

AGROSYM

BOOK OF PROCEEDINGS



*XV International Scientific Agriculture Symposium
"Agrosym 2024"
Jahorina, October 10-13, 2024*

AgroSym
2024

AGRO 2024
sym

BOOK OF PROCEEDINGS

**XV International Scientific Agriculture Symposium
“AGROSYM 2024”**



Jahorina, October 10 - 13, 2024

Impressum

XV International Scientific Agriculture Symposium „AGROSYM 2024“

Book of Proceedings Published by

University of East Sarajevo, Faculty of Agriculture, Republic of Srpska, Bosnia
University of Belgrade, Faculty of Agriculture, Serbia
Mediterranean Agronomic Institute of Bari (CIHEAM - IAMB) Italy
International Society of Environment and Rural Development, Japan
Balkan Environmental Association (B.EN.A), Greece
CDR, University of Natural Resources and Life Sciences (BOKU), Austria
Perm State Agro-Technological University, Russia
Voronezh State Agricultural University named after Peter The Great, Russia
Tokyo University of Agriculture, Japan
Jiangsu University, People's Republic of China
Shinshu University, Japan
Faculty of Agriculture, University of Western Macedonia, Greece
Arid Agricultural University, Rawalpindi, Pakistan
Chapingo Autonomous University, Mexico
Selçuk University, Turkey
University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania
Slovak University of Agriculture in Nitra, Slovakia
National University of Life and Environmental Sciences of Ukraine, Kyiv, Ukraine
Saint Petersburg State Forest Technical University, Russia
University of Valencia, Spain
Faculty of Agriculture, University of Zagreb, Croatia
Voronezh State University of Forestry and Technologies, Russia
Tarbiat Modares University, Islamic Republic of Iran
Northwest Normal University, People's Republic of China
Valahia University of Targoviste, Romania
Faculty of Agriculture, University of Akdeniz - Antalya, Turkey
Cangzhou Normal University, People's Republic of China
Ukrainian Institute for Plant Variety Examination, Kyiv, Ukraine
Institute of Animal Science - Kostinbrod, Bulgaria
National Scientific Center "Institute of Agriculture of NAAS", Kyiv, Ukraine
Department of Agricultural, Food and Environmental Sciences, University of Perugia, Italy
Watershed Management Society of Iran
Faculty of Agriculture, Cairo University, Egypt
Higher Institute of Agronomy, Chott Mariem-Sousse, Tunisia
Faculty of Economics Brcko, University of East Sarajevo, Bosnia and Herzegovina
Biotechnical Faculty, Montenegro
Institute of Field and Vegetable Crops, Serbia
Institute of Lowland Forestry and Environment, Serbia
Institute for Applied Science in Agriculture, Serbia
Agricultural Institute of Republic of Srpska - Banja Luka, Bosnia and Herzegovina
Maize Research Institute “Zemun Polje”, Serbia
Faculty of Agriculture, University of Novi Sad, Serbia
Institute for Animal Science, Ss. Cyril and Methodius University in Skopje, North Macedonia
Serbian Academy of Engineering Sciences, Serbia
Balkan Scientific Association of Agricultural Economics, Serbia
Institute of Agricultural Economics, Serbia

Editor in Chief

Dusan Kovacevic

Technical editors

Sinisa Berjan
Milan Jugovic
Rosanna Quagliariello

Website:

<http://agrosym.ues.rs.ba>

CIP - Каталогизација у публикацији
Народна и универзитетска библиотека
Републике Српске, Бања Лука

631(082)(0.034.2)

INTERNATIONAL Scientific Agriculture Symposium "AGROSYM"
(15 ; 2024 ; Jahorina)

Book of Proceedings [Електронски извор] / XV International
Scientific Agriculture Symposium "AGROSYM 2024", Jahorina,
October 10 - 13, 2024 ; [editor in chief Dusan Kovacevic]. - Onlajn
izd. - El. zbornik. - East Sarajevo : Faculty of Agriculture, 2024

Системски захтјеви: Нису наведени. - Наћin pristupa (URL):
https://agrosym.ues.rs.ba/article/showpdf/BOOK_OF_PROCEEDINGS_2024_FINAL.pdf. - Ел. публикација у ПДФ формату опсега
1552 стр. - Насл. са насловног екрана. - Опис извора дана
2.12.2024. - Библиографија уз сваки рад. - Регистар.

ISBN 978-99976-816-8-3

COBISS.RS-ID 141807105

**XV International Scientific Agricultural Symposium “Agrosym 2024”
Jahorina, October 10-13, 2024, Bosnia and Herzegovina**

HONORARY COMMITTEE

Mr. Savo Minic, Minister of Agriculture, Water Management and Forestry of Republic of Srpska, Bosnia and Herzegovina
Dr. Zeljko Budimir, Minister of Scientific-Technological Development, Higher Education and Information Society of Republic of Srpska, Bosnia and Herzegovina
Prof. dr Mario T. Tabucanon, President of the International Society of Environment and Rural Development, Japan
Prof. dr Milan Kulic, Rector of the University of East Sarajevo, Bosnia and Herzegovina
Prof. dr Dusan Zivkovic, Dean of the Faculty of Agriculture, University of Belgrade, Serbia
Dr. Maurizio Raeli, Director of the Mediterranean Agronomic Institute of Bari, Italy
Prof. Dr. Hüseyin YILMAZ, Rector of the Selcuk University, Turkey
Prof. dr Aleksey Andreev, Rector of the Perm State Agro-Technological University, Russia
Prof. dr Alexey Yu. Popov, Rector of the Voronezh State Agricultural University named after Peter The Great, Russia
Prof. dr Zhang Jijian, President of Jiangsu University, People's Republic of China
Prof. dr Barbara Hinterstoisser, Vice-Rector of the University of Natural Resources and Life Sciences (BOKU), Austria
Prof. dr Sorin Mihai Cimpeanu, Rector of the University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania
Prof. Shinichi Yonekura, Vice-President of the Shinshu University, Japan
Doc. Ing. Klaudia Halászová, Rector of the Slovak University of Agriculture in Nitra, Slovakia
Prof. dr Calin D. Oros, Rector of the Valahia University of Targoviste, Romania
Prof. Dr Katerina Melfou, Dean of the Faculty of Agriculture, University of Western Macedonia, Greece
Prof. dr Amr Ahmed Mostafa, Dean of the Faculty of Agriculture, Cairo University, Egypt
Prof. dr José Sergio Barrales Domínguez, Rector of the Chapingo Autonomous University, Mexico
Prof. dr Davut Karayel, Dean of Faculty of Agriculture, University of Akdeniz - Antalya, Turkey
Prof. Dr Eguchi Fumio, Rector of the Tokyo University of Agriculture, Japan
Prof. dr Muhammad Naeem, Vice-Chancellor of Arid Agricultural University, Rawalpindi, Pakistan
Prof. dr Zhang Zhanping, President of Cangzhou Normal University, People's Republic of China
Prof. dr Wang Zhanren, President of Northwest Normal University, People's Republic of China
Dr Chokri Thabet, the General Director of the High Agronomic Institute of Chott Mariem, Sousse, Tunisia
Prof. dr Maya Ignatova, Director of the Institute of Animal Science- Kostinbrod, Bulgaria
Prof. dr Seyed Hamidreza Sadeghi, Professor at Tarbiat Modares University and the President of the Watershed Management Society of Iran, Iran
Prof. dr Francesco Tei, Director of the Department of Agricultural, Food and Environmental Sciences, University of Perugia, Italy
Prof. dr Viktor Kaminskyi, Director of National Scientific Center „Institute of Agriculture of NAAS“, Kyiv, Ukraine
Dr. Igor Hrovatič, President of South Eastern Advisory Service Network, Croatia
Prof. dr Mirza Dautbasic, Dean of the Faculty of Forestry, University of Sarajevo, Bosnia and Herzegovina
Prof. dr Bozidarka Markovic, Dean of the Biotechnical Faculty, University of Podgorica, Montenegro
Prof. dr Rade Jovanovic, Director of the Institute for Science Application in Agriculture, Serbia
Prof. dr Lazar Radovanovic, Dean of the Faculty of Economics Brcko, University of East Sarajevo, Bosnia and Herzegovina
Prof. dr Vojislav Trkulja, Director of Agricultural Institute of Republic of Srpska - Banja Luka, Bosnia and Herzegovina
Dr. Miodrag Tolimir, Director of the Maize Research Institute “Zemun Polje”, Serbia
Prof. Dr. Jegor Miladinović, Director of the Institute of Field and Vegetable Crops, Serbia
Prof. dr Nedeljko Tica, Dean of the Faculty of Agriculture, University of Novi Sad, Serbia
Prof. dr Rodne Nastova, Director of the Institute for Animal Science, Skopje, Macedonia
Prof. dr Sasa Orlovic, Director of the Institute of Lowland Forestry and Environment, Serbia
Prof. dr Jonel Subic, Director of the Institute of Agricultural Economics, Serbia
Prof. dr Branko Kovacevic, President of the Academy of Engineering Sciences of Serbia, Serbia
Prof. dr Radovan Pejanovic, President of Balkan Scientific Association of Agricultural Economics, Serbia

SCIENTIFIC COMMITTEE

Chairman: Academician Prof. dr Dusan Kovacevic, Faculty of Agriculture, University of Belgrade, Serbia
Prof. dr Machito Mihara, Tokyo University of Agriculture, Japan
Prof. dr John Brayden, Norwegian Agricultural Economics Research Institute (NILF), Norway
Prof. dr Steve Quarie, Visiting Professor, School of Biology, Newcastle University, United Kingdom
Prof. dr Andreas Melcher, CDR, University of Natural Resources and Life Sciences (BOKU), Vienna, Austria
Prof. dr Dieter Trautz, University of Applied Science, Germany
Prof. dr Mustafa Harmankaya, Dean of Faculty of Agriculture, University of Selçuk- Konya, Turkey
Prof. dr Sergei Eliseev, Vice-Rector for Research and Innovations, Perm State Agro-Technological University, Russia
Prof. dr Dani Shtienberg, full professor, Department of Plant pathology and Weed Research, ARO, the Volcani Center, Bet Dagan, Israel
Prof. dr William Meyers, Howard Cowden Professor of Agricultural and Applied Economics, University of Missouri, USA
Prof. dr Markus Schermer, Department of Sociology, University of Innsbruck, Austria
Prof. dr Thomas G. Johnson, University of Missouri – Columbia, USA
Prof. dr Fokion Papathanasiou, School of Agricultural Sciences, University of Western Macedonia, Greece
Prof. dr Sabahudin Bajramovic, Faculty of Agriculture and Food Sciences, University of Sarajevo, Bosnia and Herzegovina
Prof. dr Hiromu Okazawa, Faculty of Regional Environment Science, Tokyo University of Agriculture, Japan
Prof. dr Tatiana Sivkova, Faculty for Veterinarian Medicine and Zootechny, Perm State Agro-Technological University, Russia
Prof. dr Aleksej Lukin, Voronezh State Agricultural University named after Peter The Great, Russia
Prof. dr Matteo Vittuari, Faculty of Agriculture, University of Bologna, Italy
Prof. Katsuharu Saito, Faculty of Agriculture, Shinshu University, Japan
Prof. dr Seyed Mohsen Hosseini, Faculty of Natural Resources, Tarbiat Modares University, Iran
Prof. dr Ardian Maci, Faculty of Agriculture and Environment, Agricultural University of Tirana, Albania
Prof. dr Regucivilla A. Pobar, Bohol Island State University, Philippines
Prof. dr Azeem Khalid, Arid Agriculture University, Rawalpindi, Pakistan
Prof. dr Aayesha Riaz, Arid Agriculture University, Rawalpindi, Pakistan
Prof. dr Munir Ahmad, Arid Agriculture University, Rawalpindi, Pakistan
Prof. dr Sudheer Kundukulangara Puliserry, Kerala Agricultural University, India
Prof. dr EPN Udayakumara, Faculty of Applied Sciences, Sabaragamuwa University, Sri Lanka
Prof. dr Vladimír Smutný, full professor, Mendel University, Faculty of agronomy, Czech Republic
Prof. dr Franc Bavec, full professor, Faculty of Agriculture and Life Sciences, Maribor, Slovenia
Prof. dr Jan Moudrý, full professor, Faculty of Agriculture, South Bohemia University, Czech Republic
Prof. dr Stefan Tyr, full professor, Faculty of Agro-biology and Food Resources, Slovakia
Prof. dr Natalija Bogdanov, Faculty of Agriculture, University of Belgrade, Serbia
Prof. dr Richard Barichello, Faculty of Land and Food Systems, University of British Columbia, Canada
Prof. dr Francesco Porcelli, University of Bari Aldo Moro, Italy
Prof. dr Vasilije Isajev, Faculty of Forestry, University of Belgrade, Serbia
Prof. dr Elazar Fallik, Agricultural Research Organization (ARO), Volcani, Israel
Prof. dr Junaid Alam Memon, Pakistan Institute of Development Economics, Pakistan
Prof. dr. Jorge Batlle-Sales, Department of Biology, University of Valencia, Spain
Prof. dr Pandi Zdruli, Land and Water Resources Department; IAMB, Italy
Prof. dr Mladen Todorovic, Land and Water Resources Department; IAMB, Italy
Dr. Hamid El Bilali, Mediterranean Agronomic Institute of Bari, Italy
Prof. dr Maksym Melnychuk, National Academy of Agricultural Science of Ukraine, Ukraine
Prof. dr Borys Sorochynskyi, Ukrainian Institute for Plant Variety Examination, Kyiv, Ukraine
Dr. Lorenz Probst, CDR, University of Natural Resources and Life Sciences (BOKU), Vienna, Austria
Prof. Dragana Sunjka, Faculty of Agriculture, University of Novi Sad, Serbia
Prof. dr Miodrag Dimitrijevic, Faculty of Agriculture, University of Novi Sad, Serbia
Prof. dr Mohsen Boubaker, High Institute of Agronomy of Chott Meriem, Sousse, Tunisia
Dr. Nouredin Driouech, Coordinator of MAIB Alumni Network (FTN), Mediterranean Agronomic Institute of Bari, Italy
Prof. dr Ion Viorel, University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania
Prof. dr. Chuleemas Boonthai Iwai, Faculty of Agriculture, Khon Kaen University, Thailand
Prof. dr Wathuge T.P.S.K. Senarath, Department of Botany, University of Sri Jayewardenepura, Colombo, Sri Lanka

Dr. Hamada Abdelrahman, Soil Science Dept., Faculty of Agriculture, Cairo University, Egypt

Prof. dr Maya Ignatova, Director of the Institute of Animal Science- Kostinbrod, Bulgaria

Prof. dr Ioannis N. Xynias, School of Agricultural Technology & Food Technology and Nutrition, Western Macedonia University of Applied Sciences, Greece

PhD ing. Artur Rutkiewicz, Department of Forest Protection, Institute of Forest Sciences, Warsaw University of Life Sciences - SGGW, Poland

Prof. dr Mohammad Sadegh Allahyari, Islamic Azad University, Rasht Branch, Iran

Dr. Lalita Siri wattananon, Faculty of Agricultural Technology, Rajamangala University of Technology Thanyaburi (RMUTT), Thailand

Prof. dr Konstantin Korlyakov, Perm Agricultural Research Institute, Russia

Dr. Mohammad Farooque Hassan, Shaheed Benazir Bhutto University of Veterinary & Animal Sciences Sakrand, Sindh, Pakistan

Dr. Larysa Prysiazniuk, Ukrainian Institute for Plant Variety Examination, Kyiv, Ukraine

Prof. dr Oksana Kliachenko, National University of Life and Environmental Science of Ukraine, Ukraine

Prof. dr Ivan Simunic, Department of amelioration, Faculty of agriculture, University of Zagreb, Croatia

Dr. Abid Hussain, International Centre for Integrated Mountain Development (ICIMOD), Nepal

Dr. Amrita Ghatak, Gujarat Institute of Development Research (GIDR), India

Prof. dr Naser Sabaghnia, University of Maragheh, Iran

Dr. Karol Wajszczuk, Poznan University of Life Sciences, Poland

Prof. dr Penka Moneva, Institute of Animal Science - Kostinbrod, Bulgaria

Prof. dr Mostafa K. Nassar, Animal husbandry Dept., Faculty of Agriculture, Cairo University, Egypt

Prof. dr Márta Birkás, full professor, St. Istvan University, Godollo - Hungary

Prof. dr Andrzej Kowalski, Director of the Institute for Agricultural and Food Economy, Warszawa-Poland

Prof. dr Yalcin Kaya, The Director of the Plant Breeding Research Center, University of Trakya, Turkey

Prof. dr Sanja Radonjic, Biotechnical Faculty, University of Montenegro, Montenegro

Prof. dr Ionela Dobrin, Department for Plant Protection, University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania

Prof. dr Inocencio Buot Jr., Institute of Biological Sciences, College of Arts and Sciences, University of the Philippines Los Banos, Philippines

Prof. dr Monica Paula Marin, Department for Animal Husbandry, University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania

Prof. dr Nedeljka Nikolova, Institute for Animal Science, Ss. Cyril and Methodius University in Skopje, Republic of Macedonia

Prof. dr Mohammad Al-Mamun, Department of Animal Nutrition, Bangladesh Agricultural University, Bangladesh

Prof. dr Anucha Wittayakorn-Puripunpinyoo, School of Agriculture and Co-operatives, Sukhothai Thammathirat Open University, Nonthaburi, Thailand

Dr. Redouane Choukr-Allah, International Center for Biosaline Agriculture (ICBA), United Arab Emirates

Prof. dr Ignacio J. Díaz-Maroto, High School Polytechnic, University of Santiago de Compostela, Spain

Prof. dr Nidal Shaban, University of Forestry Sofia, Bulgaria

Prof. dr Mehdi Shafaghati, Faculty of Geography, Tarbiat Moalem (kharazmi) University, Iran

