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Online Conference

Plant breeding for the ‘Green Deal’

BOKU

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und Saatgutkaufleute Österreichs

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Agroinfiltration of Phytophthora infestans effector gene Avr4 on potato detached leaves. The resistance protein R4 in leaf tissue interacts with Avr4 from the vector Agrobacterium tumefaciens, which results in hypersensitive response (left) compared to the mock control of A. tumefaciens with an empty vector (right).

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Table of contents

Nachruf: Josef Rath (1928-2022) 1
Johann POSCH

The Nagoya Protocol and its implementation in the European Union 3
Federica RONCHETTI

Adapting to a changing climate: first steps towards assessing a variety's climate-fitness in VCU trials 5
Philipp VON GEHREN, Svenja BOMERS, Alexandra RIBARITS, Kerstin MOTTL, Klemens MECHTLER, Clemens FLAMM, Anton BRANDSTETTER

Sensing approaches for integrating high throughput phenotyping with genomics: Exemplar 9
Filipe de JESUS COLWELL, Jock SOUTER, Ankush PRASHAR

Development of a reliable field-testing methodology for *Fusarium langsethiae* resistance in oats confirms *F. langsethiae*-specific susceptibility in certain genotypes with otherwise good FHB resistance 13
Morten LILLEMO, Espen SØRENSEN, Marit ALMVIK, Heidi UDNES-AAMOT, Ingerd S. HOFGAARD

Rigorous phenotypic selection for Fusarium head blight resistance yields winter wheat lines combining superior FHB resistance with good agronomic traits 15
Hermann BUERSTMAYR

Genomic prediction of Fusarium head blight resistance in the WheatSustain winter whe-at training set 17
Laura MORALES, Deniz AKDEMIR, Anne-Laure GIRARD, Josef HOLZAPFEL, Julia ISIDRO-SÁNCHEZ, Hubert KEMPF, Morten LILLEMO, Franziska LÖSCHENBERGER, Sebastian MICHEL, Vinay K.R. NANNURU, Melanie STADLMEIER, Barbara STEINER, Hermann BUERSTMAYR

Merging genomics and transcriptomics for predicting Fusarium head blight resistance in wheat 19
Sebastian MICHEL, Christian WAGNER, Tetyana NOSENKO, Barbara STEINER, Mina SAMAD-ZAMINI, Maria BUERSTMAYR, Klaus MAYER, Hermann BUERSTMAYR

Phenotypic and genotypic analysis of a European winter wheat panel for resistance against Fusarium head blight 21
Anne-Laure GIRARD, Laura MORALES, Hermann BUERSTMAYR

Austrian wheat varieties: Influence of plant height and dwarfing genes on susceptibility to Fusarium head blight 23
Michael OBERFORSTER

Genetic architecture of Fusarium head blight disease resistance and associated traits in Nordic spring wheat 27
Vinay Kumar Reddy NANNURU, Susanne S. WINDJU, Tatiana BELOVA, Jon Arne DIESETH, Muath ALSHEIKH, Yanhong DONG, Curt A. McCARTNEY, Maria Antonia HENRIQUES, Hermann BUERSTMAYR, Sebastian MICHEL, Theodorus H.E. MEUWISSEN, Morten LILLEMO

Genome-wide association study for resistance to stripe rust in Central European winter wheat 31
Fahimeh SHAHINNIA, Friederike SCHÜRMANN, Sabine RUDOLPHI, Josef HOLZAPFEL, Hubert KEMPF, Melanie STADLMEIER, Franziska LÖSCHENBERGER, Laura MORALES, Hermann BÜRSTMAYR, Volker MOHLER, Morten LILLEMO, Lorenz HARTL

A major QTL for yellow rust resistance on chromosome 6A shows increased frequency in recent Norwegian spring wheat cultivars and breeding lines 33
Min LIN, Jon Arne DIESETH, Muath ALSHEIKH, Ennian YANG, Josef HOLZAPFEL, Friederike SCHÜRMANN, Laura MORALES, Sebastian MICHEL, Hermann BUERSTMAYR, Morten LILLEMO

