



72nd Conference

22-24 November 2021
Online Conference

Plant breeding for the 'Green Deal'



SAATGUT
AUSTRIA 

72. Tagung

22.-24. November 2021

Online Conference

Plant breeding for the „Green Deal“

co-hosted by



with contributions from



**Wheat
Sustain**



ecobreed
IMPROVING CROPS



Funded by European Union
Horizon 2020
Grant agreement No 771367

Impressum

**Tagungsband der 72. Jahrestagung der Vereinigung
der Pflanzenzüchter und Saatgutkaufleute Österreichs,
22.-24. November 2021, Online Conference**

Herausgeber

Vereinigung der Pflanzenzüchter und Saatgutkaufleute Österreichs
Wiener Str. 64
3100 St. Pölten
E-mail: office@saatgut-austria.at
URL: www.saatgut-austria.at

Redaktion

Dr. Anton Brandstetter, Manuela Geppner
Vereinigung der Pflanzenzüchter und Saatgutkaufleute Österreichs

A.o. Univ.Prof. Dr. Heinrich Grausgruber
Universität für Bodenkultur Wien

Für den Inhalt verantwortlich

die Autoren

Foto Titelblatt

Eva Blatnik, Agricultural Institute of Slovenia (KIS), Ljubljana

*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).*

Verlag

Universität für Bodenkultur Wien
Department für Nutzpflanzenwissenschaften
Institut für Pflanzenzüchtung
Konrad Lorenz Str. 24
3430 Tulln an der Donau
E-mail: pflanzenzuechtung@boku.ac.at
URL: <https://boku.ac.at/dnw/pz>

© 2022

ISBN-13: 978-3-900932-96-1

<https://doi.org/10.5281/zenodo.5667799>

Table of contents

Nachruf: Josef Rath (1928-2022) <i>Johann POSCH</i>	1
The Nagoya Protocol and its implementation in the European Union <i>Federica RONCHETTI</i>	3
Adapting to a changing climate: first steps towards assessing a variety's climate-fitness in VCU trials <i>Philipp VON GEHREN, Svenja BOMERS, Alexandra RIBARITS, Kerstin MOTTL, Klemens MECHTLER, Clemens FLAMM, Anton BRANDSTETTER</i>	5
Sensing approaches for integrating high throughput phenotyping with genomics: Exemplar <i>Filipe de JESUS COLWELL, Jock SOUTER, Ankush PRASHAR</i>	9
Development of a reliable field-testing methodology for <i>Fusarium langsethiae</i> resistance in oats confirms <i>F. langsethiae</i> -specific susceptibility in certain genotypes with otherwise good FHB resistance <i>Morten LILLEMO, Espen SØRENSEN, Marit ALMVIK, Heidi UDNES-AAMOT, Ingerd S. HOFGAARD</i>	13
Rigorous phenotypic selection for Fusarium head blight resistance yields winter wheat lines combining superior FHB resistance with good agronomic traits <i>Hermann BUERSTMAYR</i>	15
Genomic prediction of Fusarium head blight resistance in the WheatSustain winter whe-at training set <i>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</i>	17