Prof. dr Youssif Sassine, Lebanese University Beirut, Lebanon

Prof. dr Cafer Topaloglu, Faculty of Tourism, Mugla Sitki Kocman University, Turkey

Prof. dr Seyed Hamidreza Sadeghi, Faculty of Natural Resources, Tarbiat Modares University, Iran

Prof. Zain Ul Abdin, Department of Entomology, University of Agriculture, Faisalabad, Pakistan

Prof. dr Mohsen Mohseni Saravi, University of Teheran and Member of WMSI Management Board, Iran

Prof. dr Branislav Draskovic, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina

Prof. dr Mahmood Arabkhedri, Soil Conservation and Watershed Management Research Institute and Member of WMSI Management Board, Iran

Prof. dr Ataollah Kaviani, Sari Agricultural Science and Natural Resources University and Member of WMSI Management Board, Iran

Prof. dr Tugay Ayasan, Department of Organic Farming Business Management, Osmaniye, Applied Science School of Kadirli, Osmaniye Korkut Ata University, Turkey

Prof. dr Sakine Özpınar, Department of Farm Machinery and Technologies Engineering, Faculty of Agriculture, Çanakkale Onsekiz Mart University, Çanakkale, Turkey

Prof. dr Sherein Saeide Abdelgayed, Faculty of Veterinary Medicine, Cairo University, Cairo, Egypt

Prof. dr Zohreh Mashak, Islamic Azad University, Karaj Branch, Iran

Dr. Khalid Azim, National Institute of Agriculture Research, Morocco

Dr. Mario Licata, Department of Agricultural, Food and Forest Sciences, University of Palermo, Italy

Prof. dr Srdjan Lalic, University of East Sarajevo, Bosnia and Herzegovina

Prof. Fatiha Addyoubah, Moulay Ismail University, Morocco
Prof. dr Muhammad Ovais Omer, Faculty of Bio-Sciences, University of Veterinary & Animal Sciences, Lahore, Pakistan
Dr. Edouard Musabanganji, School of Economics/CBE, University of Rwanda, Rwanda
Prof. dr Kubilay Baştaş, Department of Plant Protection, Faculty of Agriculture, Selçuk University, Turkey
Dr. Branka Kresovic, Director of the Maize Research Institute “Zemun Polje”, Serbia
Dr. Nenad Delic, Maize Research Institute “Zemun Polje”, Serbia
Dr. Milan Stevanovic, Maize Research Institute “Zemun Polje”, Serbia
Prof. Violeta Babic, Faculty of Forestry, University of Belgrade, Serbia
Dr. Svetlana Balesevic-Tubic, Institute of Field and Vegetable Crops Novi Sad, Serbia
Dr. Ana Marjanovic Jeromela, Institute of Field and Vegetable Crops Novi Sad, Serbia
Prof. dr Tatjana Krajisnik, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
Prof. dr Aleksandra Govedarica-Lucic, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
Prof. dr Desimir Knezevic, University of Pristina, Faculty of Agriculture, Kosovska Mitrovica - Lesak, Kosovo i Metohija, Serbia
Dr. Snezana Mladenovic-Drinic, Maize Research Institute “Zemun Polje”, Serbia
Prof. dr Nebojsa Momirovic, Faculty of Agriculture, University of Belgrade, Serbia
Prof. dr Osman Mujezinovic, Faculty of Forestry, University of Sarajevo, Bosnia and Herzegovina
Prof. dr Dalibor Ballian, Faculty of Forestry, University of Sarajevo, Bosnia and Herzegovina
Prof. dr Zoran Jovovic, Biotechnical Faculty, University of Montenegro, Montenegro
Prof. dr Danijel Jug, Faculty of Agriculture, University of Osijek, Croatia
Prof. dr Milan Markovic, Biotechnical Faculty, University of Montenegro, Montenegro
Prof. dr Zeljko Dolijanovic, Faculty of Agriculture, University of Belgrade, Serbia
Prof. Mirjana Jovovic, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
Prof. dr Dejana Stanic, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
Prof. Goran Marinkovic, Faculty of Technical Sciences, University of Novi Sad, Serbia
Dr Dejan Stojanovic, Institute of Lowland Forestry and Environment, Serbia
Dr Dobrivoj Postic, Institute for plant protection and environment, Belgrade, Serbia
Dr Srdjan Stojnic, Institute of Lowland Forestry and Environment, Serbia
Dunja Demirović Bajrami, Research Associate, Geographical Institute “Jovan Cvijić,” Serbian Academy of Sciences and Arts, Belgrade, Serbia

ORGANIZATIONAL COMMITTEE

Chairperson: Prof. dr Vesna Milic, Dean of the Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
Dr Marko Gutalj, Vice rector of the University of East Sarajevo, Bosnia and Herzegovina
Dr Jelena Kronic, Vice rector of the University of East Sarajevo, Bosnia and Herzegovina
Dr. Maroun El Moujabber, Mediterranean Agronomic Institute of Bari, Italy
Mrs. Rosanna Quagliariello, Mediterranean Agronomic Institute of Bari, Italy
Dr. Nouredin Driouech, Coordinator of MAIB Alumni Network (FTN), Mediterranean Agronomic Institute of Bari, Italy
Dr Milic Curovic, The journal “Agriculture and Forestry”, Biotechnical Faculty Podgorica, University of Montenegro, Montenegro
Dr. Tatiana Lysak, International Relations Office, Voronezh State Agricultural University named after Peter The Great, Russia
Dr. Oksana Fotina, International Relations Center, Perm State Agro-Technological University, Russia
Prof. dr Fokion Papathanasiou, School of Agricultural Sciences, University of Western Macedonia, Greece
Dr Ana Marjanović Jeromela, Institute of Field and Vegetable Crops, Serbia
Prof. dr Engr. Teodora Popova, Institute of Animal Science - Kostinbrod, Bulgaria
Prof. dr Mehmet Musa Ozcan, Faculty of Agriculture, Selçuk University, Turkey
Prof. dr Arfan Yousaf, Arid Agricultural University, Rawalpindi, Pakistan
Dr. Abdulvahed Khaledi Darvishan, Faculty of Natural Resources, Tarbiat Modares University, Iran
Prof. dr Nikola Pacinovski, Institute for Animal Science, Ss. Cyril and Methodius University in Skopje, N. Macedonia
MSc. Erasmo Velázquez Cigarroa, Department of Rural Sociology, Chapingo Autonomous University, Mexico
Dr. Ecaterina Stefan, University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania
Dr. Jeeranuch Sakkhamduang, The International Society of Environmental and Rural Development, Japan

Dr. Raoudha Khanfir Ben Jenana, High Institute of Agronomy of Chott Meriem, Sousse, Tunisia
Dr. Hamada Abdelrahman, Soil Science Dept., Faculty of Agriculture, Cairo University, Egypt
Prof. Dragana Sunjka, Faculty of Agriculture, University of Novi Sad, Serbia
MSc. Aleksandra Susnjar, Faculty of Agriculture, University of Novi Sad, Serbia
MSc. Dragana Boskovic, Faculty of Agriculture, University of Novi Sad, Serbia
Dr. Antonije Zunic, Faculty of Agriculture, University of Novi Sad, Serbia
Dr. Vedran Tomic, Institute for Science Application in Agriculture, Serbia
MSc. Vojin Cvijanovic, Institute for Science Application in Agriculture, Serbia
MSc. Mladen Petrovic, Institute of Agricultural Economics, Serbia
Dr. Milan Stevanovic, Maize Research Institute "Zemun Polje", Serbia
Dr. Andrej Pilipovic, Institute of Lowland Forestry and Environment, Serbia
Dr. Sc. Morteza Behzadfar, Tarbiat Modares University, Tehran, Iran
Dr. Larysa Prysiazniuk, Ukrainian Institute for Plant Variety Examination, Kyiv, Ukraine
Doc. dr Sead Ivojevic, Faculty of Forestry, University of Sarajevo, Bosnia and Herzegovina
Dr. Nenad Markovic, Enterprise E. N. (EEN) Coordinator, University of East Sarajevo, Bosnia and Herzegovina
Domagoj Group, SEASN - South Eastern Advisory Service Network, Croatia
Dr. Milan Ninkovic, Scientific Institute of Veterinary Medicine of Serbia
Prof. dr Zeljko Lakic, Agricultural Institute of Republic of Srpska - Banja Luka, Bosnia and Herzegovina
Dr. Milan Jugovic, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
Prof. dr Sinisa Berjan, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
Prof. dr Dejana Stanic, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
MSc. Milena Stankovic, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
Dr. Stefan Stjepanovic, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
MSc. Stefan Bojic, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
Dr. Tanja Jakisic, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
Dr. Boban Miletic, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
Doc. dr Nedeljka Elez, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
MSc. Selena Cevriz, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina
Dr. Branka Govedarica, Faculty of Agriculture, University of East Sarajevo, Bosnia and Herzegovina

PREFACE

Dear colleagues,

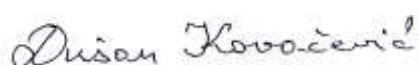
It is with great pleasure that I introduce the *Book of Proceedings* for the 15th International Scientific Agricultural Symposium “AGROSYM 2024.” I trust that you will find it a valuable resource in your work. This year, around 800 contributions have been accepted for inclusion in the *Book of Abstracts*. The themes of AGROSYM 2024 span the full spectrum of agricultural sciences, divided into seven key sessions: 1) Plant Production, 2) Plant Protection and Food Safety, 3) Organic Agriculture, 4) Environmental Protection and Natural Resource Management, 5) Animal Husbandry, 6) Rural Development and Agro-Economy, and 7) Forestry and Agroforestry.

There is growing consensus among scholars and practitioners that technological innovations have the potential to boost agricultural production, enhance supply stability, and reduce the environmental impact of farming. Technology has been especially pivotal in increasing the productivity of annual crops such as maize, rice, soybeans, wheat, and cotton. However, with trees having longer growth cycles, breeding programs for these crops require more time. New plant breeding techniques promise improvements in productivity, but they have sparked an ongoing academic debate regarding their advantages and drawbacks.

While much of the focus in the past has been on the production side of agriculture (e.g., productivity and efficiency), there is an increasing emphasis today on the consumption side and the intermediate stages of the food chain, such as processing and distribution. This shift is driving the transition toward a “farm-to-fork” approach. Globally, consumers are sending clearer signals about their preferences for higher quality, healthier, safer, and more flavorful products. In response, many agri-food companies are exploring innovative ways to gain greater control over production processes and ensure the quality and safety of final products. Furthermore, changes in investment strategies hold the potential to reduce the environmental and social costs of agriculture. It has become increasingly clear to investors that companies that prioritize sustainability and social responsibility tend to yield better long-term returns.

Agri-food systems are at the heart of global discussions surrounding sustainable development and the achievement of the United Nations Sustainable Development Goals (SDGs) by 2030. These systems are deeply connected to numerous global challenges, including climate change, poverty, food insecurity, biodiversity loss, resource depletion, and ecosystem degradation. A key goal of the sustainable agriculture movement is to create farming systems that mitigate or eliminate the environmental harms associated with industrial agriculture. Additionally, it is critical to improve the resilience of food systems to crises, shocks, and pandemics.

I would like to extend my heartfelt thanks to all the authors, reviewers, and colleagues who contributed to the editing of the *Book of Abstracts*. Special thanks are due to our co-organizers and partners for their unwavering collaboration and comprehensive support throughout this endeavor.



East Sarajevo, 10 October 2024

Prof. Dušan Kovačević, PhD

Editor in Chief, President of the Scientific Committee of AGROSYM 2024

CONTENT

PLANT PRODUCTION	31
CROP PRODUCTION: CURRENT STATE AND CHALLENGES, ADVANCES AND PROSPECTS TO BALANCE ENVIRONMENTAL, SOCIAL AND ECONOMIC IMPERATIVES	
Steve QUARRIE	32
GENETIC IMPROVEMENT OF DATE PALMS - PROTOPLASTS CULTURE OF TEGGAZA, DEGLET NOUR AND TAQUERBUCHT CULTIVARS	
Djamila YATTA-EL DJOUZI, Said. BOUDEFFEUR, Rosa. SLAMANI, Radia. AYADI, Sana. EZZOUAOUI, Lydia BOUAMRA, Mohamed KHARSSI	43
AGRICULTURAL ADAPTATION TO CLIMATE CHANGE IN ALGERIA	
Wassila HANAFAI, Nouara BOULFOUL	50
FACILITATING HYSSOP INTRODUCTION TO ARMENIA: ASSESSING GLOBAL GENE BANK RESOURCES AND CULTIVATION POTENTIAL	
Alvina AVAGYAN, Laura TADEVOSYAN, Raya BALAYAN, Vladimíra HORČINOVÁ SEDLÁČKOVÁ, Marina HOVHANNISYAN, Margarita HARUTYUNYAN	54
A STUDY OF THE EFFECT OF BIOSTIMULANT ON THE YIELD AND QUALITY OF CUCUMBER (CUCUMIS SATIVUS)	
Aleksandra GOVEDARICA-LUČIĆ, Tanja PEROVIĆ, Alma MEMIĆ, Lutvija KARIĆ, Čerima ZAHIROVIĆ SINANOVIĆ Milica STOJANOVIĆ	60
INTERDEPENDENCE OF PRODUCTIVE CHARACTERISTICS AND FORAGE QUALITY OF RED CLOVER	
Borislav PETKOVIĆ, Ilija KOMLJENOVIĆ, Vojo RADIĆ, Mihajlo MARKOVIĆ, Zoran MALIČEVIĆ	65
ECOLOGICAL CHARACTERISTICS OF MACROPHYTES OF THE PROTECTED HABITAT "GROMIŽELJ" (BOSNIA AND HERZEGOVINA)	
Milica LJUBOJEVIĆ, Natasa MARIC, Sladjana PETRONIC	71
ORGANIC PLANT BIOSTIMULANTS AND TOMATO FRUIT QUALITY	
Mirjana JOVOVIĆ, Verica MILOVIĆ, Zoranka MALEŠEVIĆ, Marko PETKOVIĆ	77
FLOWERING AND FRUIT SET OF CULTIVARS OF SWEET CHERRY IN AGRO-ECOLOGICAL CONDITIONS OF SARAJEVO	
Mirjana RADOVIĆ, Mihajlo LIZDEK, Mirko KULINA, Dejan ZEJAK, Dragan TOMOVIĆ, Slavisa MILOVANOVIĆ	84
PROSPECTS OF CORN CULTIVATION AND PRODUCTION IN THE SEMBERIJA REGION IN BOSNIA AND HERZEGOVINA	
Igor ĐURĐIĆ, Nedeljka ELEZ, Angelina PETKOVIĆ, Slađana JANKOVIĆ	90
YIELD AND CHARACTERISTICS OF BUNCHES OF RED WINE VARIETIES GROWN IN THE AREA OF TREBINJE (BOSNIA AND HERZEGOVINA)	
Tijana BANJANIN, Snežana BRKLJAČ, Zorica RANKOVIĆ VASIĆ	96

THE YIELD OF POTATOES TESTED IN MULTIPLE ENVIRONMENTS IN REPUBLIKA SRPSKA (BOSNIA AND HERZEGOVINA)

Branka GOVEDARICA, Tanja MIJATOVIĆ, Igor ĐURĐIĆ, Vesna MILIĆ, Tanja JAKIŠIĆ 103

APPLICATION OF DIFFERENT VARIANTS OF SUPERABSORBENTS AND THEIR IMPACT ON YIELD OF SELECTED POTATO VARIETIES

Saša LALIĆ, Branka GOVEDARICA, Tanja MIJATOVIĆ, Igor ĐURĐIĆ, Aleksej LUKIN, Tatiana KRIUKOVA, Vesna MILIĆ 109

ENDANGERED AND PROTECTED PLANT SPECIES OF THE RAMSAR SITES OF BOSNIA AND HERZEGOVINA

Zeljana DOKNIC, Natasa MARIC, Sladjana PETRONIC 119

THE EFFECTS OF NaCl AND KCl ON THE GERMINATION AND SEEDLING GROWTH OF *AEGILOPS CYLINDRICA* HOST SEEDS

Gergana DESHEVA, Evgeniya VALCHINOVA, Albena PENCHEVA, Bozhidar KYOSEV, Manol DESHEV 125

SEEDS QUALITY CHARACTERISTICS OF SOME MEDICINAL PLANTS FROM LAMIACEAE FAMILY USING FLUORESCENCE SPECTROSCOPY

Katya UZUNDZHALIEVA, Vanya SLAVOVA, Veselina MASHEVA 131

COMBINING ABILITY OF MID-EARLY MUTANT MAIZE LINES FOR THE GRAIN YIELD AND LENGTH OF THE EAR

Mima ILCHOVSKA, Valya BACHIYSKA, Nataliya PETROVSKA, Valentina VALKOVA 139

EVALUATION OF LANDRACE AND FOREIGN MAIZE POPULATIONS FOR BIOLOGICAL AND ECONOMIC PROPERTIES

Yuliana IORDANOVA, Nataliya PETROVSKA 146

GRAIN YIELD RESPONSE OF MAIZE, WHEAT AND BARLEY TO NITROGEN RATES AND FERTILIZATION SYSTEMS

Nedyalka YORDANOVA, Nikolay MINEV, Svetla KOSTADINOVA 152

MACRONUTRIENTS ACCUMULATION OF BARLEY DEPENDING ON THE SOIL NITROGEN LEVEL

Veselin SEVOV, Nikolay MINEV, Svetla KOSTADINOVA 158

KNEJA 652 - A LATE HYBRID FROM PORTFOLIO OF THE MAIZE RESEARCH INSTITUTE - KNEZHA FOR 2024

Valentina VALKOVA 164

STUDY OF THE INFLUENCE OF DIFFERENT PERCENTAGE STERILE PLANTS ON THE MAIZE HYBRIDS YIELD

Valentina VALKOVA Penka VULCHINKOVA, Borislava BACHIYSKA, Zhelyazko VULCHINKOV 170

USING OF HETEROSIS SELECTION IN SESAME (*SESAMUM INDICUM* L.)

