH value and availability of oxygen (aerobic or anaerobic degradation) are required for biodegradation. Biodegradable materials can be produced from synthetic and natural materials (renewable and non-renewable sources). If petroleum-based products are used to manufacture synthetic biodegradable plastics, suitable additives are added during their production to accelerate degradation. In contrast, natural biodegradable plastics (biopolymers) can mainly be produced directly from renewable sources or synthesized from monomers derived from renewable materials (e.g. polylactic acid – PLA). Commonly used plant sources are polysaccharides (starch, cellulose), proteins (soy proteins, pea proteins, zein) and lipids (waxes, oils). However, biopolymers can also be obtained from animal proteins (collagen, gelatine, whey proteins), and polysaccharides (chitosan). In addition, biodegradable plastics can be synthesized from microbial origin as well as from genetically modified plant, organic waste, agricultural waste, etc. (polyhydroxyalkanoates – PHA, bacterial cellulose, etc.). Despite the lower energy consumption during production and the reduction of carbon footprint into the environment, these biodegradable materials have not found wider commercial application due to their inferior mechanical, chemical, thermal, and barrier properties compared to conventional plastics. Therefore, their future depends on efforts to meet these requirements and reduce the price to be competitive with conventional counterparts.

Key words: biodegradable materials, plastics, sustainability, packaging

Session 3: Crop Science

Oral Presentations

O3_01

BluLeaf®: a Decision Support System (DSS) for agricultural water management

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Abstract

Agriculture 4.0 is transforming farming by integrating digital technologies in cultivation practices in order to boost production, optimize the usage of resources, and enhance sustainability. In this context, water management plays a crucial role, especially in the Mediterranean region, where the scarcity of water, variability in climatic conditions, and soil degradation pose significant obstacles to crop production. Water management represents a particularly challenging topic as excessive (or insufficient) irrigation can cause damage such as reduce the quality or the quantity of the yield. An efficient water management is even more important, if considering the increasing global food production demands and the impacts of climate change. Decision Support Systems (DSSs) are digital tools for modern agriculture, capable of helping farmers to improve their cultivation practices. DSSs are designed to collect, process, and provide relevant information, even the complex one, with simplicity and immediacy. DSSs take advantage of advanced technologies such as the Internet of Things (IoT) and Cloud Computing, to implement telemetry and control features and to execute data processing algorithms to generate summarizing indicators and powerful insights. This paper offers a comprehensive introduction to the Bluleaf® platform for digital agriculture, a cloud-based solution integrating a DSS specifically designed for agricultural water management. BluLeaf® employs real-time data coming from IoT devices and agronomical models to optimize irrigation schedules based on specific crop needs, promoting awareness in agricultural practices. BluLeaf® is served to users as a web-based application as well as a mobile application for Android and iOS devices.

Key words: digital agriculture, decision support system, irrigation management, cloud computing, agronomical models

O3_02

SMARTWATER project implementation in the period 2021-2024 and smart management of land and water resources in BiH agriculture

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Abstract

Horizon 2020 project "*Promoting SMART agricultural WATER management in Bosnia and Herzegovina*" (SMARTWATER) started in 2021. This was the first time that an academic institution from Bosnia and Herzegovina is coordinating a Horizon 2020 project. The main objective of SMARTWATER is to reinforce networking, research and S&T cooperation capacities of the University of Banja Luka (UNI-BL), the University of Sarajevo (UNSA) and other connected national institutions, in the field of sustainable agricultural water management and to increase their competency and fund-raising skills for a successful participation in the European Union Research Programs. Main project topics include: 1) cloud-based smart technologies, 2) new generation of satellite remote sensing data, 3) water-energy-food nexus and 4) climate change impact on agriculture. In the period 2021-2024 project consortium organized 3 advanced training courses, 3 summer schools, joint research activities (experiments) in 3 years and at 2 locations in BiH, 3 stakeholders' meetings (roundtables), 3 post-graduate MSc courses, 13 mutual staff exchanges, 3 hands-on workshops on R&I and worked on the development of 2 smart water management tools and smart national strategies in agriculture. Project teams' members attended more than 20 international conferences and published 15 academic papers in three abovementioned topics (https://zenodo.org/search?q=smartwater&l=list&p=1&s =10&sort=bestmatch). SMARTWATER activities are being disseminated on a regular basis at the official website (https://www.smartwater-project.eu/) and social media profiles (Facebook, Twitter/X, LinkedIn and YouTube). SMARTWATER consortium will organize an international workshop in BiH (Trebinje, May 29-30) so we call all interested stakeholders to visit our sites and to join the SMARTWATER network.

Key words: twinning, sustainability, maize, dissemination, publications

Acknowledgement: SMARTWATER - This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 952396.

O3_03

Enhancing corn yield through variable sowing: Integrating satellite and drone technologies for precision agriculture

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Abstract

Corn sowing is expected in Serbia to exceed one million hectares in 2024 in total, with a 9.6 percent increase in yield compared to 2020 and a remarkable 29.4 percent surge compared to the ten-year average. With corn being the primary export commodity of the Republic of Serbia, surpassing one billion euros in exports, optimizing sowing operations becomes paramount. Uniform seed distribution and consistent sowing depth are crucial for maximizing seed germination and growth. This study employs a cause-and-effect approach, integrating soil potential, climatic factors, and soil properties to delineate potential zones for variable corn sowing. Utilizing multispectral and aerial imagery from a DJI Mavic 3M drone with 2.5 cm/px resolution, alongside satellite images with a resolution of 3 x 3 m, enhanced green vegetation index, triangle vegetation index, and stress vegetation index are analyzed. The study utilizes a DJI Mavic 3M drone equipped with RTK signal correction for terrain mapping. Detailed terrain elevation analysis facilitates the creation of a variable sowing map. Macro experiments on 20 hectares with sowing rates ranging from 65,000 to 78,000 seeds/ha using hybrid corn with genetic potential for variable sowing demonstrate yield increases of 9.5 to 21.3 percent compared to conventional sowing. These findings validate the scalability of variable corn sowing and underscore the utility of vegetation indices for creating precision variable sowing maps.

Key words: corn production, yield increase, variable sowing, drone mapping, yield optimization

O3_04

Soil nutrient quality in organic soy production in Togo - A survey

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Abstract

The objective of this work is the analysis of the nutrient content of Togolese soil. Samples of Togolese soil from the Atakpame and Kpalime region were sampled in a crop rotation system for organic soy. The organic certification obliges the farmers to rotate their crops and not seed soybeans more than 2 times in a row. This obligation makes sense in terms of crop protection however; since it is believed that soy is enriching the soil in nitrogen as it is considered as a legume farmers tend to plant it more often. Regarding the yields from such crop rotation systems, this practice doesn't need to be favorable. Soil was analyzed to understand further the general impact of soybean production on Togolese soil. Soil nutrient characteristics were analyzed in our laboratory after common sample preparation, where roots, straws, and stones were removed. Then, qualitative and quantitative tests were performed. The texture was qualitatively analyzed. For quantitative tests, pH, moisture content, main nutrients nitrogen (N), potassium (K) and phosphate (P) were measured by separate methods: Kjedldahl method, flame photometer, and spectrophotometer. NPK values are compared to the literature and found to be generally less in concentration than reported data. We conclude our studies on Togolese soils with the reinforced idea that soil quality together with repeated planting of soy is one of the main factors for reducing crop yields, hence the addition of nutrients such as of compost can provide a positive response to the problem of yield reduction.

Key words: soy, soil quality, organic crops, NPK, Togo

O3_05

The underground properties of ribwort plantain

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Abstract

Ribwort plantain (*Plantago lanceolata* L.), a well-known plant with a global range, is widely used in grasslands and agricultural fields, mainly for its medicinal properties. Its adaptability to different ecophysiological conditions makes it a valuable plant for the remediation of soils contaminated with heavy metals. An important component found in both above and below-ground parts of the plant is aucubin (an iridoid glycoside). Experiments conducted in the past under laboratory and field conditions have shown a significant inhibitory effect of aucubin on nitrification process. Due to its effective retention of the ammonium form (NH4+) absorbed by soil colloids, the inclusion of ribwort plantain in arable farming and grassland systems is becoming a strategic way to reduce nitrate leaching and N2O emissions. The aim of this study was to compare the rooting depth and density of ribwort plantain with *Lolium multiflorum* and *Trifolium pratense* after one year of growth under field conditions. Analyses of the underground parts were carried out in Saxony (Germany), according to the methodology of Böhm 1979. In addition, data compiled using “Rhizo-II Root Biometrics Suite” software on the average distribution of root dry weight, root length density and specific root length of eleven ribwort plantain genotypes tested under field conditions in northern Switzerland will be presented. The results obtained from the root analyses prove its fast growth, high capacity to develop deep rooting patterns, which gives *Plantago lanceolata* drought tolerance and ability to acquire nutrients from deeper soil layers. This highly versatile plant can indisputably be used as a "tool" to mitigate the environmental impact of agriculture and deal with the challenges of climate change.

Key words: Plantago lanceolata, root length, root length density, N mineralization, arable farming

O3_06

Optimization of pesticide application using precision agriculture technologies and modern nozzles

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Abstract

In contemporary agriculture, the effective application of pesticides has become a crucial component for preserving and enhancing crop yields. This research focuses on the analysis of various types of nozzles, from standard ones to those with advanced technology, to explore their role in increasing the efficiency of agricultural production. Through experiments conducted in laboratory conditions and on actual wheat crops in 2023, the deposits of nozzles were examined using fluorescent tracers. The technology of multispectral drone imaging with DJI Mavic 3, at a resolution of 2.5 cm/pixel, was utilized for remote disease detection in crops. These multispectral images enabled early disease detection, contributing to a more efficient pesticide application and preventing the spread of infections. After field mapping using the drone and creating a variable-rate application map, the pesticide application was performed based on the variable-rate map. This practice allows for precise and optimized pesticide application tailored to the specific needs of each zone within the field. The integration of improved nozzles, multispectral technology, and variable-rate application maps presents a comprehensive strategy to enhance the uniformity of liquid distribution and deposits on wheat crops. These research findings have practical applications in modern agricultural practices, offering promising guidelines for sustainable, efficient, and cost-effective crop protection from harmful diseases and insects, while simultaneously increasing crop yields and reducing the negative impact of pesticides on the environment.

Key words: crop protection, pesticide application, multispectral imaging, disease detection, variable-rate application

O3_07

Growing season conditions and planting density impact on some morphological caracteristics on different maize (*Zea mays* L.) hybrids

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Abstract

The field study was conducted during 2014, 2016 and 2017 at the Agriculture school in Leskovac. Six maize hybrids from three different maturity groups were planted, two from each group. FAO400 group included ZP434 and NS4023, FAO500 included ZP555 as well as NS5051 and FAO600 included ZP 666 and NS 6030. Maize was planted on april 15th in each year at three planting densities 71429 (70x20 centimeter), 57143 (70x25 centimeter) and 47619 plants per hectare 70x30 centimeter). The plant height and first cob height varied in all three years among hybrids and planting densities. Among hybrids ZP666 was in average the highest with 262.64 centimeter while NS4023 was in average the smallest in all planting densities with and average height of 227.32 meters. The highest first cob was noticed on NS6030 and presented 112.65 centimeter while the lowest was measured on NS4023 with 108.96 centimeter far from the soil. All three years were different, whereby 2014 had the most precipitation followed by 2016 and 2017, respectively. In all three years the highest plants and cobs were noticed in the highest planting density and vice versa. The goal of this study was to see the variation of these two growing parameters for each of these six maize hybrids planted in three different densities among years.

Key words: maize, planting density, weather conditions, plant height, first cob height

O3_08

Diversity and redundancy assessment of Montenegrin and Slovenian maize landraces conserved in MRIZP gene bank

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Abstract

In the past, on the territory of the former Yugoslavia, 2217 local maize landraces were collected and maintained in the Maize Research Institute Zemun Polje (MRIZP) gene bank. Additionally, MRIZP gene bank conserved over 3500 introduced genotypes (landraces, synthetics, composites and lines), and is among the five largest in Europe. Today, we face the great challenge of preserving such a large collection, primarily due to the high regeneration costs. The goal of this study was to determine whether and to what extent MRIZP collection of local maize landraces is burdened with redundant accessions. Until now, the analysis of the gene pools collected in Montenegro and Slovenia has been done. Based on a separate analysis of white- and yellow-orange maize landraces, it can be concluded that the diversity and evolution of distinct maize landraces grown and collected in Montenegro have been simultaneously shaped by both environmental (i.e., natural selection) and socially driven factors (farmers' selection, migration and colonization processes of the human population). Although that the authenticity and variability of the Montenegrin maize landraces gene pool have largely been preserved in the MRIZP gene bank, a significant amount of redundancy was observed, as a consequence of uncoordinated collecting missions. Collecting missions on the territory of Slovenia was done much more systematically, resulting in a small number of morphologically similar, thus redundant accessions. On the basis of morphological data, a cluster analysis was performed, where Slovenian landraces were classified into 4 clusters. Taking into account the passport data, the local name and the squared Euclidean distance, redundant accessions, that predominantly belong to the first cluster, were identified. The obtained results will contribute to costs-efficient conservation in MRIZP gene bank.

Key words: conservation, duplicate accessions, genetic resources, morphology, *Zea mays* L.

O3_09

Variability of spike spikelets number in bread wheat

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Abstract

Number of spikelets per spike has related to seed yield per spike and total seed yield of wheat plant. Aim of this work is investigation of spike spikelets number variation in primary spike of wheat grown under different environmental condition. The 10 wheat genotypes were used for study. The genotypes were grown in experiment on plot size of 1 m2 in three replications in two vegetation season (2015-2017). The seeds of at the distance of 0.10 m in rows of 1.0 m length among which was the distance of 0.2 m. At the full maturity stage, the 20 plants replication-1 were used for analysis of number of spikelets per primary spike. The analysis of variance was performed by MSTAT C (5.0 version). The results showed significant differences among wheat genotypes in both years, according to number of spikelets per primary spike. On average in the first vegetation season the least number of spikelets per primary spike 19.30 had G-3502-2, while the highest number of spikelets 23.51 had G-3502-1 genotype. In second vegetation season the number of spikelets primary spike-1 varied from the lowest 19.25 in G-3502-2 genotype to the highest 25.46 in G-3502-1 genotype. The differences in average of spikelets spike-1 were determined by genetic, environmental factor and by interaction genotype/environment.

Key words: wheat, genotype, spikelets, spike, environment

O3_10

Influence of the seeding rate, row spacing, and cultivar on alfalfa forage yield in the first production year

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Abstract

Cultivated lucerne (*Medicago sativa* L.) is the most widely grown forage legume, mainly due to its high nutritive quality and yield. The objective of this study was to provide information about the optimal seeding rate and row spacing for alfalfa cultivation under rainfed conditions in the Republic of North Macedonia. Alfalfa was sown in the fall of 2020, using randomized complete block design in a split-split plot arrangement with three replications. The effects of two seeding rates (8 and 16 kg ha^{-1}) and two row spaces (20 and 40 cm) were examined on fresh forage yield (FFY) and dry matter yield (DMY) of four alfalfa cultivars. From the evaluation, the sowing method (row spacing) and cultivar choice showed a significant impact on the obtained forage yield. The higher average yield of fresh (73.7 t ha^{-1}) and dry (20.3 t ha^{-1}) forage was achieved at a sowing distance of 20 cm. Since the seeding rate did not significantly impact FFY and DMY, in regions with a temperate climate, it is recommended that lower seeding rates than 16 kg ha^{-1} should be used in order to have sufficient and cost-effective alfalfa production. The inevitable issues for increasing alfalfa production are the selection of an appropriate cultivar with good adaptability to recent climate changes within compatible establishment methods.

