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D 7.4

# Final report on WP7



Mario A. Pagnotta

## D7.4.\_Final report on WP 7

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<b>ABSTRACT (FOR DISSEMINATION)</b>	The document provides information on all training activities for the three tasks of WP7.
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### Executive summary

The main aim of the training activities under WP7 was to rapidly introduce innovations developed as part of the project into commercial practice. This in turn will maximise the effect of the R&D and Demonstration activities with respect to the main expected impact of ECOBREED project which is to improve the availability of varieties and seed suitable for organic and low-input production. This was operated by Design and deliver training workshops in a) improved genotyping (Task 7.1) b) improved phenotyping (Task 7.2), and c) participatory plant breeding and farmer participatory field trials (Task7.3).

Activities in Tasks 7.1 and 7.2 were mainly addressed to producing a cohort of young researchers and scientists with a new blend of applied and fundamental R&D skills required to (a) further improve the selection and breeding of organic crops (b) apply breeding and agronomic methodologies/approaches developed in the project to other crops and/or (c) contribute to transferring technologies developed into commercial practice. While activities in Task 7.3 were addressed to engage farmers and growers and provide training that allows them to acquire the knowledge and understanding to actively engage in PPB and manage Farmer Participatory Field Trials. The heterogeneous environments in which organic agriculture is performed need breeding programs that involve farmers who should receive the necessary expertise to run it. The impact of Task 7.3 is on the training of farmers and growers in the establishment, management and data recording required to fully evaluate these farmer-based field trials.

The four workshops in Advanced Genotypic tools trained a total of 241 young researchers in the application of new tools for assessing genetic characteristics. Particular attention was paid to the selection for organic agriculture, QTL identification, association genetics, marker-assisted breeding, and applications of transcriptomic and proteomic methods/approaches in crop breeding, which were some of the topics presented in the four workshops delivered. The impact on the participants was very high considering both the number and the high level of positive feedback received for all events.

The eight workshops in Advanced Phenotyping tools trained a total of 558 young researchers on the use of a range of sensors that can be used in Advanced Phenotyping and with extensive practical activities with drone (principles and practices) demonstrations in the field.

At the 23 events delivered for Participatory Plant Breeding (PPB) training and the organisation/management of Farmer Participatory Trials were organised by ten partners/countries. The participants were 341 overall. They were mainly farmers, but also from the seed industry, bakery, and extension services. The participants were trained on plant breeding and PPB best practices. In some cases, they were involved in the evaluation of the ECOBREED trials, giving also feedback on their data recording and needs regarding organic seeds.



### TASK 7.1 Advanced Genotyping training

The training programmes in Advanced Genotypic tools trained a total of 241 young researchers in the application of new tools for assessing genetic characteristics. Particular attention was paid to the selection for organic agriculture, QTL identification, association genetics, marker-assisted breeding, and applications of transcriptomic and proteomic methods/approaches in crop breeding, which were some of the topics presented in the four workshops delivered. The impact on the participants was very high considering both the number and the high level of positive feedback received for all events.

The bursary assigned for WP7.1 events were 10; eight for the event run on 18-22 June 2023 at Vienna and two for the event run on 4-8 December 2023 in Slovakia. No bursaries were distributed for the two events run during 2021 since they were run on-line due to COVID-19 restrictions.

**Table 1** Summary of 7.1 activities carried out and planned.

	Who	when	how	Days	PR
<b>Workshop 1</b>	BOKU	6 May 2021	online	<b>1</b>	<b>3</b>
<b>Workshop 2</b>	UNITUS	20-25 June 2021	online	<b>5</b>	<b>3</b>
<b>Workshop 3</b>	IFVC	18-23 June 2023	live	<b>4</b>	<b>4</b>
<b>Workshop 4</b>	NPPC	4-8 December 2023	live	<b>3</b>	<b>4</b>
				<b>13</b>	

### UNITUS

Location: on-line

Date: 20-25 June 2021

Number of trainers involved: 23 trainers: Mario A. Pagnotta, Vladimir Meglič, Marco Simeone, Andrea Mazzucato, Luca Bonfiglioli, Silvio Salvi, Rosario Muleo, Ivano Forgione, Giorgio Balestra, Sara Francesconi, Stefania Astolfi, Francesco Sestili, Francesco Camerlengo, Pasquale De Vita, Francesca Taranto, Barbara Farinon, Emidio Albertini, Angelo Mazzaglia, Anna Maria Timperio, Federica Gevi, Giuseppina Fanelli, Veronica Lelli, Silvia Turco

Number of participants (trainees): 68 participants from 22 countries

Programme:

Monday 21 June 2021

9.00 Welcome and introduction from the course organisers:

Welcome address:

Tuscia University Rector, DAFNE Director, President of the Italian Society of Plant Genetics

President of the Italian Society of Agricultural Genetics (SIGA).

09.15 Presentation of the ECOBREED project,

09.30 Part I: Markers and marker-assisted selection (MAS): Principles, procedures, advantages, and shortcomings.

11.15 Part II: Hardy-Weinberg principle and its implications in population management and assessment.

12.45 Discussion and remarks

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14.00 DNA bank use and advantages.  
15.00 From isoenzymes to NGS; the development of molecular markers in tomato.  
16:15 Practical use of HRM Corbett Rotor-Gene machine.  
17:30 Discussion and remarks

### Day 2 Tuesday 22 June 2021

9.00 Genotyping genome-wide based on SNP array, NGS, mapping-by-sequencing.  
10.00 KASP, HRM to genotyping specific loci.  
11.15 Practical approach to use of specific software for the design of essays  
12.15 Discussion and remarks  
13.45 Phylogenetic and NGS.  
14.45 How to manage the somaclonal variation.  
16.00 Genetic-molecular detection of phytopathogenic microorganisms.  
17.00 Biochemical and physiological mechanisms of resistance to stress and their identification  
18:00 Discussion and remarks

### Day 3 Wednesday 23 June 2021

09.00 CRISPR/Cas experimental design and applications of plant genome editing  
11.15 Designing resource-efficient durum wheat ideotypes for organic farming systems  
14.15 Practice: 1) Use of PCR markers in tomato for mapping and marker assisted selection. 2) Performing controlled crosses in tomato for genetics and breeding.  
15.30 Epi-breeding (  
17:15 Discussion and remarks

### Day 4 Thursday 24 June 2021

8.45 Diagnostics and advanced molecular characterization of plant pathogens.  
10.45 Lab: Diagnostics and advanced molecular characterization of plant pathogens.  
Mass Spectrometry:  
11.45 Part I: Principles of mass spectrometry with application to proteomics and determination of the amino acid sequence with tandem mass spectrometry.  
13.45 Part II: Mass Spectrometry, lab practices. Analysis and amino acid sequence laboratory in bovine serum albumin mass spectrometry (BSA) using MASCOT  
15:00 Discussion and remarks

### Day 5 Friday 25 June 2021

Bioinformatics:

9.00 Part I: Bioinformatics approach using R: a basic introduction.  
11.15 Continuing Part I  
14.00 Part II: Bioinformatics: case of studies  
16:00 Discussion and remarks  
17.00 questionnaire  
17.30 Closing remarks

Material Distributed

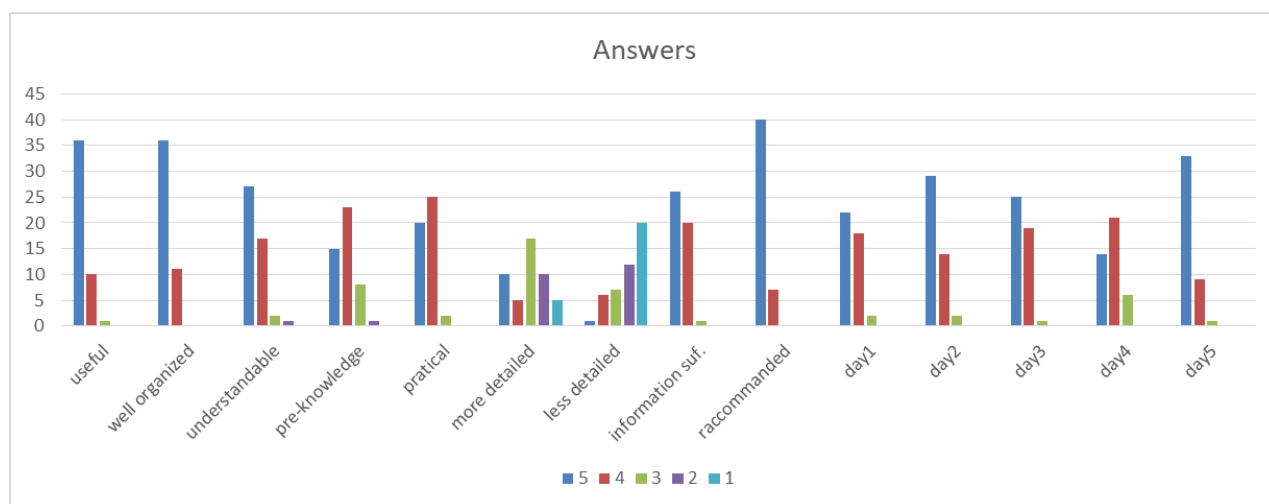
- Questionnaire
- Pdf of some lectures
- Miscellanea of didactic material for the training courses on Advanced Genotyping Training





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Description and results of the questionnaires: The questionnaire was answered and returned by 47 participants. Questionnaires included 17 questions of which 14 were required to give a score from 1 to 5 (5 = “strongly agree” and 1 = “strongly disagree”), while three were open questions requiring participant comments. All the scores were highly positive (Fig 1). For the question “The workshop was useful and informative” the received scores were 5 or 4 with a single 3, with a mean of  $4.7 \pm 0.4$  with almost all (40 answered 5 and 7 answer 4) would recommend others to attend the workshops offered. For the comments most of them would require an event in-person and would be very happy to follow future events. The answers received from the questions “I would like the workshop to be more detailed” and “I would like the workshop to be less detailed” we can conclude that the training was overall well balanced.



**Fig. 1.** Questionnaire results from the UNITUS on-line event in 2021.

Comments: Due to the pandemic the event was postponed and was subsequently moved from in-person to on-line. Being on-line bursaries were not distributed. Disadvantage for the on-line was the lack of contact among the participants, but the advantage was the high number of participants from all around the globe.

### BOKU

#### ***XXI International Workshop on Bunt and Smut Diseases***

Location: on-line

Date: 6 May 2021

Number of trainers involved: co-organised by ECOBREED and LIVESEED

Number of participants (trainees): The workshop targets professionals concerned by common bunt requirements, including organic seed producers, professionals and researchers. Participants were 150.

Activities done: 1 day was for genotyping and 1 for phenotyping training.

It was sub-divided into four Sessions (i.e. (i) Epidemiology and Pathology, (ii) Genetics and Genomics of Resistance/Pathogenicity, (iii) Resistance Breeding and Cultivar Development, (iv) Integrated Control) of about two hours each.