Stanislav STAMATOV, Veselina MASHEVA Katya UZUNDZHALIEVA 175

STABILITY OF BULGARIAN MAIZE HYBRIDS TESTED IN SERBIA

Stefan VULCHINKOV, Nenad DELIC, Zhelyazko VULCHINKOV, Jovan PAVLOV, Natalya PETROVSKA	181
TRADITIONS OF USING GEORGIAN WHEAT IN GEORGIA	
Levan UJMAJURIDZE, Tsothe SAMADASHVILI, Gulnari CHKHUTIASHVILI	190
BIOSTIMULANTS ADVERSELY AFFECTED BALSAM ESSENTIAL OIL DURING ITS FIRST YEAR OF ESTABLISHMENT	
Athina TEGOU, Dimitrios BARTZIALIS, Savvas PAPADOPOULOS, Kyriakos D. GIANNOULIS, Nicholas G. DANALATOS, Eleni WOGIATZI.....	194
BIOSTIMULANTS EFFECT ON LAVENDER YIELD IN ITS SECOND GROWING YEAR	
Kyriakos D. GIANNOULIS, Dimitra-Despoina TOSILIANI, Dimitrios BARTZIALIS, Ippolitos GINTSIODIS, Nicholas G. DANALATOS	200
INTERSPECIFIC HYBRIDIZATION BETWEEN <i>VICIA FABA</i> L. AND <i>VICIA NARBONENSIS</i> L.: PRESENT STATUS AND FUTURE PROSPECTS	
Theano B. LAZARIDOU, Ioannis N. XYNIAS, Demetrios G. ROUPAKIAS	208
INVESTIGATION OF THE EFFECTS OF DOMESTIC WATER BUFFALO, HUNGARIAN RACKA SHEEP AND HUNGARIAN GREY CATTLE GRAZING ON DIFFERENT WOOD-PASTURES IN HUNGARY	
Attila FÜRESZ, Szilárd SZENTES, Dénes SALÁTA, Zsombor WAGENHOFFER, Gabriella FINTHA, László SIPOS, Ferenc PAJOR, Károly PENKSZA.....	213
BIOLOGICAL DIVERSITY OF <i>SPINACIA OLERACEA</i> L. ACCESSIONS COLLECTED IN IRAN USING SOME MORPHOLOGICAL TRAITS	
Naser SABAGHNIA, Mohsen JANMOHAMMADI.....	219
BIOLOGICAL VARIATION OF SOME GARDEN CRESS (<i>LEPIDIUM SATIVUM</i> L.) ACCESSIONS	
Naser SABAGHNIA, Mohsen JANMOHAMMADI.....	223
GRAPHIC ANALYSIS OF GENOTYPE BY TRAIT INTERACTION IN SAFFLOWER USING BILOT METHOD	
Naser SABAGHNIA, Mohsen JANMOHAMMADI.....	227
MECHANICAL PEAR HARVESTING WITH THE "MULTIBASKET" SYSTEM	
Roberto TOMASONE, Carla CEDROLA, Mauro PAGANO	233
DEVELOPING A DECISION TREE MOBILE APPLICATION TO CONTROL A SMART GREENHOUSE IN THE JORDAN VALLEY	
Lubna NASIR EDDEEN, Ola SHALBAK, Ansar KHOURI	240
APPROACHES TO ASSESSING THE ENERGY POTENTIAL OF BIOMASS OBTAINED FROM CROP RESIDUE IN REPUBLIC OF NORTH MACEDONIA	
Igor ILJOVSKI, Zoran DIMOV, Zlatko ARSOV, Ile CANEV	247
CORRELATION ANALYSIS OF CORN BIO-MORPHOLOGICAL TRAITS IN THE INITIAL GROWTH PHASE UNDER DIFFERENT TEMPERATURE CONDITIONS	
Raisa IVANOVA, Elena LUTCAN, Alla BOROVSKAIA, Nicolai VANICOVICI.....	254

EVALUATING STRAWBERRY CULTIVAR PERFORMANCE AND RUNNER HEALTH ACROSS VARIED CLIMATIC ZONES IN POONCH DISTRICT, AZAD JAMMU AND KASHMIR IN PAKISTAN

Noosheen ZAHID, Mehdi MAQBOOL, Raheel ANWAR..... 260

ENHANCING APPLE QUALITY ASSESSMENT THROUGH ANOMALY DETECTION WITH AUTOENCODERS

Adrian IOSIF, Edmond MAICAN, Sorin-Stefan BIRIȘ, Nicolae-Valentin VLĂDUȚ 266

EXPLORING INSECTS DETECTION PERFORMANCE IN CORN PEST CONTROL WITH MOBILENET-SSD NEURAL NETWORK AND HIGHER-RESOLUTION INPUT

Edmond MAICAN, Sanda MAICAN, Sorin-Ștefan BIRIȘ, Adrian IOSIF 272

RESEARCH ON DETERMINING THE PERFORMANCE OF A VARIABLE WIDTH PLOUG DESIGNED FOR HIGH-POWER TRACTORS (180-240 HP)

Sorin-Ștefan BIRIȘ, Constantin LĂCĂTUȘU, Nicolae-Valentin VLĂDUȚ, Neluș-Evelin GHEORGHITĂ, Nicoleta UNGUREANU, Edmond MAICAN, Adrian IOSIF 279

DIGITAL TECHNOLOGIES IN AGRARIAN SCIENCE AND EDUCATION

Daniil IAKOVLEV, Alexandr PCHELNIKOV 286

INFLUENCE OF STEM CUTTING HEIGHT ON THE NUTRITIONAL VALUE OF CORN SILAGE

Aleksandar VUKOVIĆ, Dragana LALEVIĆ, Rade STANISAVLJEVIĆ, Saša BARAĆ, Milan BIBERDŽIĆ, Dragoslav ĐOKIĆ 292

APPLICATION OF THE SENSOR IN AGRICULTURE: A REVIEW OF RECENT DEVELOPMENTS

Biljana BOŠKOVIĆ, Irina MARINA, Miloš PAJIĆ, Jonel SUBIĆ 299

CONTENT OF MINERAL MATTER IN THE GRAIN OF POPCORN IN A SUSTAINABLE CULTIVATION SYSTEM WITH COVER CROPS

Biljana SEVIC, Zeljko DOLIJANOVIC, Milena SIMIC, Vesna DRAGICEVIC, Dejan CVIKIC, Jelena STOJILJKOVIC, Ivana ZIVKOVIC 304

VARIATION OF SEEDS NUMBER IN PRIMARY SPIKE OF BREAD WHEAT

Desimir KNEŽEVIĆ, Dragan GRČAK, Milosav GRČAK, Tatjana IVANOVIVIĆ, Mirela MATKOVIĆ STOJŠIN, Danijela KONDIĆ, Adriana RADOSAVAC, Aleksandar PAUNOVIĆ, Veselinka ZEČEVIĆ..... 313

FORECASTING THE IMPACT OF CLIMATE CHANGE ON WATER AVAILABILITY FOR WINTER WHEAT CROP IN THE TOPLICA DISTRICT OF SERBIA

Dženita KOCA, Gordana MATOVIĆ, Vesna POČUČA, Enika GREGORIĆ, Mirjam VUJADINOVIĆ MANDIĆ..... 321

INFLUENCE OF GENOTYPE AND IRRIGATION ON YIELD COMPONENTS OF SWEET CORN (ZEA MAYS L. VAR. SACCHARATA STURT.)

Ivan TUPAJIĆ, Marija ČOSIĆ, Aleksa LIPOVAC, Biljana ŠEVIĆ, Jelena STOJILJKOVIĆ, Maja SUDIMAC, Đorđe MORAVČEVIĆ..... 328

MARKER ASSISTED SELECTION FOR β -CAROTENE RICH MAIZE: VALIDATION OF MULTIPLEX-PCR ASSAY FOR *crtRB1* AND *lcyE* FAVOURABLE ALLELES

Marija KOSTADINOVIĆ, Danijela RISTIĆ, Milica LUČEV, Dragana IGNJATOVIĆ-MICIĆ, Jelena VANČETOVIĆ..... 334

INFLUENCE OF THE CULTIVAR, FERTILISER, AND IRRIGATION ON ICEBERG LETTUCE MORPHOLOGY - SINGLE FACTOR VS INTERACTION EFFECTS

Milica STOJANOVIĆ, Zoran DINIĆ, Dragica MILOSAVLJEVIĆ, Aleksandra GOVEDARICA-LUČIĆ, Đorđe MORAVČEVIĆ, Jelena DRAGIŠIĆ MAKSIMOVIĆ, Vuk MAKSIMOVIĆ 339

NOVEL BATAVIA LETTUCE CULTIVARS-CHOOSING THE OPTIMAL CULTIVAR FOR FRESH AND PROCESSED PRODUCTS USING WASPAS METHOD

Milica STOJANOVIĆ, Dragica MILOSAVLJEVIĆ, Jelena DRAGIŠIĆ MAKSIMOVIĆ, Vuk MAKSIMOVIĆ, Aleksandra GOVEDARICA-LUČIĆ, Radomir BODIROGA 346

YIELD RESPONSE OF MAIZE TO IRRIGATION AND PLANTING DENSITY IN THE VOJVODINA ENVIRONMENT IN SERBIA

Miodrag TOLIMIR, Branka KRESOVIĆ, Zorica SREDOJEVIĆ, Katarina GAJIĆ, Milan BRANKOV, Marijana DUGALIĆ, Boško GAJIĆ 353

STRESS RESISTANCE INDICATORS AS THE TOOL FOR SELECTING DROUGHT-TOLERANT WHEAT GENOTYPES

Mirela MATKOVIĆ STOJŠIN, Veselinka ZEČEVIĆ, Dušan UROŠEVIĆ, Dragan BOŽOVIĆ, Jasmina BAČIĆ, Kamenko BRATKOVIĆ, Desimir KNEŽEVIĆ..... 361

SOCIAL NETWORKING IN STRESS-EXPOSED PLANTS

Mirjana VUKOSAVLJEV, Brankica KARTALOVIĆ, Nevena STEVANOVIĆ, Maša BUĐEN, Nikola STANKOVIĆ, Boris BRKIĆ, Nataša LJUBIČIĆ 367

THE NORMALIZED DIFFERENCE RED EDGE INDEX (NDRE) IN GRAIN YIELD AND BIOMASS ESTIMATION IN MAIZE (*Zea mays* L.)

Nataša LJUBIČIĆ, Vera POPOVIĆ, Marko KOSTIĆ, Mirjana VUKOSAVLJEV, Maša BUĐEN, Nikola STANKOVIĆ, Nevena STEVANOVIĆ..... 373

MONITORING STRESS IN ARUGULA (*Eruca sativa*) USING A PORTABLE MULTISPECTRAL DEVICE

Nevena STEVANOVIĆ, Nataša LJUBIČIĆ, Nikola STANKOVIĆ, Maša BUĐEN, Brankica KARTALOVIĆ, Mirjana VUKOSAVLJEV 379

EFFECTS OF NITROGEN FERTILIZATION ON THE YIELD OF TRADITIONAL VARIETIES AND LANDRACES OF WINTER WHEAT

Sanja MIKIĆ, Milan MIROSAVLJEVIĆ, Ljiljana BRBAKLIĆ, Vladimir AĆIN, Jelena VISKOVIĆ, Goran JAĆIMOVIĆ 384

RESULTS OF TESTING THE WORKING QUALITY OF DIFFERENT TECHNOLOGICAL-TECHNICAL SYSTEMS FOR PRECISION SOWING OF MAIZE

Saša BARAĆ, Milan BIBERDŽIĆ, Aleksandar ĐIKIĆ, Aleksandar VUKOVIĆ, Dragana LALEVIĆ 392

SERBIAN TOMATO PRODUCTION GROSS MARGIN ANALYSIS: ECONOMIC VIABILITY AND SUSTAINABILITY OF OPEN-FIELD VS. GREENHOUSE

Sladán STANKOVIĆ, Vedran TOMIĆ, Nikola LJILJANIĆ, Dušan NIKOLIĆ, Slobodan KRNJAJIĆ, Elmira SALJNIKOV, Vesela RADOVIĆ 398

SERBIA AGRICULTURE SECTOR TRANSFORMATION DUE TO GLOBAL, CLIMATE AND EU CHALLENGES

Sladán STANKOVIĆ, Rade JOVANOVIĆ, Snežana JANKOVIĆ, Divna SIMIĆ, Dušan NIKOLIĆ, Aleksandra IVETIĆ, Jelena IVANOVIĆ, Stefana UTVIĆ 403

BIOCHEMICAL AND MOLECULAR CHARACTERIZATION OF MAIZE INBRED LINES

Snežana MLADENOVIĆ DRINIĆ, Jelena VUKADINOVIĆ, Danijela RISTIĆ, Natalija KRAVIĆ, Violeta ANĐELKOVIĆ, Nikola GRČIĆ, Ana NIKOLIĆ..... 410

ISOLATION AND CHARACTERIZATION OF PGP BACTERIA FROM *PLANTAGO LANCEOLATA* RHIZOSPHERE SOIL

Timea HAJNAL JAFARI, Vladimira ŽUNIĆ, Dragana STAMENOV, Simonida ĐURIĆ 417

THE INFLUENCE OF AUXIN OF BACTERIAL ORIGIN ON THE SEED QUALITY PARAMETERS OF SOME FIELD CROPS

Violeta MANDIĆ, Snežana ĐORĐEVIĆ, Nikola ĐORĐEVIĆ, Vesna KRNJAJA, Milica BALOŠ 424

THE INFLUENCE OF HEAVY METALS ON THE GROWTH OF THE WHEAT STEM

Violeta MICKOVSKI STEFANOVIĆ, Predrag BRKOVIĆ, Vladimir FILIPOVIĆ, Aleksa ĐUKIĆ, Nenad ŽIVKOVIĆ, Dragana STEVANOVIĆ 432

FORAGE YIELD AND WEEDNESS OF THE INTERCROPPED SPRING VETCH AND OATS

Vladeta STEVOVIĆ, Dalibor TOMIĆ, Bojana LAPČEVIĆ, Miloš MARJANOVIĆ, Nenad PAVLOVIĆ, Milomirka MADIĆ..... 437

EFFECT OF DIFFERENT MICROBIAL FERTILIZERS ON THE MORPHOLOGICAL AND PRODUCTIVE CHARACTERISTICS OF MAIZE

Željko DOLIJANOVIĆ, Vesna DRAGIČEVIĆ, Snežana ĐORĐEVIĆ, Snežana OLJAČA, Srđan ŠEREMEŠIĆ 443

EFFECT OF AMMONIUM THIOSULFATE NITROGEN FERTILIZER ON QUALITATIVE PARAMETERS OF AROMATIC PLANTS

Ivana MEZEYOVÁ, Ivana KOLLÁROVÁ, Ján MEZEY, Miroslav ŠLOSÁR, Mária BREZÁNIOVÁ..... 449

EFFECTIVENESS OF BIOSTIMULANTS ON THE QUANTITATIVE AND QUALITATIVE PARAMETERS OF BLUEBERRY (*VACCINIUM CORYMBOSUM*)

Ján MEZEY, Petra ŠEVČÍKOVÁ, Andrej SELNEKOVIĆ, Ivana MEZEYOVÁ 456

EFFECT OF CULTIVAR AND PROCESSING METHOD ON QUALITY OF CHIPS MADE FROM TURNIP, RUTABAGA AND RADISH

Miroslav ŠLOSÁR, Júlia FABIANOVÁ, Ivana MEZEYOVÁ, Ján MEZEY, Ivana TIRDILOVÁ 466

CORRELATION ANALYSIS OF CORM DENSITY AND FERTILIZATION TREATMENTS ON SAFFRON GROWTH AND YIELD IN SEMI-ARID CLIMATE

Youssef ABOU OBEID, Layla NAIM, Nidal SHABAN, Grigor ZEHIROV, Fadi Sami KARAM 473

IMPACT OF CLIMATE CHANGE ON SUNFLOWER PRODUCTION

Vojin CVIJANOVIĆ, Marija BAJAGIĆ, Mladen PETROVIĆ, Gorica CVIJANOVIĆ, Bojan DIMITRIJEVIĆ 479

ENSEMBLE EVALUATION AND MEMBER SELECTION OF REGIONAL CLIMATE MODELS FOR CROP MODEL IMPACT ASSESSMENT

Melpomeni NIKOU, Aristeidis K GEORGOULIAS, Vassilis G ASCHONITIS, Dimitris M PAPAMICHAIL, Theodoros MAVROMATIS 486

THE EFFECT OF CHANGES IN ENVIRONMENTAL CONDITIONS ON THE GROWTH AND YIELD OF BELL PEPPER

Zdenka GIREK, Suzana PAVLOVIĆ, Jelena DAMNJANOVIĆ, Dejan CVIKIĆ, Milan UGRINOVIĆ 493

PLANT PROTECTION AND FOOD SAFETY 499

MORPHOLOGICAL AND MOLECULAR IDENTIFICATION OF ECTOPARASITIC NEMATODES ASSOCIATED WITH THE GENUS XIPHINEMA SPECIES IN KOSOVO VINEYARDS

Gazmend GJINOVCI, Adnand RAMADHI, Shpend SHAHINI, Betim BRESILLA, Agron BUNJAKU, Bekri XHEMALI 500

PHYTOTOXIC EFFECTS OF *THYMUS VULGARIS* AND *CITRUS SINENSIS* ESSENTIAL OILS ON SEED GERMINATION OF SEVEN CEREAL VARIETIES