Key words: seeding rate, row spacing, cultivar, FFY, DMY

O3_11

Protein content in wheat grains as a result of interaction of agroecological conditions and agrotechnical treatments

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Abstract

The protein content (%) of wheat grains is one of the basic criteria for determining quality. The testing of protein content in winter wheat grain was carried out during two experimental seasons, 2016/17 and 2017/18, at the experimental fields of Novo Selo in Bijeljina (Semberija). The experiment was set up as a four-factor field trial in a randomized block system with three replicates. There was a total of 405 experimental plots, each the size of 18 m2. Three wheat cultivars (Nova Bosanka, Simonida and Prima) were sown with five sowing densities each: 350, 450, 550, 650 and 750 seeds m-2. Protein content was determined using a Dickey-John GAC 2000 grain analyzer in triplicate. Biometric analysis of the obtained results was performed by calculating the arithmetic mean, standard error and coefficient of variation. Comparative analyses of the studied wheat cultivars for examined traits were carried out using a 5 (sowing density) × 3 (sowing date) × 3 (cultivar) × 3 (nutrition model) analysis of variance. The significance of individual differences in the means of variance was tested with the LSD test (Fisher's least significant difference test) at the significance level of 0.05 and 0.01, while the interaction effects were analyzed using the graphical method (polynom of first and second order). Significantly higher values of the average protein content in wheat grain were recorded in the first experimental season 2016/17 (13.36%), compared to the second examined period in 2017/18 (12.52%).

Key words: wheat, interactions, cultivars, grain protein content

O3_12

Damages in wheat varieties caused by cereal leaf beetle (*Oulema melanopus* L.) under treatment by insecticid

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Abstract

Cereal leaf beetle – CLB (*Oulema melanopa* L.), both adults and larvae cause significant damage leaves of wheat, which can be reduced by the use of insecticides to control the pest. The aim of this work was study of damage flag leaf in wheat varieties caused by cereal leaf beetle and efficiency of insecticide applied for plant protection wheat against CLB. The three varieties of wheat: Zemunska Rosa, Aurelia, and Belija, were used for the study in a field designed in three repetitions with entomological cages with an area of 1 m2. The experiment caried out on field condition in Maize Research Institute, Belgrade. The damage assessment was carried out on the flag leaf area in plant population of wheat. Results of study showed significant differences in number of damaged plants in entomological cages in comparison to outside the entomological cages (open field). In entomological cages the lowest number of damaged plants was on treatment with insecticide deltamethrin in variety Aurelia (4.05%), and the highest was on control variant (without insecticide application) in variety Belija (28.45%). In crops outside the entomological cages, the cereal leaf beetle attacks caused the lowest number of damaged plants on treatment with insecticide deltamethrin in variety Zemunska Roda (8.833%) and the highest was on control variant (without insecticide application) in variety Belija (26.53%). In average for all three variety and all treatments, in entomological cages was lower number of damaged plant (11.31%), than outside the entomological cages 15.21%. Obtained values of damaged plants are significantly different. On the base of result established that number of damages plants was different among analyzed varieties on each treatment and that insecticide deltametrin had the highest efficiency in protection plant damages against the cereal leaf beetle.

Key words: cereal leaf beetle, insecticide, wheat, damage, variety

O3_13

Mycotoxin detection in *Fusarium* species complex isolates: Towards understanding toxin production and management strategies

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Abstract

Mycotoxins are toxic compounds that are naturally produced by certain types of moulds (fungi). Several hundred different mycotoxins have been identified, but the most commonly observed mycotoxins that present a concern to human health and livestock include aflatoxins, ochratoxin A, patulin, fumonisins, zearalenone and nivalenol. The effects of some food-borne mycotoxins are acute with symptoms of severe illness appearing quickly after consumption of food products contaminated with mycotoxins. Other mycotoxins occurring in food have been linked to long-term effects on health, including the induction of cancers and immune deficiency. Species of the genus *Fusarium* are plant pathogens but also contaminants of economically important plant products. They infect a large number of plant species, mostly cereals, and in addition produce mycotoxins. One of the significant mycotoxins produced by *Fusarium* spp. are enniatin (found in 17 species) and fumonisin (found in 3 species). The aim of the research was to test isolates from three different *Fusarium* species complexes for the presence of mycotoxins fumonisin and enniatin. The PCR method was used with a pair of primers ESY1F/ESY1R for the presence of enniatin production and a pair of primers Fum1F/Fum1R for the presence of the gene for fumonisin production. The first results showed that in the tested isolates there are genes for the production of enniatin, while genes for the detection of fumonisin production were not detected. Further research will focus on other mycotoxins produced by *Fusarium* spp. and testing their detection methods.

Key words: mycotoxins, *Fusarium* spp., PCR

Session 3: Crop Science

Poster Presentations

P3_01

An example of selecting a proper location for constructed wetlands installation in South Bačka District, Serbia

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Abstract

This paper presents a significant contribution to identifying favorable locations for implementing Constructed Wetlands (CWs) in the South Bačka District, Serbia. Regions facing wastewater treatment challenges often encounter difficulty selecting favorable locations for CW placement. This challenge is particularly pronounced in small rural settlements, where determining favorable CW locations becomes essential. Using geospatial data and GIS tools, the research thoroughly analyzes criteria such as distance from settlements, distance to recipients, land use, and elevation to determine the most favorable locations for CW implementation. Through a scoring system, an area of 2,134 hectares with the highest favorability score was identified. Subsequently, areas of 3,993 and 1,934 hectares were assessed as favorable and moderately favorable. Such results suggest that the South Bačka District is exceptionally favorable for CW implementation. The results provide useful guidelines for identifying and prioritizing locations for CW implementation, effectively addressing wastewater issues in the region. Further research and the application of such sustainable systems have the potential to improve water resource management and contribute to environmental conservation. The geospatial approach and scoring system represent a practical methodology for decision-making in selecting CW locations, contributing to the overall goal of sustainable water management, especially in regions facing challenges in wastewater treatment, such as small rural settlements.

Key words: wastewater treatment, constructed wetland - CWs, geographic information system -GIS, South Bačka District

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P3_02

Organic modification of clay fraction using humic acids and preparation of clay–humic acid (HA) composites

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Abstract

Pollution caused by organic contaminants has become an increasingly serious issue. Therefore, innovative and cost-effective methods of contaminant removal must be studied. Clay–humic acid (HA) composites can be considered as prospective and low-cost sorbents for such contaminants. This work aimed to examine the mineralogical composition of clay fraction in three different agricultural soils (Regosol, Chernozem, and Vertisol), and the interaction between clay minerals and humic acids isolated from these soils. Soil samples were collected at 0–25 cm depth in three different locations: Pirot (Regosol, RG), Novi Banovci (Chernozem, CH), and Umka (Vertisol, VR). This was part of the larger study where the purpose was to make a clay-HA composite for the sorption of clomazone. The mineralogical composition of clay fraction was studied using XRD analysis. The XRD patterns were obtained from oriented samples, samples saturated with ethylene glycol, and samples heated at 550°C. Regosol clay fraction consisted of kaolinite, illite, chlorite, and MLS (mixed layered silicates). Chernozem clay consisted of illite, smectite, and kaolinite. Vertisol clay fraction consisted primarily of smectite, but also a small amount of illite and kaolinite. After the interaction of clay fraction with HA it can be seen that the biggest difference occurs in the VR sample. This is due to the mineral composition of the clay fraction in this sample. Smectites have much more pronounced adsorption capacity compared to illite and kaolinite. Kaolinite clay has a low cation exchange capacity and a small surface area, so it has rarely been used as an adsorbent. Adsorption of organic HA molecules on smectites changed interlayer space causing increasing in basal space, which produced a change in peak position in the XRD pattern. In order to examine more interaction mechanisms between clay and HA, more investigation needs to be conducted.

Key words: clay, soil, humic acid, organic modification

P3_03

Changes in the values of climatic elements in the area of the South Bačka district (Serbia)

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Abstract

The analysis of current and future climate conditions is a critical step in spatial and other forms of planning, particularly in regions where agriculture constitutes the primary economic activity. To analyse changes in basic climatic elements within one such area, data observed at the Rimski Šančevi meteorological station from 1960 to 2018 were used. Mean monthly values of air temperature (Tmin, Tmax, Tmean), precipitation, sunshine hours, relative air humidity and wind velocity were used. In order to facilitate the observation of changes, data were separated into two sub-periods: 1960–1985 (Period I) and 1986–2018 (Period II). To compare these two periods, the non-parametric Mann-Whitney test was used, which compares their medians. Results indicate that statistically significantly higher Tmax occurred in January, April, June, July, and August during period II, whereas statistically significantly higher Tmin and Tmean were recorded in January, April, May, June, July, and August. Differences in the precipitation in favor of period I were observed in February, July, August, and December, while in other months the difference is in favor of period II. But, a statistically significant difference was confirmed only in September. The test showed statistically significant more sunshine hours during April, May, June, July, and August in period II. In the case of relative air humidity, no statistically significant difference was recorded. Significant differences in wind velocity in favor of period I were recorded in January, February, March, April, May, June, and December. This analysis reveals ongoing climatic changes in the region, primarily manifested through increased average monthly temperatures. In addition, changes are observed in the distribution of precipitation and the sum of sunshine hours. Such conditions lead to increased evapotranspiration and frequent occurrence of dry periods in the area.

Key words: climate change, climatic elements, Mann-Whitney, South Bačka

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P3_04

Land cover/land use of Lijevce polje in the function of agricultural land protection

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Abstract

The aim of this paper is to determine the current state of the land cover and land use in Lijevče polje, so that relevant policies can be adopted to protect the development and use of agricultural land. Land cover/land use (LC/LU) was created for areas that are located within the zone that is protected against flooding. The total of the examined area is 39,308 ha. Orthophoto images from 2012 were used to delineate the LC/LU areas, and satellite images from Google Earth for 2022 and 2023 were used to determine the changes in the LC/LU from 2012 compared to 2023. The obtained LC/LU result is presented in the form of a polygon. The Land Cover Classification System (LCCS-FAO), adapted to the conditions of BIH, was used for the delineation of the polygon (25 classes of LC/LU were recorded). LC/LU polygon layer are made in ArcGIS software. The demarcation of the areas was done in detail at a scale of 1:10000. According to LC/LU data, agricultural areas occupy 30,490 ha (77.6%), and non-agricultural areas occupy 8,818 ha (22.4%). In the structure of agricultural land use, the "cultivated" class dominates with 86.5% (26384.0 ha), meadows with 9.7% (2949.4 ha) and pastures with 2.0% (614 ha). Permanent plantations (orchards, vineyards) occupy 0.5% (166.3 ha), and abandoned areas 372.7 ha (1.2%). Of the non-agricultural areas, the "built-up" area dominates with 47.4% (4184 ha). The construction (business zone) on large agricultural plots (>100 ha) used by the former PIK Mladen Stojanović is particularly negative. Due to the construction of highway network gravel exploitation sites were recorded, which are also opened on agricultural land. The reverse process of turning non-agricultural into agricultural land was also recorded. A negative example is the draining of the marshy part of Bardača and its conversion into agricultural land.

Key words: Land cover/Land use, GIS modelling, degradation, land protection

P3_05

Soil quality as a basis for sustainable intensification of agricultural production

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Abstract

Sustainable intensification (SI) of agriculture implies an increase in yield without harming the environment and further cultivating new land areas. Research aimed to establish soil quality indicators (organic carbon, silt and clay, pH value, cation exchange capacity (CEC), soil depth and terrain slope) in 150 samples from different soil types in AP Vojvodina and based on their values, determine the suitability of different soil types for SI. The six soil quality indicators were evaluated from 1-4 points for each sample. The sum of the points of all indicators for an individual sample would classify the soil in a certain Category. Category 1 (6-10 points) is recommended only for extensification; Category 2 has more than 10 points, but one or even more indicators are in bad condition (1 point), and therefore intensification is possible only with high-risk; Category 3 (11-15 points) has a low potential for SI and intensification should be carried out with great caution; Category 4 (16-20 points) represents soils that can compensate for the impact of agricultural production on the environment. According to the results, it was determined that 25% of the soil samples are not suitable for SI, while 75% of them are suitable for SI. In soils unsuitable for SI, organic carbon was the main limiting factor. The Vertisols, Solonetz and Solonchaks groups belong to the highest Category according to suitability for SI, and Arenosols and Cambisols to the lowest. Soils with greater depth and a higher content of silt, clay and organic carbon have the highest number of points, namely the soils in the Tisa River valley and the gleyic and clayey soils of eastern and central Banat, while the lowest number is evident on sandstones and mountains. The chernozem zone is in the middle regarding the number of achieved points in terms of SI.

Key words: sustainable intensification, agricultural production, land, soil

P3_06

Content of phytosterols in organic and conventional produced maize and spelt seed

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Abstract

Phytosterols or plant sterols belong to a wide group of steroids with great physiological importance. Phytosterols are found abundant in vegetable oils and maize kernel oil. However they are also beneficial for human health. The content of phytosterols in plants is especially important because they can help to decrease cholesterol level in the intestinal tract. Numerous studies indicate that organically produced plants have a higher amount of numerous phytochemicals compared to conventional. The aim of this study was to determine the potential differences in the content of phytosterols in organically and conventionally produced maize and spelt seeds. Samples were obtained during 2016 season from experimental field of Maize Research Institute (Zemun Polje, Serbia). In order to quantify phytosterols extracts in chloroform were prepared and resulting products of the Lieberman-Burchard reaction was obtained as green colored. The absorbance of obtained green complexes was determined on a spectrophotometer at 640 nm. Results are expressed in mg kg-1 of dry sample weight (DW). According to the obtained results, organic maize seed contained double the amount of phytosterols compared to (324.97 mg kg-1 DW) conventional sample (147.02 mg kg-1 DW). Spelt seeds contained a significantly lower amount of phytosterols: conventional seed contained 288.96 mg kg-1 DW, while organic seed contained only 98.3 mg kg-1 DW. The obtained results indicated that organic maize seeds are a better source of phytosterols copared to spelt seeds.

Key words: maize, spelt, seeds, phytosterols

P3_07

Content of free polyphenols and flavonoids in organic and conventionally produced buckwheat seed

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Abstract

Buchwheat (*Fagopyrum esculentum*) is an annual alternative cereal from the Polygonaceae family gaining high attention among consumer in past decade. It is mostly grown for grain, which is processed into flour and numerous food products. Buckwheat is a very important source of phytochemicals, specially phenolics which have the many human health benefits. Numerous researches have proved that phenolics participate in the prevention of many diseases such as neurodegenerative diseases, cancer, osteoporosis, cardiovascular diseases system, diabetes, etc. In the group of cereals and alternative cereals, buckwheat stands out as a high phenolic source grain having high antioxidant capacity. The aim of this work was to determine the content of the most important antioxidants – total phenolics and flavonoids in buckwheat seed produced in organic and conventional agricultural production during 2016. Content of free (extractable) phenolics and flavonoids was determined using standard spectrophotometric methods with Folin-Ciocalteu reagent and aluminum chloride, respectively. Content of free phenolics was expressed as mg of ferulic acid equivalents (FAE) per kg of dry sample weight (DW) while free flavonoids content was expressed as mg of quercetin equivalents (QE) per kg DW. Content of free phenolics ranged from 6505.7 (organic seed) to 6656.1 (conventional seed) mg FAE/kg DW. Content of free flavonoids was 879.19 mg QE/kg DW in conventional seed, while organic buckwheat seed exhibited significantly higher content- 1094.7 mg QE/kg DW. The obtained results indicated that organic buckwheat seeds are a better source of total phenolics and flavonoids compared to conventional seeds.