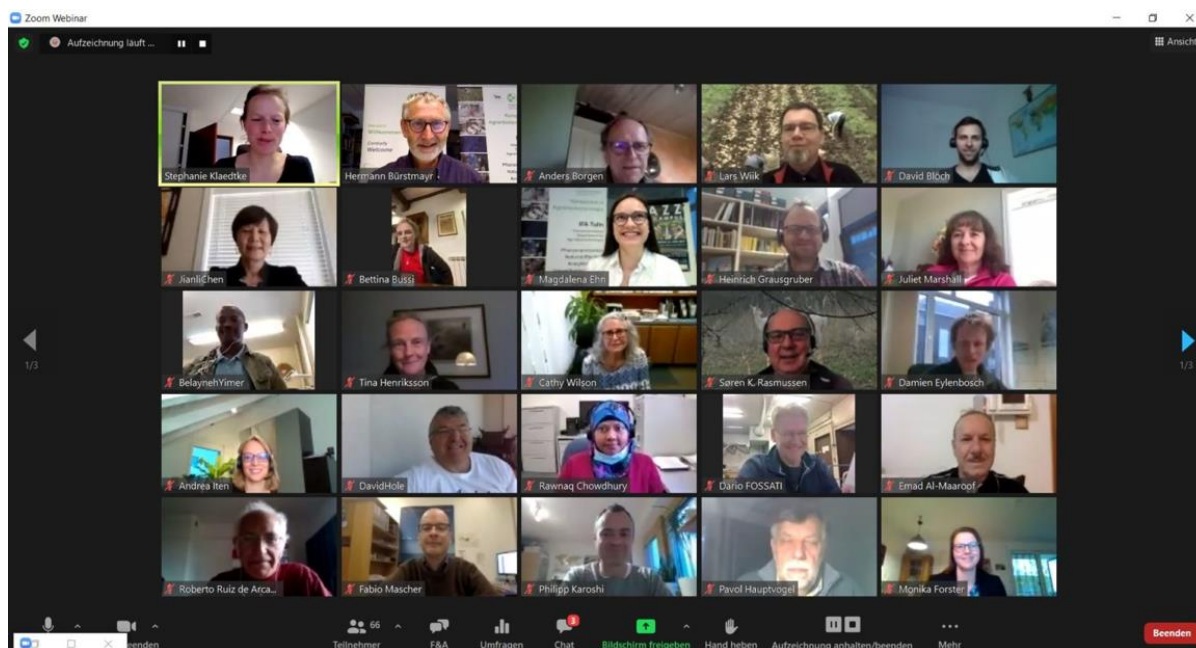
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A satellite virtual workshop (<https://bunt.boku.ac.at/satellite-workshop/>) on Common bunt requirements and norms for cereal seed production was held on 5 May at 13:00-15:00 (CEST). Monitoring seed infection rates will allow the management of common bunt in wheat and related cereals which is particularly important for organic farming. The aim of this satellite workshop was to facilitate the exchange of experiences and discussion on common bunt management in organic systems across countries.



**Fig. 2.** On-line XXI International Workshop on Bunt and Smut Diseases in 2021.

### Programme:

#### Thursday May 6, 16:00-17:50

Session 3: Resistance Breeding and Cultivar Development

Chair: Jianli Chen

Veronika Dumalasová: Reaction of Czech registered varieties and sources of resistance to common bunt and dwarf bunt

Margaret Krause: Evaluation of Genomic Selection methods for dwarf bunt resistance in wheat

Magdalena Ehn: Summary on current research activities on resistance to bunt in winter wheat at the University of Natural Resources and Life Sciences Vienna

Anders Borgen: Starke-II NIL based common bunt resistance gene mapping.

Christian Gladysz: Bunt resistant varieties, breeding and variety development at Saatzucht-Donau, Austria

#### Thursday, May 6, 18:00-20:00

Session 4: Integrated Control

Chair: Anders Borgen

M. S. Saharan: Studies on variability and host resistance for Karnal bunt of wheat in India

David Bloech: Bunt and smut diseases in cereal seed production

Matteo Petitti, Bettina Bussi: Bunt management in cereal seed networks: the case of Rete Semi Rurali's Community Seed Bank in Italy

Lars Wiik: Control of common bunt in organic wheat cultivation

Stephanie Klaedtke: Common bunt management on organic wheat: multi-factorial, knowledge-based



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Material distributed: <https://bunt.boku.ac.at/wp-content/uploads/2021/05/Book-of-Abstracts.pdf>

Description and results of the questionnaires: no questionnaires distributed but feedback provided via on-line tool (see below and/or image 3 of the picture gallery).

Comments: On-line event due to COVID restrictions. Hence, no bursaries provided and/or questionnaires distributed on site; on-line feedback.

### IFVC and KIS

Location: Vienna, Austria

Date: 18-22 June 2023

Number of trainers involved: 3 trainers from ECOBREED

Number of participants: 17 participants, students (Research/Education)

Activities done: IFVC Advanced genotyping and KIS Advances phenotyping training course was successfully held from 18 to 22 June 2023 in Vienna, Austria. In total 5 training days. Workshop gathered 17 participants. Students participated in following lecturers - Soybean pangenome and genetic diversity, Innovations in breeding technology, Genomics-assisted breeding and many more (each day program from 8:30 to 16:00).

On 22 June, there were fundamental lectures - Organic breeding, Dr. Vuk Djordjevic (IFVC), Soybean Advanced Genotyping, Dr. Marina Čeran (IFVC), Soybean Advanced Phenotyping, Dr. Nik Susic (KIS) and interactive group work (Green group, genotyping tools, moderator Dr. Marina Čeran, support Dr. Vuk Đorđević, Blue group phenotyping tools, moderator Dr. Nik Susič, support Dr. Jegor Miladinović)

#### Programme:

Day 1: Sunday, 18 June 2023

Initial meeting and preparation for lectures

Day 2: Monday, 19 June 2023

Session: Soybean pangenome and genetic diversity

Session: Innovations in breeding technology

Day 3: Tuesday, 20 June 2023

Session: Genomics-assisted breeding

Session: Yield and seed composition response to environment

Day 4: Wednesday, 21 June 2023

Session: New and emerging pests and diseases

Session: Knowledge exchange for European soybean agronomists

Session: Breeding for abiotic stress and climate change

Day 5: Thursday, 22 June 2023

Session: Germplasm collections and evaluation

Session: Breeding for biotic stress

Session: ECOBREED interactive workshop



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Material distributed: Questionnaires, brochures (online) and certificates.

Description and results of the questionnaires: The event was a successful both in terms of participation and in terms of feedback. The workshop was useful and informative for majority of participants as well as the workshop was well-organized.

Comments: 8 participants got ECOBREED bursaries, and in total 17 participants were trained.



**Fig. 3.** IFVC Advanced Genotyping and KIS Advanced Phenotyping training course in Vienna, 2023.

### NPPC

Location: NPPC – University of Ss. Cyril and Methodius in Trnava, Špačince, Slovakia

Date: 4-8 December 2023

Number of trainers involved: 6 trainers: Katarína Ondreičková, Ján Kraic, Martina Hudcovicová, Miroslav Švec, Daniel Mihálik, Lenka Klčová

Number of participants (trainees): 6 young researchers from Uzbekistan, Slovakia, Czechia, Ukraine, France, Bangladesh.

Activities done: In a three-day intensive training course, were present an overview of the advanced genotyping techniques and how to transfer them into breeding practices with an emphasis on organic agriculture. During the 2023 training course, we focused into the topics of advanced genotyping tools in relation to organic wheat improvement, such as advanced genotyping, for measuring and predicting relevant plant traits in a plant breeding context.





**Fig. 4.** NPPC training event on Advanced Genotyping in 2023.

### Programme:

#### Tuesday, December 05, 2023

08:45 – 09:00 Registration

09:00 – 09:15 Welcome and Introduction

09:15 – 09:30 Presentation of the ECOBREED project

09:30 – 11:00 Methods of molecular biology. Katarína Ondreičková, NPPC, Slovakia

11:00 – 11:15 Coffee/Tea break

11:15 – 12:45 Plant genotyping. Ján Kraic, NPPC/UCM, Slovakia

12:45 – 13:45 Lunch break

13:45 – 15:15 Plant molecular breeding. Martina Hudcovicová, NPPC, Slovakia

15:15 – 15:45 Discussion

15:45 – 17:15 Molecular methods and domestication of cereals. Miroslav Švec, Comenius University in Bratislava, Slovakia

#### Wednesday, December 06, 2023

09:00 – 12:00 Practice: Plant DNA isolation methods (alternative approaches). Daniel Mihálik, Lenka Klčová, NPPC/UCM, Slovakia

12:00 – 13:00 Lunch

13:00 – 16:00 Practice: Qualitative and quantitative analysis of isolated plant DNA. Daniel Mihálik, Lenka Klčová, NPPC/UCM, Slovakia

#### Thursday, December 07, 2023

09:00 – 12:00 Practice: Polymerase chain reaction (PCR) analysis of plant DNA. Daniel Mihálik, Lenka Klčová, NPPC/UCM, Slovakia

12:00 – 13:00 Lunch

13:00 – 16:00 Practice: Electrophoretic analysis of amplified plant DNA. Daniel Mihálik, Lenka Klčová, NPPC/UCM, Slovakia

Material distributed: information consent, information sheet, questionnaire, pdf files of lectures, didactic material for the training courses on Advanced Genotyping Training

Description and results of the questionnaires: The course was an excellent opportunity to obtain advanced knowledge, but also to train on practical aspects as the program consisted of lectures and practical task, which required active participation. The incorporation of cutting-edge genotyping tools was beneficial and useful for accelerating breeding efforts, especially for quantitative traits that are challenging to breed. The questionnaire was completed and



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returned by 5 participants. The questionnaires contained 10 questions, 7 of which required a scale from 1 to 5 with 5 being "strongly agree" and 1 being "strongly disagree" and three were for open-ended comments.

### Results of the questionnaires:

- The workshop was useful and informative: 5.00
- The workshop was well-organised: 5.00
- The subject was presented in a way that made it easy to understand: 5.00
- The practical demonstrations were detailed and understandable: 5.00
- I would like the workshop to be more detailed: 4.00
- I would like the workshop to be less detailed: 1.60
- The topics of the workshop were appropriate for my field of interest: 5.00
- Are there any comments or suggestions you would like to comment about the workshop that would make it better? Longer time span.
- What part of the workshop did you enjoy the most? Practical part.
- What part of the workshop did you enjoy the least? -.



**Fig. 5.** All questionnaire scores were highly positive at the NPPC training course in 2023.

Comments: 2 participants received ECOBREED bursaries.

### TASK 7.2 Advanced Phenotyping training

According to the GA amendment partners are supposed to organise 6 workshops covering a total of 12 days. In total 17 days via 8 workshops were delivered.

A total of 558 participants attended the workshops offered.

Nowadays digital application of fast and precise phenotyping tools (Task 7.2) is becoming more and more important. The training target was to provide technicians and young researchers with a new blend of applied and fundamental R&D skills in Advanced Phenotyping characterisation. A range of sensors that can be used in Advanced Phenotyping were illustrated, in addition, extensive practical activities were performed with drone (principles and practices) demonstrations in the field.

