

# Soybean Research for Sustainable Development



Abstracts

**World Soybean Research Conference 11**

18-23 June 2023, Vienna, Austria

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Johann Vollmann · Marjana Vasiljević · Leopold Rittler ·  
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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*

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# 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



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## Soybean phenotyping: ideotypes for organic breeding

Vuk Djordjević<sup>1</sup>, Jegor Miladinović<sup>1</sup>, Marina Čeran<sup>1</sup>, Predrag Ranđelović<sup>1</sup>, Simona Jaćimović<sup>1</sup>, Željko Milovac<sup>1</sup>, Marjana Vasiljević<sup>1</sup>, Ion Toncea<sup>2</sup>, Maria Bernhart<sup>3</sup>

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The creation of focused breeding programs for organic farming systems was encouraged by the expanding market for organic farming. Breeding efforts are being stimulated by the rising demand for soybean varieties that are appropriate for organic farming in order to better meet the unique needs of those involved in the organic value chain. Within the ECOBREED project, extensive phenotyping on 200 soybean genotypes is carried out across contrasting environments in three countries, i.e. Austria, Romania and Serbia, which will enable the identification of useful traits (variation) and the level of local adaptation of genotypes. The following traits are assessed: yield and yield supportive traits, crop growth related traits, grain quality traits, plant architecture. Multi-trait genotype-ideotype distance index (MGIDI) implemented for genotypes selection, based on multiple traits. Classical linear multi-trait selection indices are available, but multi-collinearity and arbitrary weighting coefficient selection may erode genetic gains while. MGIDI provide genotype selection based on multiple traits easy to interpret. An ideotype is a genotype that contains a set of favorable traits that enables high performance under organic and low input production. Multi-location data were analysed by linear-mixed model, and BLUP values were used for calculation of the multivariate genotype-ideotype distance index. Strength and weakness analysis performed, which are accounted for the proportion of each factor to the genotypes' MGIDI index. Factors clearly grouped similar traits and represent main performances (eg. yield supportive, seed quality, plant architecture). MGIDI and affiliated analysis, clearly identified best performance genotypes, with advantages and disadvantages of each genotype, allowing selection of soybean for organic and low input production and future breeding work. The promising usage of MGIDI index is interpretation of genotype performances in context of GxE and factors (trait groups) contribution across different environments.

**Keywords:** *Glycine max*, multi-trait genotype-ideotype distance index (MGIDI), organic production

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