Key words: buckwheat, seeds, phenolics, flavonoids

P3_08

Organic sunflower production in Serbia

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Abstract

In Serbia, organic crop production was performed on an area of 25035.1 ha in 2022. Organic fruit production (5702.79 ha) dominated total organic crop production, followed by organic cereal production (3838.54 ha), while organic cultivation of industrial crops came third with an area of 2075.73 ha. The sunflower (*Helianthus annuus*) is one of the most important oil plants in Serbia, alongside soya beans and rapeseed. The economic importance of the sunflower results from its use in the food industry (oil, margarine, flour, seeds), the chemical industry (soap, glycerine, paints, varnishes) and the pharmaceutical industry (medicines and cosmetic products) as well as the production of biodiesel. This paper contains analyses and a graphical representation of the area trends and regional distribution of organic sunflower production in Serbia. The method of secondary research was used for this purpose. Organic sunflower cultivation is performed on an area of 1309.35 ha. The Vojvodina region has the largest area of organic sunflower cultivation (1164.98). However, despite favourable agroecological conditions and market demand, organic sunflower production in Serbia is still insignificant.

Key words: sunflower, organic production, areas, regions

P3_09

Analysing the state of organic triticale production in Serbia

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Abstract

Triticale (*x Triticosecale Wittmack*) is the first cereal successfully bred by man, resulting from the crossing of wheat (*Triticum sp*.) and rye (*Secale cereale*), two species from different genera of the Poaceae family. Triticale was bred with the aim of combining the positive traits of the parent species, and has become increasingly prevalent in grain production in recent years. Organic farming is one of the fastest growing sectors of agriculture for many years, both worldwide and in Serbia. Based on data from the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia, the paper analyses and graphically illustrates ten-year triticale production in Serbia using base and chain indices. In the organic crop production system, which covers a total area of 23,527.04 ha, cereals occupy an area of 3,838.54 ha, with wheat accounting for the largest share with an area of 1,128.77 ha. Organic triticale production fluctuated greatly over the ten-year period. The smallest production of 59.04 ha was recorded in 2012, the largest in 2015 (147.14 ha). After that, production declined from year to year until it reached 66.28 ha in 2022.

Key words: triticale, areas, organic production, base indices, chain indices

P3_10

Influence of nitrogen top dressing and application of different foliar fertilizers on winter wheat productivity traits

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Abstract

Wheat is the main arable crop, grown on about 220 million hectares worldwide. Fertilization is one of the most important factors determining crops productivity and its most important characteristics. Winter wheat (*Triticum aestivum* L.) uptake from the soil large amounts of mineral elements during the growing season and it has a high soil fertility requirement, and nitrogen (N) remarkably contributes to grain yield formation. The aim of this study was to investigate the influence of N top dressing (54 kg ha^{-1} N, added as CAN mineral fertilizer) and the combination of nitrogen and different foliar fertilizers: Fitofert Speed G (3 l ha^{-1}), Slavol (7 l ha^{-1}) and Wuxal super (7 l ha^{-1}) on some parameters of productivity and morphological characteristics of the winter wheat variety Farinelli. The field trial was carried out in 2022/2023 growing season under the agro-ecological conditions of Zaječar, Serbia, on Vertisol soil type. Control treatment received no fertilization. Standard agricultural techniques were applied as in regular winter wheat cultivation. Stem height was increased under all treatments in comparison to control (59.3 cm), whilst the highest plants were recorded under treatment with combination of N and foliar fertilizer Wuxal super (67.5 cm). In each of fertilization treatments plants had 6 internodes, and this number was much higher than 4 internodes recorded in control. The highest number of spikes per m^2 was obtained in the treatment with N and foliar fertilizer Fitofert Speed G while the lowest was recorded in the control (491 and 432 spikes per m^2, respectively).

Key words: wheat, nitrogen, fertilization, morphological characteristics

P3_11

The effect of different microbial fertilizers on the productivity of soybean

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Abstract

The experiment with low-input technology of soybean was conducted at the research and study field "Radmilovac", Faculty of Agriculture Belgrade in 2022 on the luvic chernozem soil type, in completely randomized blocks. Cropping system included tillage with a disc harrow at 20-25 cm with the complete previous crop residues incorporation and the pre-sowing tillage with a harrow. The basic fertilization was conducted in autumn with 300 kg ha^{-1} NPK (15:15:15). For top dressing in spring, the following microbiological fertilizers were applied: biofertilizer ("Slavol", manufacturer "Agrounik" Serbia) with 5.0 l ha^{-1} in two treatments and Eko lame 10 l ha^{-1} in three treatments. The top dressing in the control variant was done with nitrogen fertilizer AN at the rate of 40 kg ha^{-1} N. The soybean (NS Maximus) cultivars were used. The crop was grown in a six-crop rotation (winter wheat-maize-spring barley+red clover-red clover-soybean-sunflower). Statistical analysis confirmed that top dressing had a greater effect on the productivity of soybean. The highest grain weight per plant (30.4 g) and absolute weight (180.2 g) was achieved with the microbiological fertilizer Eko Lame, the lowest with the control variant (18.1 and 178.6 g). The differences achieved were statistically very significant. This led to a statistically very significant increase in grain yield of this variant (3400 kg ha^{-1}) compared to the control (2800 kg ha^{-1}), i.e. a significant increase compared to foliar fertilization with Slavol (3280 kg ha^{-1}). The use of microbiological fertilizers had an effect on the increased competitiveness against weeds and the increase in grain yield.

Key words: fertilizer, yield, soybean, top dressing

P3_12

Consuming organic food and human health benefit

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Abstract

The demand for organic food shows a growing trend due to the increased awareness of the importance of regular consumption of healthy food on human health. Organic food products have certificates because they are produced according to organic standards. The use of synthetic fertilizers, pesticides and genetic modification is not allowed in organic production. Many studies point to differences in favor of organic foods, including indications of beneficial health effects. The aim of this study was to present the impact of organic food consumption on human health. Organic food of biological origin is characterized by the absence or presence of traces of pesticides, a low content of nitrates and an increased content of polyphenols, iron, magnesium and vitamin C. Organic products of animal origin contain healthy unsaturated fatty acids. Organic dairy products have a higher content of protein and saturated fatty acids than conventional products. Regular consumption of organic fruits and vegetables and dairy products reduces the risk of preeclampsia in pregnancy, reduction in obesity and body mass index (BMI), and non-Hodgkin lymphoma in women and (NHL) and colorectal cancers. The positive effect on health is the result of a reduced amount of pesticide residues and an increased intake of secondary plant metabolites that characterize organic food. Further research is needed to confirm the trends observed in existing data and clarify the exact relationships between agricultural management, diet quality and impact on health.

Key words: plant metabolites, organic food, health, cancer, pesticides

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P3_13

Effect of biostimulator Fitostemin-WP® on yield and quality characteristics of rice (*Oryza sativa* L.)

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Abstract

A field experiment was conducted in Kochani town, eastern of Macedonia, to determine the effects of biostimulator Fitostemin-WP® on some yield and quality properties of one rice variety - Opale, during 2020-2021. In a field experiment arranged in the Zade method, two treatments were studied: control and variant 1. As basic fertilizers were applied 350 kg/ha NPK (16:16:16) and 200 kg/ha Urea (46% N) in the phase of tillering at the whole experimental area before sowing. The control treatment has only the basic fertilizers while variant 1 was treated also with Fitostemin-WP® in dosage of 100 g/ha, once during the vegetation period (tillering stage). Parameters that were examined in this study were: biological, grain and straw yield, number of productive tillers/m^2, panicle weight and milling fractions. Results were analyzed with ANOVA and LSD test. The results about the biological yield averages vary from 19261.67 kg/ha for the variant 1 to 17691.67 kg/ha for the control. For the number of productive tillers/m2 the average for variant 1 (561) were on par with the control (541), as well as the panicle weight (variant 1 1065.83 kg/ha and control 1068.33 kg/ha). Fitostemin-WP® showed approximately the same average values about the total milling fractions of the rice examined in both years regardless of the treatments. According to the results from this research study, statistically significant differences were not found in these two years of field experiment for the examined parameters. It is necessary to continue the field experiment with more frequent usage (2 or 3 times during the vegetation period of the rice production) of the Fitostemin-WP®.

Key words: Herbal vaccine, biological yield, productive tillers, milling fractions

P3_14

The influence of different fertilization methods on the components of yield and the grain yield of faba bean (*Vicia faba* ssp. *eufaba* var. *minor*)

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Abstract

The research was carried out on the experimental field of the PI Agricultural Institute of the Republic of Srpska, Banja Luka in 2021 and 2022. These studies aimed to investigate the impact of different fertilization treatments on yield components and grain yield of faba bean (*Vicia faba* var. *minor*) in the agro-ecological conditions of the Banja Luka region. The experiment was set up in four replications in a randomized block system. In both years of the experiment, beans were sown by hand in March with 160 kg ha^{-1} of seeds. Four fertilization treatments were applied to the faba bean crop: control, 300 kg ha^{-1} NPK 15:15:15, 250 ml ha^{-1} Slavol S, and 300 kg ha^{-1} NPK 15:15:15 + 250 ml ha^{-1} Slavol S. During these tests, the following properties were monitored: plant height, number of pods/plant, length of pods, number of grains/pods, mass of grains/pods, mass of 1000 grains and yield of grains/ha. In the first year of research, the average height of the faba bean plants varied from 78.8 cm in the Slavol S treatment to 83.0 cm in the NPK 15:15:15 + Slavol S treatment. The highest average number of grains/pods and the number of pods/ plants was found in faba bean plants that were grown in the treatment with NPK 15:15:15 + Slavol S. In the second year of research, the faba bean plants in the treatment with Slavol S were the lowest, and the plants in the treatment with NPK 15:15:15 had the highest average height. Faba bean plants grown in the NPK 15:15:15 treatment had the highest average number of grains/pods and the longest pod length in 2022. This research achieved the highest average two-year faba bean grain yield with NPK 15:15:15 + Slavol S treatment, respectively 2 958.5 kg ha^{-1}.

Key words: Vicia faba var. minor, fertilization treatment, grain yield

P3_15

The influence of fertilization on the quality and yield of sweet corn

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Abstract

The aim of this study was to evaluate the influence of fertilization on the quality and yield of sweet corn. The influence of fertilization on cob length and diameter on yield and yield components was investigated. The trial was conducted on the premises of the maize research institute "Zemun Polje". Two genotypes of sweet maize grown (ZP 355su and ZP 4118). The first tillage and basic fertilization were carried out in autumn. The second fertilization consisted of a combination of basic fertilization and microbiological seed treatment, while the third fertilization consisted of a combination of the first two fertilizations and foliar fertilization. There was no statistically significant difference in cob length between the observed genotypes, indicating that fertilization had no significant effect on this trait. However, a statistically very significant difference in cob diameter was observed between the genotypes. The first genotype had a higher mean value of 5.22 cm, while the second genotype had a mean value of 4.82 cm. The interaction of genotype and fertilization significantly influenced the piston diameter. There was no statistically significant difference in yield components between genotype and fertilization. However, the genotype had a statistically very significant effect on yield, while the effect of fertilization was not statistically significant. The first genotype gave better results with 9.20 t/ha than the second genotype with 7.09 t/ha. Considering that yield is the most important component in sweet corn cultivation, it was found that the genotype ZP 355su, a hybrid with shorter vegetation, gave a better yield compared to the hybrid ZP 4118su. In addition, it was found that the interaction of genotype and fertilization in this case had an effect on cob diameter, but not on yield, yield components and cob length.

Key words: sweet corn, fertilization, yield, cob length, cob diameter.

P3_16

Effects of foliar application of *Ascophyllum nodosum* extract on bean productivity under the influence of soil reaction as a factor of abiotic stress

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Abstract

Crops can be exposed to various stress factors such as salinity, drought, waterlogging and soil reaction. Among these factors, acidic soil reaction is a major threat to most soils in Serbia. Currently, biostimulators are considered to effectively stimulate plant growth regardless of growing conditions. Therefore, effects of foliar application of *Ascophyllum nodosum* seaweed extract (AnE) as biostimulator on bean productivity under stress (acidic soil reaction) and non-stress (neutral reaction) conditions were investigated in pot experiment in chamber. AnE was applied foliar shortly before flowering in dose 1 L/ha and solution concentrations of 0.25%, 0.5%, and 1%. The dynamic of Nitrogen Balance Index (NBI), chlorophyll, and flavonol content were monitored in vivo non-destructively using a Dualex sensor. Measurements were performed in six replicates on the uniform, fully developed leaves of the same plants, which were later used to determine morpho-physiological parameters (shoots dry and fresh weight of, leaf area) and yield (mass, total number of pods and number of mature pods). In non-stressed plants, the application of AnE at concentrations of 0.5% and 1% led to an extension of the vegetation period and delay in their maturity, leading to an increase in shoot dry and fresh weight and leaf area, as well as decrease in NBI, chlorophyll and flavonol. Consequently, the prolonged vegetation led to a decrease in the number and mass of fully developed pods. In contrast, in plants grown under stress conditions, the application of AnE was effective at concentration of 0.5%, resulted in a shortening of growing period and in an increase of yield. Thus, foliar application of AnE should be carefully planned, especially with regard to growing conditions and solution concentrations. These results should be further investigated using different plant species in field conditions, where the plants are simultaneously exposed to different stress factors.

Key words: Ascophyllum nodosum, bean, soil reaction, vegetative period, yield

P3_17

Genotype and fertilization effect on nitrogen content in maize (*Zea mays* L.)

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Abstract

Nitrogen (N) is an essential nutrient for maize growth and development, as well as an important factor in sustainable maize production. Timing and rate of nitrogen fertilizer application can influence maize grain yield, N uptake, and nitrogen use efficiency (NUE) parameters. Efficient nitrogen fertilizer management is essential for achieving economic yields and for enhancing N use efficiency. The experiment was conducted at the Institute of Field and Vegetable Crops, National Institute of the Republic of Serbia situated at N 45° 19', E 19° 50'. An experiment was a randomized complete block design (RCBD) in a factorial arrangement with four replications during the two years. Four divergent maize, NS-4023, NS-6010, NS-6030 and NS-640 were grown under eight nitrogen combinations: fertilizer combinations with nitrogen addition in autumn and spring. The following factors were studied: N1: P60K60; N2: P60K60 + Nmin spring; N3: P60K60 + N40autumn + Nmin spring [(nitrogen added based on mineral nitrogen content in spring (NO_3-N)]; N4: P60K60 + N60spring; N5: P60K60 + N100spring; N6: P60K60 + N40autumn + N60spring + Zn; N7: P60K60 + N40autumn + N80spring + Zn; N8: P60K60 + N160spring + Zn in both years of study. Zinc was applied as zinc sulfate (ZnSO4) in the amount of 1.0 kg ha^{-1} with foliar spraying, in the fourth and sixth week after sowing. Plant tissue analyses included contents of nitrogen in leaves and grain. Leaf samples (25 leaves) were taken under the cob in the silking stage (the second half of July). After maize harvest from each elementary plot cobs were taken for nitrogen analysis in grain. Results showed a fairly wide variability for leaf (1.91-2.58%) and grain N concentration (1.22-1.42%), amongst the hybrids, across different nitrogen systems fertilization. The two-way interaction of year and fertilization rate, fertilization rate and genotype significantly affected leaf and grain nitrogen concentration, respectively. Future studies need to be done in different locations in South Pannonian Basin to investigate the rates and timing effects of mineral fertilizers on the on the mineral composition and productivity of the maize.