Merging genomics and transcriptomics for predicting Fusarium head blight resistance in wheat <i>Sebastian MICHEL, Christian WAGNER, Tetyana NOSENKO, Barbara STEINER, Mina SAMAD-ZAMINI, Maria BUERSTMAYR, Klaus MAYER, Hermann BUERSTMAYR</i>	19
Phenotypic and genotypic analysis of a European winter wheat panel for resistance against Fusarium head blight <i>Anne-Laure GIRARD, Laura MORALES, Hermann BUERSTMAYR</i>	21
Austrian wheat varieties: Influence of plant height and dwarfing genes on susceptibility to Fusarium head blight <i>Michael OBERFORSTER</i>	23
Genetic architecture of Fusarium head blight disease resistance and associated traits in Nordic spring wheat <i>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, Theodor H.E. MEUWISSEN, Morten LILLEMO</i>	27
Genome-wide association study for resistance to stripe rust in Central European winter wheat <i>Fahimeh SHAHINNIA, Friederike SCHÜRMANN, Sabine RUDOLPHI, Josef HOLZAPFEL, Hubert KEMPF, Melanie STADLMEIER, Franziska LÖSCHENBERGER, Laura MORALES, Hermann BÜRSTMAYR, Volker MOHLER, Morten LILLEMO, Lorenz HARTL</i>	31
A major QTL for yellow rust resistance on chromosome 6A shows increased frequency in recent Norwegian spring wheat cultivars and breeding lines <i>Min LIN, Jon Arne DIESETH, Muath ALSHEIKH, Ennian YANG, Josef HOLZAPFEL, Friederike SCHÜRMANN, Laura MORALES, Sebastian MICHEL, Hermann BUERSTMAYR, Morten LILLEMO</i>	33
<i>Phs-A1</i> confers pre-harvest sprouting resistance independent of phenology in European winter wheat and multiple genomes reveal structural variation <i>Hermann Gregor DALLINGER, Naim AZRAK, Franziska LÖSCHENBERGER, Christian AMETZ, Sebastian MICHEL, Hermann BÜRSTMAYR</i>	35
Field phenotyping: Unmanned aerial vehicle (UAV) multispectral imaging for winter wheat survival estimation <i>Sahameh SHAFIEE, Tomasz MROZ, Ingunn BURUD, Morten LILLEMO</i>	37
Frost resistance of winter wheat tested within the ECOBREED project <i>Ondřej VEŠKRNA, Stanislav JEŽEK, Irena BÍŽOVÁ, Václav ŠKARÝD, Pavel HORČIČKA</i>	39
Genetic improvement of grain yield and associated traits in Norwegian spring wheat <i>Tomasz MROZ, Jon Arne DIESETH, Morten LILLEMO</i>	41
Multi-environment trials of the ECOBREED wheat diversity panel <i>Heinrich GRAUSGRUBER, Mária MEGYERI, Paval HAUPTVOGEL, Miroslava FUSKOVÁ, Cristina Mihaela MARINCIU, Gabriela ȘERBAN, Nadine BAUER, Maximilian MAYER, Ondrej VESKRNA, Bojan JOCKOVIC, Primož TITAN, Vladimir MEGLIČ</i>	43
Baking quality of wheat in organic farming <i>Pavel HORČIČKA, Ondrej VEŠKRNA, Stanislav JEŽEK, Tibor SEDLÁČEK</i>	53