The bursaries assigned for WP7.2 were 18; ten for the event run on 24-30 July 2022 in Vienna and eight for the event run on 19-22 June 2023 by KIS. No bursaries were distributed for the two events run on-line due to COVID-19 restrictions. For the event run on 24-30 July 2022 in Vienna initially 14 bursaries were allocated, but for personal reasons, 4 participants did not use the hotel whose expenses were covered by the bursary.

**Table 2.** Summary of Task 7.2 activities carried out and planned.

	Organiser	Date	Mode	Days	PR
<b>Workshop 1</b>	NPPC	06 November 2019	In-person	<b>1</b>	<b>2</b>
<b>Workshop 2</b>	NPPC	30 January 2020	In-person	<b>1</b>	<b>2</b>
<b>Workshop 3</b>	BOKU	5 May 2021	On-line	<b>1</b>	<b>3</b>
<b>Workshop 4</b>	NPPC/PSI	24-25 May 2021	On-line	<b>2</b>	<b>3</b>
<b>Workshop 5</b>	KIS/UNEW	22-23 June 2021	In-person	<b>2</b>	<b>3</b>
<b>Workshop 6</b>	BOKU	24-30 July 2022	In-person	<b>6</b>	<b>3</b>
<b>Workshop 7</b>	UNEW	4-5 August 2022	In-person	<b>2</b>	<b>3</b>
<b>Workshop 8</b>	KIS	19-22 June 2023	In-person	<b>2</b>	<b>4</b>
				<b>17</b>	

#### NPPC (2019)

Location: Piešťany, Slovakia

Date: 6 November 2019

Number of trainers involved: 13 trainers: Mária Jamborová, Ivan Masár, Gyula Zalabai, Katarína Bučková, Pavol Hauptvogel, Dušan Janoviček, Juraj Vranka, Bohdana Hrbáčková, Zuzana Ciesarová, Kristína Kukurová, Václav Müller, Pavol Beránek and Soňa Gavurníková.

Number of participants (trainees): 67 participants: 18 farmers, 7seed industry, 1 extension service, 28 research/education, 2 policy makers and 11others.

Activities done: The workshop topics were the latest trends in cereal breeding, market and selected wheat products, breeding, registration of new wheat varieties, growing of organic crops, control activities of plant commodities, wheat quality and weather conditions in the Slovak Republic.





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### Programme:

8:30 – 9:00 Registration

9:00 – 9:15 Opening

9:15 – 9:35 Situation on the wheat market and selected wheat products, Ing. Ivan Masár, NPPC-VÚEPP)

9:35 – 9:55 Trends in wheat breeding in Istropol Solary a.s.

9:55 – 10:15 Testing and registration of new wheat varieties in Slovakia (Ing. Katarína Bučková, ÚKSÚP v Bratislave, skúšobná stanica Želiezovce)

10:15- 10:35 Increasing the efficiency and competitiveness of organic crop production (Ing. Pavol Hauptvogel, PhD., NPPC-VÚRV)

10:35 – 10:50 Break, refreshments

10:50 – 11:20 Organic cultivation and processing of spelt in Biomila (Ing. Dušan Janoviček, BIOMILA spol. S r.o.)

11:20 – 11:40 Control activities in ŠVPS SR (State Veterinary and Food Administration of the Slovak Republic) – plant commodities (Ing. Juraj Vranka, ŠVPS SR)

11:40 – 12:00 Mycotoxins in cereals (Ing. Bohdana Hrbáčková, O.K. Servis BioPro)

12: 00 – 12:20 Acrylamide in bakery products (Ing. Zuzana Ciesarová, CSc., NPPC-VÚP)

12:20 – 12:40 Possibilities of increasing the fibre content in bakery products (Ing. Kristína Kukurová, PhD., NPPC-VÚP)

12:40 – 13:00 Break, refreshments

13:00 - 13:30 Measurement of quality parameters of cereals (Václav Müller, O.K. Servis BioPro)

13:30 – 13:50 Weather in the 2018/2019 growing season (Mgr. Pavol Beránek, SHMÚ)

13:50 – 14:10 Wheat quality in Slovakia in 2019 (Ing. Soňa Gavurníková, PhD., NPPC-VÚRV)

14:10 – 14:20 Discussion, Conclusion

14:20 – 15:00 Lunch

Material distributed: information consent, information sheet\_ECOBREED, brochures.

Description and results of the questionnaires: The workshop was an excellent opportunity to gain knowledge on the current market situation for wheat and selected wheat products. Important information was presented on the ECOBREED project and the possibilities to increase the efficiency and competitiveness of organic crop production. The participants were provided with information on trends in wheat breeding, methods of evaluation and registration of new wheat varieties in Slovakia and control activities of the Veterinary and Food state authorities. Results on the quality of wheat in Slovakia and different methods of measuring the quality of cereals were presented. Interesting information was given on mycotoxins in cereals, acrylamides in bakery products and how to increase the fibre content in bakery products.

In the discussion, participants of the workshop were interested more detailed in the ECOBREED project, its objectives and structure. They were also interested in the plants studied in the project. They were also asking questions connected to ecological farming in Biomila.

The event was a successful both in terms of participation and in terms of feedback. On the negative side, participants were not interested in completing a questionnaire after the event. The workshop was useful and informative for majority of participants as well as the workshop was well-organised.

Comments: The workshop "Cereals in everyday practice" was organised as part of the Science and Technology Week 2019 for the public. Biomila was participating at the seminar, lecture + products presentation.



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**Fig. 6.** Advanced Phenotyping training in Piešťany, 2019.

### NPPC (2020)

Location: AgroBioTech Research Centre, Slovak University of Agriculture, Nitra, Slovakia

Date: 30 January 2020

Number of trainers involved: 14 trainers: Vladimír Meglič, Marian Brestič, Uroš Žibrat, Ankush Prasad, Pavol Hauptvogel, Marian Brestič, Marek Kovár, Marek Živčák, Oksana Sytar, Erik Chovanček, Lenka Botyanská, Kristína Gašparovič, Mária Barboričová and Andrej Filaček

Number of participants (trainees): 15 participants from 4 countries.

Activities done: Presentations and hands-on demonstrations on high-throughput phenotyping, small phenotyping devices, and interactive discussion.

First part of the Workshop was intended that all participants get familiar with the ECOBREED's experiments, research procedures and equipment housed at all participating institutions. For that purpose, each participant gave a presentation on their work, expertise and results achieved. That was followed by the presentations of the hosting Institution, SUA Nitra, giving overview of the Agrobiological research and plant phenotyping at SUA Nitra, that was followed by the specific presentations on Optical sensors for high-throughput plant phenotyping, Phenotyping of wheat Genebank accessions using RGB and hyperspectral data and Phenotyping of rare crops.

The afternoon session was devoted to the hands-on experiments using small equipment for phenotyping in the SUA Phenotyping facility, and demonstration of the high-throughput phenotyping set-up and their experiments.

Programme:

09:00 – 09:15 Welcome and organisational issues, Vladimír Meglič, Pavol Hauptvogel

09:15 – 10:30 Introduction to the Ecobreed phenotyping and Slovak wheat research

Vladimír Meglič, project coordinator, Uroš Žibrat, KIS, Ankush Prasad, UNEW, Pavol Hauptvogel, NPPC



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10:30 – 11:30 Phenotyping – AgroBioTech Research Center, Marian Brestič: Agrobiological research and plant phenotyping at SAU Nitra, Marek Kovár: Optical sensors for high-throughput plant phenotyping at SAU Nitra, Marek Živčák: Phenotyping of wheat Genebank accessions using RGB and hyperspectral data, Oksana Sytar: Phenotyping of rare crops.

11:30 – 13:00 Lunch

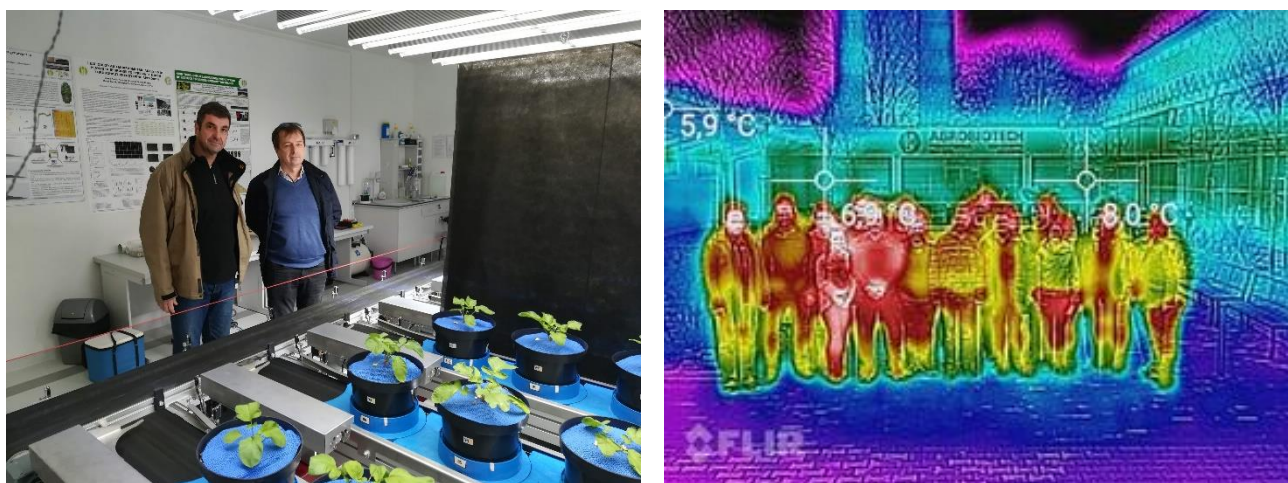
13:00 – 15:30 Phenotyping - AgroBioTech laboratory, Marian Brestič, Marek Živčák, Marek Kovár, Erik Chovanček, Lenka Botyanská, Kristína Gašparovič, Mária, Barboričová, Andrej Filaček: demonstration activities: high-throughput phenotyping, small equipment for phenotyping. Interactive discussion.

15:30 – 16:00 General discussions, conclusions and AOB, Vladimír Meglič, project coordinator.

Material distributed: brochures SUA. The SUA researchers didn't agree to publish their presentations on the ECOBREED intranet, so only KIS and UNEW ones are available.

Description and results of the questionnaires: Presentations generated interest and discussions on different phenotyping methodology used for experiments and possibility of introducing those to the ECOBREED project. Unfortunately, discussion ceased when representative of SUA, Prof. Brestič, announced their none availability for the workshop. This negative attitude resulted in a lack of interest from participants in the elaboration of the questionnaire.

Comments: After the SUA representative, Prof. Brestic, stated that they were not available for the project, it was agreed that further partnerships would be sought to carry out experiments in Advanced Phenotyping and training to fulfil the task in WP7.



**Fig. 7.** Training in 2020 at the AgroBioTech Research Centre.



### BOKU

#### XXI International Workshop on Bunt and Smut Diseases

Location: on-line

Date: 5 May 2021

Number of trainers involved: co-organised by ECOBREED and LIVESEED

Number of participants (trainees): The workshop targets professionals concerned by common bunt requirements, including organic seed producers, officials and researchers. Participants were 150.

