

Soybean Research for Sustainable Development



Abstracts

World Soybean Research Conference 11

18-23 June 2023, Vienna, Austria

GOLD SPONSORS



SILVER SPONSORS



BRONZE SPONSORS

SPECIAL SPONSORS



food cluster of lower austria



Kofinanziert von der Europäischen Union



EXHIBITORS



Immer einen Schritt voraus!



Johann Vollmann · Marjana Vasiljević · Leopold Rittler ·
Jegor Miladinović · Donal Murphy-Bokern

Editors

Soybean Research for Sustainable Development

Abstracts of the World Soybean Research Conference 11 (WSRC 11)
18-23 June 2023
Vienna, Austria



University of Natural Resources and Life Sciences, Vienna, Austria

Editors

Johann Vollmann, Marjana Vasiljević, Leopold Rittler, Jegor Miladinović, Donal Murphy-Bokern

Title

Soybean Research for Sustainable Development. Abstracts of the World Soybean Research Conference 11 (WSRC 11), 18-23 June 2023, Vienna, Austria

Publisher

University of Natural Resources and Life Sciences, Vienna, Austria

ISBN: 978-3-900397-09-8. doi: 10.5281/zenodo.7974681

Corresponding editor: Dr. Johann Vollmann, ✉ johann.vollmann@boku.ac.at

Edition 1.1

The abstracts submitted by the authors have not undergone a rigorous editorial review. Thus, full responsibility for text and scientific content of each abstract is with the respective authors.

Correct citation

Vollmann J., Vasiljević M., Rittler L., Miladinović J., Murphy-Bokern D. (eds.) 2023: Soybean Research for Sustainable Development. Abstracts of the World Soybean Research Conference 11 (WSRC 11), 18-23 June 2023, Vienna, Austria. University of Natural Resources and Life Sciences, Vienna, Austria. doi: 10.5281/zenodo.7974681

Pdf e-book published through

ZENODO repository: <https://doi.org/10.5281/zenodo.7974681> and LegumeHub: www.legumehub.eu

Front page image source

Nikolaus Joseph v. Jacquin (1781-1786): *Icones Plantarum Rariorum*. Vol. I, C.F. Wappler Publ., Vienna. Plate 145. For detail information see poster abstract on page 518.

Conference venue: Austria Center Vienna, Bruno-Kreisky-Platz 1, 1220 Vienna, Austria

Acknowledgements

The editors thank Mrs. Theresa Schauppenlehner (Columbus Congress & Events, Vienna, Austria) for technical support during the preparation of this document. The editors are also grateful to Mrs. Marcella Gross-Varga (Donau Soja, Vienna, Austria) for handling author communications. Mr. Martin Pachner (University of Natural Resources and Life Sciences Vienna, Tulln an der Donau, Austria) contributed to abstract formatting. Mr. Xindong Yao (Harbin, Heilongjiang, China) contributed to author communications and translation of Chinese abstracts. Mr. Matthias Svojtka (University of Vienna, Botany Section of Biology and Botany Library, Vienna, Austria) provided access to N.J. Jacquin's 1781-1786 publication containing the first colorized image of a soybean plant (see front cover page). The editors are also grateful to members of the scientific committee who reviewed all submitted contributions for their scientific content.

World Soybean Research Conference 11 (2023)

International Scientific Committee

Alvadi Balbinot | Embrapa, Brazil
Kristin Bilyeu | University of Missouri, USA
Adeney de Freitas Bueno | Embrapa, Brazil
Marina Ćeran | Institute of Field and Vegetable Crops, Serbia
Vuk Djordjević | Institute of Field and Vegetable Crops, Serbia
Tomislav Duvnjak | Agricultural Institute Osijek, Croatia
Julio Ferrarotti | Haziak, Argentina
Volker Hahn | University of Hohenheim, Germany
Tianfu Han | Chinese Academy of Agricultural Sciences, China
Fernando Henning | Embrapa, Brazil
Jeong-Dong Lee | Kyungpook National University, South Korea
Zenglu Li | University of Georgia, USA
Keshun Liu | United States Department of Agriculture, USA
Febina Mathew | North Dakota State University, USA
Mark Messina | Loma Linda University, USA
Jegor Miladinović | Institute of Field and Vegetable Crops, Serbia
Alexandre Nepomuceno | Embrapa, Brazil
Henry Nguyen | University of Missouri, USA
Leonardo Daniel Ploper EEAOC, Tucumán, Argentina
Vara Prasad | Kansas State University, USA
Istvan Rajcan | University of Guelph, Canada
Milind Ratnaparkhe | Indian Council of Agriculture Research (ICAR), India
Asheesh Singh | Iowa State University, USA
Johann Vollmann (chair) | University of Natural Resources and Life Sciences Vienna, Austria
Deyue Yu | National Key Laboratory of Crop Genetics and Germplasm Enhancements, China