Key words: nitrogen, rates, timing, fertilization, genotype, maize

P3_18

The weed seed bank in cabbage and soybean crops

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Abstract

Weed management is one of the mandatory control measures in agriculture due to many harmful effects the weeds have on the crops. In recent years the attention given to the weed seed bank, as the main source of the weeds' continuous occurrence in the nature, is rising. Knowing the weed seed bank in the agroecosystems is making the monitoring of the weeds, planning the weed management, as well as the assessment of their occurrence, easier. The weed seed bank presents a peculiar reservoir of the weed seeds which are able to germinate and establish new weed plants in certain soil and environmental conditions. In this paper the analysis of the weed seed bank in the cabbage and soybean crops at the locality of Kljajićevo, Serbia, during 2022 and 2023 was carried out. The soil samples were taken from three soil depths: 0-10, 10-20 and 20-30 cm in 10 replicates per plot, after which they were sieved through a system of copper sieves under a stream of lukewarm water. Then, the weed seeds were manually separated from the remaining organic matter and determined by the use of binoculars. After two weeks of seed germination under the controlled conditions, the seeds that did not germinate were separated and their viability was assessed using the Crush test. In the cabbage, according to the obtained results, the presence of 17 weed species was determined, of which the largest number of the seeds belonged to *Portulaca oleracea* and *Amaranthus retroflexus*. In the soybean, the presence of 13 weed species was noted, with the dominance of *A. retroflexus* and *Chenopodium hybridum*. Seed germination in a climate chamber, along with the Crush test, determined that the highest percentage of viable seeds belonged to *A. retroflexus*.

Key words: weeds, seed viability, Crush test

P3_19

The fruit morphology of some *Xanthium* species

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Abstract

Xanthium species are widespread weed species, in many countries characterized as invasive species. Due to the tendency for occasional cross-pollination (less than 12%) among subspecies, many variations arise, which often result in small, local, but unstable taxa so identification could be very problematic. Based on morphological characteristics, two species of the genus *Xanthium* were identified: *X. orientale* L. and *X. spinosum* L. Within the species *X. orientale* L., two subspecies were identified: *X. orientale* L. subsp. *italicum* (Moretti) Greuter and *X. orientale* L. subsp. *riparium* (Čelak.) Greuter. Morphological characteristics of the fruit as size, weight, and morphology of the fruit/seed coat can be very helpful for the identification of species or lower taxonomic categories. Morphological characteristics of the fruit (fruit length, length of apical beaks, fruit width with and without lateral beaks and mass of fruit) were recorded. Among the observed subspecies *X. orientale* L. subsp. *italicum* and *X. orientale* L. subsp. *riparium*, morphological differences are noticeable primarily in the appearance of the lateral and the apical beaks of the fruit.

Key words: weed, *Xanthium*, identification, morphological characteristics of fruit

P3_20

Productivity of less cultivated species *Avena strigosa* Schreb. - black oats - and her health benefits

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Abstract

Black oat grain - *Avena strigosa* Schreb. is on the list of 20 healthiest products. It is desirable in the diet because it has a lower proportion of carbohydrates and is rich in proteins (up to 15%, where the amino acid lysine dominates), then oils, cellulose, minerals and vitamins and can provide great health benefits. The oil content in oat seeds reaches up to 10%, depending on the location and tested year. The following fatty acids dominate in the seed: linoleic (45%), oleic (30%), palmitic (20%), stearic (6%), linoleic (6%) and myristic (4%) acids. Black oats are also a forage crop used for cover cropping, weed control and nematode control. Allelopathic compounds released through the oats roots inhibit weed growth. It produces a large amount of biomass that decomposes quickly, and returns valuable nutrients and organic particles back to the soil. Although the grain of black oats has excellent nutritional value, this species is less cultivated in the world and in our country. This study aims to test black oats and examine its morphological and productive properties at the Bački Petrovac location. An experiment with two populations: G1- black oats - "crni" and G2- "rutavi" oat, was set up in three repetitions on the plots of the Institute of Field and Vegetable Crops in Bački Petrovac, in 2023. Sowing was done in April and harvesting was done at the technological maturity of the crop, when plants from each repetition were taken for analysis: plant height, plant height to panicle, root length, plant weight, grain weight and number of grains per plant. Genotype had a significant effect on grain yield per plant and yield components. G2 - "Rutavi" oats had statistically significantly higher values for plant height (145 cm) and plant height to panicle (125 cm) compared to G1- black oats (108 cm and 90 cm). Black oats had higher values for root length (8), plant weight (9 g), grain weight (3 g) and number of grains (95) compared to G2 (6; 5 g; 1.2 g; 65). The results show that black oats can be successfully grown in Bačka region in Vojvodina. Eating oats helps prevent some diseases: digestion, insomnia, anxiety, depression, nervousness, hoarseness, arteriosclerosis, dermatitis and some forms of cancer, lowers cholesterol, blood sugar and high blood pressure.

Key words: black oat, less cultivated species, grain, health benefits

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P3_21

The concentration of heavy metals in sediments of drainage canals

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Abstract

Heavy metals (HM) are potentially toxic, persistent, and non-degradable elements. HMs have the ability to deposit, accumulate, and increase their concentration in the sediments of water bodies. They can pose a serious risk to the environment. Negative consequences occur within the canals themselves and surrounding agricultural land. In the lowland, predominantly agricultural region of Vojvodina (the northern part of Serbia), there exists a relatively dense network of drainage canals. These canals are in direct connection with the arable land. They are exposed to the processes of erosion, runoff, leaching, and the effects of chemical agents from agriculture. Some of their sections are recipients of untreated wastewater from settlements and industries. In about 100 sediment samples from the canals, the concentrations of the following HMs were analyzed: Pb, Cd, Cr, Ni, Cu, Zn, and the estimated risk to the environment. HM concentrations were found in a very wide range: Pb 0-322 (Avg. 39.8), Cd 0-135 (4.04), Cr 0-6996 (293.18), Ni 4.2-829 (42.59), Cu 3.6-347 (52.74), and Zn 11.9-1084 (202.74) mg/kg. The percentage of analyzed samples with HM concentrations higher than the prescribed maximum allowed concentrations (MAC) was 1%, 5%, 10%, 17%, 11%, and 14%, respectively, for Pb, Cd, Cr, Ni, Cu, and Zn. Extremely high values were found in some samples taken in the zone of influence of settlements and industry: 2.5 to even 29 times higher than the prescribed MAC. Based on the conducted research, it can be stated that in addition to the agronomic, hydro technical, and economic aspects, the ecological aspects of the problem of sediments in drainage canals are also very pronounced.

Key words: drainage canals, sediments, heavy metals, pollution

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P3_22

Modeling reference evapotranspiration in Vojvodina Province using artificial neural networks

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Abstract

Reference evapotranspiration (ET0) represents an important element in the water balance analysis. Its calculation is a cornerstone of engineering drainage and irrigation systems, particularly within hydro-melioration practices. It is necessary for calculating irrigation norms and plant water requirements and determining the correct irrigation regimen. Considering that crop irrigation water needs are closely related to ET0, determining ET0 represents a key task in water resource management planning. This study explores the effectiveness of applying Artificial Neural Networks (ANN) in estimating ET0 by analyzing limited meteorological variables. These ANN models harness daily meteorological parameters, including maximum temperature, minimum temperature, relative humidity, wind speed, and global radiation, as input variables to deduce ET0 outputs. The applied daily dataset was collected from the Novi Sad station in Vojvodina Province, Serbia. For the validation of the developed Artificial Intelligence models, the FAO-56 Penman-Monteith equation was employed as a benchmark. The accuracy of the developed model was assessed using quantitative metrics, including R2, NSE, RMSE, and MAE. Considering individual and potential combinations of these five input variables and varying numbers of hidden neurons, 31 distinct model architectures were analyzed to evaluate their accuracy in predicting ET0. The results revealed that the proper selection of neural network architecture reduced errors and enhanced the relationship between dependent and independent variables. Comparative performances of ANN models indicated that the choice of meteorological input variables and model architecture are the primary determinants of ANN model performance. A comparative analysis of ANN model performance indicates that selecting meteorological input variables and model architecture are key factors influencing ANN model performance.

Key words: Artificial neural network, meteorological data, reference evapotranspiration, FAO-56 PM

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P3_23

Response of soybean to deficit irrigation

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Abstract

Drip irrigation is gaining increased interest in the production of soybeans. The changing climate causes an increased demand for water sources of good quality. Consequently, the drip irrigation method should be adapted for the rational use of limited water supplies. Introducing deficit irrigation instead of traditional watering rates is imposed as a potential solution to achieve this goal. Therefore, the research examines the possibility of deficit irrigation in soybean production. The experiment was conducted in field conditions during 2022-2023, in the Vojvodina region, the northern part of Serbia, at the experimental field in Bački Petrovac, the Institute of Field and Vegetable Crops, Novi Sad. The irrigation was scheduled using the water balance method. The irrigation rate was 30 mm in the vegetative and 40 mm in the reproductive stages. Three treatments were investigated: full irrigation of soybean (F), regulated deficit irrigation (RDI) with 20% less irrigation rates in the vegetative stages, and sustained deficit irrigation (SDI) with 20% less irrigation rates through the whole season. The rainfed treatment was also included. No significant yield decrease was found between F and RDI, while the yield reduction was the highest on SDI. The lowest yield was on rainfed treatment. Irrigation and evapotranspiration water use efficiency were similar on F and SDI, while lower values were found on SDI. The yield response factor is below 1, indicating that the soybean is tolerant to water deficit. The average value in the dry year is about 0.68 and in the humid year 0.74 without major variations between F and RDI. Lower values were found on SDI which corresponds to the achieved yields. Based on the data on yield and water use efficiency, it can be concluded that RDI can be recommended in soybean production in climatic conditions of the Vojvodina region.

Key words: soybean, drip irrigation, deficit irrigation

P3_24

Water characteristic of grassland soils (Eastern Serbia)

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Abstract

Soil water characteristic (SWC) is an important hydraulic property. Changes in plant diversity in arid and semi-arid grassland ecosystems are closely related to soil moisture. The main objective of this study was to measure the SWC of Calcomelanosols (Leptosol and Phaeozems) under grassland vegetation in Eastern Serbia (Mts. Rtanj, Devica and Ozren). A total of ten representative soil profiles were excavated, described and sampled. Soil saturated water content (SSWC), field water capacity (FWC) and wilting point (WP) were measured at pressures of 0.0 kPa, -33 kPa and -1500 kPa, respectively. The plant available water capacity (AWC) and the water storage capacity (WSC) were calculated. The saturated hydraulic conductivity (Ksat) was measured using the falling water head test. The basic physical and chemical soil properties were determined by common methods. The average SSWC value was high (71.8±2.97%). The FWC showed high values (exceeding 35%) and the WP was estimated as relatively high (exceeding 23.1%). AWC values ranged from 8.09 to 11.9% (average 9.98±1.43%). Shallower soil depth mainly caused low to moderate soil WSC. The Ksat ranged from 21.1 cm h−1 to 66.5 cm h−1 (average 46.0±16.03 cm h−1). The Ksat measurements showed that the soils in the study area belonged to the high and very high classes. SWC showed a significant ($p<0.05$) correlation with the following soil parameters: depth, texture, structure, humus and CEC. The investigated soils are primarily characterized by a lower WSC, which is mainly influenced by the shallower soil depth. Nevertheless, the species richness was not affected by the moderate SWC, and the grassland vegetation, corresponding to the Festucion valesiacae and Saturejion montanae alliances, is characterized by exceptional species diversity at the study sites.

Key words: calcomelanosols, SWC, FWC, WP, WSC

P3_25

Screening of annual wild Helianthus species for *Frankliniella occidentalis* tolerance

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Abstract

Frankliniella occidentalis (thrips) is a widespread polyphagous insect pest that causes damage and yield losses. Control of this and other thrips species is challenging due to the emergence of insecticide-resistant populations. Wild sunflower species have proven useful in sunflower breeding programs as a source of resistance genes. Therefore, this work is aimed to evaluate the suseptibility of five annual wild species of Helianthus (*H. annuus*, *H. argophillus*, *H. neglectus*, *H. praecox* and *H. petiolaris*) in relation to the tolerance of *F. occidentalis*. The bioassay was set up in a greenhouse with an uncontrolled thrips population, in ten replicates. The number of adults of F. occidentalis was counted twice during the experiment, within ten days, from five leaves of each plant (replication). The density of non-glandular trichomes on both epidermises was analyzed with a light microscope on the same leaves (except *H. argophyllus*). According to our results, the highest average number of thrips adults was on *H. annuus* and *H. argophilus* during both observation periods that also have a very dense indumentum. The most tolerant, with the lowest number of thrips adults were *H. praecox* and *H. neglectus*, characterized with less developed indumentum. According to our results, we can conclude that the density of non-glandular trichomes does not affect the preference of *F. occidentalis*. However, the development and distribution of the leaf epidermal cuticle, epicuticular waxes and glandular trichomes (capitate and linear) may be related to the degree of resistance, which will be subject of our future research.

Key words: thrips, wild sunflower, indumentum

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P3_26

Sunflower breeding for biotic and abiotic challenges

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Abstract

Sunflower (*Helianthus annuus* L.) breeding for biotic and abiotic challenges is a dynamic and multidisciplinary process that requires ongoing research and adaptation to evolving agricultural and environmental conditions. It plays a crucial role in ensuring the sustainability and productivity of sunflower crop worldwide, as an important source of edible oil for human consumption. Sunflower is host for large number of pathogenic microorganism that can cause a significant reduction in yield such as Plasmopara halstedii, Sclerotinia sclerotiorum, Verticillium dahliae, Macrophomina phaseolina, Fusarium spp. etc. Another important biotic threat on sunflower is certainly the parasitic plant broomrape (*Orobanche cumana*) which is one of the most important breeding topic worldwide. Breeding process typically combines traditional breeding methods and modern biotechnological tools to enhance the efficiency and precision of the breeding process. It is aimed to identify and incorporate genes or traits associated with resistance or tolerance to certain biotic stress and utilize molecular markers linked to genes associated with. Abiotic stress tolerance involves selection and development of genotypes that can withstand and thrive in unfavorable environmental conditions such as drought, salinity, high temperatures, etc. In that regard, effective sunflower breeding is aimed at combining phenotypic data with genotypic information for more effective selection via utilizing advanced phenotyping technologies to accurately assess plant performance under different stress conditions. In addition, work on increasing and maintaining the existing genetic diversity in sunflower gene banks is essential for long-term resilience against evolving biotic and abiotic stresses.