Activities done: 1 day was for genotyping and 1 for phenotyping training. It was subdivided into four Sessions (i.e. (i) Epidemiology and Pathology, (ii) Genetics and Genomics of Resistance/Pathogenicity, (iii) Resistance Breeding and Cultivar Development, (iv) Integrated Control) of about two hours each. ECOBREED partners involved: Hermann Bürstmayr, Magdalena Ehn (BOKU), Veronika Dumalasová (CRI).

A satellite virtual workshop (<https://bunt.boku.ac.at/satellite-workshop/>) on Common bunt requirements and norms for cereal seed production was held on 5 May at 13:00-15:00 (CEST). Monitoring seed infection rates will allow the management of common bunt in wheat and related cereals which is particularly important for organic farming. The aim of this satellite workshop was to facilitate the exchange of experiences and discussion on common bunt management in organic systems across countries. ECOBREED partners involved: Heinrich Grausgruber (BOKU).

#### Programme:

##### Wednesday, May 5, 13:00-15:00

Satellite Workshop: Common bunt requirements and norms for cereal seed production and their implications for bunt management in organic farming

Chair: Stephanie Klaedtke

##### Wednesday May 5, 16:00-17:50

Session 1: Epidemiology and Pathology

Chair: Fabio Mascher

Vesna Župunski - Status of *Tilletia* spp. in Serbia – past, present, future

Geoffrey Orgeur - Common bunt: study of prevalent virulences in France and development of a resistance test for registration in the French Catalogue of common wheat varieties

Monika K. Forster - Development of a qualitative and quantitative qPCR assay to detect teliospores of *Tilletia controversa* in wheat seed samples.

Somayyeh Sedaghatjoo - Inter- and intra-species genomic comparison of *Tilletia caries*, *T. controversa*, and *T. laevis*

##### Wednesday, May 5, 18:00-20:00\*

Session 2: Genetics and Genomics of Resistance/Pathogenicity

Chair: Hermann Buerstmayr

Li Gao - Transcriptome analysis of wheat spikes infected by *Tilletia controversa* Kühn and characterization of histological changes in resistant and susceptible varieties.

Jianli Chen - Assessment of two quantitative trait loci for dwarf bunt resistance in winter wheat grown in Pacific Northwest of the USA



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Raman Dhariwal - Mapping common bunt resistance loci in Canadian wheat cultivar AAC Tenacious  
Søren K. Rasmussen - Association mapping for common bunt resistance in wheat

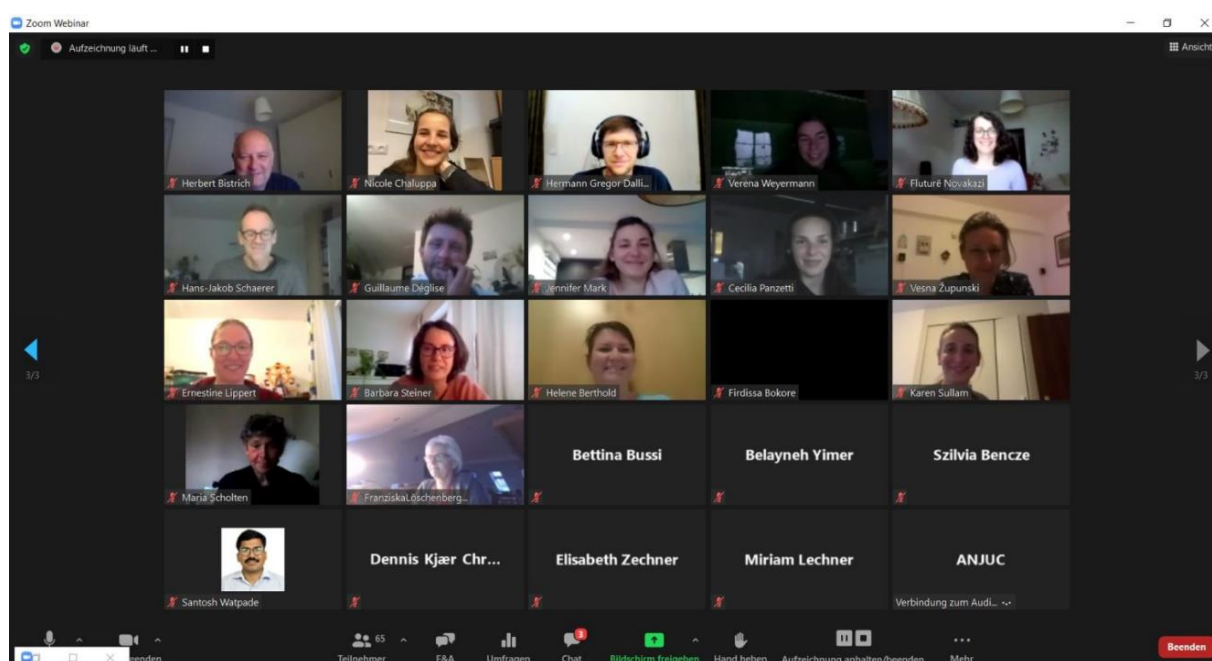
Jelena Baćanović-Šišić - Network-based GWAS of race-specific resistances to common bunt (*Tilletia caries*) in wheat

Dennis Kjær Christensen - Is Bt8 located at Chromosome 6D and closely linked to Bt10?

Material distributed: <https://bunt.boku.ac.at/wp-content/uploads/2021/05/Book-of-Abstracts.pdf>

Description and results of the questionnaires: no questionnaires distributed but feedback provided via online tool (see below and/or image 3 of the picture gallery).

Comments: On-line event due to COVID restrictions. Hence, no bursaries provided and/or questionnaires distributed on site; online feedback.



**Fig. 8.** On-line XXI International Workshop on Bunt and Smut Diseases in 2021.

### NPPC

Location: on-line

Date: 24-25 May 2021

Number of trainers involved: 9 i.e. Vladimir Meglič, Pavol Hauptvogel, Martin Trtílek, Ankush Prashar, Anže Županič, Uroš Žibrat, Klára Panzarová, Lukáš Spíchal and Mirella Sorrentino.

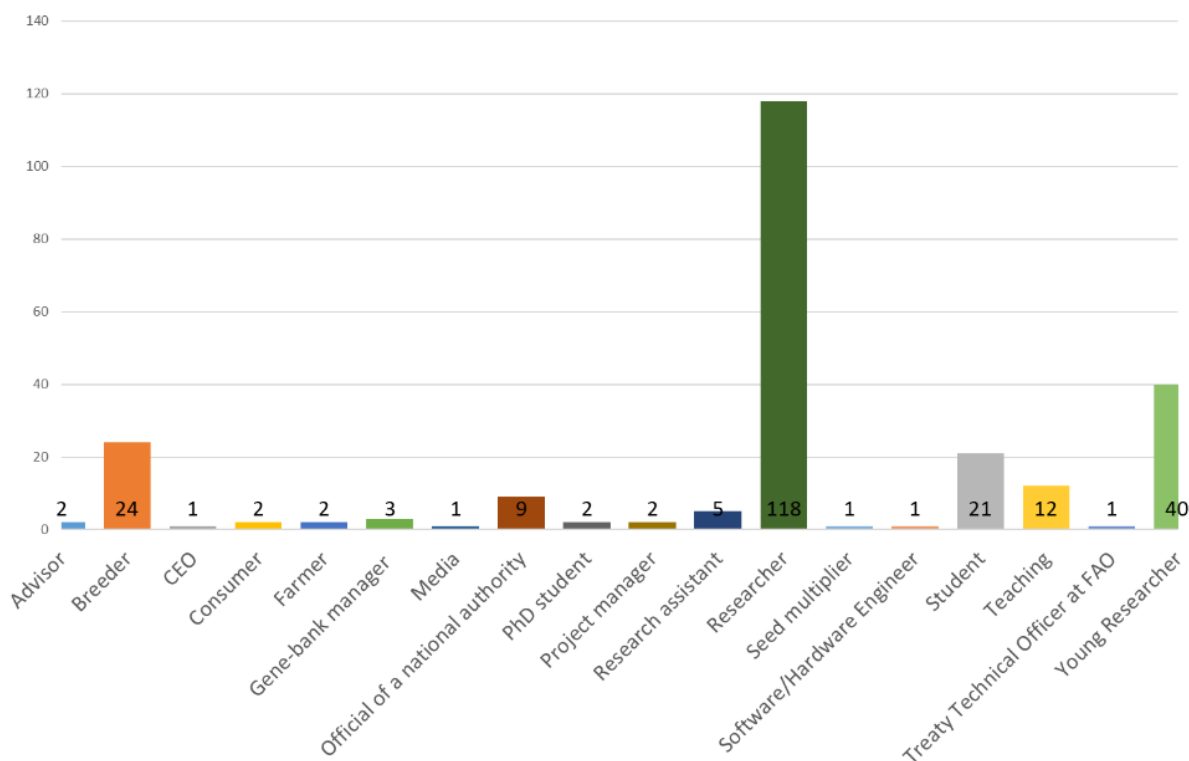
Number of participants (trainees): 247 from 45 countries were registered (Argentina, Australia, Austria, Belgium, Bosnia and Herzegovina, Canada, Croatia, Czech Republic, Denmark, Egypt, Estonia, Finland, Germany, Greece, Hungary, Chile, China, India, Ireland, Israel, Italy, Japan, Latvia, Lithuania, México, Morocco, Netherlands, Nigeria, Norway, Oman, Pakistan, Philippines,



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Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Switzerland, Syria, Uganda, United Kingdom and Vietnam).

The participants (trainees) divided into the following categories: Advisor (2), Breeder (24), CEO (1), Consumer (2), Farmer (2), Gene-bank manager (3), Media (1), Official of a national authority (9), PhD student (2), Project manager (2), Research Assistant (5), Researcher (118), Seed multiplier (1), Software/Hardware Engineer (1), Student (21), Teaching (12), Treaty Technical Officer at FAO (1) and Young Researcher (40).



**Fig. 9.** Overview of the number of registered participants.

Activities done: A practical training "State-of-the-art technologies for plant phenotyping" included an introduction to plant phenotyping, sensor technologies, application of high-throughput phenotyping in crop studies, non-invasive crop phenotyping, environmental characterisation, data analysis and modelling and the potential use of sensors for non-invasive crop phenotyping. The practical part included demonstration activities on high throughput phenotyping and interactive discussion.