Local Organizing Committee

Institute of Field and Vegetable Crops (Novi Sad)

Vuk Djordjević
Dragana Latković
Jegor Miladinović
Marjana Vasiljević

Donau Soja Association (Vienna)

Elisabeth Berger
Marcella Gross-Varga
Matthias Kroen (chair)
Donal Murphy-Bokern
Leopold Rittler

Columbus Congress & Events (Vienna)

Renate Androsch-Holzer
Sissy Aschenbach
Karin Fussi
Theresa Schauppenlehner

WSRC Continuing Committee

The Continuing Committee for the World Soybean Research Conference (WSRC) is comprised of four soybean specialists from each of four regions of the world for a two-conference term plus the past chair-person. Two members from each region are elected at each conference.

Chair of the WSRC Continuing Committee

Ricardo Vilela Abdelnoor | Brazilian Agriculture Research Corporation (Embrapa Soja), Londrina, PR, Brazil

REGION I - USA and Canada

Randall Nelson | USDA-ARS, Urbana, IL, USA

Zenglu Li | University of Georgia, Athens, GA, USA

Istvan Rajcan | University of Guelph, Guelph, Canada

Lorna Woodrow | Agriculture and Agri-Food Canada, Harrow, Canada

REGION II - México, Central America, South America, and the Caribbean Islands

Ricardo Vilela Abdelnoor | Brazilian Agriculture Research Corporation (Embrapa Soja), Londrina, PR, Brazil

Alexandre Jose Cattelan | Brazilian Agriculture Research Corporation (Embrapa Soja), Londrina, PR, Brazil

Eligio N. Morandi | Universidad Nacional de Rosario, Cordoba, Argentina

Julio Ferrarotti | Haziak, Rosario, Argentina

REGION III - Continental Asia (Bangladesh, Burma, Cambodia, India, Nepal, Laos, Malaysia, Pakistan, Thailand, Vietnam, China, North and South Korea)

Philips Varghese | Agharkar Research Institute (MACS), Maharashtra, India)

Wenbin Li | Northeast Agricultural University, Harbin, China

Xiaobing Liu | Northeast Institute of Geography and Agroecology, Harbin, China

Deyue Yu | Nanjing Agricultural University/National Center for Soybean Improvement, Nanjing, China

REGION IV – Africa and adjacent Island countries, Indonesia, Europe, Middle East, Oceania, Philippines, Sri Lanka, Australia, New Zealand, Japan, Russia and East European countries

Makita Hajika | NARO Institute of Crop Science, Tsukuba, Japan

Monique Berger | Université de Toulouse, Toulouse, France

Gerhard Jan Hendrik Scholtemeijer | Protein Research Foundation, Rivonia, South Africa

Willem Engelbrecht | K2 Seed Marketing, South Africa

Past chair of the WSRC Continuing Committee

Leonardo Daniel Ploper | Estación Experimental Agroindustrial Obispo Colombres (EEAOC), Tucumán, Argentina

Foreword

At present, the world community is facing substantial changes of different nature which have a considerable impact on the global food and nutrition situation: Man-made climate change is becoming clearly visible and is negatively affecting food security, while disruptions and changes in global supply chains also contribute to increased food insecurity as well as economic instability. The soybean stands in the middle of these processes, as it is and continues to be the most important protein and oilseed crop of the world, which is utilized for the production of livestock feeds, numerous human food components, and non-food products. Due to a global rise in the consumption of meat and dairy products during previous decades, the massive expansion of soybean production was partly associated with increased greenhouse gas emission, deforestation, and loss of biodiversity. Because of this, present soybean production is experiencing harsh criticism from science and civil society.

Therefore, the timely motto of the World Soybean Research Conference 11 is “*Soybean research for sustainable development*”. As research and development are the major engine behind any progress in crop production, agricultural research is urgently needed to mitigate the negative effects of climate change and to minimize the impact of soybean on the environment towards a fully sustainable soybean production in the near future. This includes a reduction of production inputs through improvement of agronomic and genetic input efficiency, new pathways in livestock feed uses, and finally an enhanced direct utilization of soybeans in human foods. The five major themes of the conference are (i.) breeding-genetics-genomics-biotechnology, (ii.) food-feed-nutrition, (iii.) agronomy-physiology-agrotechnology, (iv.) weeds-diseases-pests, and (v.) business-policy-market issues, which will be elaborated in over 30 scientific parallel sessions, 4 plenaries and 2 poster sessions. The versatility of approaches to sustainable soybean production is well reflected by miscellaneous contributions from fields such as genetic diversity, genomics-assisted soybean breeding, genome editing, stress and climate change mitigation, novel developments in soy-foods and feeds including chemistry, nutrition and health, agro-technology and data-driven crop and soil management, organic soybean production, seed science, the soybean rhizosphere, progress in the management of weeds, diseases and pests, as well as policy and environmental sciences.