Key words: sunflower, biotic and abiotic stress, resilience

P3_27

Chemical and antioxidant analysis of sunflower hybrids in Serbia

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Abstract

Sunflower seeds and their oils have been integral to human diets since ancient times, offering a rich source of essential nutrients, vitamins, minerals, and beneficial fatty acids. Notably, sunflower seeds contain significant levels of phenolic compounds, including flavonoids and polyphenols, renowned for their nutraceutical properties that promote human health. These compounds exhibit potent antioxidant activity, crucial for combating oxidative stress-related ailments such as premature aging, cardiovascular issues, neurodegenerative disorders, and certain cancers. In this study, we examined the oil, protein and tocopherols contents, as well as the levels of total polyphenols and flavonoids, across 20 different sunflower genotypes to assess the potential of these seeds as a source of valuable natural compounds. The seed's oil percentage was determined using Maran Ultra Resonance NMR, while protein content was assessed via the Dumas method. Total flavonoid content was measured using AlCl3 colorimetry, and polyphenol content was estimated using the Folin-Ciocalteu assay. Tocopherols were quantified through HPLC with fluorescence detection (λex=280 nm, λem=340 nm), using n-hexane/ethyl acetate (70/30, v/v) as the mobile phase at a flow rate of 1 ml/min. Oil content ranged from 32.46% (NS Fantazija) to 51.60% (NS Trifun), while protein content ranged from 13.94% (NS Zmaj) to 26.58% (NS Kiril Pr). Total polyphenol content varied from 381.4 (Konfidens AR6) to 593.4 (NS Romeo) mg of chlorogenic acid equivalent per 100 g dry matter, and flavonoid content ranged from 193.0 (Konfidens AR6) to 335.8 (Duško) mg of catechin equivalent per 100 g dry matter. Moreover, the levels of total tocopherols spanned from 245.63 mg/kg (NS Kruna) to 584.47 mg/kg (NS Romeo), with alpha-tocopherols being the predominant form, ranging from 245.63 to 563.73 mg/kg (NS Kruna and NS Romeo, respectively), and beta-tocopherols from 10.66 to 41.03 mg/kg (Duško and NS Konstantin, respectively). These findings underscore the potential for breeding initiatives aimed at developing sunflower hybrids with superior grain quality attributes tailored for diverse applications. This study provides valuable insights that can inform the development of novel sunflower hybrids with improved nutritional profiles and broader utility across various sectors.

Key words: sunflower seed, protein, oil, tocopherols, antioxidant capacity

P3_28

Phenotypic characterization of rice genotypes (*Oryza sativa* L.)

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Abstract

The study was conducted to examine the phenotypic properties and to study their variability. The experiment was carried out in a randomized block system with 53 rice genotypes in three replications, with a plot size of 3 m^2 during 2022 vegetative year. From each genotype, 10 plants were randomly selected, and 9 phenotypic properties were examined for each of them. The influence of genotypes is highly significant for all analyzed properties: plant height, stem height, panicle length, panicle weight, number of filled grains in a panicle, number of unfilled grains in a panicle, weight of filled grains, weight of unfiled grains and number of primary branches per panicle. Also, the obtained results show that there is phenotypic variation among genotypes for these properties. The obtained results were statistically analyzed by ANOVA and were tested with the LSD test, with a probability of 0.001. GN-104 showed the highest value for panicle length (20.25 cm), the highest total number of grains (131), as well as the highest number of filled grains (106.7). GN-119 has maximum values for panicle weight (3.79 g) and number of filled grains (3.43), along with GN-102 (3.49). GN-152 has above average values for all positive traits but belongs to tall genotypes. GN-153 has the lowest weight per panicle (1.29 g), the lowest number of filled grains per panicle (40.47) and the lowest weight of filled grains (1.10 g), while GN-103 has the lowest number of unfilled grains per panicle. The wide phenotypic variation can be used in rice breeding programs, i.e., crossing genotypes with desired properties.

Key words: height, weight, filled grains, primary branches, paddy rice

P3_29

Variability of thousand seed weight in bread wheat (*Triticum aestivum* L.)

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Abstract

Thousand-seed weight (TSW) is one of the traits which related to yield and milling quality of wheat. The aim of this work was to study the variability of the thousand-seed weight of bread wheat varieties grown under different environmental condition. For study were used fifty wheat varieties in a field experiment which design in a randomized block system in three replications on the field in Kraljevo, Serbia during two vegetation season (2015-2017). The seeds of the varieties were sown at the distance of 0.10 m in rows of 1.0 m length among which was the distance of 0.2 m. Sixty plants at the full maturity stage (20 plants replication^{-1}) were harvested and used for analyzing the thousand-seed weight. The analysis of variance was performed by MSTAT C (5.0 version). Similarities among wheat were analyzed by using the hierarchical method of the Euclidean distance. The results showed significant differences in the thousand-seed weight among varieties in both years, estimated by the F-test. On average, in the first vegetation season the least thousand-seed weight (39.14 g) was recorded in the Lepenica variety, while the highest thousand-seed weight (54.66 g) was recorded in the Zadruga variety. In the second vegetation season, thousand-seed weight varied from the lowest (34.57 g) in NS Rana 2 to the highest (50.33 g) in Šumadinka. The similarity was illustrated on a dendogram contained four clusters in the first year and six clusters of varieties in the second year. The prominent cluster contained different numbers and compositions of varieties with the highest degree of similarity. The differences in average of thousand-seed weight were determined by genetic, environmental factor and by interaction genotype/environment.

Key words: wheat, variety, thousand-seed weight, similarity, environment

P3_30

Specificities of growing seed wheat in agroecological conditions of Bosnia and Herzegovina

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Abstract

Winter wheat is the most important winter crop in Bosnia and Herzegovina as well as in the region. The yield of winter wheat varies depending on the variety and agroecological growing conditions. For sowing wheat, the sowing rate is 250-300 kg ha $^{-1}$. About 50,000 ha are sown annually in Bosnia and Herzegovina, which requires about 15,000 tons of seeds. From this quantity, about 10% of needs are met from own production, and the rest of the seeds are imported. This paper analyzes the production of seed wheat at one of the largest domestic producers of wheat seeds. The paper presents data on seed production in two years, at three locations with four genotypes. The obtained results show that superior yields can be achieved using appropriate agricultural techniques and an assortment with good genetic predispositions. Due to the specificity of climatic and edaphic factors, good results are also achieved when growing specific genotypes with increased protein and gluten content. Statistically highly significant ($p<0.01$) positive correlations were found between protein content and gluten content (0.98**). Highly significant correlations were found between hectolith mass and protein content (0.60**) and gluten (0.56**). The goal of the work is to increase the domestic production of seed wheat, as well as to carry out rezoning of the sowing of the appropriate assortment based on the analysis.

Key words: seed, variety, seed yield

P3_31

Assessing the impact of soil type and seasonal variations on wheat spike index

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Abstract

Understanding how wheat genotypes respond to diverse environmental conditions is crucial in the face of climate change and varying agroecological factors, given that wheat is one of the world's most important crops, providing a significant portion of global food security. To address this, a study analyzed 27 wheat genotypes in solonetz (Kumane, Serbia) and chernozem (Rimski Šančevi, Serbia) soils over two growing seasons. The aim was to investigate how these genotypes perform in different soil types and under varying precipitation levels. It was found that increased soil alkalinity reduces spike weight and grain weight per spike, but proportionally, resulting in similar spike index values across different soil types (0.75 in chernozem and 0.73 in solonetz). The genotype Bankut 1205 had the highest spike index on solonetz (0.82), while the genotype Pesma exhibited the highest spike index on chernozem (0.89). In the season with lower precipitation (2017/2018), a higher spike index was recorded compared to the season with favorable precipitation (2015/2016), indicating plants directed more resources towards grain formation under drought stress. The genotype Pesma had the highest spike index in the 2015/2016 season (0.87), while the genotype Renesansa had the highest spike index in the 2017/2018 season (0.81). Chernozem soil exhibited higher stability, resulting in less variation in spike index values between seasons compared to solonetz soil. Differences in spike index values between different agroecological conditions may result from complex interactions between soil type, season, and plant tolerance to stress factors, with plants showing greater adaptation to drought. This study emphasizes the importance of studying spike index for better understanding wheat adaptability to changing environmental conditions.

Key words: solonetz, chernozem, spike index, tolerance, drought

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P3_32

Characterization of maize genotypes included in SafeSeed project based on kernel hardness and color

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Abstract

As a part of the SafeSeed project, funded by the Science Fund of the Republic of Serbia (call Prisma) among other traits, we will assess the tolerance of a up to 30 genotypes of 10 agronomically important plant species to the most important stored product pests. 39 maize genotypes of different genetic composition were included in the research. Inbred lines of standard grain type and corresponding F1 hybrids, populations of different genetic basis, biparental F2 obtained from F1 hybrids, local and introduced populations were examined. This paper presents preliminary results of morphological characterization of mentioned maize genotypes, based on kernel hardness and color. As a wide variety of material was examined, including flint and popcorn (as the hardest), dent, and maize genotypes with sugary and oily kernel type (as the softest), significant differences in the hardness and color of the kernels were recorded. As these can affect the interaction with store product pests, the tolerance level might differ among genotypes.

Key words: Zea mays, kernel traits, populations, genetic variability, store product pests

P3_33

Unraveling genetic diversity of maize inbred lines from MRI gen bank using single-nucleotide polymorphism markers

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Abstract

Understanding maize germplasm's genetic diversity is essential for developing new and improved hybrids with stable yields under diverse environments, especially in the era of devastating consequences of climate changing. The application of high-throughput genotyping techniques to analyze maize inbreds from gene banks offers a valuable opportunity to gain insights into new sources of genetic variability. This knowledge is indispensable for driving advancements in crop improvement. This research aimed to analyze the genetic variability and population structure of 63 maize inbreds collected from diverse sources within the MRI gene bank using 16,366 informative single nucleotide polymorphism (SNP) markers of 25k SNP array (Illumina Infinium Arrays). The polymorphic information content (PIC), major allele frequency, the number of alleles, heterozygosity, and gene diversity were estimated. Genetic distances were calculated and used for cluster and PCoA analysis. Population structure analysis was done using STRUCTURE software. Through the application of cluster analysis, the 63 samples originating from three different geographical regions (Balkan, USA and SUN, former Soviet Union of Socialist Republics) were classified into three distinct groups. In Cluster I two subclusters consist of inbred lines form SUN and two subclasters of inbred lines from Balkan and USA. Cluster II have two subclasters (1 lines from USA and SUN and 2 Balkan and SUN) and cluster III mainly consist of lines from Balkan and SUN. However, the results of Principal Coordinates Analysis (PCoA) revealed a different classification – majority of the genotypes were grouped together whereas a few inbred genotypes were observed to be randomly distributed. The pattern of grouping of the lines based on the STRUCTURE analysis was in concordance with the results of the cluster analysis. Acquiring additional information, such as pedigree data, is essential for obtaining a more profound and accurate understanding of the relationships among the tested maize genotypes.

Key words: maize, diversity pattern, population structure, SNP array

P3_34

Combining abilities as a prerequisite for creating high-yielding maize hybrids (*Zea mays* L.)

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Abstract

Combining abilities of maize inbred lines play a key role in creating high-yielding hybrids, contributing to the improvement of agricultural production and food security. Good combiners are not only genotypes with high combining abilities, but they must also possess other desirable traits. Through careful analysis of general and specific combining abilities, considering genetic diversity and desired traits, the best parents for creating high-yielding hybrids can be identified. General and specific combining abilities are key concepts in maize breeding, allowing for the assessment of genetic interactions between different parental genotypes. The aim of this study is to determine whether inbred lines with the highest general combining ability values produce hybrids with the highest specific combining ability values for grain yield and yield components. The study used seven maize inbred lines crossed using the diallel method to produce 21 hybrids. The trial was conducted in 2018 at three locations using a completely randomized block design with the inbred lines and hybrids planted in three replications. The inbred lines ZPL2 and ZPL4 had the highest general combining ability values for grain yield, ZPL2 and ZPL7 for ear length, ZPL4 and ZPL5 for number of kernel rows, and ZPL2 and ZPL7 for number of kernels per row. The hybrid combinations ZPL1 x ZPL4 and ZPL2 x ZPL4 had the highest specific combining ability values for grain yield, ZPL1 x ZPL4 and ZPL2 x ZPL6 for ear length, ZPL1 x ZPL4 and ZPL5 x ZPL6 for number of kernel rows, and ZPL1 x ZPL4 and ZPL2 x ZPL6 for number of kernels per row. Based on the results for each trait, it is evident that it is sufficient for one parent to have high general combining ability values to produce high specific combining ability values when combined with another parent.

Key words: combining abilities, maize, grain yield, yield components

P3_35

Multi environment maize yield trials: Cleaned vs raw field yield data

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Abstract

Yield multi environment trials are conducted in order to enable selection of the most successful genotypes. It is critical because of existence of Genotype by Environment interaction. Generally, data can be considered high quality if it fits for intended use in operations, decision making and planning. As the results of trials cannot be directly interpreted without previous statistical processing, quality of raw data as input for biometrical analysis is essential for obtaining relevant measure of genotype in terms of productivity and adaptability (reliability) of new advanced maize hybrids. The importance of having reliable data in any statistical analysis cannot be stressed enough. Often, the analyst may get fascinated by the complexity or beauty of the statistical method being applied, while the data itself may be unreliable and lead to results which suggest courses of action without a solid basis. Data cleaning should be based primarily on breeders notes, referring to plot score. It is widely accepted that even up to 30% data points can be replaced with calculated value without significant loss in data quality (Woyann et al., 2017). Additional information on suspected outliers can be get from Box plot analysis. A good researcher spends more than 75% of his/her time on collecting and cleaning data, and developing hypothesis, and only up to 25% on the actual statistical data processing and deriving results. Data cleaning generally lead to decrease of variance, standard deviation, coefficient of variation and Least Significant Difference between genotypes. At the same time, data cleaning usually lead to increase in mean values, mean square values and F test values in ANOVA. MS for environment and especially error MS tends to be a way lower compared to uncleaned data.

Key words: Maize breeding, plot scoring, data cleaning

P3_36

The proportion of surviving genotypes of red clover in relation to their origin

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Abstract

Red clover is an important fodder crop grown in all agricultural areas of the world, but is most productive in temperate zones. It can be sown as a monoculture, but is a more often a component of clover-grass mixtures. 46 red clover accessions were analyzed to determine the proportion of surviving genotypes and observations were made during the second year of cultivation. The red clover collection included accessions of different geographical origin and the trial was guided in a randomized block design with three replicates at the testing place Rimski Šančevi in Novi Sad, Serbia. Our results showed that the degree of ploidy had no effect on the distribution of surviving plants. The most numerous and persistent genotypes were predominantly of southern European and American/Australian origin. Genotypes from north-western Europe and central-eastern Europe showed no tendency to group, but were evenly represented in terms of survival rate. The observed phenotypic variation in the number of surviving red clover genotypes is the result of both genetic and environmental factors, and when selecting for improved tolerance to biotic and abiotic stress and for persistence, the origin of the parental material must be taken into account.