Fatma Zohra HAMDANI, Namira MHAMED BOUZINA, Imane KRAOUCHE 506

MICROBIOLOGY OF WATER IN PRIMARY FOOD PRODUCTION

Bojan GOLIC, Dragan KNEŽEVIĆ, Biljana PEĆANAC 514

HARMFUL ENTOMOFAUNA ON STRAWBERRY IN BIJELJINA AREA (BOSNIA AND HERZEGOVINA)

Dejana STANIĆ, Milanka MAŠANOVIĆ 520

EFFECT OF CEREAL-LEGUME INTERCROPPING AND MARIGOLD *TAGETES* SP. ON SOIL PLANT PARASITIC NEMATODES

Georgi DIMITROV, Lilyana KOLEVA 531

THE EFFECT OF ESSENTIAL OILS ON MYCELIAL GROWTH AND SPORULATION OF *BOTRYTIS CINEREA*

Slavko GRGIĆ, Tamara SIBER, Dunja ĆOSIĆ, Karolina VRANDEČIĆ, Elena PETROVIĆ, Jasenka ĆOSIĆ 538

IN VIVO EVALUATION OF ANTIFUNGAL ACTIVITY OF NICOTINAMIDE COMPOUNDS AGAINST *BOTRYTIS CINEREA* IN TOMATOES

Tamara SIBER, Elena PETROVIĆ, Jasenka ĆOSIĆ, Karolina VRANDEČIĆ 544

THE LIPOLYSIS LEVEL OF SOME GREEK ARTISANAL CHEESES: A REVIEW OF LAST YEAR'S DATA

Aikaterini GEORGALA	550
INFLUENCE OF FEED FORM ON YELLOW MEALWORM ADULT PRODUCTIVITY: PRELIMINARY RESULTS	
Fjolla AVDYLAJ, Flutura LAMAJ, Ferdinando BALDACCHINO	556
NATURAL ENEMIES OF THE FALL ARMY WORM <i>SPODOPTERA FRUGIPERDA</i> (LEPIDOPTERA: NOCTUIDAE) IN JORDAN AND PALESTINE	
Ahmad KATBEH-BADER, Ibrahim AL-JBOORY, Thaer YASEEN	561
EVALUATION OF <i>PSEUDOMONAS</i> FOR THE MANAGEMENT OF TOMATO DISEASE AND PESTS	
Redouan QESSAOUI, Salahddine CHAFIKI, Abdelmalk MAHROUG, Abdelhadi AJERRA, Abdelghani TAHIRI, Naima AIT AABD, Mohamed ALOUANI, Bouchra CHEBLI, Rachid BOUHARROUD	567
PHOSPHATE SOLUBILIZATION BY THE FLUORESCENTS <i>PSEUDOMONAS</i>	
Redouan QESSAOUI, Salahddine CHAFIKI, Naima CHABBI, Abdelmalek MAHROUG, Abdelghani TAHIRI, Naima AIT AABD, Mohamed ALOUANI, Rachid BOUHARROUD	573
ANTIOXIDANT ACTIVITY OF EXTRACTS FROM DIFFERENT COMPONENTS OF THE INFRUCTESCENCES OF TWO CHESTNUT CULTIVARS	
Elsa RAMALHOSA, Filipe LEMA, Maria Halana FLORINDO DA SILVA, Filomena BARREIRO, Arantzazu SANTAMARIA-ECHART, Tatiana SCHREINER, Maria do Céu FIDALGO, Cristina OLIVEIRA, Paula BAPTISTA	579
2022 FARMERS’ WILLINGNESS TO REDUCE THE USE OF HERBICIDES IN MANAGING WEEDS IN RICE CROPS	
Maria DE FÁTIMA OLIVEIRA, Isabel CALHA, Pedro REIS	585
EXPLORING INSECTS DETECTION PERFORMANCE IN CORN PEST CONTROL WITH MOBILENET-SSD NEURAL NETWORK AND HIGHER-RESOLUTION INPUT	
Edmond MAICAN, Sanda MAICAN, Sorin-Ştefan BIRIŞ, Adrian IOSIF	593
IMPROVING ENERGY EFFICIENCY IN ROMANIAN AGRICULTURE: MECHANICAL ENGINEERING'S CHALLENGES AND CONTRIBUTIONS	
Neluş-Evelin GHEORGHITĂ, Sorin-Ştefan BIRIŞ, Nicoleta UNGUREANU, Mariana IONESCU	600
PNEUMATIC CONVEYING SYSTEMS IN THE AGRI-FOOD INDUSTRY – STATE OF THE ART	
Raluca-Adriana ZOTA, Sorin-Ştefan BIRIŞ, Neluş-Evelin GHEORGHITĂ	606
PLECTOSPHAERELLA CUCUMERINA – NEW AND EMERGING PATHOGEN OF LETTUCE IN BALKAN REGION	
Milica MIHAJLOVIĆ, Jovana HRUSTIĆ, Ana VUČUROVIĆ, Maja ŽIVANOVIĆ, Brankica PEŠIĆ	614
EFFICACY OF PYRAFLUFEN-ETHYL IN THE CONTROL OF SUCKERS IN RASPBERRY, APPLE AND PLUM ORCHARDS IN SERBIA	

Ana ANĐELKOVIĆ, Dragana MARISAVLJEVIĆ, Stefan KOVAČEVIĆ, Danijela ŠIKULJAK	620
EFFECTS OF THE INSECTICIDE LAMBDA-CYHALOTHRIN IN CONTROL OF <i>APHIS POMI DE GEER</i> IN APPLE ORCHARDS	
Slavica VUKOVIĆ, Dragana ŠUNJKA, Antonije ŽUNIĆ, Miloš PETROVIĆ, Nikola LAČARAC, Dragana BOŠKOVIĆ, Aleksandra ŠUŠNJAR, Jelena EĆIMOVIĆ	625
PARAQUAT AND OTHER DESSICANTS – INFLUENCE ON PLANTS AND OTHER ORGANISMS	
Bogdan NIKOLIĆ, Sanja ĐUROVIĆ, Boris PISINOV, Vladan JOVANOVIĆ, Tijana DUDIĆ, Miloš DUGALIĆ	629
THE ROLE OF VOLATILE ORGANIC COMPOUNDS IN PLANT-SOIL COMMUNICATION	
Brankica KARTALOVIĆ Mirjana VUKOSAVLJEV, Nevena STEVANOVIĆ, Boris BRKIĆ, Nikola STANKOVIĆ, Maša BUĐEN, Nataša LJUBIČIĆ	639
APPLICATION OF MATHEMATICAL DECONVOLUTION ON FTIR SPECTRA FOR DETERMINATION OF PROTEIN STRUCTURE IN TOMATO (<i>Solanum lycopersicum L.</i>) TREATED WITH <i>TRICHODERMA SPP.</i>	
Daniela DJIKANOVIĆ, Igor VUKELIĆ, Danka RADIĆ, Ilinka PEĆINAR, Steva LEVIĆ, Dejana PANKOVIĆ, Ksenija RADOTIĆ	644
CONTACT TOXICITY OF THE <i>PINUS SIBIRICA</i> ESSENTIAL OIL AGAINST <i>DROSOPHILA SUZUKII</i>	
Dragana BOŠKOVIĆ, Nuray BASER, Slavica VUKOVIĆ, Sanja LAZIĆ, Aleksandra ŠUŠNJAR, Dušan ČULUM, Antonije ŽUNIĆ, Jelena EĆIMOVIĆ, Dragana ŠUNJKA	650
PRELIMINARY STUDY OF ESSENTIAL OILS EFFECT ON <i>BOTRYTIS CINEREA</i>	
Jelena EĆIMOVIĆ, Dragana BOŠKOVIĆ, Slavica VUKOVIĆ, Sanja LAZIĆ, Aleksandra ŠUŠNJAR, Antonije ŽUNIĆ, Dragana ŠUNJKA.....	656
MYCOPOPULATION ON RASPBERRIES IN SERBIA	
Tanja VASIĆ, Sanja ŽIVKOVIĆ, Darko JEVREMOVIĆ, Aleksandra LEPOSAVIĆ, Stefan KOVAČEVIĆ, Jordan MARKOVIĆ, Aleksandra BULAJIĆ	661
PHYTOPATOGENIC FUNGI OF ALFALFA IN SERBIA	
Tanja VASIĆ, Sanja ŽIVKOVIĆ, Jordan MARKOVIĆ, Sonja FILIPOVIĆ, Debasis MITRA	667
INFLUENCES OF DIFFERENT DRYING METHODS ON THE CHEMICAL COMPOSITION OF BURLEY TOBACCO	
Vesna RADOJIČIĆ, Tijana UROŠEVIĆ	673
CHEMICAL TRANSFORMATIONS IN FLUE-CURED TOBACCO DEPENDING ON THE DRYING METHOD: A REVIEW	
Vesna RADOJIČIĆ, Marija SRBINOSKA, Lazar PEJIĆ, Tijana UROŠEVIĆ	678
MICROBIOLOGICAL QUALITY OF HOMOLJA WHITE CHEESE IN BRINE	
Višnja SIKIMIĆ, Slavica ČABRILO, Aleksandra MILUTINOVIĆ, Nada JELIĆ.....	684

CORRELATION BETWEEN TOTAL POLYPHENOLS CONTENT AND TOTAL FLAVONOIDS CONTENT IN RED GRAPEFRUIT WITH ANTIOXIDANT ACTIVITY

Vojkan MILJKOVIĆ, Ivana GAJIĆ, Radomir LJUPKOVIĆ, Jelena MRMOŠANIN, Milena MILJKOVIĆ 691

PEARSON'S CORRELATION COEFFICIENT FOR TOTAL POLYPHENOLS AND TOTAL FLAVONOIDS WITH ANTIOXIDANT ACTIVITY IN TOMATO JUICE

Vojkan MILJKOVIĆ, Ivana GAJIĆ, Jelena MRMOŠANIN, Milena MILJKOVIĆ 694

CORDYCEPS SINENSIS MUSHROOMS, THEIR ANTIOXIDANT, ANTIMICROBIAL ACTIVITY AND COMPLEXATION WITH SILVER IONS

Anna UHRINOVÁ, Lucia UNGVARSKÁ MAĽUČKÁ 698

SURVEILLANCE OF *RHIZOCTONIA SOLANI* STRAIN PATHOGENICITY ON DIFFERENT CROP SPECIES AND BIOCONTROL POTENTIAL OF CANDIDATE AGENTS

Abdelhak RHOUMA, Lobna HAJJI-HEDFI, Omaira BARGOUGUI, Amira KHLIF, Samar DALI 704

EFFECTIVENESS OF *PSEUDOMONAS* SP. CULTURE FILTRATE IN THE MANAGEMENT OF *ALTERNARIA SOLANI* CAUSING TOMATO EARLY BLIGHT

Abdelhak RHOUMA, Lobna HAJJI-HEDFI, Omaira BARGOUGUI, Amira KHLIF, Samar DALI 712

A REVIEW OF UTILIZING ENTOMOPATHOGENIC NEMATODES FOR CONTROLLING STORAGE PESTS

Alperen Kaan BÜTÜNER, İsmail Alper SUSURLUK 720

OLFACTORY RESPONSE OF AN IMPORTANT TURF PEST, *DORCADION PSEUDOPREISSI* BREUNING (COL.: CERAMBYCIDAE) TO DIFFERENT ESSENTIAL OILS

Esin SERT, Nimet Sema GENÇER 726

ASSESSMENT OF NON-INTENTIONALLY ADDED SUBSTANCES MIGRATION FROM PLASTIC PACKAGING TO FOOD

Arca AKBAŞ, Özlem KIZILIRMAK ESMER 732

EXTENDING THE POSTHARVEST QUALITY OF MINIMALLY PROCESSED (SLICED) PEACHES BY POSTHARVEST ASCORBIC ACID IMMERSION AND CHITOSAN COATING TREATMENTS

Sevil UNAL, Ferhan K. SABIR 739

METHYL JASMONATE MAINTAINS THE POSTHARVEST PHYSICAL AND BIOCHEMICAL QUALITY PROPERTIES OF 'ALPHONSE LAVELLÉE' (*Vitis vinifera* L.) TABLE GRAPES DURING COLD STORAGE

Sevil UNAL, Ferhan SABIR, Zahidenur TURAN, Ali SABIR 746

DETERMINATION METHOD OF HEXAKANAZOL AND TEBUCUNAZOL RESIDUES BY CAPILAR ELECTROPHORESIS

Ülkü Dilek UYSAL ÖZDEMİR, Tufan GÜRAY 753

DETERMINATION METHOD OF HEXACONAZOLE AND TEBUCUNAZOL RESIDUES BY CAPILLARY ELECTROPHORESIS

Tufan GÜRAY, Ulku Dilek UYSAL 759

SUPPRESSION OF OSTRINIA NUBILALIS IN CORN WITH UAV – SPRAY APPLICATION

Zoran STOJANOVIĆ, Momir ALVIROVIĆ, Gordana ĐORĐEVIĆ, Mladen PETROVIĆ, Vojin CVIJANOVIĆ 766

APPLICATION OF BACILLUS SPP. IN PLANT PROTECTION AND GROWTH PROMOTION OF CEREALS

Marina JOVKOVIĆ, Magdalena KNEŽEVIĆ, Marina DERVIŠEVIĆ, Jelena MAKSIMOVIĆ, Galina JEVĐENOVIĆ, Mira MILINKOVIĆ, Aneta BUNTIĆ 773

ORGANIC AGRICULTURE..... 779

VARIATION OF ORGANIC CARBON CONCENTRATION IN BUCKWHEAT GROAT WASTE EXTRACTS

Odeta POCIENE, Rasa SLINKSIENE 780

EFFECTS OF HARVESTING TIME ON ESSENTIAL OIL YIELD AND COMPONENTS OF ORGANICALLY GROWN THYME (*Thymus vulgaris* L.)

Mehmet ARSLAN, Sancar BULUT 787

USE OF ESSENTIAL OIL FOR WEED CONTROL IN ORGANIC FARMING

Mehmet ARSLAN, Sancar BULUT 793

ENVIRONMENT PROTECTION AND NATURAL RESOURCES MANAGEMENT..... 798

EVALUATION OF GROUNDWATER QUALITY OF THE TIRANA (ALBANIA) WASTE TREATMENT AREA

Ornela SHOSHI, Greta MALAJ 799

SOLID-STATE FERMENTATION CELLULASES PRODUCTION ON WHEAT BRAN

Nabila BELHAMICHE, Souheila OUANAS, Francis DUCHIRON, Said BENALLAOUA 808

INVASIVE SPECIES IN THE VINEYARDS OF BOSNIA AND HERZEGOVINA

Mate BOBAN, Helena BREKALO, Sandra MEDIĆ, Antonela MUSA, Danijela PETROVIĆ 812

STRUCTURE OF AGRICULTURAL LAND LOSSES IN FORMER YUGOSLAVIA COUNTRIES OVER THE PERIOD 1990-2018

Branislav DRAŠKOVIĆ, Miroslav LALOVIĆ, Milan GLIŠIĆ, Ljiljana TANASIĆ, Darko MARKOVIĆ 818

THE LIFE CYCLE OF THAUMETOPOEA PITYOCAMPA (DENIS & SCHIFFERMÜLLER, 1775) ON THE PINE TREES OF THE CITY OF MOSTAR AND THE HEALTH RISK

Alma ČOLAK, Denisa ŽUJO ZEKIĆ Emina ADEMOVIĆ, Alisa HADŽIABULIĆ, Elma TEMIM 824

ALLERGENIC WOODY PLANT SPECIES IN THE COURTYARDS OF SCHOOLS IN THE CITY OF MOSTAR IN BOSNIA AND HERZEGOVINA

Danijela PETROVIĆ, Helena BREKALO, Sandra MEDIC, Antonela MUSA, Toni GALIĆ, Mate BOBAN..... 831

EFFECT OF FERTILIZATION AND TYPE OF GRASS-LEGUMINOUS MIXTURE ON GRASSLAND COVER ON TECHNOGENIC SOIL

Nenad MALIĆ, Una MATKO, Ivana TOŠIĆ 837

SANITARY WASTEWATER FROM CAMPS AT HIGHWAY CONSTRUCTION SITES

Zoranka MALEŠEVIĆ, Mirjana JOVOVIĆ, Selena ČEVRIZ 846

EVALUATION OF SERUM CYSTATIN C, SYMMETRIC DIMETHYLARGININE (SDMA), CREATININE AND UREA IN CLINICALLY HEALTHY GERIATRIC HORSES

Adelina KARASTOEVA, Sasho SABEV 852

ULTRAFILTRATION SEPARATION AND APPLICATION OF WASTE POLYPHENOLS FROM OIL-BEARING ROSES

Milena MITEVA, Yana KOLEVA, Viktoria TRIFONOVA, Ana DOBREVA..... 859

CLIMATE NEUTRALITY AND THE ROLE OF EMISSIONS TRADING IN THE EUROPEAN UNION

Monika SABEVA, Diana KOPEVA 865

EVALUATION OF PHYTOREMEDIATION POTENTIAL OF *SIDA HERMAPHRODITA* GROWN IN CONTAMINATED SOILS WITH HEAVY METALS

Violina ANGELOVA, Vera KOLEVA..... 871

CHEMICAL PROPERTIES AND POTENTIALLY TOXIC ELEMENTS IN ANTHROPOGENIC SOILS ON FLYSCH DEPOSITS IN OLIVE GROVES OF KAŠTELA BAY, CROATIA

Aleksandra BENSA, Katarina MATAN, Nikolina JURKOVIĆ BALOG, Aleksandra PERČIN..... 877

SOIL PROPERTIES AND SOIL FERTILITY EVALUATION OF BUKOVICA REGION, CROATIA

Danijela JUNGIC, Jurica ŠKRLEC, Stjepan HUSNJAK, Aleksandra BENSA..... 884

STUDY OF MICROPLASTICS IN SOIL AMEDEMEMENTS

Ioanna CHOMATA, Chrysi A. P APADIMITRIOU 890

PRODUCTION PRACTICES OF ECONOMICALLY IMPORTANT CROPS OF GREECE AS A POTENTIAL SOURCE OF MICROPLASTICS IN THE SOIL ECOSYSTEM