Evaluation and selection of durum wheat accessions suitable for organic production <i>Luca BONFIGLIOLI, Ieva URBANAVIČIŪTĒ, Mario Augusto PAGNOTTA</i>	55
Evaluating salt effects on durum wheat root system using non-invasive phenotyping technique at early plant developmental stages <i>Ieva URBANAVIČIŪTĒ, Luca BONFIGLIOLI, Kerstin A. NAGEL, Mario Augusto PAGNOTTA</i>	59
Compatibility screenings of wheat cultivars with arbuscular mycorrhizal fungi: lessons from pot and field experiments <i>Karin HAGE-AHMED, Jordan LEBESMŪHLBACHER, Susanne BAUMGARTNER, Paul BILSBORROW, Heinrich GRAUSGRUBER</i>	63
Evaluation of marker-assisted selection for introgressed exotic common bunt resistance QTL in a back-cross population <i>Magdalena EHN, Maria BUERSTMAYR, Hermann BUERSTMAYR</i>	65
Evaluation of ECOBREED winter wheat germplasm for common bunt resistance <i>Kilian PFATRISCH, Martina STERNBAUER, Veronika DUMALASOVÁ, Cristina MARINCIU, Heinrich GRAUSGRUBER</i>	67
ECOBREED project and common bunt field inoculation trials at the Crop Research Institute <i>Veronika DUMALASOVÁ, Heinrich GRAUSGRUBER</i>	73
Comparison of pathogenicity of Austrian isolates of <i>Tilletia caries</i> on common wheat (<i>Triticum aestivum</i>) <i>Elisabeth RITZER, Magdalena EHN, Michael OBERFORSTER, Hermann BUERSTMAYR</i>	75
Enhanced exudation of BOA, HMBOA, HBOA and DIBOA by wheat seedlings in proximity to common purslane (<i>Portulaca oleracea</i>) and annual ryegrass (<i>Lolium rigidum</i>) <i>Muhammad Iftikhar HUSSAIN, Yedra VIETES-ÁLVAREZ, Manuel J. REIGOSA, Adela María SÁNCHEZ-MOREIRAS</i>	77
Diversity of spelt and common wheat grown under different management based on their bioactive component composition <i>Viola TÓTH, Verica TAKAČ, Lovro SINKOVIČ, Vladimir MEGLIČ, Gyula VIDA, Marianna RAKSZEGI</i>	79
Identification of useful traits for organic soybean breeding in limiting and changing agro-climatic conditions <i>Vuk ĐORĐEVIĆ, Marjana VASILJEVIĆ, Predrag RANĐELOVIĆ, Jegor MILADINOVIĆ, Marina ČERAN, Maria BERNHART, Ion TONCEA</i>	81
ECOBREED participatory trials for organic soybean production in Serbia <i>Marjana VASILJEVIĆ, Vuk ĐORĐEVIĆ, Predrag RANĐELOVIĆ, Jegor MILADINOVIĆ, Željko MILOVAC, Marina ČERAN, Darko MARIĆ</i>	83
<i>Bruchus rufimanus</i> - a pest complicates domestic legume seed production <i>Johann HUBER, Nicole CHALUPPA, Benno VOIT, Berta KILLERMANN</i>	85
Breeding climbing beans for intercropping with maize <i>Eva ZAND, Willmar LEISER</i>	87
Selection of advanced potato breeding lines at the Agricultural Institute of Slovenia within the ECOBREED project <i>Peter DOLNIČAR, Eva BLATNIK, Vladimir MEGLIČ</i>	91
(Pre-)Breeding of potatoes suitable for organic farming in the ECOBREED project <i>Jarosław PLICH, Beata TATAROWSKA</i>	93
Pathological and yield components analysis of potato varieties potentially applicable for organic production <i>Zsolt POLGÁR, Dalma PRIBÉK, Ádám ESZTERGÁLYOS, István WOLF</i>	95
Marker-assisted and effector selection of potato genotypes with quantitative resistance to late blight <i>Eva BLATNIK, Marinka HORVAT, Sabina BERNE, Miha HUMAR, Peter DOLNIČAR, Vladimir MEGLIČ</i>	97
Physiological response to drought stress in two potato (<i>Solanum tuberosum</i> L.) cultivars under greenhouse conditions <i>Ana VOJNOVIĆ, David LENARČIČ, Dominik VODNIK, Peter DOLNIČAR, Vladimir MEGLIČ</i>	99
Phenotypic characterisation of ECOBREED buckwheat genetic resources <i>Lovro SINKOVIČ, Barbara PIPAN, Dagmar JANOVSÁ, Vladimir MEGLIČ</i>	101
Preparation of buckwheat DNA extracts for further marker-assisted selection activities <i>Barbara PIPAN, Lovro SINKOVIČ, Dagmar JANOVSÁ, Meiliang ZHOU, Vladimir MEGLIČ</i>	103
Phenolic compounds in buckwheat: Road to agroecology <i>Yedra VIEITES ÁLVAREZ, Adela María SÁNCHEZ-MOREIRAS, Manuel Joaquín REIGOSA ROGER, Muhammad Iftikhar HUSSAIN</i>	105
Phenotypic plasticity, yield stability and signature of stable isotopes of carbon and nitrogen in safflower under saline environment <i>Muhammad Iftikhar HUSSAIN, Zafar I. KHAN, Adele MUSCOLO, Manuel J. REIGOSA</i>	107