Key words: red clover, collection, genotypes, survival rate, geographical origin

P3_37

Productivity of red clover (*Trifolium pratense* L.) on acidic soil

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Abstract

Red clover is an important forage plant species for the production of fodder, primarily in mountain areas and soils of poorer quality. Low pH reaction of the soil and poor supply of phosphorus are limiting factors for the cultivation of most plant species on soils with such chemical characteristics. The aim of these investigations was to determine the productivity and variation in the height of the plant, the yield of green mass and the yield of hay of red clover grown on acidic soil, in order to find out which varieties give the highest yields of green mass and hay, and for the purpose of their greater use in production. The research was carried out by analyzing five varieties of red clover in two cuts in each of the two years in the BDS area of the city of Banja Luka. A large part of the soil of Republic of Srpska has an acidic reaction and also mostly has a low level of phosphorus. The selection of the best varieties of red clover for production on such soils will enable obtaining satisfactory forage yields. For the examined parameters, statistically significant differences were obtained between swaths and varieties. The highest average values of plant height, yield of green mass and hay were obtained in the first cutting of the second year. The lowest average yields were achieved by the variety Viola. The highest average height was of the variety Una, the highest yield of green mass was of the variety K-39, and the hay of variety Kolubara. Based on the obtained results, varieties K-39, Kolubara and Una can be recommended for growing on acidic soil.

Key words: red clover, variety, yield, soil, soil pH

P3_38

New species of shield bug *Perillus bioculatus* (Fabricius, 1775) in Bosnia and Herzegovina

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Abstract

Perillus bioculatus (Fabricius, 1775) – "two-spotted stink bug" belongs to the family Pentatomidae (Heteroptera). This species is known as a predator of Colorado potato beetle (*Leptinotarsa decemlineata*, Say), which is a serious pest of potatoes and other cultivated and wild solanaceous plants. It is native to North America. In first half of the 20th century, it was introduced to Europe as a potential biological agent against Colorado potato beetle, with limited success. In 1990s its was present in Europe in Czechoslovakia, Germany, Russia and Yugoslavia. Nowadays it is present in Turkey, Greece, Bulgaria, Serbia, Moldova, Ukraine and Romania. The presence of a new species in Bosnia and Herzegovina was first noticed in the northern part of the country, near the town Šamac (Gajevi, 44°56'24.70'' N 18°27'40.54'' E). On September 12, 2023, three adults were found in a private warehouse on potato tubers. Another nineteen specimens were caught on the northwest of the country, in the village house near Banja Luka (Kadinjani, 44°50'10.01'' N 17°22'59.59'' E). In December 2023, sixteen adults were hidden in window frames and in February 2024 three adults were on the outer wall near the stacked wood. The species was identified at the Faculty of Agriculture, University of Banja Luka, based on morphological characteristics. It has three color forms: white, yellow and red of which white and red were present. *Perillus bioculatus* is also known as a predator of *Ophraella communa* (LeSage), the ragweed leaf beetle, which has been recently reported from Bosnia and Herzegovina. Considering that the species is present in northern and western parts of the country, it is assumed that it has already become established. Further studies are necessary to understand its effect on some pests and beneficial insects in the area.

Key words: stinkbug, *Perillus bioculatus*, biological control, *Leptinotarsa decemlineata*

P3_39

Presence of entomopathogenic nematodes on agricultural fields in the Republic of Srpska

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Abstract

Managemnet of insect pests in agricultural production becomes more challenging every year. Increased awareness of the negative effects of pesticides on the environment and human health has resulted in a ban of many pesticides. Many countries have introduced stricter regulation of the production, registration and use of pesticides, which increases costs and reduces the availability of these agents. Moreover, there are numerous reports of resistance on certain active ingredients. In the last two-three decades, biological control has gain more attention and become popular as an alternative for pesticides. Entomopathogenic nematodes, together with their bacterial symbionts showed potential as biological control agents against insect pests. Entomopathogenic nematodes are naturally present in the soils all over the world. The purpose of doing a survey could be search for more populations with better properties of confirmation of presence of certain species since it is a requirement in some countries for their registration. Survey on presence of entomopathogenic nematodes was carried out during 2021 and 2022 from agricultural areas throughout the Republic of Srpska. A total of 560 samples were taken from arable agricultural areas, from fruit-growing orchards and nurseries. Entomopathogenic nematodes were isolated using "trap" insect *Galleria mellonella*. A total of 38 (6.7%) samples were positive for entomopathogenic nematodes. In this research, the most common and widespread nematode was *Steinernema feltie*, while the first report of its presence for the territory of Republika Srpska and Bosnia and Herzegovina was confirmed for *S. affinae* for controlling insects.

Key words: biological control, presence, distribution, *Steinernema*, survey

P3_40

Control of white potato cyst nematode (*Globodera palida*) with plant extracts

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Abstract

Potato cyst nematodes (PCN), *Globodera pallida* and *G. rostochiensis* are endoparasites that cause significant yield losses in potato crops and are currently considered as a serious economic threat. Both species are A2 quarantine pests for the European and Mediterranean Plant Protection Organization and Bosnia and Herzegovina. Their ability to survive in the absence of the hosts for two decades make control extremely challenging. It is especially difficult to control *G. pallida* since a few potato genotypes have resistance to this species. Recent ban of efficient nematocides left growers without effective method of control. In this study we tested plant extract with commercial name AromaDEZ against *G. pallida* in greenhouse conditioning. Three different treatments two aqueous formulations of 1% and 2% and one powder formulations were applied plus control. The experiment was done with five replicates in the pots filed with silver sand. Together with planted potato tubers of Agria variety 35 cysts were wrapped in the net bags and buried in to the sand. In the treatment with powder formulation control effect was 100%. In the treatments with aqueous formulation effect was significant. Although the experiment was conducted on a smaller number of plants, the difference between the treatment with plant extracts and the control was significant. In this study plant extracts of the product AromaDEZ revealed potential in management of *G. pallida* and mechanism of suppression should be studied further.

Key words: biological control, cyst nematode, *Globodera pallida*, AromaDEZ, potato

P3_41

Essential oils as potential alternative biocontrol products against plant pathogens

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Abstract

Essential oils (EOs) are aromatic, volatile liquids obtained from plant material through steam distillation and named after the plant from which they are derived. 3000 EOs have been identified and about 300 types of EOs are used in the production of perfumes due to their scent. EOs properties such as antioxidant, antimicrobial, and anti-inflammatory activities have been known for a long time and are hence widely used in traditional medicines, cosmetics, and food industries. The antimicrobial properties of essential oils against numerous plant pathogens (especially bacteria and fungi), insects, and weeds have been known since ancient times, and they can be successfully applied as biopesticides in plant protection. This paper aimed to indicate, through a review of the literature, the biopesticide potential of EOs and the possibility of their use in protecting plants from plant pathogens, especially in organic agriculture. Their use in agriculture remains limited by their rapid degradation, limited duration of effect, and non-target toxicity. Nowadays, biopesticides represent only 5% of the overall pesticide market. However, biopesticides have experienced rapid growth in recent years with an average annual growth rate of 9–20% and numerous authors predicted to outpace that of chemical pesticides. Despite numerous studies in which the biopesticidal potential of EOs from plants has been proven, their mechanism of action at the molecular level has not been sufficiently studied. Another shortcoming is the small number of preparations on the world market that are in commercial use.

Key words: essential oils, fungi, bacteria, mode of action

P3_42

Identification and quantification of *Fusarium* pathogens in winter wheat crops from South Moravia

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Abstract

Fusariosis, commonly known as ear rot in cereals, presents a significant challenge to global cereal production, with its impact varying seasonally. This study focuses on the detection and identification of *Fusarium* pathogens in winter wheat, comparing molecular findings with visual symptom assessments. The research highlights the limitations of visual diagnosis, as similar symptoms can arise from non-pathogenic stress or physiological maturation. Sampling was conducted on winter wheat cultivars at the BBCH85 stage, targeting ears with visible symptoms. PCR analysis with species-specific primers was employed to detect the four most prevalent Fusarium species in cereals: *F. graminearum*, *F. culmorum*, *F. avenaceum*, and *F. poae*. The results indicated a dominant presence of *F. graminearum*, with occasional detection of *F. culmorum* and *F. poae*. Confirmation of *F. graminearum* was achieved through rDNA sequencing in the ITS1 and ITS2 regions. Quantitative analysis using qPCR and normalized relative quantification revealed a 10 to 100-fold increase in *F. graminearum* DNA in symptomatic ears compared to asymptomatic ones. However, 20% of visually symptomatic samples did not exhibit this increase, suggesting that other factors may contribute to the observed symptoms. The study concludes that while visual assessment can indicate potential fusariosis, it should be complemented with molecular methods for accurate diagnosis. This approach can prevent misdiagnosis due to abiotic stress or natural maturation, ensuring precise pathogen identification and aiding in effective disease management.

Key words: *Fusariosis*, winter wheat, crops, cereals, PCR

Session 4: Animal Science

Oral Presentations

O4_01

Nutritional aspects of total mix ration and their impact on the activity of dairy cows

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Abstract

The aim of this research was to determine and analyse the relationships between selected parameters in high-producing Holstein-Friesian dairy cows at different lactation phases (early lactation – G1, peak cow – G2 and peak first lactation period – G3). As a first step in the study, the influence and relationship between the selected parameters on rumination time (RT) and time of feed intake (FIT). The amount of starch in the total mixed ration (TMR) showed a medium negative correlation with the FIT ($p<0.05$), while the content of physically effective neutral-detergent fibre showed a significant positive correlation with the RT ($p<0.01$). The study also analysed the relationship of the different fractions retained on the sieves using the Penn State Particle Separator method and then evaluated their effect on dairy cow activity (FIT, RT) and inactivity time (IT). This process was realised using BouMatic's RealTime Activity software. In the results, a statistically significant difference was identified between G1, which intake a lower amount of fibre retained on the second sieve (25%), with the G2, where the intake of the fibre fraction represented 50% and for the G3 represented 49% ($p<0.05$). Based on these data, the results indicate a statistically significant difference in FIT, RT or IT between the groups ($p<0.05$). From these results, it was found that G1 prefer a higher intake of fractions contained in pad the TMR which leads to a reduced intake of particles retained on the second sieve, which in turn is reflected in lower activity time or FIT and RT. This reduced activity time results in increased IT. On the other side, G2 and G3 showed a preference for increased intake of fibrous particles, which was positively correlated with an increase RT or FIT.

Key words: dairy cows, nutrition, fiber, starch, activity

Acknowledgement: Project no. 1/0321/23

O4_02

Mastitis makes changes in the blood antioxidant enzyme activity during the transition period of dairy cows: Part II

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Abstract

During the transition period in dairy cows, significant metabolic changes occur, potentially leading to oxidative stress. Early postpartum is also the riskiest period due to the increased susceptibility of dairy cows to mastitis. This study aimed to assess the enzymatic antioxidant status by analyzing the activity of superoxide dismutase (SOD) and glutathione peroxidase (GPX) in blood obtained from cows with mastitis and comparing it with samples from healthy cows. The two years prospective study was carried out to assess the changes occurring in the activity of antioxidant enzymes SOD and GPX in blood serum in three physiological periods: the dry period 21 days before calving, the period from the beginning of lactation until the 21st day in lactation and period from the 22nd to the 42nd day in lactation. All cows were allocated in groups regarding the season years of calving. Categorisation of the observed population was done following screening for mastitis using udder clinical examination, the California Mastitis Test, and bacteriological culturing. The groups included healthy cows, those with abnormal milk secretion (AMS), and cows with intramammary infection (IMI). Enzyme activity was assessed in blood serum using spectrophotometric methods. The physiological stages in the transition period when blood samples were taken, showed a statistically significant influence ($p<0.001$) on SOD and GPX activity in blood serum. There were statistically significant positive correlations between the activity of GPX and SOD in blood serum. Health disorders of the mammary gland showed a statistically significant influence on GPX activity in blood serum ($p<0.05$), but there wasn't a statistically significant influence on SOD activity in blood serum. The findings suggest that maintaining a balanced diet with sufficient antioxidants and managing environmental stressors can mitigate oxidative stress during the transition period, also reducing the risk of mastitis in early lactation.

Key words: dairy cows, oxidative stress, udder disorders

O4_03

Polymorphism of β-Casein in Holstein cows in Vojvodina

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Abstract

One of the most important milk proteins β-Casein has several genetic variations of which the two are the most important A1 and A2 type. The goal of the research is to determine the frequency of A1 and A2 alleles, and the different types of genotypes inside the population of Holstein cows on the territory of Vojvodina. A1 type of this protein is during digestion in the gastrointestinal system decomposes to certain opioid peptides, such as 7-casomorphine (BCM7) which causes damage to various systems and leads to the development of many diseases. Many studies claim that this opioid peptide is to some extent involved in the development of autism, schizophrenia, several of allergic reactions and disorders of digestive system. After the concern about A1 variant on human health, a selection favoring the A2 allele was carried out in different countries, which has not been proven to harm human health. This study included 30 samples of Holstein cows which are tested for β-Casein polymorphism. DNA isolation was performed from the follicle of the tail hair. The methods included in the study are based on DNA isolation, the PCR gene amplification method and the use of RFLP method to detect various forms of the gene that determines β-Casein. Out of 30 samples, A2A2 genotype had frequency 0.97, and A1A2 genotype had frequency 0.03. Alleles' frequency of the A1 and A2 was 0.016 and 0.984. Research on this topic is important for raising the awareness of breeders, in order to pay attention to β-casein and its consequences on human health, that is, to enable breeders to select those cattle that carry the allele for the A2 form of β-casein in their genome.

Key words: β-Casein, Holstein cows, polymorphism, selection

O4_04

The potential of various fatty acids found in milk and dairy products to prevent cancer

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Abstract

Cancer represents a serious health issue that has become increasingly prevalent in the human population across the globe. However, studies have shown that a majority of cancer cases can be prevented through the adoption of an appropriate lifestyle and a diet that is rich in nutrients and anti-cancer components. One such component that has been found to have anti-inflammatory and anti-cancer properties is fatty acid, which is present in varying amounts in milk and dairy products. The objective of this study was to delve into the anti-cancer potential of saturated, monounsaturated and polyunsaturated fatty acids that are present in milk and dairy products. Additionally, the study aimed to highlight the significance of milk and dairy products as an essential component of a healthy, balanced and sustainable human diet. By understanding the role of fatty acids in milk and dairy products, we can gain valuable insight into the potential that these products have in preventing cancer. This knowledge can be used to encourage people to adopt healthier lifestyles and diets, which can ultimately lead to a reduction in the number of cancer cases worldwide.

Key words: milk, dairy products, fatty acids, anticancer potential

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O4_05

Impact of non-genetic factors on reproductive traits of ewes and lamb weight until weaning in the Sjenica Pramenka sheep

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Abstract

The aim of this study was to determine the significance of the farm (as a factor) on the fertility traits and body weight of ewes (ewe lambs and mature ewes), as well as on the body weight of lambs until weaning, and also the significance of the mother's age (as a factor) on the body weight of lambs at birth, the impact of type and sex (as factors) on birth weight and the weight trajectory of lambs from birth to weaning, depending on the mentioned factors. Examination of reproductive and productive traits, as well as the impact of factors on these traits in the population of Sjenica Pramenka sheep, was conducted on four family farms in the municipality of Valjevo. Analyzing the influence of multiple factors involved a sample of a total of 124 female breeding animals (ewe lambs and mature ewes), 149 lambs, and 4 rams of Sjenica Pramenka breed. The results of the study showed that the farm had a very highly statistically significant influence on the body weight of ewes and the body weight of lambs at birth, at 30 and 90 days of age ($P<0.001$). The age of ewes significantly affected fertility ($P<0.05$). The highest fertility was observed in ewes aged between 12 and 14 months at first mating, reaching 1.44, while the lowest fertility was observed in ewes mated at the age of 8 to 10 months, with a fertility rate of 1.09. The influence of birth type had a very highly statistically significant impact in all three monitoring periods ($P<0.001$), while sex did not significantly affect the weight of lambs in all 3 monitoring periods.