Christos ARAMPATZIS, Ekavi ISARI, Petros KOKKINOS, Ioannis KALAVROUZIOS 895

ENHANCING SOIL BULK DENSITY PREDICTION: A COMPARATIVE PRELIMINARY STUDY OF ML METHODS AND PEDOTRANSFER FUNCTIONS

Melpomeni NIKOU, Panagiotis TZIACHRIS, Eirini METAXA 901

PRODUCTION TECHNOLOGY OF AN INNOVATIVE SOIL FERTILITY IMPROVEMENT MEANS	
Aleksandrs ADAMOVICS, Janis MILLERS	908
GREEN LOGISTICS PRINCIPLES AND PRACTICES IN LOGISTICS COMPANIES IN LATVIA	
Andra ZVIRBULE, Gunta GRINBERGA-ZALITE, Anita AUZINA.....	914
TOWARDS SUSTAINABLE CONSUMPTION: INSIGHTS FROM LATVIAN WASTE MANAGEMENT PRACTICES	
Gunta GRINBERGA-ZALITE, Andra ZVIRBULE, Anita AUZINA.....	921
FORECAST POST-2022 BARLEY PRODUCTION IN LIBYA USING TIME SERIES ANALYSIS TO ACHIEVING SELF -SUFFICIENCY	
Jamal Ali Mohamed EHDADAN.....	928
THE ROLE OF WHEAT IN LIBYA AND THE IMPACT ON FOOD SECURITY: CHALLENGES AND OPPORTUNITIES	
Jamal Ali Mohamed EHDADAN.....	933
A SYSTEMATIC REVIEW OF THE IMPACT OF CLIMATE CHANGE ON AGRICULTURE AND FUTURE ADAPTATION STRATEGIES FOR NORTH MACEDONIA	
Elizabeta DIMITRIESKA STOJKOVIKJ, Radmila CRCEVA NIKOLOVSKA, Risto UZUNOV, Sandra MOJSOVA, Aleksandra ANGELESKA, Ljupco ANGELOVSKI....	939
TRANSLOCATION OF ENDANGERED SPECIES <i>SERRATULA LYCOPIFOLIA</i> (VILL.) A. KERN. IN THE REPUBLIC OF MOLDOVA	
Olga IONITA, Elena TOFAN-DOROFEEV, Veaceslav GHENDOV	948
LEVERAGING BLOCKCHAIN TECHNOLOGY TO ENHANCE SUSTAINABILITY AND TRACEABILITY IN GLOBAL AGRI-FOOD VALUE CHAINS	
Manal BELATIK, Mustapha OUATMANE	954
CLIMATE CHANGE IMPACT ON VEGETABLE CROPS AND POTENTIAL FOR ADAPTATION	
Anuoluwapo AYOBAMI OWOLABI, Funmilayo MARY OLOYEDE	960
GROUNDWATER QUALITY FOR IRRIGATION AND DOMESTIC USES OF AIR MOUNTAINS IN SEMI ARID REGION (AGADEZ, NIGER)	
Alhassane ILLIAS, Maman Sani ABDOU BABAYE, Souleymane ISSA MALAN S....	974
BIOPHYSICAL CHARACTERIZATION OF THE IRRIGATION ALONG THE TELWA VALLEY, IN THE DEPARTEMENT OF TCHIROZERINE, AGADEZ	
Mahamadou MOUSSA DIT KALAMOU, Ama Souleymane ABOUBACAR, Maharazu A. YUSUF	980
Characteristics of the Study Area.....	982
Irrigated areas along the stream in the three municipalities.....	982
OPTIMIZING PHOTOSYNTHETIC MICROBIAL FUEL CELLS: EFFECTS OF ELECTRIC STIMULATION ON BIOFILM GROWTH	

Adam STAROWICZ, Paulina RUSANOWSKA, Marcin ZIELIŃSKI	987
THE INFLUENCE OF AIR TEMPERATURE TRENDS ON CHERRY PLUM (<i>PRUNUS CERASIFERA</i> EHRH) IN THE BLUE-GREEN INFRASTRUCTURE	
Mirjana OCOKOLJIĆ, Đurđa PETROV, Nevenka GALEČIĆ, Dejan SKOČAJIĆ, Dragan VUJIČIĆ, Isidora SIMOVIĆ	1000
GREEN INFRASTRUCTURE: IMPLEMENTATION OF WINTERSWEET IN LANDSCAPE DESIGN AND ENHANCEMENT OF ECOSYSTEM SERVICES	
Mirjana OCOKOLJIĆ, Đurđa PETROV, Nevenka GALEČIĆ, Dejan SKOČAJIĆ, Dragan VUJIČIĆ, Isidora SIMOVIĆ	1007
TILLAGE SYSTEMS - ADVANTAGES AND DISADVANTAGES IN TERMS OF NUTRIENT CONTENT, YIELD AND ECONOMIC PROFITABILITY	
Dragana LALEVIĆ, Milan BIBERDŽIĆ, Aleksandar VUKOVIĆ, Saša BARAĆ, Lidija MILENKOVIĆ, Zoran S. ILIĆ, Olivera ŠUŠA	1014
SOIL WATER RETENTION IN PANNONIAN CHERNOZEM	
Vladimir ĆIRIĆ, Dragana MARINKOVIĆ, Dragan RADOVANOVIĆ	1021
ASSESSING THE INFLUENCE OF NITROGEN PRESSURE ON NITROGEN COMPOUND LEVELS AND COMPOSITION IN SELECTED SURFACE WATER BODIES	
Marija PEROVIĆ, Vesna OBRADOVIĆ	1027
NITROGEN PRESSURE IMPACT ON GROUNDWATER NITROGEN COMPOUND LEVELS	
Marija PEROVIĆ, Vesna OBRADOVIĆ	1033
BIO-CONTROL OF THE FIVE MOST INVASIVE WEEDS AS A NARATIVE FOR THE SUSTAINABLE GOVERNANCE OF BALKAN NATURAL RESOURCES	
Renata GAGIĆ-SERDAR, Miroslava MARKOVIĆ, Bojan KONATAR, Suzana MITROVIĆ, Danilo FURTULA, Ljubinko RAKONJAC	1039
RESTORATION AND CONSERVATION OF THE PROTECTED TREE <i>QUERCUS ROBUR</i> L. AT THE SITE "JOZIĆA KOLIBA", SERBIA	
Suzana MITROVIĆ, Milorad VESELINOVIĆ, Zlatan RADULOVIĆ, Nevena ČULE, Snežana STAJIĆ, Miroslava MARKOVIĆ, Marija MILOSAVLJEVIĆ	1047
EVALUATING CORROSION AND INCRUSTATION RISKS IN SELECTED WELLS IN DANUBE ALLUVIUM	
Vesna OBRADOVIĆ, Marija PEROVIĆ, Predrag PAJIĆ	1054
SHEEP WOOL BRIQUETTES	
Dominika GORNIK BUČAR, Janij KAVČIČ, Bojan GOSPODARIČ	1059
SPATIOTEMPORAL VARIATION OF SNOWFALL AND SNOW COVER IN URBAN CENTERS OF THE WESTERN BLACK SEA REGION, TURKEY	
Hüseyin SENSOY, İlyas BOLAT	1065
THE EFFECT OF THE COMBINED USAGE OF HYDROFOBIC AND HYDROPHILIC AGENTS ON THE STALING OF BREAD	
Sultan ARSLAN-TONTUL	1071

LESS CLEAN WATER FOR AGRICULTURE DUE TO MILITARY ACTIVITIES IN UKRAINE	
Vita STROKAL, Maryna LADYKA, Yevgeniy BEREZHNIAK	1076
SOIL PROFILES IN GATACKO POLJE IN EASTERN REPUBLIC OF SRPSKA, BOSNIA AND HERZEGOVINA	
Vesna TUNGUZ, Turgay DINDAROGLU, Bojana PETROVIC.....	1083
SOIL FERTILITY IN EASTERN REPUBLIC OF SRPSKA, BOSNIA AND HERZEGOVINA	
Vesna TUNGUZ, Turgay DINDAROGLU, Bojana PETROVIC.....	1090
ASSESSMENT OF POTENTIAL TOXIC ELEMENTS IN SOILS OF THREE URBAN AREAS AROUND VOLOS (GREECE) INDUSTRIAL ZONE	
Georgios CHARVALAS, Elpiniki SKOUFOGIANNI, Aikaterini MOLLA, Savvas PAPADOPOULOS, Evaggelia CHATZIKIROU, Aris KYPARISSIS, Olga CHRISTOPOULOU	1097
CIRCULAR ECONOMY MODEL IN AQUACULTURE SECTOR IN LATVIA	
Agnese EIZENBERGA	1102
RESEARCH OF ARSENIC (As) CONTENT IN AGRICULTURAL LAND	
Vladimir SABADOŠ, Danijela ŽUNIĆ	1108
ANIMAL HUSBANDRY	1115
THE EFFECTS OF HEAT STRESS ON THE EXISTENCE OF STAPHYLOCOCCI IN MILK PRODUCED BY DAIRY COWS	
Nassima BOUHROUM, Halima OUADEH, Leyla SLATNA, EL Hassan LANKRI ...	1116
MICROBIOLOGICAL SAFETY OF FEED IN 2023	
Bojan GOLIC, Dragan KNEŽEVIĆ, Dragan KASAGIĆ	1121
THE IMPACT OF AGE ON REPRODUCTIVE TRAITS OF SIMMENTAL CATTLE	
Jelena NIKITOVIC, Tatjana KRAJISNIK, Stevan RAJIC	1127
HISTOLOGICAL ANALYSIS OF STRIATED MUSCULATURE WITH THE PURPOSE OF ASSESSING MEAT QUALITY	
Nadžida MLAČO, Amela KATICA.....	1133
INVESTIGATION OF THE EFFECTS OF DOMESTIC WATER BUFFALO, HUNGARIAN RACKA SHEEP AND HUNGARIAN GREY CATTLE GRAZING ON DIFFERENT WOOD-PASTURES IN HUNGARY	
Attila FÜRÉSZ, Szilárd SZENTES, Dénes SALÁTA, Zsombor WAGENHOFFER, Gabriella FINTHA, László SIPOS, Ferenc PAJOR, Károly PENKSZA.....	1141
INBREEDING IN LATVIAN DARKHEADED SHEEP BREED BY PEDIGREE DATA	
Līga PAURA, Daina JONKUS	1147
COMPARATIVE EFFICACY OF DIFFERENT ACARICIDAL COMPOUNDS AGAINST TICKS INFESTING BOVINE IN AND AROUND RAWALAKOT AZAD KASHMIR, PAKISTAN	

Anisa MUSHTAQ, Murtaz UL HASAN, Asim SHAMIM, Muhammad ALI ABDULLAH SHAH, Muhammad ARIF ZAFAR, Muhammad SHOAB, Abdul ASIM FAROOQ, Saif UR REHMAN, Aayesha RIAZ, Muhammad KAMRAN	1153
THE FUNCTIONAL CHARACTERISTICS OF STARCH IN GROWING PIG NUTRITION	
Bojan STOJANOVIĆ, Vesna DAVIDOVIĆ, Aleksandra IVETIĆ, Blagoje STOJKOVIĆ, Saša OBRADOVIĆ, Ivana GRUJIĆ	1160
EVALUATING THE INCLUSION OF PUMPKIN SEED CAKE IN DAIRY COWS DIET ON MILK PRODUCTION	
Jordan MARKOVIĆ, Tanja VASIĆ, Sanja ŽIVKOVIĆ, Nedeljko RACIĆ, Đorđe LAZAREVIĆ, Marija STEPIĆ, Milomir BLAGOJEVIĆ	1167
THE CONTENT OF UREA IN THE MILK OF SIMMENTAL COWS IN DIFFERENT SEASONS AND HOUSING SYSTEMS	
Mladen TRIVUNOVIĆ, Ksenija ČOBANOVIĆ, Mirko IVKOVIĆ, Denis KUČEVIĆ, Tamara PAPOVIĆ	1173
CLAW LESIONS IN DAIRY COWS IN SERBIA	
Milan NINKOVIĆ, Nemanja ZDRAVKOVIĆ, Nemanja JEZDIMIROVIĆ, Jovan BOJKOVSKI, Sveta ARSIĆ	1180
ANIMAL PRODUCTS AS FUNCTIONAL FOOD AND ALIGNING THEIR USE WITH EU REGULATIONS	
Aleksandra MILOŠEVIĆ, Milena MILOJEVIĆ, Suzana KNEŽEVIĆ, Maja DOŠENOVIĆ MARINKOVIĆ, Goran STANIŠIĆ	1184
THE INFLUENCE OF POLLUTANTS ON THE CHEMICAL AND MICROBIOLOGICAL QUALITY OF THE RIVER IBAR	
Saša OBRADOVIĆ, Raško STEFANOVIĆ, Nenad ĐORĐEVIĆ, Bojan STOJANOVIĆ, Vladimir ŽIVKOVIĆ	1190
APPLICATION OF AROMA IN THE NUTRITION OF ANIMALS WITH FUR-CHINCHILLA	
Saša OBRADOVIĆ, Raško STEFANOVIĆ, Nenad ĐORĐEVIĆ, Bojan STOJANOVIĆ, Siniša BERJAN	1196
CHARACTERISTICS OF HERZEGOVINIAN CHEESE IN SACK	
Snežana JOVANOVIĆ, Tanja VUČIĆ	1202
THE EFFECT OF GENOTYPE AND PROTEASE ENZYME ON THE WEIGHT AND PERCENTAGE OF MEAT CLASSES IN CHICKENS	
Vladimir DOSKOVIĆ, Snežana BOGOSAVLJEVIĆ-BOŠKOVIĆ, Zdenka ŠKRBIĆ, Miloš LUKIĆ, Bojan STOJANOVIĆ, Simeon RAKONJAC, Veselin PETRIČEVIĆ ..	1208
EFFECTS OF ROOSTER PRESENCE IN FREE-RANGE SYSTEMS ON EGG QUALITY	
Ali AYGUN, Dogan NARINC	1213
COMPARISON OF THREE DIFFERENT LAYER GENOTYPES RAISED IN A FREE-RANGE SYSTEM FOR EGG PRODUCTION PERFORMANCE	
Ali AYGUN, Dogan NARINC, Hasan ARISOY	1218

RESPONSE OF BROILERS TO A FERMENTED PROTEIN SUPPLEMENTARY FEED

Canan KOP-BOZBAY, Ahmet AKDAĞ..... 1225

LAYING PERFORMANCE OF LAYING HENS FED A FERMENTED PROTEIN SUPPLEMENTARY FEED

Canan KOP-BOZBAY, Ahmet AKDAĞ..... 1231

COMPUTATIONAL FLUID DYNAMICS (CFD) APPLICATIONS IN LIVESTOCK BUILDINGS

Yasemin KOCAMAN, Selda UZAL SEYFİ..... 1236

THE EFFECT OF DIFFERENT RAISING CONDITIONS ON LIVE WEIGHT AFTER SHEARING AND GREASY WOOL YIELD IN FAT TAILED EWES

Turgut AYGÜN..... 1242

OCCUPATIONAL ACCIDENTS, DISEASES AND PREVENTION IN CROP AND ANIMAL PRODUCTION

Turgut AYGÜN..... 1248

CURRENT SITUATION OF HORSE BREEDING AND POSSIBILITIES IN BİNGÖL PROVINCE OF TÜRKİYE

Turgut AYGÜN..... 1255

EFFECT OF BUCKWHEAT ON PERFORMANCE, EGG QUALITY AND HATCHING CHARACTERISTICS IN JAPANESE QUAIL

Vildan KOÇBEKER, Abdoulaziz Hamissou MAMAN, Ali AYGUN, Cansu BULUT, Ahmet GUNES 1261

A STUDY CONCERNING THE EVALUATION OF THE BALANCE OF ENERGY DURING EARLY LACTATION

Vildan KOÇBEKER..... 1268

THE EFFECT OF EGG WEIGHT ON CHICK QUALITY AND HATCHING RESULTS IN BROILER BREEDERS

Zeynep YARDIM, Nilgün UZUN, Elif AĞÖREN, A. Emre KARABAŞ 1274

RURAL DEVELOPMENT AND AGRO-ECONOMY..... 1281

CHALLENGES OF SUSTAINABLE INNOVATION IN THE ALGERIAN FOOD INDUSTRY

Nouara BOULFOUL , Wassila HANAFI, Malika MAHDID, Salima SALHI..... 1282

ENHANCING ORGANIZATIONAL MANAGEMENT AND DECISION-MAKING THROUGH DASHBOARD IMPLEMENTATION : A CASE STUDY OF THE ALGERIAN RED MEAT COMPANY, ALVIAR

Nouara BOULFOUL , Malika MAHDID, Amina BOUKHORS..... 1290

RISK ANALYSIS OF INVESTING IN GREENHOUSE VEGETABLE PRODUCTION

Radomir BODIROGA, Grujica VICO, Milica STOJANOVIĆ, Ljubiša ŠEVKUŠIĆ, Stana TEŠIĆ, Jovana SPASOJEVIĆ..... 1300

BIODIVERSITY FINANCE – CURRENT FINANCIAL FLOWS AND FUNDING GAPS

Zorica GOLIC, Saša LALIĆ 1308

CLIMATIC REGIONALIZATION AND RAINFED AGRICULTURAL PRODUCTION IN THE STATE OF MARANHÃO, BRAZIL

Erika Costa SOUSA, Jose de Jesus Sousa LEMOS, Ronaldo Haroldo Nascimento de MENEZES..... 1318