### Programme:

1st Day: 24th of May 2021 (Monday)

09:00 – 09:15 Welcome: Pavol Hauptvogel, Klára Panzarová, Mario Pagnotta and Vladimir Meglič

09:15 – 09:30 ECOBREED – towards improvement in organic breeding: Vladimir Meglič, KIS, Slovenia

09:30 – 09:45 Phenotyping of plant genotypes in the ECOBREED project and role of the NPPC: Pavol Hauptvogel, NPPC, Slovakia

09:45 – 10:00 New advances and future technology steps in non-invasive phenotyping: Martin Trtílek, PSI Research Centre, PSI, Czech Republic

10:00 - 10:50 Crop sensing in field: phenotyping and monitoring exemplars



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Ankush Prashar, UNEW, UK

10:50 – 11:10 Coffee Break

11:10 – 12:00 Good data management practice: National Institute of Biology, Slovenia, Anže Županič, University of Ljubljana, Slovenia

12:00 – 12:50 Data pre-processing and exploration: Uroš Žibrat, KIS

12:50 – 14:00 Lunch

14:00 – 14:50 Characterisation of adaptive responses to single and combined stresses in Desirée: Klára Panzarová PSI Research Centre, PSI, Czech Republic

14:50 – 15:40 High-throughput screening approaches to identify elite varieties for improved agronomic performance under different growth conditions: Lukáš Spíchal, Centre of Region Haná for Biotechnological and Agricultural Research, Czech Advanced Technology and Research Institute, Palacký University Olomouc

15:40 – 16:30 Fast and effective screening of biostimulants using high-throughput automated plant phenotyping: Mirella Sorrentino, PSI Research Center, PSI, Czech Republic

2nd Day: 25th of May 2021 (Tuesday)

09:00 – 10:30 State-of-art technology for plant cultivation and high-throughput phenotyping in PSI Research Center: Klára Panzarová, PSI Research Centre, PSI, Czech Republic

10:30 – 10:50 Coffee Break

10:50 – 11:40 Phenotyping of selected plant genotypes in frame of ECOBREED project in PSI Research Center: Klára Panzarová, PSI Research Centre, PSI, Czech Republic

11:40 – 12:30 Hand-held devices for small scale non-destructive phenotyping of plants in control and field conditions: Klára Panzarová, PSI Research Centre, PSI, Czech Republic

12:30 – 13:00 Open table for discussion: Application of high-throughput phenotyping in crop studies - Burning needs and key challenges. Discussion lead by Heinrich Gausgruber

13:00 – 13:30 Conclusions and closing remarks: Vladimír Meglic, Co-ordinator of project ECOBREED.

**Material distributed:** Questionnaire. PDF with lectures from the on-line training and materials on advanced training on phenotyping; Information consent; Information sheet.

**Description and results of the questionnaires:** The training on advanced phenotyping was an excellent opportunity to learn about new knowledge and advances and future technological steps in non-invasive phenotyping, screening approaches to identify elite varieties for improved agronomic traits under different growing conditions. Important information on the ECOBREED project and the possibilities on phenotyping of plant genotypes in the ECOBREED project were presented.

The event was successful both in terms of participation and feedback. Two hundred and forty-seven participants from 45 countries registered and of these 169 were always connected and followed the thirteen lectures over the two days. The feedback was very positive.

In a discussion led by Heinrich Gausgruber, the trainees were interested in the possibilities of applying high-throughput phenotyping in plant studies e.g. in cereal roots, rice and sorghum phenotyping platforms. They were interested in the topics of integration of genomic approaches with phenotyping of plant genetic resources, examples of methodologies and computational tools, screening of biostimulants and time-series analysis. Questions were also addressed on the role of digitisation in transferring research knowledge to commercial practice and for use by the broad community of researchers in developing countries. The discussion focused on molecular biological analyses related to sophisticated phenotyping and large-scale remote sensing of field crops, from crop establishment to harvest time estimation.



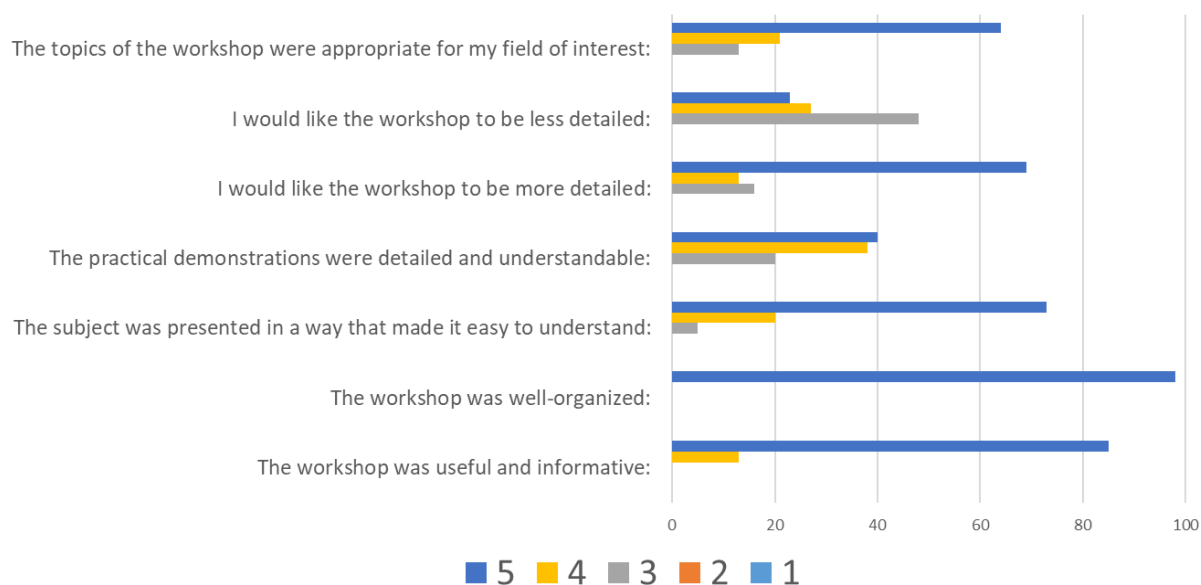


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The Questionnaire was answered and returned by 98 participants. Questionnaires included 10 questions for 7 were required to give a score from 1 to 5 (5 being “strongly agree” and 1 being “strongly disagree”) while three were for open comments/feedback. For the question “The workshop was useful and informative”, scores of 5 to 1 were obtained, with an average of 4.5. From the responses obtained from the questions on detail or less detail we assume that the training was well balanced. In the case of comments, respondents had no comments and were particularly interested in the presentations.

All the scores were highly positive as indicated in the following graph:

- The workshop was useful and informative: 4.87
- The workshop was well-organised: 5.00
- The subject was presented in a way that made it easy to understand: 4.69
- The practical demonstrations were detailed and understandable: 4.20
- I would like the workshop to be more detailed: 4.54
- I would like the workshop to be less detailed: 3.74
- The topics of the workshop were appropriate for my field of interest: 4.52
- Are there any comments or suggestions you would like to comment about the workshop that would make it better? No comments
- What part of the workshop did you enjoy the most? Presentation
- What part of the workshop did you enjoy the least? No comments



**Fig 10** Questionnaire from the NPPC 2021 event.

Comments: Due to the pandemic the event was moved from presence to on-line mode. The bursaries were not distributed because the training on advanced phenotyping was on-line. Disadvantage for the on-line was the lack of contact among the participants, but the advantage was the high number of participants from all around the world.

According to GA and the contract with PSI (Contract for work no. 1499/2020 / NPPC-VÚRV between NPPC a PSI), advanced training in plant phenotyping for researchers and plant breeders was planned to be carried out during the ongoing experiment.

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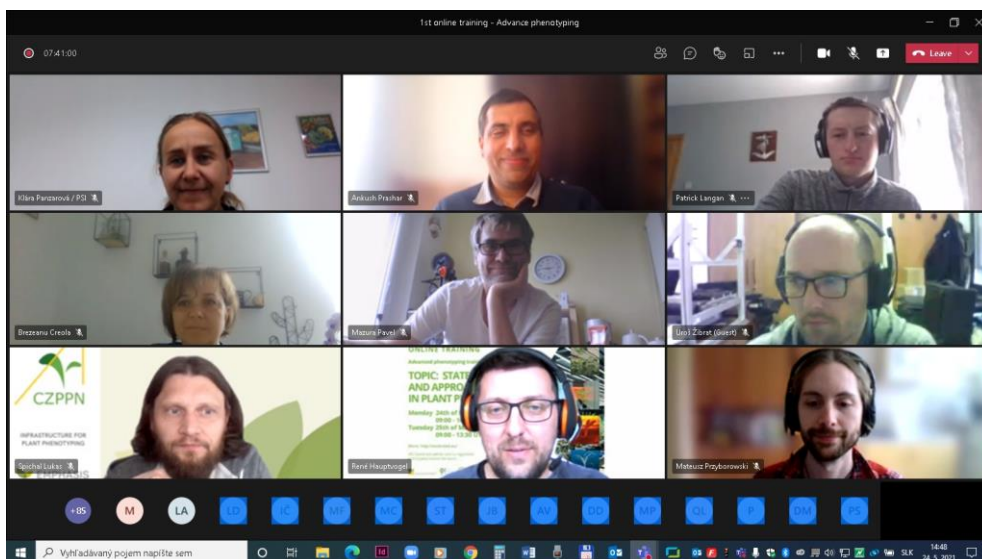


Fig. 11. NPPC on-line event in 2021.

### KIS and UNEW

Location: Nafferton Farm, UK

Date: 22-23 June 2021

Number of trainers involved: see programme below

Number of participants (trainees): 17 external attendees: 2 from plant breeding companies, 7 from universities, 1 from a Research Institute and 7 from Industry.

Activities done: External presentations on 'Remote soil moisture measurement with a home-made Infrared Hyperspectral imager', 'Drone RGB and Multispectral data analyses and Multispectral data analyses. The programme also included demonstrations on 'Sensor tools for phenotyping' and 'Fixed wings and Multirotor' drone flights.



Fig. 12. Advanced Phenotyping training in the UK in 2021.

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### Programme:

#### 22nd July Thursday

12:45 Nibbles and Coffee 1pm:

1.00 the ECOBREED Project - Paul Bilsborrow

1:10pm - Remote sensing basics - Ankush Prashar

1:40 pm - Crop sensing: Some exemplars - Ankush Prashar

2pm - Sensor tools for phenotyping - Demonstration from Ankush Prashar and Phatchareeya Waiphara

2:50pm - Practical considerations for imaging

3:00pm - Coffee Break

3:20pm - Hyperspectral lab demonstration - Ankush Prashar and Phatchareeya Waiphara

3:50pm - Data pre-processing and analysis steps and examples - Ankush Prashar

4:20pm - Remote soil moisture measurement with a homemade Infrared Hyperspectral imager - Cyril Bourgenot

4:40pm - Seminar from Avinash Agarwal

5pm: End of day one

#### 23rd July Friday

9am - Drone Flight: Fixed wings and Multirotor: Data Collection and Basics of flight. Jock Souter and Ankush Prashar

10am: GPS systems - Jock Souter

10.30 am: Drone RGB and Multispectral data analysis - Jock Souter, Ankush Prashar and Phatchareeya Waiphara

11am - Examples from Slovenia: Uros Zibrat

11:20am - Presentation from Shara Ahmed on Multispectral data analysis 11:40 am - Discussions and Conclusions - Paul Bilsborrow

12:00pm End of workshop

## **BOKU**

Location: Vienna, Austria

Date: 24-30 July 2022

Number of trainers involved: see programme below; teachers from ECOBREED partners: Ankush PRASHAR (UNEW), Uros ZIBRAT (KIS), Johann VOLLMANN (BOKU), Gudrun KINZ (BOKU)

Number of participants (trainees): 30 (education)

### Programme:

#### Sun. Jul 24, 2022

14:30-19:00 Meet and greet.