Phs-A1 confers pre-harvest sprouting resistance independent of phenology in European winter wheat and multiple genomes reveal structural variation 35
Hermann Gregor DALLINGER, Naim AZRAK, Franziska LÖSCHENBERGER, Christian AMETZ, Sebastian MICHEL, Hermann BÜRSTMAYR

Field phenotyping: Unmanned aerial vehicle (UAV) multispectral imaging for winter wheat survival estimation 37
Sahameh SHAFIEE, Tomasz MROZ, Ingunn BURUD, Morten LILLEMO

Frost resistance of winter wheat tested within the ECOBREED project 39
Ondřej VEŠKRNA, Stanislav JEŽEK, Irena BÍŽOVÁ, Václav ŠKARÝD, Pavel HORČIČKA

Genetic improvement of grain yield and associated traits in Norwegian spring wheat 41
Tomasz MROZ, Jon Arne DIESETH, Morten LILLEMO

Multi-environment trials of the ECOBREED wheat diversity panel 43
Heinrich GRAUSGRUBER, Mária MEGYERI, Pavol HAUPTVOGEL, Miroslava FUSKOVÁ, Cristina Mihaela MARINCIU, Gabriela ŞERBAN, Nadine BAUER, Maximilian MAYER, Ondrej VESKRNA, Bojan JOCKOVIC, Primož TITAN, Vladimir MEGLIČ

Baking quality of wheat in organic farming 53
Pavel HORČIČKA, Ondrej VEŠKRNA, Stanislav JEŽEK, Tibor SEDLÁČEK

Evaluation and selection of durum wheat accessions suitable for organic production 55
Luca BONFIGLIOLI, Ieva URBANAVIČIŪTĖ, Mario Augusto PAGNOTTA

Evaluating salt effects on durum wheat root system using non-invasive phenotyping technique at early plant developmental stages 59
Ieva URBANAVIČIŪTĖ, Luca BONFIGLIOLI, Kerstin A. NAGEL, Mario Augusto PAGNOTTA

Compatibility screenings of wheat cultivars with arbuscular mycorrhizal fungi: lessons from pot and field experiments 63
Karin HAGE-AHMED, Jordan LEBESMÜHLBACHER, Susanne BAUMGARTNER, Paul BILSBORROW, Heinrich GRAUSGRUBER

Evaluation of marker-assisted selection for introgressed exotic common bunt resistance QTL in a back-cross population 65
Magdalena EHN, Maria BUERSTMAYR, Hermann BUERSTMAYR

Evaluation of ECOBREED winter wheat germplasm for common bunt resistance 67
Kilian PFATRISCH, Martina STERNBAUER, Veronika DUMALASOVÁ, Cristina MARINCIU, Heinrich GRAUSGRUBER

ECOBREED project and common bunt field inoculation trials at the Crop Research Institute 73
Veronika DUMALASOVÁ, Heinrich GRAUSGRUBER

Comparison of pathogenicity of Austrian isolates of *Tilletia caries* on common wheat (*Triticum aestivum*) 75
Elisabeth RITZER, Magdalena EHN, Michael OBERFORSTER, Hermann BUERSTMAYR

Enhanced exudation of BOA, HMBOA, HBOA and DIBOA by wheat seedlings in proximity to common purslane (*Portulaca oleracea*) and annual ryegrass (*Lolium rigidum*) 77
Muhammad Iftikhar HUSSAIN, Yedra VIETES-ÁLVAREZ, Manuel J. REIGOSA, Adela Maria SÁNCHEZ-MOREIRAS

Diversity of spelt and common wheat grown under different management based on their bioactive component composition 79
Viola TÓTH, Verica TAKAČ, Lovro SINKOVIČ, Vladimir MEGLIČ, Gyula VIDA, Marianna RAKSZEGI

