

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

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 colored 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.

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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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Exploration of selective genotyping and selective phenotyping for optimization of soybean genomic prediction models

Marina Čeran¹, Vuk Đorđević¹, Jegor Miladinović¹, Predrag Ranđelović¹, Marjana Vasiljević¹, Simona Jaćimović¹, Vojin Đukić¹

¹Institute of Field and Vegetable Crops, Novi Sad, Serbia

The accuracy of genomic selection can be affected by several factors including trait architecture and heritability, marker density, linkage disequilibrium between markers and trait loci, statistical models, training population size, composition, and population structure. The selection of a minimal and optimal marker set with high prediction accuracy as an alternative to reduce genotyping costs, computational time, and multicollinearity for the genomic selection is a challenging task. Furthermore, optimal training population size is mostly determined empirically, by random sampling a whole set of genotypes, which may not reflect the true relationships in the population and may lead to the loss of rare genotypes and alleles. Selective phenotyping could reduce the number of genotypes tested in the field while preserving the genetic diversity of the initial population. This study aimed to evaluate different methods of selective genotyping and phenotyping on the accuracy of genomic prediction for soybean yield. The evaluation was performed on three different populations: recombinant inbred lines, multifamily diverse lines, and germplasm collection. Strategies adopted for marker selection were: SNP pruning, approaches with and without re-estimation of marker effects, randomly selected markers, and genome-wide association study-based strategy. Reduction of the number of genotypes is performed by selecting a core set from the initial population based on marker data. In 10-fold cross-validation and external validation, the average prediction ability using all markers was different among examined populations. Generally, all datasets followed a similar pattern of prediction ability for different marker reduction strategies. The selective phenotyping procedure based on maker data in all cases had higher values compared to minimal values of random sample selection. Overall, obtained results indicate that selective genotyping and phenotyping can be integrated as useful tools that can improve or retain selection accuracy by reducing genotyping or phenotyping costs for genomic selection.

Acknowledgments: This research was supported by the European Union's Horizon 2020 Project *ECOBREED - Increasing the efficiency and competitiveness of organic crop breeding* under grant agreement number 771367.

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