RURAL DEVELOPMENT VIA TRANSFORMING AGRO-INDUSTRIAL WASTE DERIVED FROM BIOMASS TO SUSTAINABLE BIOENERGY

Agapi VASILEIADOU 1327

DEVELOPING TECHNOLOGY TRANSFER OFFICES TO SUPPORT INNOVATION: A CO-DESIGN PROCESS INITIATIVE IN BURKINA FASO AND NIGER

Annarita ANTONELLI, Francesco NOTARANGELO, Damiano PETRUZZELLA, Daniel DORI, Bilampoa GNOUMOU/THIOMBIANO, Feridjou Emilie Georgette SANON/OUATTARA, Halima OUMAROU DIADIE, Daouda ANZA, Abdoulaye SOULEYMANE..... 1333

AGRI-FOOD RESEARCH IN CHAD

Hamid EL BILALI, Tarek BEN HASSEN, Sinisa BERJAN 1340

CIRCULAR AGRI-FOOD SYSTEMS: INTEGRATING NEXT-GEN TECHNOLOGIES FOR ZERO-WASTE AGRICULTURE

Luma Abu ORABI 1350

ANALYSIS OF PRODUCTION AND EXPORT OF MONTENEGRIN WINE WITH PARTICIPATION OF SMALL PRODUCERS

Nataša PEROVIĆ, Bojana RISTANOVIĆ..... 1355

PERCEPTUAL ANALYSIS OF MOUNTAIN ZONE GOVERNANCE: CASE OF THE TICHOUKT MASSIF - MIDDLE ATLAS, MOROCCO

Youssef BELHAJ , Mohamed OUCHERROU 1362

DYNAMICS OF OASIS AGRICULTURE IN MOROCCO: BETWEEN INSTITUTIONAL GOVERNANCE AND CLIMATIC CHALLENGES

Laila CHIABRI, Abdellah BENTAHAR, Aziz MESSOUSSI..... 1368

THE ECONOMIC AND ENVIRONMENTAL COST OF CULTIVATING OIL PALMS IN PAKISTAN

Rahatullah KHAN, Junaid Alam MEMON, Muhammad ARFAN..... 1375

SETTLEMENT OF YOUNG FARMERS: IDENTIFICATION OF MAIN CONSTRAINTS FROM THE RESULTS OF A SURVEY

Pedro REIS, Maria de Fátima Lorena de OLIVEIRA, Ana NOVAIS 1381

STRATEGIC OBJECTIVES OF THE DEVELOPMENT OF ORGANIC AGRICULTURE IN THE REPUBLIC OF SERBIA

Dragana ĐURIĆ, Jelena DAMNJANOVIĆ, Jelena MASLOVARA JOVANOVIĆ..... 1388

THE POWER OF RURAL TOURISM: INSIGHTS FROM LOCAL COMMUNITY IMPACT STUDIES

Dunja DEMIROVIĆ BAJRAMI, Adriana RADOSAVAC, Desimir KNEŽEVIĆ	1397
THE INFLUENCE OF YIELD AND PRICE FROM THE CURRENT YEAR ON SOWING AREA OF POTATO IN FOLLOWING YEAR – A MULTIPLE LINEAR REGRESSION	
Ljiljana DRINIĆ, Nebojša NOVKOVIĆ, Dragana NOVAKOVIĆ	1404
CHALLENGES OF SETTING UP AN ORGANIC VEGETABLES COOPERATIVE IN SERBIA	
Ratko BOJOVIC, Richard SIMMONS, Steve QUARRIE	1410
COMMON AGRICULTURAL POLICY INCENTIVES FOR HEDGEROW MANAGEMENT: A SLOVENIAN CASE STUDY	
Andreja BOREC, Tina LEŠNIK	1417
GROSS PROFIT ANALYSIS OF LEGUME-CEREALS ROTATION	
Zuhail KARAKAYACI	1424
COST BENEFIT ANALYSIS OF BULB ONION PRODUCTION USING MANUAL HARVESTING SYSTEM IN THE SOUTHEAST REGION, USA	
Esendugue Greg FONSAH, Ajay Kiran NEMALI, Guy HANCOCK, Bhabesh DUTTA, Subas MALLA	1430
CONSIDERATIONS CONCERNING THE EVOLUTION OF AGRITOURISM GUESTHOUSES IN ROMANIA	
Irina Adriana CHIURCIU, Elena SOARE, Carina DOBRE	1437
FORESTRY AND AGRO-FORESTRY	1443
STUDY OF THE CORK QUALITY FROM <i>QUERCUS SUBER</i> L. IN NORTH-WEST ALGERIA	
Mustapha El Habib FRIHI, Belkheir DEHANE	1444
INFLUENCE OF <i>JUNIPERUS SABINA</i>, ALGINITE AND BIOREGULATORS ON SEED GERMINATION KINETICS OF ROZNAVA ORIGIN BEECH	
Dina ELISOVETCAIA, Raisa IVANOVA, Jan BRINDZA	1451
CULTURE OF THE SILVER FIR (<i>ABIES ALBA</i> MILL.) IN ORAVIȚA VALLEY, ROMANIA	
Cornelia BUZATU-GOANȚĂ	1457
THE POTENTIAL OF LAND FOR THE IMPLEMENTATION OF FOREST CLIMATE PROJECTS IN RUSSIA	
Svetlana MORKOVINA, Denis KUZNETSOV	1465
CHARACTERIZATION OF ANTAGONISM OF FUNGI <i>EPICOCCUM NIGRUM</i> AND <i>DIAPORTHE ERES</i>	
Aleksandar VEMIĆ, Sanja JOVANOVIĆ, Aleksandar LUČIĆ, Zlatan RADULOVIĆ, Katarina MLADENOVIĆ, Ljubinko RAKONJAC, Vladan POPOVIĆ	1471
TAXONOMY AND PHYTOGEOGRAPHY ANALYSIS OF MEDICINAL PLANTS WITHIN MANAGEMENT UNIT „GOČ-SELIŠTE“	
Dušan JOKANOVIĆ, Vesna NIKOLIĆ JOKANOVIĆ, Kristina ŽIVANOVIĆ, Nikola DORĐEVIĆ, Bojan TUBIĆ	1477

VARIABILITY OF VESSELS AND WOOD RAYS DENSITY BY CONTAINER SEEDLINGS OF DIFFERENT SPECIES FROM QUERCUS GENERA	
Dušan JOKANOVIĆ, Vesna NIKOLIĆ JOKANOVIĆ, Kristina ŽIVANOVIĆ, Marko MARINKOVIĆ, Filip JOVANOVIĆ	1483
THE CONDITION OF THE TREE CROWNS ON ICP LEVEL I PLOTS IN AP VOJVODINA, SERBIA	
Milan DREKIĆ, Leopold POLJAKOVIĆ - PAJNIK, Marina MILOVIĆ, Zoran GALIĆ, Branislav KOVAČEVIĆ, Predrag PAP	1488
INVESTIGATION OF ENVIRONMENTAL CONDITIONS FOR THE DEVELOPMENT OF FIR DECAYING FUNGI	
Miroslava MARKOVIĆ, Renata GAGIĆ – SERDAR, Ljubinko RAKONJAC.....	1495
EFFECT OF COMMERCIAL BIOFERTILIZER ON THE GROWTH PARAMETERS OF TWO-YEAR-OLD NORTHERN RED OAK (<i>QUERCUS RUBRA</i> L.) SEEDLINGS	
Sanja JOVANOVIĆ, Aleksandar VEMIĆ, Aleksandar LUČIĆ, Ljubinko RAKONJAC, Vladan POPOVIĆ	1501
PLANTING ENERGY CROPS FOR BIOMASS PRODUCTION ON DEPOSOL SOIL	
Saša PEKEČ, Saša ORLOVIĆ, Branislav KOVAČEVIĆ, Marina MILOVIĆ, Leopold POLJAKOVIĆ PAJNIK, Lazar KESIĆ, Nikola PERENDIJA	1506
ANALYSIS OF FOREST DAMAGE: 20-YEAR STUDY IN SERBIA	
Zoran PODUŠKA, Snežana STAJIĆ, Branka PAVLOVIĆ, Jovana CVETKOVIĆ	1511
SILVICULTURE IN THE FUNCTION OF SUSTAINABLE FOREST MANAGEMENT - CASE STUDY OF SE „SRBIJAŠUME“	
Zvonimir BAKOVIĆ, Vladimir VASIĆ, Branko KANJEVAC, Snežana STAJIĆ	1518
SILVOPASTURE SYSTEM COMMUNITY LIVESTOCK PERMIT HOLDERS PERCEPTIONS AND CHALLENGES IN THE LIMPOPO PROVINCE, SOUTH AFRICA	
Phokele MAPONYA, Kgosi MONGWAKETSI, Takalani TAHULELA, Nico OLIVIER	1525
SILVOPASTURE SYSTEM COMMUNITY LIVESTOCK PERMIT HOLDERS FOOD SECURITY STATUS IN THE LIMPOPO PROVINCE, SOUTH AFRICA	
Phokele MAPONYA, Kgosi MONGWAKETSI, Takalani TAHULELA, Nico OLIVIER	1534
DETERMINATION OF ARBUSCULAR MYCORRHIZAL FUNGI SPECIES AT DIFFERENT DEPTHS OF SOIL BENEATH THE PURE SESSILE OAK (<i>Quercus petraea</i> [Matt.] Liebl.) CANOPIES WITHIN A TEMPERATE FOREST STAND	
Melih ÖZTÜRK, Şahin PALTA, Eren BAŞ, Kamil ÇAKIROĞLU.....	1540
AUTHOR INDEX.....	1547

EVALUATING CORROSION AND INCRUSTATION RISKS IN SELECTED WELLS IN DANUBE ALLUVIUM

Vesna OBRADOVIĆ, Marija PEROVIĆ*, Predrag PAJIĆ

Jaroslav Černi Water Institute, Belgrade, Serbia

*Corresponding author: marija.perovic@jcerni.rs

Abstract

The determination of corrosion and incrustation risks in drainage wells is crucial for the maintenance of water extraction infrastructure, ensuring the required efficiency in groundwater levels maintaining, and safeguarding the functionality and longevity of water extraction systems. Analytical methods have long been established for assessing water aggressiveness, providing insights into the groundwater environment susceptibility to corrosion or incrustation of underground structures. The assessment of groundwater aggressiveness is facilitated by the Langelier (LSI) and Ryznar indices (RSI), while Johnson's Classification aids in understanding incrustation phenomena. Based on conducted groundwater sampling campaign in 2021, for four drainage wells in Danube alluvium, the risks of chemical corrosion and incrustation were calculated. Revealed results indicated that groundwater was characterised with oxygen level of 2.5 mg/l – 3.75 mg/l and redox values in range of 362 mV to 583 mV, with very variable iron content. Based on the negative LSI values, examined groundwater from B-1, B-2, and B-4 is undersaturated and tends to dissolve calcium carbonate. The calculated indices for B-3 suggest mild incrustation tendencies, indicating a propensity for carbonate precipitation. Groundwater in zone B-4 stood out as highly corrosive. Saturation indices indicated groundwater tendencies towards either calcium carbonate dissolution or precipitation. The choice of construction materials significantly influences corrosion susceptibility, necessitating pre-emptive measures. Understanding groundwater behavior regarding scaling and corrosion is pivotal for effective prevention and maintenance planning. By implementing tailored strategies, such as pH adjustment and corrosion-resistant coatings, the detrimental effects of scaling and corrosion can be mitigated, ensuring the longevity of drainage well systems and minimizing operational costs. Regular monitoring of groundwater chemistry enables timely interventions, fostering sustainable water management practices.

Keywords: *groundwater, corrosion, incrustation, Langelier, Ryznar.*

Introduction

The most common processes that contribute to the inevitable reduction in yield, known as "well aging," after long-term exploitation, are corrosion and incrustation-chemical scaling. The inclination of water towards either can significantly impact the transmission and distribution of water, influencing both economic considerations and public health concerns (Derakhshannia et al., 2020; Lodha et al., 2023; Mokhtari et al., 2010). Corrosion represents a set of chemical, electrochemical, and biochemical processes that lead to damage and physical degradation of well construction. The basic precondition for the occurrence of corrosion of well construction metal parts is high mineralization, as well as the activity of microorganisms in water, especially sulfate-reducing bacteria. Favorable factors for the formation and development of corrosion include increased acidity of groundwater, increased content of dissolved oxygen (>2 mg/l), sulfides (>1 mg/l), and humic acids (>50 mg/l), presence of organic acids, low water hardness, and increased mineralization (>1000 mg/l). Incrustation or

chemical scaling is the process of depositing insoluble materials in the pre-filter zone of the well or in the well's filtration construction itself; it distinguishes mechanical, chemical, biochemical, and biological scaling. Chemical scaling is the process of forming precipitates through chemical reactions, usually in the form of scale on the filtration construction and in the pre-filter zone of the well. Favorable factors for the formation and development of incrustation include increased alkalinity of groundwater, increased content of bicarbonates (>300 mg/l), iron (>2 mg/l), and manganese (>1 mg/l), and oxygen content below the aerobic boundary of the environment (<0.5 mg/l). Pumping of groundwater leads to disturbance of the natural chemical equilibrium of groundwater as a result of hydrodynamic disturbances in the aquifer, contact of groundwater with atmospheric oxygen, loss of dissolved gases, and deposition of corresponding substances. Filtration and pre-filter zone scaling are conditioned by disturbances in the carbonate equilibrium of water and redox processes in the narrow zone of the well. In order to predict examined groundwater aggressiveness, the Langelier and Ryznar number were calculated, and Johnson's Classification were estimated.

Materials and methods

The settlement of Vinci in Serbia is located on the right bank of the Danube River. Situated in the coastal area, Vinci occupies terrain elevations ranging from 70 to 75 meters above sea level (mnm), with the majority of the settlement positioned between 71 and 73 mnm. The lower-lying section of the settlement, below 72 mnm, lies adjacent to the Danube River, extending westward towards the "Vinci" water source (supplying the Golubac municipality), and partly towards the north and northwest, reaching the lower terrains of the Vinci-Požarevac drainage system.

In 1994, a drainage system consisting of a total of 4 operational wells (B-1 to B-4) with their own pumps and outlets into the Danube River was constructed to protect the lowest parts of the terrain in the developed area of the Vinci settlement (Figure 1). Following their construction, the wells were equipped with hydraulic and electrical equipment and put into operation. The primary role of this drainage system is to safeguard the lower coastal area of the Vinci settlement from the increased Danube levels. For these wells the Langelier and Ryznar indices were calculated as well as Johnson's Classification was determined.



Figure 1 The locations of the monitored wells

The Langelier index and Ryznar number

The Ryznar Stability Index (RSI) is a parameter used to assess the scaling potential and corrosiveness of water (Ryznar, 1944). It helps determine whether water tends to form scale (such as calcium carbonate deposits) or if it is corrosive. The Ryznar index is calculated using water analysis data, including parameters like pH, conductivity, total dissolved solids (TDS), calcium concentration, bicarbonate concentration, and water temperature. Calculated pHS value, corresponds to the equilibrium state in the solution of carbonate compounds. The pHS value represents the hydrogen ion index corresponding to the equilibrium saturation of groundwater with carbonic acid compounds. The pH value reflects the real concentration of hydrogen ions in groundwater when measured directly on-site. Conversely, pH values obtained in laboratory settings typically register higher than those measured directly on-site. In light of analyzed literature data (Shankar, 2014), a practical formula has been proposed to calculate pHS values as follows (Eq.1):

$$pH_S = 9,92 - \frac{t \left[\begin{smallmatrix} 0 \\ C \end{smallmatrix} \right]}{40} - \log \left[Ca^{++} (mg/l) \right] - \log \left[HCO_3^- (mg/ekv/l) \right] + 0,2 \log \left[S.O. (mg/l) \right]$$

(1)

t - temperature of groundwater (°C),

S.O. - dry residue (mg/l)

In terms of the stability of carbonate systems in water, the Ryznar criterion or number is introduced, expressed as:

$$RSI = 2pHS - pH$$

RSI has only positive values, and the higher the values, the more corrosive the water is (Table 1).

Table 1. Ryznar index and water tendency towards incrustation or corrosion

RSI value	Indication of water aggressiveness
4-5	Highly incrustive
5-6	Mildly incrustive
6-7	Mildly incrustive or corrosive
7-7.5	Corrosive
7.5-9	Highly corrosive
>9	Extremely corrosive

The Ryznar index complements the Langelier Saturation Index (LSI), which also assesses water scaling potential. While Ryznar gives an indication of water aggressiveness, the LSI considers both scale and corrosion potential (Eq. 2).

$$LSI = pH - pHS$$

(2)

If the measured pH value is less than the calculated pHS value ($LSI < 0$), the concentration of dissolved CO_2 in groundwater is above equilibrium, and groundwater can dissolve carbonate compounds. If, however, the pH value is greater than the calculated pHS value ($LSI > 0$), the concentration of dissolved CO_2 in groundwater is below equilibrium, and calcium carbonate can precipitate from groundwater.

Values of LSI can be interpreted as follows:

- Positive value: water tends to precipitate calcium carbonate.
- Zero: water is in equilibrium.
- Negative value: water is undersaturated, tends to dissolve calcium carbonate.

Johnson's Classification is relevant to incrustation processes. This classification helps in understanding the propensity of groundwater to form incrustations, which can be valuable for various applications, including water supply management and infrastructure maintenance. According to Johnson's Classification the process of incrustation occurs in groundwater with the following characteristics: the water is alkaline, i.e., pH is > 7.5 , carbonate content in water exceeds 300 mg/L, indicating the potential for calcium carbonate precipitation. The iron content in water is greater than 2 mg/L. The process of iron precipitation from water is intensified by biological processes - the action of iron bacteria. The manganese content in water is over 1 mg/L.