#### Mon. Jul 25, 2022

9-10:30 Welcome

11-12:30 Student presentations 1

13:30-15 Ankush Prashar: Introduction into the topic: remote sensing, phenotyping, breeding

15:30-17:00 Karl Schmid: (on-line) Deep learning for plant phenotyping

#### Tue. Jul 26, 2022

9-10:30 Wrap up previous day, Student presentations 2

11-12:30 Uroš Žibrat / Ankush Prashar: Sensing and sensors, from hand-held to satellites





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13:30-15 Uroš Žibrat: Data pre-processing for downstream analysis

15:30-17:00 Uroš Žibrat / Ankush Prashar: practical example

Wed. Jul 27, 2022

Excursion

Bus departure: 08:00

Wintersteiger Plant Breeding Technology Ried/Innkreis

Saatzucht Donau, Reichersberg: Soybean Breeding for Central Europe

Return Tulln 19:00

Thu. Jul 28, 2022

9-10:30 Wrap up previous day, Student presentations 3

11-12:30 Johann Vollmann: Hyperspec Measurements Soybean

13:30-15 Johann Vollmann: Data Analysis - Soybean Hyperspec Measurements

15:30-17:00 Johann Vollmann: Data Analysis - Soybean Hyperspec Measurements: Water and Nitrogen Status

17:30-19 Evening Grill Party

Fri. Jul 29, 2022

9-10:30 Wrap up previous day, Student presentations 4

11-12:30 Gudrun Kinz: UAV based RGB Imaging

13:30-15 Gudrun Kinz: UAV based RGB Imaging

17:30-19 Gudrun Kinz: UAV based RGB Imaging

Sat. Jul 30, 2022

9-10:30 Exam

11-12:30 Wrap Up all week, closing the summer school

Material distributed: Slides of presentations

Comments: Problems with handling the bursaries. On the base of the request, nationality, CV, gender, and motivation were allocated 14 bursaries to the participants. Due to personal reasons some of the candidates for the bursary did not use the bursary which consisted of hotel discounts. At the end, 10 bursaries were paid by the Project Co-ordinator for a total of 1,920.00 €.



**Fig. 13.** Advanced Phenotyping event at BOKU in 2022.



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### UNEW

Location: Nafferton Farm (UK)

Date: 4-5 August 2022

Number of participants (trainees): 16 attendees which included 12 researchers, 4 from industry.

Activities done: The workshop looked at a range of sensors which can be used in Advanced Phenotyping and also looked at flying a drone (principles and practices) in the field.

Programme:

Workshop will run from 12.30pm on Thursday 4th August until the early afternoon of Friday 5th August. This is an introductory workshop covering different sensing tools for field phenotyping and their applications as a part of the EU ECOBREED project covering improvement in organic breeding.

In short, the program will cover:

- Conventional phenotyping and the need for advanced techniques
- Basics of remote sensing
- Sensor tools for non-destructive phenotyping
- In-field demonstration
- Demonstration of preliminary data analysis approaches
- Hands on sensor use
- Phenotyping and monitoring exemplars- Talks from Participants
- Demonstration of drone flights in the field



**Fig. 14.** Advanced Phenotyping training in UK in 2022.

### KIS

Location: Austria Center Vienna, Austria

Date: 19-22 June 2023

Number of trainers involved: Uroš Žibrat - material (handbook, lectures, exercises) preparation; Nik Susič - gave lectures, leading interactive groups

Number of participants (trainees): The workshop was attended by 17 participants,



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Activities done: Lectures and exercises about advanced phenotyping and remote sensing. Interactive group work.

Programme:

Day 1: Monday, 19 June 2023

Initial meeting

Innovations in breeding technology

Day 2: Tuesday, 20 June 2023

Strategies for disease, pest and weed control.

Precision agriculture and yield-gap analysis for resource-use efficiency

Day 3: Wednesday, 21 June 2023

Managing disease, pest and weed resistance.

Using data-driven knowledge for profitable crop management

Day 4: Thursday, 22 June 2023

Advanced tools and sensors for soybean protection

Chemistry and nutrition of soybeans and soy products

Policy and the regulatory environment

ECOBREED workshop

Material distributed: PDF of Lecture notes and exercises; PDF of Remote sensing handbook

Description and results of the questionnaires: The feedback was greatly positive. The workshop was useful and informative for majority of participants as well as the workshop was well-organised.

Comments: 8 ECOBREED bursaries were assigned.



**Fig. 15.** Plant phenotyping workshop in Vienna in 2023.





### TASK 7.3 Participatory Plant Breeding (PPB) training and the organisation/management of Farmer Participatory Trials

According to the GA, each partner involved in WP7 was supposed to run 2 training events involving farmers/stakeholders to increase farmer skills to enhance farmer selection and seed production efforts.

Twenty-three events were delivered for a total of 341 trainees involved; in general, these were single-day events, except one organised by BOKU which was three days. The 23 events were organised by ten partners/countries attended on average about 14 participants for events (from 4 to 32) which were mainly farmers but also from the seed industry, bakery, and extension services.

The heterogeneous environments in which organic agriculture is performed need breeding programs that involve farmers who should receive the necessary expertise to run it. The impact of Task 7.3 is on the training of farmers and growers in the establishment, management and data recording required to fully evaluate these farmer-based field trials.

The participants were trained on plant breeding and PPB best practices. In some cases, they were involved in the evaluation of the ECOBREED trials, giving also feedback on their data recording and needs regarding organic seeds.

**Table 3** Summary of Task 7.3 activities carried out and planned.

	who	when	how long	PR
<b>Workshop 1</b>	NATUR	8 June 2021	1	3
<b>Workshop 2</b>	IHAR	23 July 2021	1	3
<b>Workshop 3</b>	UNITUS	28 May 2022	1	3
<b>Workshop 4</b>	BOKU	7 June 2022	1	3
<b>Workshop 5</b>	IFVC	9 June 2022	1	3
<b>Workshop 6</b>	UNITUS	10 June 2022	1	3
<b>Workshop 7</b>	BOKU	13-15 June 2022	3	3
<b>Workshop 8</b>	NPPC	15 June 2022	1	3
<b>Workshop 9</b>	NPPC	21 June 2022	1	3
<b>Workshop 10</b>	KIS	24 June 2022	1	3
<b>Workshop 11</b>	NPPC	29 June 2022	1	3
<b>Workshop 12</b>	NPPC	30 June 2022	1	3
<b>Workshop 13</b>	CRI	29 August 2022	1	3
<b>Workshop 14</b>	CRI	30 August 2022	1	3
<b>Workshop 15</b>	IFVC	2 September 2022	1	3
<b>Workshop 16</b>	IHAR	29 September 2022	1	3
<b>Workshop 17</b>	KIS	12 October 2022	1	4
<b>Workshop 18</b>	NATUR	10 February 2022	1	4
<b>Workshop 19</b>	MATE	29 June 2023	1	4
<b>Workshop 20</b>	UNEW	11 July 2023	1	4
<b>Workshop 21</b>	MATE	19 October 2023	1	4
<b>Workshop 22</b>	BOKU	14 November 2023	1	4
<b>Workshop 23</b>	UNEW	14 December 2023	1	4
			25	



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### NATUR (2021)

Location: Dottenfelder Hof (Germany)

Date: 8 June 2021

Number of trainers involved: Organic plant breeders 2

Number of participants (trainees): Farmers 9

Programme:

Visit the breeding programmes both for lines and populations, both for self-pollinated and cross-pollinated crops.

Carl Vollenweider from Dottenfelder Hof and Werner Vogt-Kaute from Naturland e.V. gave an introduction. Outside in the breeding plots crossing and selection in all generations was presented. There was enough time to discuss all the questions of the farmers.



**Fig. 16.** PPB training in Germany in 2021.

Material distributed: Questionnaires, presentations.

Description and results of the questionnaires: 4 questionnaires were filled out

1. Attitudes towards organic seed (OS) in your county. Rank the five-point scale for each statement (1 – strongly disagree; 2 – disagree; 3 – neutral; 4 – agree; 5 – strongly agree)

OS is easily available for varieties that I want to use	3.5
Price for OS is accessible	3.75
Availability of OS has improved in the last 5 years	3.75
The quality of OS that I use is high	4.25
I'm encouraged to use OS by my certifier	3.25
By using OS, I support the competitiveness of the organic sector	4.75

2. Ranking of different actions to boost the use of organic seed (OS) in your country. Rank the five-point scale for each statement (1 – most important; 2 – important; 3 – average importance; 4 – not important; 5 – least important)



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Improve availability of OS for locally adapted varieties	1.75
More efforts in breeding for organic farming	1.5
Using open pollinated varieties	2.25
More information on availability of OS in foreign markets	2.75
Stricter national rules for grading	3.25

3. Technical challenges in organic seed production. Rank the five-point scale for each statement (1 – most important; 2 – important; 3 – average importance; 4 – not important; 5 – least important)

Yield losses/volatility	2.75
Seed borne pests and diseases	1.25
Weed contamination	2.25
Finding organic seed multipliers	2.5
Seed storage and treatment	2.0
Germination rate and seed size	2.0
Hybrid propagation	4.25

4. Marketing issues with organic seed (OS). Rank the five-points scale for each statement (1 – strongly disagree; 2 – disagree; 3 – neutral; 4 – agree; 5 – strongly agree)

OS production is more costly than conventional seed production	4.75
OS is an important part of organic agriculture	5.0
The OS market might become profitable in the next 5 years	3.25
Demand for OS is more volatile than demand for conventional seed	2.5
Farmers are willing to pay the higher price for OS	4.0
Offering both organically & conventionally produced seed is logistically too costly	3.25

5. Policy measures to enhance organic seed (OS) production. Rank the five-point scale for each statement (1 – strongly disagree; 2 – disagree; 3 – neutral; 4 – agree; 5 – strongly agree)

More research on organic seed production economics	4.25
Phasing out derogations in the new organic's regulation	2.5
Stricter derogation rules in the next 5 years	2.5
More information on organic seed market demand	4.0
Expand the range of organically allowed seed treatments	2.5
Introduction of subsidies to support organic seed production	3.75
Increase training on organic seed production	3.75

6. Organic seeds availability. Rank the five-point scale for each crop (1 – enough in the market; 2 – occasionally available; 3 – not available; 4 – depending on the variety; 5 – I use home saved seeds). Multiple choices possible.