The WSRC 11 organizers have received over 500 scientific contributions, and the most outstanding scientists from all major soybean producing countries including China, the United States, Argentina, Canada, Brazil, India, Ukraine, France, Serbia, Japan and South Korea will share and discuss their latest results. In addition, reports from all world regions with significant soybean production will provide unique insights into specific issues of soybean cropping and utilization. Dedicated workshops have been organized to address specific needs such as soybeans for Africa, or soybean breeding for organic farming. In the time since the last World Soybean Research Conference, huge progress has been achieved in the utilization of genomic information, in data-driven agronomic decision-making as well as in various other aspects of soybean biology including the interaction with stress factors. Thus, the conference aims at

fostering the exchange of new knowledge and stimulating collaborative research among the world scientific community. Apart from oral presentations, poster sessions and an industry exhibition provide unique opportunities for personal interaction between the conference participants. Posters in particular are covering a very wide range of specific topics and research questions, and therefore poster sessions are a major source of exchange and scientific inspiration.

I am grateful to all conference chairpersons, members of the international scientific committee, members of the WSRC continuing committee and to all scientific contributors for their excellent inputs to compile an outstanding program, which delivers both a comprehensive overview as well as numerous specific highlights and new landmarks of soybean research. I also thank all sponsors, industry representatives and exhibitors for their valuable support of this conference. And most particularly, I acknowledge the help of the two WSRC organizing teams of the earlier conferences to be held in Savannah, GA, United States and Novi Sad, Serbia which had to be cancelled due to natural disasters; both teams were generously sharing their experience and preparation work they had carried out before.

During the historical Vienna World Exposition of 1873, soybean made its first legendary appearance on the international stage. In 2023 - 150 years later - the soybean community is back in Vienna. I wish all participants of the World Soybean Research Conference 11 many inspiring encounters and helpful insights for meeting the challenges ahead of us.

Johann Vollmann

Chair, International Scientific Committee, WSRC 11

Vienna, June 18, 2023

Table of contents

Soybean lifetime achievement awards	1
Plenary presentations	11
Thematic presentations	
A. Breeding, genetics, genomics, and biotechnology	27
B. Food, feed, and nutrition	247
C. Agronomy, physiology, and agrotechnology	301
D. Weeds, diseases, pests, and their management	425
E. Business, legal, and corporate social responsibility (CSR)	503
F. Other themes	509
Sponsored pages	529
Author index	535

The use of rhizobacteria *Bacillus subtilis* for biotic stress management in soybean plants

Djordje Malenčić¹, Ana Manojlović¹, Jovana Šućur Elez¹, Simonida Djurić¹, Aleksandra Petrović¹, Jegor Miladinović^{1,2}

¹Faculty of Agriculture Novi Sad, Novi Sad, Serbia, ²Institute of Field and Vegetable Crops, Novi Sad, Serbia

The current study looks at the possibility of using plant growth-promoting rhizobacteria (PGPR) *Bacillus subtilis* as biocontrol agent to enhance plant's tolerance to insect attack. Under stress conditions, the metabolism of a plant cell is generally characterized by elevated formation of reactive oxygen species (ROS). However, plants have developed antioxidant protective mechanisms against oxidative stress. The aim of this paper was to determine the activities of antioxidant enzymes present in roots and leaves of inoculated and non-inoculated soybean seedlings (with and without exposure to mites, *Tetranychus urticae*), as well as the level of lipid peroxidation (LP). Results have shown higher LP intensity in non-inoculated plants treated with mites compared to the control group. During biotic stress caused by mite attack, inoculation successfully reduced oxidative stress. Thus, it seems that inoculation with *B. subtilis* itself produced mild stress, which was beneficial to soybean plants. Superoxide dismutase (SOD) activity was in positive correlation with LP intensity ($r = 0.99$), while pyrogallol- and guaiacol-peroxidases (PPX, GPX) were especially active in plant roots after the inoculation. Catalase (CAT) activity was minor both in leaves and roots. Due to PGPR properties of *B. subtilis* influence on plant morphology was examined as well. Characterization of two isolates, denoted as B3 and B44 (*Bacillus* spp.), was carried out. Both isolates have shown ability to produce HCN, enzymes: lipase, urease, gelatinase, but not cellulase. However, isolate B3 was found to be positive for production of siderophores, while B44 was not. The obtained results indicate that inoculation of soybean seeds with *B. subtilis* improves plant tolerance to mite attacks.

W | S | R | C | 11



World Soybean
Research Conference

18 – 23 June 2023

Vienna | Austria

University of Natural Resources
and Life Sciences, Vienna
doi: 10.5281/zenodo.7974681