Results and Discussion

Considering the results of water quality testing, pH values ranged from a minimum of 7.16 in zone B-1 to a maximum of 7.62 in zone B-4, ranging from neutral to slightly alkaline values (Table 2). Carbonates were not detected, except in zone B-4, manganese content was >1 mg/L, and iron content varied widely, from 0.3 mg/l to even 5.42 mg/l (in B-2 and B-4). Along with high manganese values in groundwater in all four examined zones, microbial-mediated precipitation of iron and manganese and the formation of iron and manganese incrustations (iron and manganese oxide-hydroxides) are likely. Based on the negative values of LSI calculated according to the above relation, groundwater in the zones of hydro-technical facilities B-1, B-2, B-3, and B-4 is undersaturated and tends to dissolve calcium carbonate. The LSI value in zone B-3, according to the parameters calculated from measurements conducted in 2021, tends towards carbonate precipitation (Table 3). Based on the Ryznar number, groundwater in zones B-1 and B-2 fell within the range of corrosive waters, while zone B-3 exhibited characteristics of both weakly incrustive and corrosive waters. Groundwater in zone B-4 stood out as highly corrosive.

Table 2. Selected groundwater quality parameters

Sampling site		B-1	B-2	B-3	B-4
Parameter	Unit				
pH вредност		7.16	7.23	7.62	7.53
Ec	$\mu\text{S}/\text{cm}$	499	488	583	362
Eh	mV	371.5	394.2	363	389.9
DO	mgO_2/l	2.5	3.59	3.75	2.96
Iron (II)	mg/l	0.72	0.4	0.21	0.26
Iron	mg/l	2.77	5.42	0.72	0.3
NH ₄	mgN/l	1.36	0.72	1.02	0.14
NO ₂	mgN/l	0.006	0.054	0.038	0.028
NO ₃	mgN/l	0.15	0.81	0.62	2.83
Cl	mg/l	17.6	17.44	17.49	11.07
SO ₄	mg/l	3.33	15.5	18.35	25.47
H ₂ S	mg/l	<0.04	<0.04	<0.04	<0.04
TOC	mg/l	2.48	1.98	3.8	3.89
OP	mgP/l	0.218	0.34	0.08	0.262
TDS	mg/l	322	302	360	243
Total hardness	mg CaCO ₃ /l	222.4	233.4	275.4	151.3

Table 3. Saturation indices in groundwater

Well	Redox (mV)	LSI	Ryznar
B-1	371.5	-0.1	7.4
B-2	394.2	-0.08	7.4
B-3	363	0.42	6.8
B-4	389.9	-0.10	7.7

Several factors contribute to the corrosion of well materials. High mineralization levels in groundwater, along with the presence of dissolved gases and organic matter, can accelerate corrosion processes. Additionally, the pH level of the groundwater plays a crucial role, as acidic conditions can promote the dissolution of metallic components. Common materials used in well construction, such as steel, cast iron, and galvanized steel, are prone to corrosion if not adequately protected. Corrosion can lead to structural deterioration, leakage, and ultimately, the failure of the well system. Therefore, it is essential to select corrosion-resistant materials or apply protective coatings to extend the lifespan of wells and ensure the reliability of groundwater supply systems. Furthermore, proper design and construction practices, along with regular inspection and maintenance, are essential for mitigating corrosion risks in well infrastructure. By understanding the factors influencing corrosion and employing appropriate preventive measures, the integrity and functionality of well systems can be preserved, ensuring the sustainable management of groundwater resources.

Conclusion

Understanding the groundwater potential for chemical scaling and corrosion is important from several aspects: managing prevention of scaling, corrosion control, and maintenance planning. Groundwater with high mineral content, particularly calcium carbonate, can lead to scaling in drainage well systems. This scaling can clog pipes, reduce flow rates, and interfere with the operation of pumps and other equipment. By knowing the groundwater potential, appropriate measures can be taken to mitigate scaling, such as adjusting pH levels or installing filtration systems. By assessing the potential for corrosion based on groundwater characteristics such as pH, dissolved oxygen content, and mineral content, protective measures like corrosion-resistant coatings or cathodic protection systems can be implemented to prolong the lifespan of drainage well infrastructure. Understanding the potential for chemical precipitation and corrosion allows for proactive maintenance planning. Regular monitoring of groundwater chemistry parameters can help identify changes over time, allowing for timely interventions to prevent or mitigate scaling and corrosion issues. This proactive approach can minimize downtime, reduce repair costs, and ensure the efficient operation of drainage well systems.

References

- Derakhshannia M., Dalvand S., Asakereh B., Ostad-Ali-Askari K. (2020). Corrosion and deposition in Karoon River, Iran, based on hydrometric stations. *International Journal of Hydrology Science and Technology* 10 (4).
- Lodha R., Sharma Y., Surecha O.P., Trivedi A., Chaplot H., Chaudhary M, Choudhar S. (2023). Scaling Potential and Corrosion Assessment through Langelier Saturation Index and Ryznar Stability Index of Under Ground Water in Udaipur, Rajasthan. *IARJSET* ISSN (O) 2393-8021, ISSN (P) 2394-1588, 10(7) .
- Mokhtari, S.A., Aalighadri, M., Hazrati, S., Sadeghi, H., Gharari, N., & Ghorbani, L. (2010). Evaluation Of Corrosion And Precipitation Potential In Ardebil Drinking Water Distribution System By Using Langelier & Ryznar Indexes. *Journal Of Health And Hygiene*, 1(1 (1)), 14-23. Sid. <https://Sid.Ir/Paper/226950/En>
- Ryznar, J.W. (1944). A new index for determining amount of calcium carbonate scale formed by a water. *J - Am Water Works Assoc* 36(4):472–483.
- Shankar, B.S. (2014). Determination of scaling and corrosion tendencies of water through the use of Langelier and Ryznar indices. *Scholars J Eng Technol (SJET)* 2(2A):123–127.

AUTHOR INDEX

A. Emre KARABAŞ	1273	Ama Souleymane ABOUBACAR	979
Aanuoluwapo AYOBAMI OWOLABI	959	Amela KATICA	1132
Aayesha RIAZ	1152	Amina BOUKHORS	1289
Abdelghani TAHIR	572	Amira KHLIF	703, 711
Abdelghani TAHIRI	566	Ana ANĐELKOVIĆ	619
Abdelhadi AJERRA	566	Ana DOBREVA	858
Abdelhak RHOUMA	703, 711	Ana NIKOLIĆ	409
Abdellah BENTAHAR	1367	Ana NOVAIS	1380
Abdelmalek MAHROUG	572	Ana VUČUROVIĆ	613
Abdelmalk MAHROUG	566	Andra ZVIRBULE	913, 920
Abdoulaye SOULEYMANE	1332	Andrej SELNEKOVIĆ	455
Abdoulaziz Hamissou MAMAN	1260	Andreja BOREC	1416
Abdul ASIM FAROOQ	1152	Aneta BUNTIĆ	772
Adam STAROWICZ	986	Angelina PETKOVIĆ	89
Adelina KARASTOEVA	851	Anisa MUSHTAQ	1152
Adnand RAMADHI	499	Anita AUZINA	913, 920
Adrian IOSIF	265, 271, 278, 592	Anna UHRINOVÁ	697
Adriana RADOSAVAC	312, 1396	Annarita ANTONELLI	1332
Agapi VASILEIADOU	1326	Ansar KHOURI	239
Agnese EIZENBERGA	1101	Antonela MUSA	811, 830
Agron BUNJAKU	499	Antonije ŽUNIĆ	624, 655
Ahmad KATBEH-BADER	560	Antonije ŽUNIĆ	649
Ahmet AKDAĞ	1224, 1230	Arantzazu SANTAMARIA-ECHART	578
Ahmet GUNES	1260	Arca AKBAŞ	731
Aikaterini GEORGALA	549	Aris KYPARISSIS	1096
Aikaterini MOLLA	1096	Aristeidis K GEORGOULIAS	485
Ajay Kiran NEMALI	1429	Asim SHAMIM	1152
Albena PENCHEVA	124	Athina TEGOU	193
Aleksa ĐUKIĆ	431	Attila FÜRESZ	212
Aleksa LIPOVAC	327	Attila FÜRESZ	1140
Aleksandar ĐIKIĆ	391	Aziz MESSOUSSI	1367
Aleksandar LUČIĆ	1470, 1500	Bekri XHEMALI	499
Aleksandar PAUNOVIĆ	312	Belkheir DEHANE	1443
Aleksandar VEMIĆ	1470, 1500	Betim BRESILLA	499
Aleksandar VUKOVIĆ	291, 391, 1013	Bhabesh DUTTA	1429
Aleksandra ANGELESKA	938	Bilampoa GNOUMOU/THIOMBIANO	1332
Aleksandra BENSA	876, 883	Biljana BOŠKOVIĆ	298
Aleksandra BULAJIĆ	660	Biljana PEĆANAC	513
Aleksandra GOVEDARICA-LUČIĆ	59, 338, 345	Biljana SEVIC	303
Aleksandra IVETIĆ	402, 1159	Biljana ŠEVIĆ	327
Aleksandra LEPOSAVIĆ	660	Blagoje STOJKOVIĆ	1159
Aleksandra MILOŠEVIĆ	1183	Bogdan NIKOLIĆ	628
Aleksandra MILUTINOVIĆ	683	Bojan DIMITRIJEVIĆ	478
Aleksandra PERČIN	876	Bojan GOLIĆ	513, 1120
Aleksandra ŠUŠNJAR	624, 649, 655	Bojan GOSPODARIČ	1058
Aleksandrs ADAMOVIČS	907	Bojan KONATAR	1038
Aleksej LUKIN	108	Bojan STOJANOVIĆ	1159, 1189, 1195, 1207
Alexandr PCHELNIKOV	285	Bojan TUBIĆ	1476
Alhassane ILLIAS	973	Bojana LAPČEVIĆ	436
Ali AYGUN	1212, 1217, 1260	Bojana PETROVIC	1082, 1089
Ali SABIR	745	Bojana RISTANOVIĆ	1354
Alisa HADŽIABULIĆ	823	Boris BRKIĆ	366, 638
Alla BOROVSKAIA	253	Boris PISINOV	628
Alma ČOLAK	823	Borislav PETKOVIĆ	64
Alma MEMIĆ	59	Borislava BACHIYSKA	169
Alperen Kaan BÜTÜNER	719	Boško GAJIĆ	352
Alvina AVAGYAN	53	Bouchra CHEBLI	566

Bozhidar KYOSEV	124	Dragan BOŽOVIĆ	360
Branislav DRAŠKOVIĆ	817	Dragan GRČAK	312
Branislav KOVAČEVIĆ	1487, 1505	Dragan KASAGIĆ	1120
Branka GOVEDARICA	102, 108	Dragan KNEŽEVIĆ	513, 1120
Branka KRESOVIĆ	352	Dragan RADOVANOVIĆ	1020
Branka PAVLOVIĆ	1510	Dragan TOMOVIC	83
Brankica KARTALOVIĆ	366, 378, 638	Dragan VUJIČIĆ	999, 1006
Brankica PEŠIĆ	613	Dragana BOŠKOVIĆ	624, 649, 655
Branko KANJEVAC	1517	Dragana ĐURIĆ	1387
Canan KOP-BOZBAY	1224, 1230	Dragana IGNJATOVIĆ-MICIĆ	333
Cansu BULUT	1260	Dragana LALEVIĆ	291, 391, 1013
Carina DOBRE	1436	Dragana MARINKOVIĆ	1020
Carla CEDROLA	232	Dragana MARISAVLJEVIĆ	619
Ćerima ZAHIROVIĆ SINANOVIĆ	59	Dragana NOVAKOVIĆ	1403
Christos ARAMPATZIS	894	Dragana STAMENOV	416
Chrysi A. P APADIMITRIOU	889	Dragana STEVANOVIĆ	431
Constantin LĂCĂTUȘU	278	Dragana ŠUNJKA	624, 649, 655
Cornelia BUZATU-GOANȚĂ	1456	Dragica MILOSAVLJEVIĆ	338, 345
Cristina OLIVEIRA	578	Dragoslav ĐOKIĆ	291
Daina JONKUS	1146	Dunja ČOSIĆ	537
Dalibor TOMIĆ	436	Dunja DEMIROVIĆ BAJRAMI	1396
Damiano PETRUZZELLA	1332	Đurđa PETROV	999, 1006
Daniel DORI	1332	Dušan ČULUM	649
Daniela DJIKANOVIĆ	643	Dušan JOKANOVIĆ	1476, 1482
Daniil IAKOVLEV	285	Dušan NIKOLIĆ	397, 402
Danijela JUNGIC	883	Dušan UROŠEVIĆ	360
Danijela KONDIĆ	312	Dženita KOCA	320
Danijela PETROVIĆ	811, 830	Edmond MAICAN	265, 271, 278, 592
Danijela RISTIĆ	333, 409	Eirini METAXA	900
Danijela ŠIKULJAK	619	Ekavi ISARI	894
Danijela ŽUNIĆ	1107	EL Hassan LANKRI	1115
Danilo FURTULA	1038	Elena LUTCAN	253
Danka RADIĆ	643	Elena PETROVIĆ	537, 543
Daouda ANZA	1332	Elena SOARE	1436
Darko JEVREMOVIĆ	660	Elena TOFAN-DOROFEEV	947
Darko MARKOVIĆ	817	Eleni WOGIATZI	193
Debasis MITRA	666	Elif AĞÖREN	1273
Dejan CVIKIC	303	Elizabeta DIMITRIESKA STOJKOVIKJ	938
Dejan CVIKIĆ	492	Elma TEMIM	823
Dejan SKOČAJIĆ	999, 1006	Elmira SALJNIKOV	397
Dejan ZEJAK	83	Elpiniki SKOUFOGIANNI	1096
Dejana PANKOVIĆ	643	Elsa RAMALHOSA	578
Dejana STANIĆ	519	Emina ADEMOVIĆ	823
Demetrios G. ROUPAKIAS	207	Enika GREGORIĆ	320
Dénes SALÁTA	212, 1140	Eren BAŞ	1539
Denis KUČEVIĆ	1172	Erika Costa SOUSA	1317
Denis KUZNETSOV	1464	Esendugue Greg FONSAH	1429
Denisa ŽUJO ZEKIĆ	823	Esin SERT	725
Desimir KNEŽEVIĆ	312, 360, 1396	Evaggelia CHATZIKIROU	1096
Diana KOPEVA	864	Evgeniya VALCHINOVA	124
Dimitra-Despoina TOSILIANI	199	Fadi Sami KARAM	472
Dimitrios BARTZIALIS	193, 199	Fatma Zohra HAMDANI	505
Dimitris M PAPAMICHAIL	485	Ferdinando BALDACCHINO	555
Dina ELISOVETCAIA	1450	Ferenc PAJOR	212, 1140
Divna SIMIĆ	402	Ferhan K. SABIR	738
Djamila YATTA-EL DJOUZI	42	Ferhan SABIR	745
Dogan NARINC	1212, 1217	Feridjou Emilie Georgette SANON/OUATTARA	1332
Dominika GORNIK BUČAR	1058	Filip JOVANOVIĆ	1482
Đorđe LAZAREVIĆ	1166	Filipe LEMA	578
Đorđe MORAVČEVIĆ	327, 338		

Filomena BARREIRO	578	Jasenska ČOSIĆ	537, 543
Fjolla AVDYLAJ	555	Jasmina BAČIĆ	360
Flutura LAMAJ	555	Jelena DAMNJANOVIĆ	492, 1387
Francesco NOTARANGELO	1332	Jelena DRAGIŠIĆ MAKSIMOVIĆ	338, 345
Francis DUCHIRON	807	Jelena EĆIMOVIĆ	624, 649, 655
Funmilayo MARY OLOYEDE	959	Jelena IVANOVIĆ	402
Gabriella FINTHA	212, 1140	Jelena MAKSIMOVIĆ	772
Galina JEVĐENOVIĆ	772	Jelena MASLOVARA JOVANOVIĆ	1387
Gazmend GJINOVIĆ	499	Jelena MRMOŠANIN	690, 693
Georgi DIMITROV	530	Jelena NIKITOVIC	1126
Georgios CHARVALAS	1096	Jelena STOJILJKOVIC	303
Gergana DESHEVA	124	Jelena STOJILJKOVIĆ	327
Goran JAČIMOVIĆ	383	Jelena VANČETOVIĆ	333
Goran STANIŠIĆ	1183	Jelena VISKOVIĆ	383
Gordana ĐORĐEVIĆ	765	Jelena VUKADINOVIĆ	409
Gordana MATOVIĆ	320	Jonel SUBIĆ	298
Gorica CVIJANOVIĆ	478	Jordan MARKOVIĆ	660, 666, 1166
Greta MALAJ	798	Jose de Jesus Sousa LEMOS	1317
Grigor ZEHIROV	472	Jovan BOJKOVSKI	1179
Grujica VICO	1299	Jovan PAVLOV	180
Gulnari CHKHUTIASHVILI	189	Jovana CVETKOVIĆ	1510
Gunta GRINBERGA-ZALITE	913, 920	Jovana HRUSTIĆ	613
Guy HANCOCK	1429	Jovana SPASOJEVIĆ	1299
Halima OUADEH	1115	Júlia FABIANOVÁ	465
Halima OUMAROU DIADIE	1332	Junaid Alam MEMON	1374
Hamid EL BILALI	1339	Jurica ŠKRLEC	883
Hasan ARISOY	1217	Kamenko BRATKOVIĆ	360
Helena BREKALO	811, 830	Kamil ÇAKIROĞLU	1539
Hüseyin SENSOY	1064	Karolina VRANDEČIĆ	537, 543
Ibrahim AL-JBOORY	560	Károly PENKSZA	212
Igor ĐURĐIĆ	89, 102, 108	Károly PENKSZA	1140
Igor ILJOVSKI	246	Katarina GAJIĆ	352
Igor VUKELIĆ	643	Katarina MATAN	876
Ile CANEV	246	Katarina MLADENOVIĆ	1470
Ilija KOMLJENOVIĆ	64	Katya UZUNDZHALIEVA	130, 174
Ilinka PEČINAR	643	Kgosi MONGWAKETSI	1524, 1533
İlyas BOLAT	1064	Kristina ŽIVANOVIĆ	1476, 1482
Imane KRAOUCHE	505	Ksenija ČOBANOVIĆ	1172
Ioanna CHOMATA	889	Ksenija RADOTIĆ	643
Ioannis KALAVROUZOTIS	894	Kyriakos D. GIANNOULIS	193, 199
Ioannis N. XYNIAS	207	Laila CHIABRI	1367
Ippolitos GINTSIODIS	199	László SIPOS	212, 1140
Irina Adriana CHIURCIU	1436	Laura TADEVOSYAN	53
Irina MARINA	298	Layla NAIM	472
Isabel CALHA	584	Lazar KESIĆ	1505
Isidora SIMOVIĆ	999, 1006	Lazar PEJIĆ	677
İsmail Alper SUSURLUK	719	Leopold POLJAKOVIĆ - PAJNIK	1487
Ivan TUPAJIĆ	327	Leopold POLJAKOVIĆ PAJNIK	1505
Ivana GAJIĆ	690, 693	Levan UJMAJURIDZE	189
Ivana GRUJIČIĆ	1159	Leyla SLATNA	1115
Ivana KOLLÁROVÁ	448	Lidija MILENKOVIĆ	1013
Ivana MEZEYOVÁ	448, 455, 465	Liga PAURA	1146
Ivana TIRDILOVÁ	465	Lilyana KOLEVA	530
Ivana TOŠIĆ	836	Ljiljana BRBAKLIĆ	383
Ivana ZIVKOVIC	303	Ljiljana DRINIĆ	1403
Jamal Ali Mohamed EHDADAN	927, 932	Ljiljana TANASIĆ	817
Jan BRINDZA	1450	Ljubinko RAKONJAC	1038, 1470, 1494, 1500
Ján MEZEY	448, 455, 465	Ljubiša ŠEVKUŠIĆ	1299
Janij KAVČIĆ	1058	Ljupco ANGELOVSKI	938
Janis MILLERS	907	Lobna HAJJI-HEDFI	703, 711