Wheat	1.0
Soybean	4.0
Potatoes	4.0
Buckwheat	-
Corn	1.0
Vegetables	-
Small grains	2.5
Grain legumes	2.5
Oilseeds	3.0
Fodder plants	2.0

7. What are important traits for an organic variety in your region? Rank the five-point scale for each statement (1 – most important; 2 – important; 3 – average importance; 4 – not important; 5 – least important)



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Yield	2.0
Yield stability	1.75
Weed suppression	1.75
Quality (e.g. baking quality)	1.75
Lodging	2.25
Maturity	2.5
Taste	2.25
Diseases resistance (please give examples): late blight, yellow rust	1.5

### IHAR (2021)

Location: Boguchwała (Poland)

Date: 23 July 2021

Number of trainers involved: Jarosław Plich (trainer/organiser), Beata Tatarowska (trainer/organiser), Michał Noworól (trainer/organiser), Paweł Bereś IOR-PIB (trainer)

Number of participants (trainees): 24 participants: 16 Farmers, 6 Extension service, 2 other

Activities done: breeding and growing of organic potato.



**Fig. 17.** PPB training in Poland in 2021.

#### Programme:

During the training four lectures were delivered. Lectures included: a) General information about ECOBREED project; b) Organic potato – focus on resistance breeding; c) Colorado potato beetle – raising issue in organic (and conventional) potato growing systems; d) Participatory potato breeding. During the training were presented demonstration fields with collection of ECOBREED potato cultivars.

Material distributed: ECOBREED Consent Form; Information sheet for Voluntary Participation in ECOBREED Training; Questionnaire “How to improve the supply of organic seeds”

Description and results of the questionnaires: Questionnaire results showed in OS production the most important are: yield losses/volatility, seed borne pests and diseases, weed contamination, finding organic seed multipliers, seed storage and treatment, germination rate and seed size and hybrid propagation. The questions regarding organic seeds demonstrate a



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strong interest in this material even if cost and quality are not adequate. Most of the answer consider important to improve the organic seeds availability and the breeding activities. They consider also important the seeds health and the final yield.

### UNITUS - 1 (2022)

Location: Montalto, Viterbo, Italy

Date: 28 May 2022

Number of trainers involved: Mario Pagnotta, Luca Bonfiglioli, Ieva Urbanaviciute

Number of participants (trainees): 4 Farmer, 1 Seed industry, 1 Extension service, 1 Research/Education

Activities done: Explained the ECOBREED activities and the material available. Participants evaluate the accessions.

Material distributed: Agreement for PERSONAL DATA MANAGER

The questionnaire was divided into three major parts: the first part where the farmers provided us with information about their farm; the second part where the farmers told us what they think are the most important traits for organic farming; the third part where the farmers directly evaluated every single accession in field.



**Fi.g 18.** PPB event in Viterbo in 2022.

### BOKU - 1 (2022)

Location: Starnwörth & Absdorf, Austria

Date: 7 June 2022

Number of trainers involved: Heinrich Grausgruber (BOKU): Introduction to ECOBREED and organic breeding methods and current activities; demonstration of field plots with homogeneous varieties and organic heterogeneous material (OHM). Carl Vollenweider: introduction into current regulations and strategies to create OHM. Alfred Grand: demonstration of field plots with OHM.





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Number of participants: 20 trainees divided into categories: 5 Farmer, 5 Seed industry, 1 Extension service, 1 Research/Education, 7 NGO, 1 Media; 19 from Austria and 1 from Germany

Activities done: Practical demonstrations and oral presentations directly on the fields; in-person practical demonstration of distinctive wheat characters and disease symptoms: scoring, description, data collection.

### Programme:

Morning: visit to farmer wheat fields with different varieties (incl. OHM) in Starnwörth; afternoon: demonstration plots (OHM wheat, rye landraces/populations) in Absdorf.

Material distributed: Folders with bullet points with respect to current regulations of OHM.



**Fig. 19.** PPB event in Austria in 2022.

## IFVC (2022)

Location: Rimski šančevi, Serbia

Date: 9 June 2022

Number of trainers involved: Vuk Đorđević (WP4 leader, soybean breeder, presentation of ECOBREED project and “Uključivanje organskih proizvođača u proces oplemenjivanja soje za organsku proizvodnju – Participatory Plan Breeding Principles”); Marjana Vasiljević (Participant in ECOBREED project, trial visit)

Number of participants (trainees): 5 farmers, 7 Research/Education

Activities done: Training included the visit of the soybean trial (Tasks 6.2 and 6.3), in total 8 soybean varieties were presented, as well as the soybean CCP. After the trial visit, training was continued indoors, where a presentation on “Participatory Plan Breeding Principles” was held, it included all important information on organic seed, which soybean traits are important. Before the presentation, the questionnaires were distributed to participants, and during the presentation, trainers tried to answer and explain all the important steps in the breeding process and what the role of farmers is.

### Programme:



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9:30 – 10:00 | Registration

10:00 – 10:30 | ECOBREED project Dr Vuk Đorđević, senior research associate, IFVC

10:30 – 11:30 | Trial Visit MSc Marjana Vasiljević, Junior Research Assistant – cultivation practices, IFVC

11:30 – 14:00 | Participatory Plant Breeding Principles Dr. Vuk Đorđević, senior research associate, soybean breeder

14:00 – 14:30 | Conclusions

Material distributed: Questionnaires.

Description and results of the questionnaires: Questionnaire results showed that the following traits such as yield, yield stability and quality were assessed as the most important (10 to 12 positive answers). Additionally, traits such as height of lowest pod, lodging and maturity were scored with up to 6 positive answers. According to the questionnaire, the main challenge in organic production is weed suppression (12 positive answers, 100%), but also 66% were positive for breeding soybeans – in the sense of stability for human consumption.



**Fig. 20.** Trial visit to Rimski šančevi in Serbia.



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### UNITUS - 2 (2022)

Location: Azienda Agricola Pastificio Fornovecchino, Viterbo, Italy

Date: 10 June 2022

Number of participants (trainees): 3 Farmer, 1 Seed industry, 1 other (Baker).

Activities done: Explained the breeding principles, the traits evaluated, and the evaluation sheets distributed.

Programme: Evaluation of field trial where 10 durum wheat accessions were sown.

Material distributed: Agreement for PERSONAL DATA MANAGER.

The questionnaire was divided into three major parts: the first part where the farmer provided us with information about his farm; the second part where the farmer told us which he thinks are the most important traits for organic farming; the third part where the farmers directly evaluate every single accession in field.



**Fig. 21.** PPB training in Viterbo in June 2022.





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### BOKU – 2 (2022)

#### XXII International Workshop on Bunt and Smut Diseases

Location: Tulln an der Donau, Austria

Date: 13-15 June 2022

Number of trainers involved: Hermann Bürstmayr & Magdalena Lunzer (BOKU): field phenotyping of common bunt and Fusarium head blight; resistance gene annotation to differential set. Anders Borgen & Dennis K. Christensen (Agologica): genetic mapping of common bunt resistance genes

Number of participants (30 trainees): 4 Seed industry, 2 Extension service, 24 Research/Education,



**Fig. 22.** PPB training in Tulln in 2022.

#### Programme:

##### Tuesday, 13 June 2023

9:00 Registration Desk Opens

10:00 Guided Tour of Plant Breeding Research at BOKU Campus Tulln

12:30 Opening of the Workshop

Session 1

13:00 Hole, D. David's Adventures in Tilletia-land: with apologies to Lewis Carroll.

13:50 Bengtsson, T. The stinking comeback – measures to understand the cause of the re-emergence of common bunt in Swedish winter wheat?

14:15 Krause, W. Genomic selection for dwarf bunt resistance in wheat.

14:40 Lunzer, M. Wheat (*Triticum aestivum*) chromosome 6D harbours a major QTL for common bunt resistance present in the Bt11 bunt differential.

15:05 Joshi, P. Assessment of Common Bunt and Dwarf Bunt Resistance in Bt-Differential Lines Grown in Diverse Environments

16:10 Borgen, A. Determination of virulence of European races of common bunt using a differential set of wheat cultivars.

16:20 Borgen, A. Co-evolution of virulence and resistance in heterogeneous wheat populations.

16:30 Borgen, A. Annotation of differential lines used for resistance trials for common bunt.

16:40 Borgen, A. Gene postulation based on phenotyping wheat varieties with a differential set of virulence races of common bunt (*Tilletia caries*).



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16:50 Borgen, A. Registered varieties and Organic Heterogeneous Material (OHM) with resistance to common bunt in Europe.

Wednesday, 14 June 2023

Session 2

9:00 Dhillon, G. S. Candidate gene analysis for the 7DS QTL associated with dwarf bunt resistance of winter wheat using targeted capture sequencing technology.

9:25 Dumalasová, V. Reaction of wheat genotypes to Czech common bunt and dwarf bunt samples.

9:50 Ciuca, M. A wheat-rye translocation 1AL.1RS involved in wheat resistance to bunt.

10:50 Lunzer, M. How long does it take to develop high performing and common bunt resistant winter wheat lines using organics-compliant methods?

11:15 Fischbach, M.E. Identification of novel seed treatments and adapted agronomic practices to control common bunt in organic wheat production.

11:40 Ren, Z. Microbiome Signature of Endophytes in Wheat Seed Response to Wheat Dwarf Bunt Caused by *Tilletia controversa* Kühn.

13:50 Recreation Tour Wachau Valley, Bus departure in front of the University building.

Thursday, 15 June 2023

9:00 Poster Session

Christensen, D. K. Genetic Mapping of Common Bunt Resistance Gene Bt1.

Christensen, D. K. Genetic Mapping of Common Bunt Resistance Gene Bt7.

Christensen, D. K. Genetic Mapping of Common Bunt Resistance Gene Bt9.

Christensen, D. K. Genetic Mapping of Common Bunt Resistance Gene Bt10.

Christensen, D. K. Preliminary Genetic Mapping of Common Bunt Resistance Gene Bt13.

Christensen, D. K. Genetic Mapping of Common Bunt Resistance Gene BtZ.

Lunzer, M. Genome-wide association mapping identifies common bunt resistance loci in a wheat diversity panel.

Rabl, J. Variation in aggressiveness and virulence among eight common bunt sources collected in Austria.

Steiner, B. Association genetics of common bunt resistance in *Aegilops tauschii* – preliminary results.

Plüme, S. Loose smut resistant spring barley breeding for organic farming.

Dumalasová, V. HealthyMinorCereals spelt diversity panel reaction to rusts, powdery mildew, leaf blotch and common bunt.

10:30 Breeders' Workshop:

all participants Round table discussion on co-ordinated research ideas and efforts to control bunt and smut diseases.

14:30 Field Visit at BOKU Campus Tulln: Research on resistance to Fusarium head blight and common bunt of wheat.

Material distributed: Book of abstracts

([https://boku.ac.at/fileadmin/data/H03000/H97000/H97100/pdf/Book\\_of\\_Abstracts\\_Bunt\\_and\\_Smut\\_Workshop\\_2023.pdf](https://boku.ac.at/fileadmin/data/H03000/H97000/H97100/pdf/Book_of_Abstracts_Bunt_and_Smut_Workshop_2023.pdf)); Slides of presentations (see link above for programme)



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### NPPC – 1 (2022)

Location: SEMA HŠ s.r.o. in Sládkovičovo Nový dvor, Slovakia

Date: 15 June 2022

Number of trainers involved: 6 trainers: Pavol Hauptvogel, Gabriela Šeböková, Soňa Gavurníková, Miroslava Fusková, Dominika Mikušová, Michaela Tholtová

Number of participants (trainees): There were 32 participants from 2 countries (Slovakia and Poland) and of these, 15 were researchers, 10 farmers, 4 advisors, 2 national authorities and 1 policy maker.