Identification of useful traits for organic soybean breeding in limiting and changing agro-climatic conditions 81
Vuk ĐORĐEVIĆ, Marjana VASILJEVIĆ, Predrag RANĐELOVIĆ, Jegor MILADINOVIĆ, Marina ĆERAN, Maria BERNHART, Ion TONCEA

ECOBREED participatory trials for organic soybean production in Serbia 83
Marjana VASILJEVIĆ, Vuk ĐORĐEVIĆ, Predrag RANĐELOVIĆ, Jegor MILADINOVIĆ, Željko MILOVAC, Marina ĆERAN, Darko MARIĆ

Bruchus rufimanus - a pest complicates domestic legume seed production 85
Johann HUBER, Nicole CHALUPPA, Benno VOIT, Berta KILLERMANN

Breeding climbing beans for intercropping with maize 87
Eva ZAND, Willmar LEISER

Selection of advanced potato breeding lines at the Agricultural Institute of Slovenia within the ECOBREED project 91
Peter DOLNIČAR, Eva BLATNIK, Vladimir MEGLIČ

(Pre-)Breeding of potatoes suitable for organic farming in the ECOBREED project 93
Jarosław PLICH, Beata TATAROWSKA

Pathological and yield components analysis of potato varieties potentially applicable for organic production 95
Zsolt POLGÁR, Dalma PRIBÉK, Ádám ESZTERGÁLYOS, István WOLF

Marker-assisted and effector selection of potato genotypes with quantitative resistance to late blight 97
Eva BLATNIK, Marinka HORVAT, Sabina BERNE, Miha HUMAR, Peter DOLNIČAR, Vladimir MEGLIČ

Physiological response to drought stress in two potato (*Solanum tuberosum* L.) cultivars under greenhouse conditions 99
Ana VOJNOVIĆ, David LENARČIČ, Dominik VODNIK, Peter DOLNIČAR, Vladimir MEGLIČ

Phenotypic characterisation of ECOBREED buckwheat genetic resources 101
Lovro SINKOVIČ, Barbara PIPAN, Dagmar JANOVSKÁ, Vladimir MEGLIČ

Preparation of buckwheat DNA extracts for further marker-assisted selection activities 103
Barbara PIPAN, Lovro SINKOVIČ, Dagmar JANOVSKÁ, Meiliang ZHOU, Vladimir MEGLIČ

Phenolic compounds in buckwheat: Road to agroecology 105
Yedra VIEITES ÁLVAREZ, Adela María SÁNCHEZ-MOREIRAS, Manuel Joaquin REIGOSA ROGER, Muhammad Iftikhar HUSSAIN

Phenotypic plasticity, yield stability and signature of stable isotopes of carbon and nitrogen in safflower under saline environment 107
Muhammad Iftikhar HUSSAIN, Zafar I. KHAN, Adele MUSCOLO, Manuel J. REIGOSA

Preface

In its 72-year long history, the Annual Conference of the Austrian Association of Plant Breeders and Seed Merchants was now held two consecutive years as an online conference due to COVID-19 restrictions. The topic of the conference from 22nd-24th November 2022 was *Plant breeding for the Green Deal*.

The conference was opened by a key-note lecture on *The European Green Deal and its farm to fork strategy* by Georg Häusler from the European Commission, Directorate-General for Agriculture and Rural Development (AGRI). The European Green Deal was announced in December 2019 as a response to climate change, loss of biodiversity and environmental pollution, aiming to improve the well-being of people. The communication, press releases, highlights, actions, factsheets and other documents on this European priority can be retrieved at the official website of the European Union (https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en). The Farm to Fork strategy, which Mr. Häusler introduced in his lecture, is at the heart of the European Green Deal with the aim to make food production, food processing and distribution, and food consumption more sustainable, as well as to prevent food loss and waste (https://ec.europa.eu/food/horizontal-topics/farm-fork-strategy_de).