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

Diversity of spelt and common wheat grown under different management based on their bioactive component composition

Viola TÓTH¹, Verica TAKAČ², Lovro SINKOVIČ³, Vladimir MEGLIČ³, Gyula VIDA¹,
Marianna RAKSZEGI¹

¹ Agricultural Institute, Centre for Agricultural Research, ELKH, Brunszvik u. 2, Pf. 19, 2462 Martonvásár, Hungary

² Laboratory for Biotechnology, Institute of Field and Vegetable Crops, Maksima Gorkog 30, 21101 Novi Sad, Serbia

³ Agricultural Institute of Slovenia, Hacquetova ul. 17, 1000 Ljubljana, Slovenia

(✉) toth.viola@atk.hu

Abstract

Wheat and other cereals are important sources of dietary fibre and antioxidants. Most of the bioactive components are found in the outer layers and aleurone layers of the seed, but also the flour contains some. The major dietary fibre components in the wheat grain are cell wall polysaccharides such as arabinoxylan and β -glucan, which account for about 70% and 20%, respectively, of the total cell wall polysaccharides in the starchy endosperm. Barley and oats are rich in β -glucan, while wheat and rye are richer in arabinoxylan. Arabinoxylan has two forms, *i.e.* water-soluble (WE) and insoluble (WU) fractions, which differ in their health benefits. Antioxidants (*e.g.*, alkylresorcinol) delay or inhibit oxidation processes. Alkylresorcinol is formed in the organism and acts against free radicals, which are responsible for the cell degradation.

Spelt (*Triticum spelta*) is often supposed to be healthier than common wheat (*T. aestivum*), but this assumption has never been confirmed based on the compositional properties of the grain. However, the environment and field management practices could also influence grain composition. The current study evaluated differences in the composition of bioactive components between spelt and wheat, as well as the effects of growing location and field experimental practices. Five wheat and five spelt varieties were grown for three years (2019-2021) at two sites in Hungary (M, conventional; O, organic). The organic site was an experimental field, where no artificial fertilisation and chemical treatment was applied for at least three years. The total amount of mixed-linkage β -glucan was determined according to the ICC166 Standard Method using the Megazyme assay kit (Megazyme, Bray, Ireland). Total and water-extractable pentosans, of which arabinoxylan (AX) is the major component, were determined by the colorimetric method. Alkylresorcinol content was measured by spectrophotometry.

The results showed that the main fibre of wheat, arabinoxylan (AX) content, was higher in wheat than in spelt, but there were no differences between conventional and organic growing sites. The water-extractable fraction of arabinoxylan (WEAX) was also higher in common wheat than in spelt, with no differences due to field management practice (conventional vs. organic). β -Glucan, present in lower amounts than arabinoxylan, showed also higher amounts in common wheat than in spelt. The highest mean value was found for both species at the organic site. However, variation was high in the wheat samples grown on the organic site. The content of alkylresorcinol, which has antioxidant activity, was similar in spelt and wheat, with higher variation in wheat (Fig. 1). Consequently, the content of dietary fibre (arabinoxylan, β -glucan) was lower in spelt than in common wheat under both conventional and organic growing conditions. No difference was found in the mean alkylresorcinol content of spelt and common wheat at any of the sites. Organic field management resulted in significantly higher mean β -glucan content for both species compared to the conventional site.

Keywords

Alkylresorcinol · arabinoxylan · beta-glucan · diversity · organic farming · *Triticum aestivum* · *Triticum spelta*

Acknowledgements

The research was funded by the projects K135211, BI-HU/19-20-003, 2018-2.1.11-TÉT-SI-2018-00010 and COST Action 18101.