Lubna NASIR EDDEEN	239	Milica BALOŠ	423
Lucia UNGVARSKÁ MALUČKÁ	697	Milica LJUBOJEVIĆ	70
Luma Abu ORABI	1349	Milica LUČEV	333
Lutvija KARIĆ	59	Milica MIHAJLOVIĆ	613
Lydia BOUAMRA	42	Milica STOJANOVIĆ	59, 338, 345, 1299
Magdalena KNEŽEVIĆ	772	Milomir BLAGOJEVIĆ	1166
Mahamadou MOUSSA DIT KALAMOU	979	Milomirka MADIĆ	436
Maharazu A. YUSUF	979	Milorad VESELINOVIĆ	1046
Maja DOŠENOVIĆ MARINKOVIĆ	1183	Miloš DUGALIĆ	628
Maja SUDIMAC	327	Miloš LUKIĆ	1207
Maja ŽIVANOVIĆ	613	Miloš MARJANOVIĆ	436
Malika MAHDID	1281, 1289	Miloš PAJIĆ	298
Maman Sani ABDOU BABAYE	973	Miloš PETROVIĆ	624
Manal BELATIK	953	Milosav GRČAK	312
Manol DESHEV	124	Mima ILCHOVSKA	138
Marcin ZIELIŃSKI	986	Miodrag TOLIMIR	352
Margarita HARUTYUNYAN	53	Mira MILINKOVIĆ	772
Mária BREZÁNIOVÁ	448	Mirela MATKOVIĆ STOJŠIN	312, 360
Maria de Fátima Lorena de OLIVEIRA	1380	Mirjam VUJADINOVIĆ MANDIĆ	320
Maria DE FÁTIMA OLIVEIRA	584	Mirjana JOVOVIĆ	76, 845
Maria do Céu FIDALGO	578	Mirjana OCOKOLJIĆ	999, 1006
Maria Halana FLORINDO DA SILVA	578	Mirjana RADOVIĆ	83
Mariana IONESCU	599	Mirjana VUKOSAVLJEV	366, 372, 378, 638
Marija BAJAGIĆ	478	Mirko IVKOVIĆ	1172
Marija ČOSIĆ	327	Mirko KULINA	83
Marija KOSTADINOVIĆ	333	Miroslav LALOVIĆ	817
Marija MILOSAVLJEVIĆ	1046	Miroslav ŠLOSÁR	448, 465
Marija PEROVIĆ	1026, 1032, 1053	Miroslava MARKOVIĆ	1038, 1046, 1494
Marija SRBINOSKA	677	Mladen PETROVIĆ	478, 765
Marija STEPIĆ	1166	Mladen TRIVUNOVIĆ	1172
Marijana DUGALIĆ	352	Mohamed ALOUANI	566, 572
Marina DERVIŠEVIĆ	772	Mohamed KHARSSI	42
Marina HOVHANNISYAN	53	Mohamed OUCHERROU	1361
Marina JOVKOVIĆ	772	Mohsen JANMOHAMMADI	218, 222, 226
Marina MILOVIĆ	1487, 1505	Momir ALVIROVIĆ	765
Marko KOSTIĆ	372	Monika SABEVA	864
Marko MARINKOVIĆ	1482	Muhammad ALI ABDULLAH SHAH	1152
Marko PETKOVIĆ	76	Muhammad ARFAN	1374
Maryna LADYKA	1075	Muhammad ARIF ZAFAR	1152
Maša BUĐEN	366, 372, 378, 638	Muhammad KAMRAN	1152
Mate BOBAN	811, 830	Muhammad SHOAIIB	1152
Mauro PAGANO	232	Murtaz UL HASAN	1152
Mehdi MAQBOOL	259	Mustapha El Habib FRIHI	1443
Mehmet ARSLAN	786, 792	Mustapha OUATMANE	953
Melih ÖZTÜRK	1539	Nabila BELHAMICHE	807
Melpomeni NIKOU	485, 900	Nada JELIĆ	683
Mihajlo LIZDEK	83	Nadžida MLAČO	1132
Mihajlo MARKOVIĆ	64	Naima AIT AABD	566, 572
Milan BIBERDŽIĆ	291, 391, 1013	Naima CHABBI	572
Milan BRANKOV	352	Namira MHAMEDİ BOUZINA	505
Milan DREKIĆ	1487	Naser SABAGHNIA	218, 222, 226
Milan GLIŠIĆ	817	Nassima BOUHROUM	1115
Milan MIROSAVLJEVIĆ	383	Natalija KRAVIĆ	409
Milan NINKOVIĆ	1179	Nataliya PETROVSKA	138, 145
Milan UGRINOVIĆ	492	Natalya PETROVSKA	180
Milanka MAŠANOVIĆ	519	Nataša LJUBIČIĆ	366, 372, 378, 638
Milena MILJKOVIĆ	690, 693	Natasa MARIC	70, 118
Milena MILOJEVIĆ	1183	Nataša PEROVIĆ	1354
Milena MITEVA	858	Nebojša NOVKOVIĆ	1403
Milena SIMIC	303	Nedeljka ELEZ	89

Nedeljko RACIĆ.....	1166	Raisa IVANOVA	253, 1450
Nedyalka YORDANOVA.....	151	Raluca-Adriana ZOTA.....	605
Neluş-Evelin GHEORGHÎĂ	278, 599, 605	Rasa SLINKSIENE.....	779
Nemanja JEZDIMIROVIĆ ¹	1179	Raško STEFANOVIĆ.....	1189, 1195
Nemanja ZDRAVKOVIĆ.....	1179	Ratko BOJOVIC	1409
Nenad DELIC	180	Raya BALAYAN.....	53
Nenad ĐORĐEVIĆ.....	1189, 1195	Redouan QESSAOUI.....	566, 572
Nenad MALIĆ	836	Renata GAGIĆ – SERDAR	1494
Nenad PAVLOVIĆ	436	Renata GAGIĆ-SERDAR.....	1038
Nenad ŽIVKOVIĆ	431	Richard SIMMONS	1409
Nevena ČULE	1046	Risto UZUNOV	938
Nevena STEVANOVIĆ	366, 372, 378, 638	Roberto TOMASONE	232
Nevenka GALEČIĆ	999, 1006	Ronaldo Haroldo Nascimento de MENEZES ³	1317
Nicholaos G. DANALATOS	193, 199	Rosa. SLAMANI	42
Nico OLIVIER.....	1524, 1533	Şahin PALTA	1539
Nicolae-Valentin VLĂDUŢ	265, 278	Said BENALLAOUA	807
Nicolai VANICOVICI	253	Said. BOUDEFFEUR	42
Nicoleta UNGUREANU	278	Saif UR REHMAN	1152
Nidal SHABAN	472	Salahddine CHAFIKI.....	566, 572
Nikola ĐORĐEVIĆ	423, 1476	Salima SALHI.....	1281
Nikola GRČIĆ	409	Samar DALI.....	703, 711
Nikola LAČARAC.....	624	Sana. EZZOUAOUI.....	42
Nikola LJILJANIĆ.....	397	Sancar BULUT	786, 792
Nikola PERENDIJA	1505	Sanda MAICAN	271, 592
Nikola STANKOVIĆ.....	366, 372, 378, 638	Sandra MEDIĆ	811, 830
Nikolay MINEV.....	151, 157	Sandra MOJSOVA.....	938
Nikolina JURKOVIĆ BALOG	876	Sanja ĐUROVIĆ	628
Nilgün UZUN	1273	Sanja JOVANOVIĆ.....	1470, 1500
Nimet Sema GENÇER.....	725	Sanja LAZIĆ.....	655
Noosheen ZAHID	259	Sanja LAZIĆ.....	649
Nouara BOULFOUL.....	49, 1281, 1289	Sanja MIKIĆ.....	383
Nuray BASER.....	649	Sanja ŽIVKOVIĆ	660, 666, 1166
Odetta POCIENE	779	Saša BARAĆ	291, 391, 1013
Ola SHALBAK	239	Saša LALIĆ	108, 1307
Olga CHRISTOPOULOU.....	1096	Saša OBRADOVIĆ	1159, 1189, 1195
Olga IONITA	947	Saša ORLOVIĆ	1505
Olivera ŠUŠA	1013	Saša PEKEČ	1505
Omaima BARGOUGUI.....	703, 711	Sasho SABEV.....	851
Ornela SHOSHI	798	Savvas PAPADOPOULOS.....	193, 1096
Özlem KIZILIRMAK ESMER	731	Selda UZAL SEYFİ.....	1235
Panagiotis TZIACHRIS	900	Selena ČEVRIZ	845
Paula BAPTISTA.....	578	Sevil UNAL	738, 745
Paulina RUSANOWSKA	986	Shpend SHAHINI	499
Pedro REIS.....	584, 1380	Simeon RAKONJAC	1207
Penka VULCHINKOVA	169	Simonida ĐURIĆ.....	416
Petra ŠEVČÍKOVÁ	455	Sinisa BERJAN.....	1339
Petros KOKKINOS.....	894	Siniša BERJAN.....	1195
Phokele MAPONYA.....	1524, 1533	Sladjan STANKOVIĆ.....	397, 402
Predrag BRKOVIĆ	431	Sladjana JANKOVIĆ.....	89
Predrag PAJIĆ	1053	Sladjana PETRONIC	70, 118
Predrag PAP.....	1487	Slavica ČABRILO	683
Rachid BOUHARROUD	566, 572	Slavica VUKOVIĆ	649
Rade JOVANOVIĆ.....	402	Slavica VUKOVIĆ	624, 655
Rade STANISAVLJEVIĆ	291	Slavisa MILOVANOVIĆ	83
Radia. AYADI	42	Slavko GRGIĆ.....	537
Radmila CRCEVA NIKOLOVSKA.....	938	Slobodan KRNJAJIĆ.....	397
Radomir BODIROGA.....	345, 1299	Snežana BOGOSAVLJEVIĆ-BOŠKOVIĆ	1207
Radomir LJUPKOVIĆ.....	690	Snežana BRKLJAČ	95
Rahatullah KHAN.....	1374	Snežana ĐORĐEVIĆ.....	423, 442
Raheel ANWAR	259	Snežana JANKOVIĆ	402

Snežana JOVANOVIĆ	1201	Vanya SLAVOVA	130
Snežana MLADENOVIĆ DRINIĆ	409	Vassilis G ASCHONITIS	485
Snežana OLJAČA	442	Veaceslav GHENDOV	947
Snežana STAJIĆ	1046, 1510, 1517	Vedran TOMIĆ	397
Sonja FILIPOVIĆ	666	Vera KOLEVA	870
Sorin-Stefan BIRIŞ	265	Vera POPOVIĆ	372
Sorin-Ştefan BIRIŞ	271, 592	Verica MILOVIĆ	76
Sorin-Ştefan BIRIŞ	278, 599, 605	Vesela RADOVIĆ	397
Souheila OUANAS	807	Veselin PETRIČEVIĆ	1207
Souleymane ISSA MALAN S	973	Veselin SEVOV	157
Srdan ŠEREMEŠIĆ	442	Veselina MASHEVA	130, 174
Stana TEŠIĆ	1299	Veselinka ZEČEVIĆ	312, 360
Stanislav STAMATOV	174	Vesna DAVIDOVIĆ	1159
Stefan KOVAČEVIĆ	619, 660	Vesna DRAGICEVIC	303
Stefan VULCHINKOV	180	Vesna DRAGIČEVIĆ	442
Stefana UTVIĆ	402	Vesna KRNJAJA	423
Steva LEVIĆ	643	Vesna MILIĆ	102, 108
Stevan RAJIC	1126	Vesna NIKOLIĆ JOKANOVIĆ	1476, 1482
Steve QUARRIE	31, 1409	Vesna OBRADOVIĆ	1026, 1032, 1053
Stjepan HUSNJAK	883	Vesna POČUČA	320
Subas MALLA	1429	Vesna RADOJIČIĆ	672, 677
Sultan ARSLAN-TONTUL	1070	Vesna TUNGUZ	1082, 1089
Suzana KNEŽEVIĆ	1183	Viktoria TRIFONOVA	858
Suzana MITROVIĆ	1038, 1046	Vildan KOÇBEKER	1260, 1267
Suzana PAVLOVIĆ	492	Violeta ANĐELKOVIĆ	409
Sveta ARSIĆ	1179	Violeta MANDIĆ	423
Svetla KOSTADINOVA	151, 157	Violeta MICKOVSKI STEFANOVIĆ	431
Svetlana MORKOVINA	1464	Violina ANGELOVA	870
Szilárd SZENTES	212, 1140	Višnja SIKIMIĆ	683
Takalani TAHULELA	1524, 1533	Vita STOKAL	1075
Tamara PAPOVIĆ	1172	Vladan JOVANOVIĆ	628
Tamara SIBER	537, 543	Vladan POPOVIĆ	1470, 1500
Tanja JAKIŠIĆ	102	Vladeta STEVOVIĆ	436
Tanja MIJATOVIĆ	102, 108	Vladimir AČIN	383
Tanja PEROVIĆ	59	Vladimir ČIRIĆ	1020
Tanja VASIĆ	660, 666, 1166	Vladimir DOSKOVIĆ	1207
Tanja VUČIĆ	1201	Vladimir FILIPOVIĆ	431
Tarek BEN HASSEN	1339	Vladimir SABADOŠ	1107
Tatiana KRIUKOVA	108	Vladimir VASIĆ	1517
Tatiana SCHREINER	578	Vladimir ŽIVKOVIĆ	1189
Tatjana IVANOVIVIĆ	312	Vladimíra HORČINOVÁ SEDLÁČKOVÁ	53
Tatjana KRAJISNIK	1126	Vladimira ŽUNIĆ	416
Thaer YASEEN	560	Vojin CVIJANOVIĆ	478, 765
Theano B. LAZARIDOU	207	Vojkan MILJKOVIĆ	690, 693
Theodoros MAVROMATIS	485	Vojo RADIĆ	64
Tijana BANJANIN	95	Vuk MAKSIMOVIĆ	338, 345
Tijana DUDIĆ	628	Wassila HANAFI	49, 1281
Tijana UROŠEVIĆ	672, 677	Yana KOLEVA	858
Timea HAJNAL JAFARI	416	Yasemin KOCAMAN	1235
Tina LEŠNIK	1416	Yevgeniy BEREZHNIYAK	1075
Toni GALIĆ	830	Youssef ABOU OBEID	472
Tsotne SAMADASHVILI	189	Youssef BELHAJ	1361
Tufan GÜRAY	752, 758	Yuliana IORDANOVA	145
Turgay DINDAROGLU	1082, 1089	Zahidenur TURAN	745
Turgut AYGÜN	1241, 1247, 1254	Zdenka GIREK	492
Ulku Dilek UYSAL	758	Zdenka ŠKRBIĆ	1207
Ülkü Dilek UYSAL ÖZDEMİR	752	Zeljana DOKNIC	118
Una MATKO	836	Zeljko DOLIJANOVIĆ	303
Valentina VALKOVA	138, 163, 169	Željko DOLIJANOVIĆ	442
Valya BACHIYSKA	138	Zeynep YARDIM	1273

Zhelyazko VULCHINKOV	169, 180
Zlatan RADULOVIĆ	1046, 1470
Zlatko ARSOV	246
Zoran DIMOV	246
Zoran DINIĆ	338
Zoran GALIĆ	1487
Zoran MALIČEVIĆ	64
Zoran PODUŠKA	1510
Zoran S. ILIĆ	1013

Zoran STOJANOVIĆ	765
Zoranka MALEŠEVIĆ	76, 845
Zorica GOLIĆ	1307
Zorica RANKOVIĆ VASIĆ	95
Zorica SREDOJEVIĆ	352
Zsombor WAGENHOFFER	212, 1140
Zuhai KARAKAYACI	1423
Zvonimir BAKOVIĆ	1517