Plant breeding is considered a congenial partner to the European Union's strategy towards more sustainable developments in agriculture and beyond. However, various scientists believe that the goals of Europe's Farm to Fork strategy may be jeopardized by insisting on the current regulation of new plant breeding techniques and biotech innovations. Kai Purnhagen, Chair of Food Law at the University of Bayreuth, outlined in his lecture aspects of conflicts in the EU's commitment to biotechnology and organic farming. Prof. Purnhagen's arguments and ideas can be retrieved from several recent publications (*e.g.*, Purnhagen *et al.*, 2018; 2021; Eriksson *et al.*, 2019; Purnhagen & Wesseler, 2021; Wesseler *et al.*, 2022)

In the meantime, Russia's invasion of Ukraine got worse the rising of global food prices which started already in fall 2020 with lower harvests and disrupted supply chains due to climate change and COVID-19, respectively. Especially dramatic is the rise of the vegetable oil price (FAO, 2022) as the Black Sea region is a crucial source for sunflower oil. Hence, voices rose to water down the objectives, targets and timeline of the Farm to Fork strategy for Europe's food security (Bounds, 2022). A rather improper demand in view of 88 million tons of food waste per year (EUFIC, 2021; European Commission, https://ec.europa.eu/food/safety/food-waste_en). Therefore, the challenge is not so much an increase in production but in avoiding food waste. Moreover, significant amounts of grain are produced to feed swine and poultry although meat consumption in most European countries is already too high and associated with adverse health behaviours and characteristics (Richi *et al.*, 2015; Papier *et al.*, 2021). Intensive agriculture and livestock production ignoring animal welfare also leads to deforestation, loss of biodiversity, habitat fragmentation and pollution. Besides increasing urbanization and global connectedness, it is these environmental factors which in return are drivers of increasing human-animal contacts and accelerated transmission rates of zoonotic diseases such as COVID-19 (Mishra *et al.*, 2021; Holmes, 2022). Europe's Farm to Fork strategy might be ambitious from today's viewpoint but inevitable in order to stop the growth of badlands caused by human greed. Overexpansion, climate change, environmental degradation and wrong leadership led to the collapse of Ancient Egypt, Carthage, Classical Greek, the Roman Empire, Mesoamerican and many other societies in history (see *e.g.* Diamond, 2005). Today we are visiting the ruins of these vanished cultures, we are impressed by their size and beauty, they stimulate our fantasy, but have we learned their lessons?

Heinrich Grausgruber

72. Tagung der Vereinigung der Pflanzenzüchter und Saatgutkaufleute Österreichs
22.-24. November 2021, Online Conference, Raumberg-Gumpenstein, Österreich

ECOBREED participatory trials for organic soybean production in Serbia

Marjana VASILJEVIĆ[1], Vuk ĐORĐEVIĆ[1], Predrag RANĐELOVIĆ[1], Jegor MILADINOVIĆ[1], Željko MILOVAC[1], Marina ĆERAN[1], Darko MARIĆ[2]

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Abstract

Due to the rising demand for organic food products and increased availability of organic products, global production of organically grown crops has increased. In 2020, organic agriculture was practised in 187 countries worldwide, on 72.3 million ha of agricultural land by at least 3.1 million farmers. The area of organically managed soybean worldwide was 644 323 ha. Soybean production is of great importance since the soybean grain is used in various industries, including human as well as animal nutrition and pharmaceutical production. Soybean has a special place in organic cultivation because it brings different agronomic benefits to farmers and it is considered a niche product for feed and food use. Furthermore, soybean is primarily a climate-smart crop that conserves soil fertility for increased productivity of other important field crops, and its place in organic production is very valuable. The importance of soybean comes from the exceptionally favorable grain chemical composition (≈40% protein, ≈20% lipids). Soybeans are relatively easy to produce under organic conditions due to available production technology. One of the most important tasks for farmer is to select soybean varieties for specific production conditions.