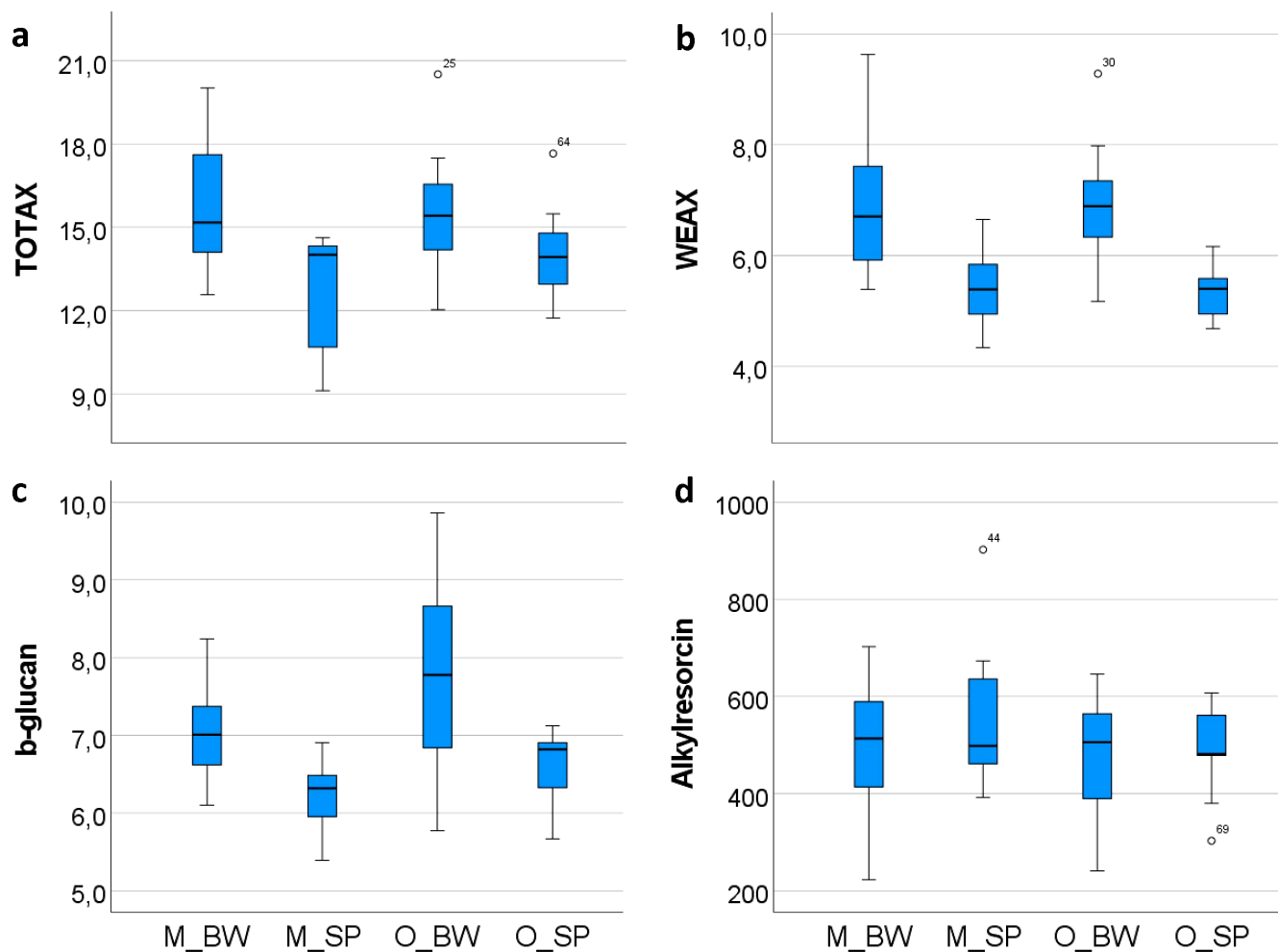


Figure 1 Variation in bioactive components of common wheat (BW) and spelt (SP) grown under conventional (M) or organic (O) management in Martonvásár, Hungary, from 2019 to 2021. **a** Total-arabinoxylan content (TOTAX; mg·g⁻¹); **b** Water extractable-arabinoxylan content (WEAX; mg·g⁻¹); **c** β-glucan content (mg·g⁻¹); **d** alkylresorcinol content (μg·g⁻¹)

References

Douglas SG (1981) A rapid method for the determination of pentosans in wheat flour. *Food Chem* 7: 139–145. DOI: 10.1016/0308-8146(81)90059-5

ICC (1998) ICC 166 Standard Method: Determination of β-glucan in barley, oat and rye. International Association for Cereal Science and Technology (ICC), Vienna.

Tłuścik F, Kazubek A, Mejbaum-Katzenellenbogen W (1981) Alkylresorcinols in rye (*Secale cereale* L.) grains. VI. Colorimetric micro-method for the determination of alkylresorcinols with the use of diazonium salt, Fast Blue B. *Acta Soc Bot Pol* 50: 645-651. DOI: 10.5586/ASBP.1981.086