Key words: farm, fertility, age, body weight of lambs

O4_06

Plant species richness and biomass chemical composition of the pastures in different areas of Montenegro

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Abstract

The aim of this research was to determine plant species richness and biomass composition of the pastures from different altitudes in Montenegro: lowland, highland and mountain. The pastures differ in the number of plant species and participation of the most dominant plant families. The largest number of plant species was in the mountain area (62), than in highland (53) and the smallest in lowland (44). The most favourable ratio of plant families that directly affects nutritional value of the biomass was in the highland (28.31%), than in mountain (25.8 %), while the lowest was in the lowland pasture (18.15). Index of pasture quality was the highest in the highland (3.545), than in lowland (3.344) and the lowest in the mountain pasture (3.172). Content of dry matter in the sampled biomass from all three pasture areas ranged from 277.12 g/kg to 301.56 g/kg, cellulose content from 266.39 to 286.11 g/kg DM, fat content from 14.45 g/kg to 15.42 g/kg DM and crude protein content from 100.97 g/kg to 145.67 g/kg DM. Average yield of pasture biomass in the first pasture area was 1976 kg/ha, in the second 2098 kg/ha, while in third it was the lowest, 1173 kg/ha. The differences were statistically significant ($p < 0.05$). The highland pasture had the best characteristics for both factors (plant species richness and biomass composition). Despite of the richest plant species, the mountain pasture was characterized by a lower protein content, while in terms of representation of the valuable plant species, it had a medium quality.

Key words: pastures, plant species, biomass yield, sward quality

O4_07

Precise feeding of fattening pigs and its effect on business economics for the example of Bosnia and Herzegovina

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Abstract

The observation was carried out at one farm in Bosnia and Herzegovina on two rounds of Danbred genotypes from Hungary (n = 691) and Denmark (n = 695). A total of 1,386 animals were observed in the period December 2022 – September 2023. The farm is of recent construction, equipped with Big Dutchman equipment as well as a feeding line for dry fattening. On the farm, conventional fattening with one type of mixture is usually applied for the sake of simplicity, with the use of 3 % premix and an increased amount of soybean meal and full-fat soybeans in the recipes. Corn, wheat, and wheat bran were used as cereals. By applying the concept of precise feeding with the use of custom-made premix in the product Amino Profi Plus® (3.5 % premix), fattening was introduced in the III phase with a reduced proportion of soybean meal and full-fat soybeans and with the addition of a mixture of organic acids via water (0.2%). The results of this type of feeding were reflected in the following parameters: the average duration of fattening was shortened by 24 days (from 130 to 106 days), although in the second cycle, the piglets entered lighter (27.00 vs. 23.11 kg), the average daily gain was increased by 21% (from 0.817 to 0.980 kg/d), while feed conversion ratio decreased by 7% (from 2.74 to 2.55 kg/kg). At the same time, mortality rates were reduced by 39% (from 2.60 to 1.58%). Although it is about two different turns and two different seasons, the obtained results indicate that the observation should be continued in other seasons as well, to be able to draw more precise conclusions, but it is already visible that the use of synthetic amino acids with the reduction of raw proteins in the mixture leads to better production and economical results.

Key words: fattening, precise feeding, protein decrease

O4_08

Effect of rearing system and genotype of laying hens on the breaking strength of tibia and femur

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Abstract

The aim of this study was to determine the effect of the rearing system and the genotype of laying hens on the breaking strength of the tibia and femur. The experiment was conducted in a 2x2 factorial design with two laying hen genotypes (commercial hybrid Isa Brown and New Hampshire dual-purpose breed) and two rearing systems (floor and organic). At the end of the one-year production cycle, six birds per group (24 hens in total) were randomly selected and slaughtered. To examine the quality of the bones, the femur and tibia were removed from each slaughtered laying hen. The breaking strength was measured by a three-point bending test with the IPNIS device. The results show that the rearing system had no significant effect on the breaking strength of the femur and tibia. On the other hand, genotype had a significant effect on femur and tibia breaking strength, such that the New Hampshire hens had better bone quality than Isa Brown hens. Importantly, there was a significant interaction between rearing system and genotype on tibia breaking strength - in the floor rearing system, the New Hampshire genotype had significantly higher breaking strength than the Isa Brown genotype, while the difference that occurred in the organic system between the genotypes studied was not statistically confirmed.

Key words: bone quality, laying hens, rearing systems, genotype

O4_09

Effect of different production systems on quality of table eggs

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Abstract

The aim of the research was to determine the quality of table eggs from enriched cages, organic and free-range systems. For the purposes of the research, 30 eggs from three different production systems were used, where the external and internal quality of the eggs was examined. Eggs from the enriched cages system had the highest weight (57.65g), and significant differences were found between eggs from the organic (50.52g) and free range systems (56.75g), as well as the organic and enriched cages ($p<0.05$). Eggs from the free range system had a significantly lower shape index (73) compared to the enriched cages and organic systems (78.23 and 77.79, respectively) (p0.05). The highest values of shell thickness (0.37mm) and shell weight (5.82g) were found in eggs from enriched cages, and significant differences were found between the systems ($p<0.05$). The value of albumen height was the highest in organic eggs (7.42), then in the cage system (7.40), and lowest from the free range system (6.08) ($p<0.05$). Eggs from the organic system had the highest value of Haugh units (88.37), while eggs from the free-range system had the lowest value (77.58) and significant differences between the systems were found (p0.05). Based on the obtained results, it can be concluded that the production system significantly influenced certain parameters of the internal and external quality of table eggs.

Key words: organic, enriched cages, free-range, egg quality

O4_10

An overview of the fish issues facing Gwagwalada's fish farmers and traders Nigeria's Abuja

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Abstract

The disconnection between sellers, transporters, and buyers is quite high among the many fish farmers in Gwagwalada, which has reduced the average fish farmer's income. The need for more research on the most effective ways to prepare fish for human consumption is evident, as is the need to reduce fish spoilage. Additionally, feed producers are increasing the amount of fish by products they use and there are unidentified specialized groups that control the various value chains in the fish industry. Research is still needed to determine whether the government knows what to do to look at various value chains, such as those that involve drying fish, transportation value chains, preservation, marketing, and those interested in using fish products. The issues also relate to the processing of fish and adding value to it, and there are few people that are engaged and need to be promoted to the level of attracting the needed foreign exchange and investors. such as those involving innovations in fish drying, transportation value chains, preservation, marketing, and the use of fish by products, drying, and storage within the markets, and this will be provided on the paper will also suggest ways to ameliorate the various challenges. Various populations were contacted, and the majority of them still believe that there are different opportunities that lie down in the value of the fishing chain, in as not get develop and explore.

Key words: fish, farmers, issues, Gwagawalada

O4_11

Influence of Lipizzan stallions on body measurements of foals

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Abstract

The development of foals, from the moment of foaling to separation from the mother, is the most important and decisive period for the further life of the foal. This paper shows the influence of stallions on some body measurements of foals. The research was conducted in the period from 2019 to 2023 and a total of 60 foals were measured, which were offsprings of 5 sire lines at the Vučijak stud. The basic body measurements of foals at 7 days old were measured by tap: the withers height, the chest and cannon bone circumference and body weight. In order to monitor the significance of the influence of sire lines and individual stallions on body measurements of foals, a simple analysis of variance with an unequal number of repetitions was used. The results of the research were processed in Microsoft Excel and SPSS. The obtained results showed that there is no significant influence of sire lines on body measurements of foals, but there is a highly significant influence of the individual stallions on body measurements of foals. Stallion 675 Conversano Neretva XXIII had a statistically significant influence on chest girth and body weight in foals, where the average weight of his offspring was 55.3 kg and the average chest girth was 84.7 cm, while the smallest influence in foals was the stallion 695 Pluto Sutjeska XXXII with the smallest average body weight of 41.3 kg and an average chest girth of 76.7 cm in his offspring. The research showed that the stallions can have a significant influence on body measures of offspring's. The results can be used in future breeding programs, with the aim to improve body conformation of the next generation of Lipizzan horses from Stud Vučijak.

Key words: Lipizzan, stallion, body measurements, foal

O4_12

Fatty acid profile of commercial dry dog foods with and without insect

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Abstract

The aim of the study was to determine the fat content and fatty acid (FA) profile, mainly the MUFAs, PUFAs, SFAs, EPA, DHA, oleic, linoleic, palmitic, lauric acid (LaA) of eight samples (A-H), of dry granulated foods for adult dogs available on the Slovak market. Four (E-H) of the eight samples (n=3) contained insects. Samples were analyzed in the Laboratory of Quality and Nutritional Value of Feed of the SUA in Nitra. Dry matter content was determined by drying the sample at 103±2°C to constant weight. Fat content was determined by acid hydrolysis method. FA were determined by the GC system Agilent 6890A. The fat content in the dry matter ranged from 10% (A) to 13% (C, D, G, H). The proportion of MUFAs in the samples were determined to be between 39% (A, D, E) and 50% (H). The most abundant MUFA in the samples was oleic acid with the highest proportion in the H sample, up to 48%. Content of PUFAs varied from 19% (C) to 35% (A, G, H). Of the PUFAs, linolenic acid was the most abundant, ranging from 17% (C, D, F) to 32% (A). DHA acid was present in less than 0.5% in samples A, B, D, and 1% in samples E and F. DHA was present only in sample E (less than 0.5%). Of the SFAs (13% - H to 37% - D), palmitic acid (G, H - 9% to D - 24%) and LaA were the most abundant. In samples that didn't contain insects LaA was only present in amount lesser than 0.5%. In the group of samples that contained insects, LaA was present in the samples ($P<0.05$) E, G (8%), F (9%), wasn't present in sample H. Samples E, G and F contained *Hermetia illucens* larvae, sample H contained *Tenebrio molitor*.

Key words: PUFA, DHA, EPA, lauric acid, insect, canine feed

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Session 4: Animal Science

Poster Presentations

P4_01

Nutrition of dairy cows by supplementing the ration with hydroxy minerals compared to chelated minerals

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Abstract

Minerals are important in metabolic processes in the body. Since minerals are essential substances, i.e. the body cannot synthesize them by itself, it is necessary to introduce them into the body through food, water and nutritional supplements. In this paper, an analysis was made in the feeding of dairy cows by adding hydroxy minerals in relation to chelated ones. There were two groups of dairy cattle, in each group there were 20 animals. Production indicators were monitored; milk production, its chemical composition and health indicators. In addition, the consistency of the dung was monitored, with which the digestibility of the meal and the influence of added supplements could be determined. Observing the results of the general production indicators obtained in this research, no noticeable differences were found between the experimental and control groups, only the consumption of dry matter during the first and third measurements was 6% and 13.5% higher in the experimental group compared to the control group. The health status of the animals was uniform and there were no significant differences between the groups. Analysis of the milk at the end of the experiment revealed a difference of 9% in the percentage of milk fat in favor of the control group. Food digestibility was better in the experimental group at the first measurement, while food digestibility was uniform at the second measurement. According to the above, the conclusion can be drawn that the addition of hydroxy minerals in relation to chelated ones did not improve the observed indicators, however, as hydroxy minerals are still more favorable than chelated ones on the market, they could be more economically profitable.

Key words: dairy cows, hydroxy minerals, chelated minerals, digestibility

P4_02

Analysis of the metabolic profile of dairy cows

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Abstract

The metabolic profile is a diagnostic procedure that determines the concentrations of certain biochemical blood parameters to obtain data on the balance of organic and inorganic substances and the functional state of certain organs important in the metabolism of high-milk cows. The goal of the research was to determine, through biochemical parameters, the state of energy metabolism, protein metabolism, and mineral substances, as well as the state of certain organs important of high-milk cows. Research was conducted on the farm "Milošević" in Katun on a group of pregnant heifers 30 days before and 30 days after calving. The number of cows included in this research is 21 cows of high-bred heifers of the Simmental (n=7), Holstein (n=7) breed and their hybrids (n=7), as well as 45 cows of high-milk Simmental (n=15), Holstein (n=15) breed and their hybrids (n=15)). After taking blood from the tail vein, laboratory tests of serum, Ca, P, ratio Ca:P, Ca++, Mg, Protein, Albumin, Globulin, Urea, Glycemia were performed and compared with reference values. The obtained data were statistically processed and the mean values, standard deviation, and coefficient of variation were determined. The obtained results indicate that at the time of blood sampling, the animals were energetically stable with mild hypoproteinemia in the whole calf as a result of hypogammaglobulinemia, which can lead to a decrease in milk yield and milk quality in the colostrogenesis phase, disturbances in the immunological status of newborn calves, as well as increased mobilization of Ca from bones.

Key words: metabolism, dairy cows, serum

P4_03

Milk urea nitrogen as an indicator of ammonia emission from dairy farms

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Abstract

The purpose of this research was to determine the variability of daily milk yield, milk quality and to evaluate milk urea nitrogen to predict the potential of ammonia pollution from farms and to test was it affected by the stage of lactation, season and the dietary crude protein concentration, using a precision dairy farming methodology. The research was estimated under production conditions in three different farms located in various places in the Province of Vojvodina and represent different animal housing and feeding technologies. The statistical analyses were performed with the Statistica program package. The statistical investigation was conducted using ANOVA, and correlation and regression analyses. The results emphasized that the optimum amount of urea in milk is 15-30 mg dL^{-1}, and there was a strong relationship between ammonia emission and MUN which was not different among lactation stages. Interest about environmental pollution has been growing, in Europe several regulatory enactments are controlling possible environmental pollution from dairy farms based on milk urea nitrogen which allows specifying possible pollution sources and accordingly, notifying farms about some prevention actions. Test day records should be used not just for evaluating animal productivity but also for monitoring of ammonia pollution from dairy cattle farms.

Key words: MUN, test day record, ammonia emission, dairy cattle

P4_04

The change in the number of somatic cells in cow's milk during lactation

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Abstract

Somatic cell count (SCC) in milk is an indicator of udder health and frequency of clinical and subclinical mastitis incidence in dairy herds, and it is also often used to determine quality payments to dairy producers. SCC is influenced by a large number of factors such as genetic factors, udder infection status, age of the cow, stage and sequence of lactation. According to legal regulations, a bulk tank cow's milk may contain up to 400,000 SCC/ml. Milk from a healthy udder contains less than 200,000 SC/ml. The aim of this study was to determine the influence of lactation stage on the SCC in cows' milk. The present research included 25,460 individual milk samples were collected at monthly DHI milk tests. Analyses of raw milk samples were carried out on the FOSS instruments – CombiFossTMFT+. Statistical data processing was carried out by applying General Linear Model procedure, Statistics 14. Significant differences in the SCC observed between different lactation stage. The SCC was lowest in the first 100 days of lactation (255,450/ml) and after it increased, reaching the highest value at the end of lactation (308,840/ml).

Key words: milk, somatic cell count, stage of lactation

P4_05

Ricotta, by-products or cheese of the new generations

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Abstract

The aim of this work is to present the results of the research, obtained for the nutritional values of the Ricotta cheese by-products in the productions of Trappist cheese. The production of albumen cheeses is possible thanks to the specific properties of whey proteins, which are not sensitive to the action of acid or rennet enzymes, so they remain unchanged during the coagulation of milk, and after separating the curds, they almost completely turn into whey. This paper presents the nutritive benefits of a Ricotta made from whey remaining after the production of Trappist cheese. The content of total dry matter in Ricotta is 27.9%., content of fat is 15.00%. Milk fat content in dry matter we get 55.17, the protein content obtained by the tests was 8%, and ash content of 0.62% was obtained. The energy value of whey is 181 kcal or 752 kJ.