On-farm variety trials were set up in Serbia as part of the ECOBREED project. Aim of these trials was to support farmers in the selection of new varieties for their respective pedo-climatic zones and locations. Organic farmers typically have extensive knowledge of crop traits required for optimal agronomic performance, as well as quality requirements required by the industry and consumers. The trials served as a baseline for the following season. During the growing period organic farmers were actively involved in evaluations, and they were trained to be able to select soybean varieties that are better suited to their specific area and growth conditions.

The trials were set up in 2021 on five locations: (i) Rimski Šančevi (45°30'59.5"N, 19°59'26.3"E); (ii) Šuljam (45°05'20.2"N, 19° 40'14.5"E); (iii) Bela Crkva (44°57'27.1"N, 21°19'11.2"E); (iv) Čurug (50°36'71.3"N, 42°06'20"E); and (v) Banatsko Karđorđevo (45° 35'26.5"N, 20°33'42.2"E). Soybean varieties from the 00, 0, I, and II maturity groups were evaluated in the trial network. The varieties were 'Xonia' from Saatzucht Gleisdorf, Austria, and 'NS Altis', 'NS Apolo', 'NS Mercury', 'Rubin' and 'Zora' from the Institute of Field and Vegetable Crops, Novi Sad, Serbia. The crops were sown in early April and harvested in September. The experiment was set up as strip trial with a plot size of 300 m^2 per variety. Inter-row management was performed twice during the growing season in May as well as manual weed control. The trials were harvested in September according to the maturity of the varieties. From each plot, three samples from central rows were taken for yield, protein and oil content measurements.

The varieties from the 00 to II maturity groups showed different adaptability to the specific conditions of the involved farms. Grain yield was between 1.96 and 4.61 $t \cdot ha^{-1}$ (Fig. 1), while protein content was within the range of 33% to 44% d.m. The lowest yields (1.96 - 2.88 $t \cdot ha^{-1}$) were recorded at Bela Crkva which is not a preferable soybean growing region. Highest yields for all varieties (3.48 - 4.53 $t \cdot ha^{-1}$) were observed in Čurug.

Keywords

Glycine max · organic farming · protein · yield

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References

Hartman GL, Pawlowski ML, Herman TK, Eastburn D (2016) Organically grown soybean production in the USA: Constraints and management of pathogens and insect pests. Agronomy 6: 16. DOI: 10.3390/agronomy6010016

Meier C, Sampson G, Larrea C, Schlatter B, Voora V, Dang D, *et al*. (2020) The state of sustainable markets 2020: Statistics and emerging trends. International Trade Center (ITC), Geneva.

Vasiljević M, Đorđević V, Ranđelović P, Miladinović J, Milovac Ž, Ćeran M, Marić D (2022) ECOBREED participatory trials for organic soybean production in Serbia. In: Vereinigung der Pflanzenzüchter und Saatgutkaufleute Österreichs (Ed), 72. Jahrestagung 2021, 22-24 November, Raumberg-Gumpenstein, pp 83-84. University of Natural Resources and Life Sciences, Vienna, Austria. ISBN-13: 978-3-900932-96-1

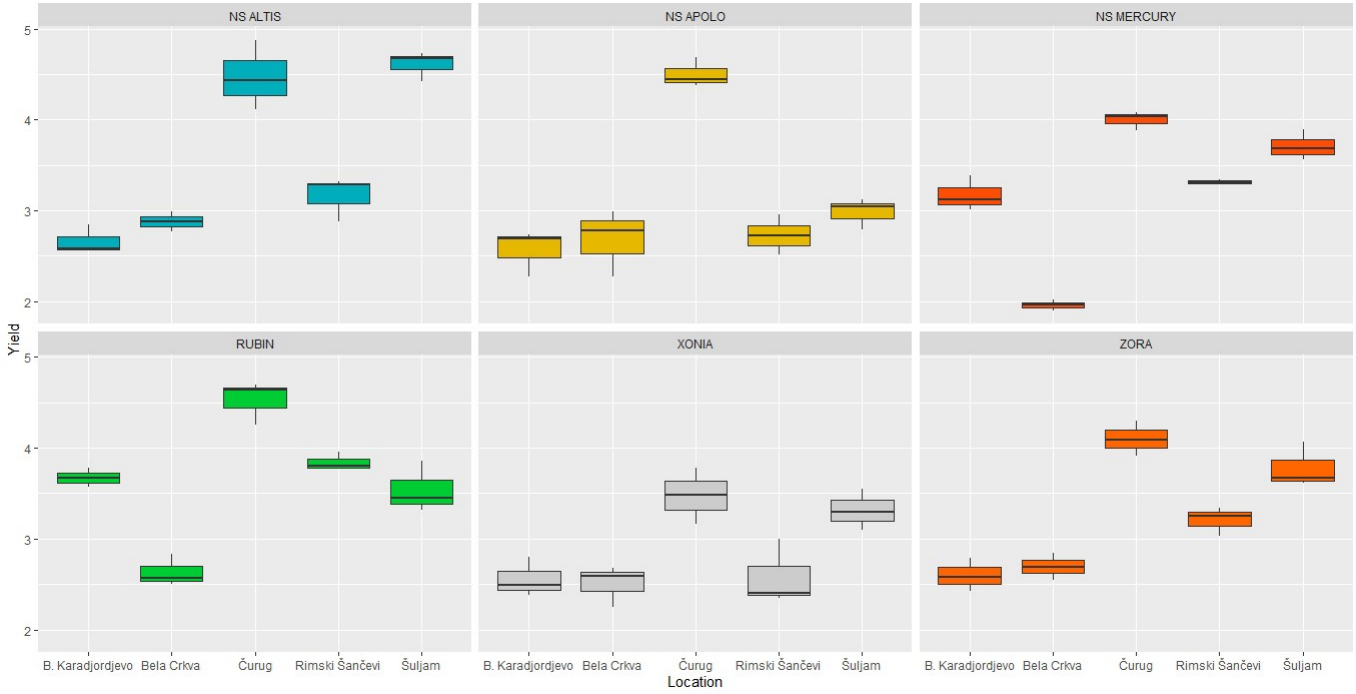

Figure 1 Soybean yield (t·ha^{-1}) of six varieties (*i.e.*, 'NS Altis', 'NS Apolo', 'NS Mercury', 'Rubin', 'Xonia', 'Zora') in the ECOBREED farmers participatory trials at five locations in Serbia 2021.

Kamara AY, Kamai N, Kanampiu F, Kamsang L, Kamara AY (2018) Gender analysis of soybean adoption and impact. International Institute of Tropical Agriculture (IITA), Ibadan.

Kuepper G (2003) Organic soybean production. Appropriate Technology Transfer for Rural Areas (ATTRA), Pub. CT120, Butte, MT.

Vollmann J, Menken (2012) Soybean: Breeding for organic farming systems. In: Lammerts van Bueren ET, Myers JR (eds), Organic crop breeding, pp 203-214. John Wiley & Sons, Chichester. DOI: 10.1002/9781119945932.ch12

Vollmann J, Bernhart M, Petrović K, Miladinović J, Djordjević V (2019) Soybean breeding for organic farming: breeding goals and options. In: Vereinigung der Pflanzenzüchter und Saatgutkaufleute Österreichs (Ed), 69. Jahrestagung 2018, 19-21 Nov, Raumberg-Gumpenstein, pp 51-55. University of Natural Resources and Life Sciences, Vienna.

Willer H, Trávníček J, Meierm C, Schlatter B (2021) The world of organic agriculture 2021. FIBL & IFOAM - Organics International, Frick.