Key words: Ricotta, nutritional value, whey

P4_06

Quality of Skorup – traditional Montenegrin dairy product

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Abstract

Skorup is a traditional full-fat dairy product from Montenegro. Its main qualities are a very high milk fat content and centuries-old technology of production. The mountainous regions of Montenegro are known by Skorup production, which is often made with cow's, ewe's and mixed milk. The aim of this research was to collect the most important data about quality of raw milk used for Skorup production (cow's and mixed cow's + ewe's milk), as well as the chemical and the microbiological quality of Skorup, produced using traditional technology. The chemical quality of raw milk and milk that remained after the production of Skorup was analyzed by the method of infrared spectrophotometry (IR), and the somatic cells count by flow cytometry method. For the chemical analysis of cheese, method of Fourier transform infrared spectrophotometry (FTIR) was used. The data were analysed by one way analysis of variance (ANOVA) performed using the statistical software Statistica. The average fat content in raw cow's milk was 3.53% and mixed milk 4.24%, and protein 3.17% (cow's milk) and 4.32% (mixed milk). Milk that remains after the production of Skorup is of good quality and can be used as a raw material for production of hard low-fat cheese Prljo. The high content of fat in dry matter, both in fresh (85.49% mixed milk; 87.05% cow's milk) and in the Skorup ripened for 60 days (86.62%, 88.76%, respectively), shows its high nutritional value.

Key words: chemical quality, raw milk, Skorup

P4_07

Optical properties and physical appearance of pork

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Abstract

Pork is traditionally present in the population's diet, and based on this, most consumers have a built-in perception of the optical properties and physical appearance, which is what they require when purchasing pork. This paper investigates consumers' perceptions of the optical properties and physical appearance of pork through a survey questionary. The aim of study was to analyze how consumers perceive the color, shine, texture and other characteristics of pork and how important the quality of these characteristics is to them when choosing a product. The survey included a sample of 185 respondents with different demographic characteristics. The results showed that consumers most value meat color as an indicator of freshness and quality (80%), especially natural color (71%), transparent structure (55.5%), shiny surfaces (31.4%), good uniformity (48.1 %), pleasant smell (44.8%) and umami taste (81.1%), while the texture also plays an important role (43.2%). The freshness of the meat is considered the most important factor for the consumers (90%), in addition to consistency (69.2%), origin (81.1%9), expiration date (74.32%), composition on the declaration (47.29%) and other characteristics. Understanding consumer's perception of the optical properties and physical appearance of pork meat can help improve marketing strategies and produce products that would better meet consumer needs.

Key words: consumers, pork, optical properties, texture, consistency

P4_08

Genetic bottleneck analysis in populations of Banat Naked Neck breed using microsatellite markers

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Abstract

Banat Naked Neck is a Serbian autochthonous breed of chicken that is traditionally raised in the Province of Vojvodina, where this breed originated in the middle of the 19th century. The resistance and productivity of this dual-purpose breed in modest raising conditions contributed to its recent popularity in alternative systems for the production of meat and eggs of special quality. The *ex situ* conservation program also contributed to the increase in the population and the number of breeders of this breed. However, recent population growth was preceded by a multi-decade period during which the Banat Naked Neck was marginalized by more productive genotypes, finding its niche as small flocks raised by a small number of breeders. In order to detect a significant excess in heterozygosity, an indication of the recent passage of the population through a genetic bottleneck, data obtained from the analysis of 29 microsatellite markers generated for four populations of Banat Naked Neck were used. Three tests (Sign test, Standardized differences test, Wilcoxon Rank Test) were applied under the assumption of three mutational models (IAM, TPM, SMM) using the program Bottleneck 1.2.02. The results obtained using the Standardized differences test in the TPM model, recommended for analyzes with more than 20 polymorphic loci, confirmed the hypothesis of the existence of a bottleneck effect in all the studied populations. This effect is probably due to changes in the number of flocks and their size in the past of the Banat Naked Neck breed, which is in agreement with the available historical data. Also, the results signal a threat for the studied populations in terms of the potential reduction of genetic variability, as an important basis for the development of conservation and improvement programs of the Banat Naked Neck breed.

Key words: chicken, Banat Naked Neck, bottleneck effect, microsatellite markers

P4_09

Estimates of genetic parameters for some morphological traits of the Lipizzan horses

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Abstract

The aim of this study was to estimate genetic parameters for these morphological traits of Lipizzan horses from Vučijak. Basic morphological measurements (height at withers - HW, chest circumference - CC and cannon bone circumference - CBC) were recorded to characterise the population of Lipizzan horses from State Stud Vučijak. Genetic variances and covariances were estimated by the restricted maximum likelihood model (REML) using Wombat software, including the fixed effects of sex, birth month, birth year, month of measurement, year of measurement, age, measurer, together with a random additive genetic animal component and the residual effect. The data file includes a total of 79 horses measurement, and pedigree data with 223 horses. The average values of HW, CC and CBC were 150.02 cm, 178.24 cm and 19.51 cm, respectively. Heritability estimates were 0.78 for HW, 0.67 for CC and 0.60 for CBC. Genetic correlations were positive and high (from 0.88 to 0.99), while phenotypic correlations were positive and moderately high (from 0.46 to 0.58).

Key words: morphological traits, pedigree, heritability, genetic and phenotypic correlations

P4_10

The impact of climate change on horse breeding

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Abstract

The objective of this research was to demonstrate how horse breeding is impacted by climate change. Horse breeding and equestrian sports are natural activities that can greatly contribute to the conservation of animal and plant species. Due to the development of technology and the widespread application of practical knowledge, horse breeding has evolved into an impressive industry, although it faces numerous challenges associated with climate change. Given that climate change is already a reality, we must learn to manage extreme and unpredictable weather patterns. Adapting to climate change and its impacts on horses necessitates the involvement of a large number of individuals with diverse knowledge and skills, who must work together to develop adaptive strategies that can be refined and adapted over time.

Key words: horse breeding, climate change

P4_11

The status of donkey population and rearing practices in Montenegro

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Abstract

The objective of this study was to present typical breed characteristics and rearing practices of the donkey population in Montenegro. According to official statistical data, the population of donkey in Montenegro (with mules) is less than 500 animals. The domestic Balkan donkey, reared in Montenegro for centuries, belongs to the wider population of the Balkan donkey. The research was conducted on a population of 85 adult animals reared in more than 20 private farms. Measurements of body development were made, and data was collected for 11 body measures. The average height to the withers was 97.63 cm, body length 102.86 cm, chest circumference 115.06 cm, chest depth 41.4 cm, cannon circumference 12.96 cm, and body weight 115.19 kg. The index of body format was 95% and shows that the donkey population has a rectangular body format. The most common hair color was gray (48%), dark brown and brown color 25 and 20%, and only 7% were black. The different ways of use of the donkey were identified. On some farms donkeys are still used as working animals and reared in a fully extensive system. The value of indices of working ability show that investigated animals have a carrying capacity of 73.07 kg in a gallop and 123.97 kg in a walk. On some farms, donkeys are used for milk production. The results of chemical analysis of donkey milk samples show that the average content of milk fat was 0.77%, protein 1.77%, and lactose 6.22%. The third rearing practice of donkeys is their using only for recreation and entertainment of children and tourist attraction in rural areas. It can be concluded that new rearing practices and the use of donkeys in Montenegro are still under development and that, together with the in situ preservation program, will significantly contribute to their preservation.

Key words: domestic Balkan donkey, body measures, milk quality, rearing practices

P4_12

Effects of water temperature and different types of feed on specific growth rate (SGR) and thermal unit growth coefficient (TGC) of rainbow trout

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Abstract

The aim of this study was to analyze the effects of water temperature and different types of commercial feed on the specific growth rate (SGR) and thermal unit growth coefficient (TGC) of rainbow trout reared in cages. The experiment was carried out in six cages during six months in two separate periods (October-January and April-July). Rainbow trout (n = 25,000 per period), from a common pool were placed into the 6 cages. Six types of commercial feed were used. The average initial weight of rainbow trout in October was 95.3 g, and in April it was 96.1 g. Fish weight gain controls were performed every 15 days, on a sample of 100 fish/cage. Specific growth rate (SGR) and thermal unit growth coefficient (TGC) were used for the analysis and prediction of rainbow trout weight growth. The average water temperature in October - January was 7.76 oC (4.1 - 12.5), and in April - July 12.95 oC (7.5 - 26.9). In both periods, SGR and TGC were higher in fish fed commercial diets with higher protein and fat content with lower feed consumption. In the period of low water temperatures, the predicted fish weight calculated from SGR and TGC are similar, but they do not agree with the observed weight growth. The increase in water temperature results in higher SGR and TGC, but due to high and significant variations in water temperature and increase in fish weight, the growth rate is moderate. With increasing water temperature, the observed increase in weight compared to the predicted weight of rainbow trout is similar. The SGR model is not applicable when there is no data on the achieved weight growth, and a more realistic prediction of the weight growth of rainbow trout is using the TGC model.

Key words: temperature, SGR, TGC, rainbow trout

P4_13

Analysis of morphological characteristics of winter bees from the reproductive centers of the Republic of Srpska

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Abstract

This paper presents the results of research on the analysis of morphological characteristics of the winter bee *Apis mellifera carnica* Polman 1879, from 10 registered reproductive centers for queen bee production in the Republic of Srpska. The aim of the research is to determine, through the analysis of morphological characteristics of winter bees - tongue length, corbicula surface, tomentum width, color of the abdomen, hair length, and cubital index, whether there is an influence of other bee races on the autochthonous Carniolan bee race from the territory of the Republic of Srpska. The research was conducted in 2021, with 24 bee samples taken from each reproductive center (8 queen mothers), totaling 240 samples. The obtained data are presented by standard descriptive measures, arithmetic mean, and standard deviation ($\bar{x} \pm s_{\bar{x}}$). The results of the research indicate certain differences in the morphological characteristics of winter bees at registered reproductive centers in the Republic of Srpska. Further selective work should continue to preserve the autochthonous race of bees *Apis mellifera carnica* in our reproductive centers, achieved through constant and continuous control of queen bees taken for queen mothers.

Key words: bee, *Apis mellifera carnica*, morphological characteristics, reproductive centers, queen bee

P4_14

Biological and ecological characteristics of the invasive species *Dreissena polymorpha* from the Drina River and Višegrad Lake

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Abstract

Dreissena polymorpha originate from the basins of the Black, Caspian and Azov Seas. In the 19th century, the freshwater mussel *Dreissena polymorpha* was introduced to Europe and spread rapidly, extending its range to the Balkan region. It was first recorded in Bosnia and Herzegovina 50 years ago. *Dreissena polymorpha* is a mussel that tolerates low oxygen concentration in the water, high temperatures and water pollution. Due to its high filtering capacity and massive dispersal, *Dreissena polymorpha* displaces native species in the same habitats. Its activity reduces the availability of resources and alters the composition and structure of macrozoobenthos communities. The aim of this study is to describe some biological and ecological characteristics of *Dreissena polymorpha* from the Drina River in the area of Višegrad and Višegrad Lake. The population density in the Drina River is 42 individuals/m^2, and in Višegrad Lake 93 individuals/m^2. The average weight of individuals was 0.25 g ± 0.09g SD in the river and 0.16 g ± 0.12 g SD in the lake. The average shell length was 14.05 mm ± 4.25 mm SD (Drina), or 17.08 mm ± 3.36 mm SD (Višegrad Lake). The average height of the shell is 4.35 mm ± 1.09 mm SD (Drina), i.e. 4.25 mm ± 0.95 mm SD (Lake Višegrad), while the average width of the shell is 7.07 mm ± 2.46 mm SD (Drina), i.e. 8.5 mm ± 1.85 mm SD (Višegrad Lake). These are the first published data on the allochthonous (invasive) species of the genus Dreissena in the Drina River in the Višegrad region. The introduction and spread of these mussel species of the *Dreissena polymorpha* is the result of stocking or aquaculture, as the larvae of these species are also transferred to new habitats through the transfer of fish fry material from farmed fish species.

Key words: Dreissena polymorpha, Drina River, Višegrad Lake, population-ecological parameters

P4_15

Microbiological safety of feed in year 2022

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Abstract

The microbiological safety of feed directly affects the health status of animals and their production results, as well as the safety of food of animal origin. The aim of the study was to determine the microbiological safety of feed in the year 2022 in the Republic of Srpska (Bosnia and Herzegovina), during which 313 samples were tested. Samples were tested for *Salmonella* spp., coagulase positive staphylococci and *Staphylococcus aureus*, *Clostridium perfringens*, the total number of microorganisms and the total number of yeasts and molds, by test methods BAS EN ISO 6579-1, BAS EN ISO 6888-1, BAS EN ISO 7937, BAS EN ISO 4833-1 and BAS ISO 21527-2. Samples of feed were tested within self-control (91.69%) and official controls (8.31%). In relation to the Rulebook on microbiological criteria in feed, 39.94% of unsatisfactory samples were identified, of which 95.20% were from self-control and 4.80% from official controls. The highest percentage of unsatisfactory samples of feed was due to the increase in total yeasts and molds (36.74%) and increase in total number of microorganisms (30.03%), while the negligible percentage of unsatisfactory samples was due to the presence of pathogens *Salmonella* spp. (0.38%), *Clostridium perfringens* (0.19%) and coagulase-positive staphylococci and *Staphylococcus aureus* (0.03%). The cause of unsatisfactory feed samples is primarily an increase in the total number of microorganisms and the total number of yeasts and molds. This risk is constantly present, varies significantly and mostly leads to indirect losses in animal production. The risk of the presence of pathogens in animal feed is negligible. microbiological safety of animal feed depends on numerous factors, the most important of which are feed quality, climatic conditions and technological production process.

Key words: feed, microbiology, safety

P4_16

Microbiological purity of food business operators in the period 2022-2023

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Abstract

The examination was carried out during 2022 (4,827 samples) and 2023 (6,392 samples). Samples of swabs of equipment, devices, utensils, work surfaces, work clothes and hands of workers in production, processing and traffic in facilities and means of transport that come into contact with food, where there is a risk of the appearance and spread of an infectious disease, were used as test material. The samples come from facilities for the production, processing and distribution of food, restaurants and other catering establishments where food is served, facilities in the field of upbringing, education and social protection (facilities for housing people) and means of transport that come into contact with food. The aim of the research is to assess the state of microbiological purity in the food chain. The samples were tested for colony count, *Enterobacteriaceae*, *Salmonella* and *Listeria monocytogenes*, using the methods BAS EN ISO 4833-1, BAS EN ISO 21528-2, BAS EN ISO 6579-1 and BAS EN ISO 11290-1. The obtained results indicate a high risk of enterobacteria and the need for a high level of awareness of the risks that this entails, permanent education of people who come into contact with food and constant undertaking of hygiene measures in all phases of the food business. Effective cleaning and disinfection programs in the food chain have led to minimization of microbiological purity risks for pathogenic *Salmonella* and *Listeria monocytogenes*. A similar principle should be applied when it comes to saprophytes and enterobacteria, and in the first-place general hygiene measures.

Key words: microbiology, colony count, *Enterobacteriaceae*, *Salmonella*, *Listeria monocytogenes*