Activities done: During the training event, field experiments and practices in organic plant breeding were presented to the participants. Using examples with winter wheat, the trainers demonstrated why we need plant breeding for organic agriculture. Representatives of national authorities explained legislative changes in organic crop production. The NPPC researcher presented the quality results of wheat varieties in organic production.



**Fig. 23.** PPB training in Slovakia in 2022.

#### Programme:

09:15-10:30 Visit and demonstration of the organic winter wheat trials: Pavol Hauptvogel, Gabriela Šeböková, Soňa Gavurníková, Miroslava Fusková

10:30-11:00 Transfer to the farmyard to SEMA HŠ s.r.o. v Sládkovičove Nový dvor

11:00-11:30 Presentation of the project ECOBREED. Why do we need organic plant breeding?: Pavol Hauptvogel, Miroslava Fusková

11:30-12:00 Legislative changes in organic plant production: Dominika Mikušová and Michaela Tholtová

12:00-12:30 Quality of wheat varieties in organic production: Soňa Gavurníková

12:30-13:00 Lunch break

13:00-14:00 Final discussion about organic plant breeding and seed multiplication: Pavol Hauptvogel, Gabriela Šeböková, Soňa Gavurníková and Miroslava Fusková

Material distributed: Questionnaire; PDF of some lectures; Information consent; Information sheet

Description and results of the questionnaires: This training aimed to facilitate the exchange of experiences and discussion on joint management in ecological systems in Slovakia and Poland.



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The results of the respondents showed that the workshop was very useful and informative with a very good organisation. The topics were presented in a way that made it easy to understand with detailed practical examples.

The questionnaire was answered and returned by 15 participants. Questions about organic seeds show great interest even though the price and quality are higher. Respondents consider it important to improve the availability of organic seeds and breeding activities. All scores were highly positive as shown in the following text and graph.

- The workshop was useful and informative: 4.87
- The workshop was well-organised: 5.00
- The subject was presented in a way that made it easy to understand: 4.93
- The practical demonstrations were detailed and understandable: 5.00
- I would like the workshop to be more detailed: 4.60
- I would like the workshop to be less detailed: 2.00
- The topics of the workshop were appropriate for my field of interest: 4.87
- Are there any comments or suggestions you would like to comment about the workshop that would make it better? -
- What part of the workshop did you enjoy the most? Presentation a practical part
- What part of the workshop did you enjoy the least? -



**Fig. 24.** Scores of the questionnaire from NPPC event in June 2022.



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### NPPC - 2 (2022)

Location: Horné Mýto, Istropol Solary, Slovakia

Date: 21 June 2022

Number of trainers involved: 7 trainers: Gyula Zalabai, Tibor Csémy, Pavol Hauptvogel, Miroslava Fusková. Soňa Gavurníková, Dominika Mikušová, Michaela Tholtová

Number of participants (trainees): There were 13 participants from Slovakia and of these, 7 were researchers, 2 breeders, 1 farmer and 3 national authorities.

Activities done: The training event was focused on organic plant breeding. Participants were presented with field experiments and procedures in ecological plant breeding. On the examples of winter wheat, trainers and breeders of Istropol Solary a.s. explained the necessity of plant breeding for organic farming. Representatives of national authorities explained legislative changes in organic crop production.

Programme:

09: 30 -10:30 Organic plant breeding of wheat at Istropol Solary a.s.: Gyula Zalabai, Tibor Csémy, Pavol Hauptvogel

10:30-11:00 Presentation of the project ECOBREED - Do we need organic plant breeding?: Pavol Hauptvogel, Miroslava Fusková.

11:00-11:30 Quality of wheat varieties in organic production: Soňa Gavurníková

11:30-12:00 Legislative changes in organic plant production: Dominika Mikušová and Michaela Tholtová

12:00-12:30 Final discussion about organic plant breeding: Gyula Zalabai, Tibor Csémy, Pavol Hauptvogel, Soňa Gavurníková, Miroslava Fusková

Material distributed: Information consent; Information sheet; Questionnaire; Pdf of some lectures

Description and results of the questionnaires: Participants of the training event visited the breeding nurseries of winter wheat and durum wheat. The questionnaires were answered and returned by 6 participants. The results of the respondents showed that the workshop was very useful and informative with a very good organization. The topics were presented in a way that made it easy to understand with detailed practical examples. All scores were highly positive as shown in the following text and graph.

- The workshop was useful and informative: 5.00
- The workshop was well-organised: 5.00
- The subject was presented in a way that made it easy to understand: 5.00
- The practical demonstrations were detailed and understandable: 5.00
- I would like the workshop to be more detailed: 3.00
- I would like the workshop to be less detailed: 3.00
- The topics of the workshop were appropriate for my field of interest: 5.00
- Are there any comments or suggestions you would like to comment about the workshop that would make it better? -
- What part of the workshop did you enjoy the most? Field experiments and practical part
- What part of the workshop did you enjoy the least? -





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**Fig. 25.** Scores of the questionnaire from NPPC event in June 2022.



**Fig. 26.** PPB training in Slovakia in 2022.

### KIS - 1 (2022)

Location: KIS IC Jablje, Mengeško polje

Date: 24 June 2022

Number of trainers involved: Peter Dolničar, potato breeder & researcher

Number of participants (trainees): 4 farmers, which are interested in cooperation in organic potato breeding program.

Activities done: Evaluation of foliage of 223 advanced potato clones

Programme:

The event took place in the field trial of organic potato breeding and selection of the Agricultural Institute of Slovenia in IC Jablje (Mengeš, Slovenia), where 223 advanced potato clones from breeding years 2011 to 2018 were grown for selection under organic conditions.

In the morning, the questionnaire was provided to the farmers. After filling the questionnaire, the instructions and basic training on evaluation of foliage of potato clones were provided to the farmers.



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In the afternoon the farmers evaluated the foliage of all 223 advanced potato clones, directly every single clone in the field using farmer eyes and their experiences.



**Fig. 27.** Observation of foliage of potato clones from organic breeding program by farmers at KIS in IC Jablje.

### Material distributed:

A questionnaire was provided to each farmer. The questionnaire was divided into three parts: the first part where the farmer provided us with information about his farm; a second part where the farmer told the organizers what they think are the most important traits for organic potato cultivation a third part where the farmer got the information about the evaluation of the potato breeding clones in the field.

### **NPPC - 3 (2022)**

Location: Biomila, spol. s r.o., Rudník, Slovakia

Date: 29 June 2022

Number of trainers involved: 8 trainers: Ing. Dušan Janoviček, Pavol Hauptvogel, Miroslava Fusková, Soňa Gavurníková, Jana Hendrichová, Dominika Mikušová, Michaela Tholtová, Katarína Hanzelyová

Number of participants (trainees): 22 participants from Slovakia and of these, 4 were researchers, 9 farmers, 3 research assistants, 2 students, 3 national authorities and 1 media (Naše pole).

Activities done: Lectures about organic management oriented to the project ECOBREED, evaluation of the quality of winter wheat varieties. Also were interested in information about legislative changes in organic plant production and registration of new cultivated plant varieties. Our partner from Biomila spol. s r.o. presented a demonstration of farmer participatory trials.

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### Programme:

09:30-10:30 Visit and demonstration of farmer participatory trials: Ing. D. Janoviček

10:30-11:00 Presentation of the project ECOBREED: P. Hauptvogel, M. Fusková

11:00-11:30 Evaluation of the quality of winter wheat varieties in the Ecobreed project: S. Gavurníková, J. Hendrichová

11:30-12:00 Legislative changes in organic plant production: D. Mikušová, M. Tholtová

12:00-12:30 Registration of new cultivated plant varieties: K. Hanzelyová

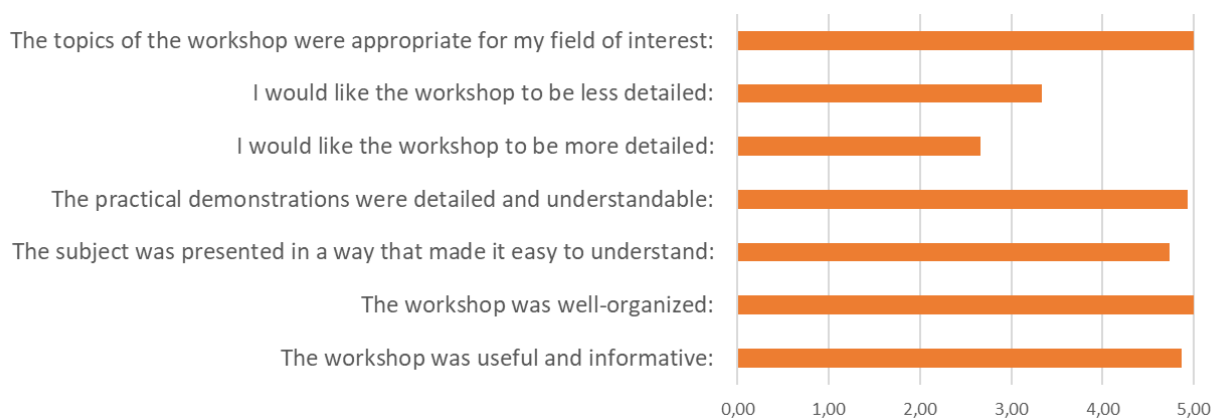
12:30-13:00 Discussion

Material distributed: Information consent; Information sheet; Questionnaire; PDF of some lectures

Description and results of the questionnaires: The questionnaires were answered and returned by 15 participants. The results of the respondents showed that the training was very useful and informative with a very good organisation. The topics were presented in a way that made it easy to understand with detailed practical examples. The results of the respondents showed that the training was very useful and informative with a very good organization of NPPC and Biomila spol. s r.o.

All scores were highly positive as shown in the following text and graph.

- The workshop was useful and informative: 4.87
- The workshop was well-organised: 5.00
- The subject was presented in a way that made it easy to understand: 4.73
- The practical demonstrations were detailed and understandable: 4.93
- I would like the workshop to be more detailed: 2.67
- I would like the workshop to be less detailed: 3.33
- The topics of the workshop were appropriate for my field of interest: 5.00
- Are there any comments or suggestions you would like to comment about the workshop that would make it better? Shorter lectures
- What part of the workshop did you enjoy the most? OE field trials and tasting of organic products.
- What part of the workshop did you enjoy the least? -



**Fig. 28.** Scores of the questionnaire from NPPC event in June 2022.





**Fig. 29.** PPB training in Slovakia in 2022.

### **NPPC – 4 (2022)**

Location: Research breeding station at Víglaš Pstruša, Slovakia

Date: 30 June 2022

Number of trainers involved: 8 trainers: Peter Hozlár, Pavol Hauptvogel, Miroslava Fusková, Dominika Mikušová, Michaela Tholtová, Katarína Hanzelyová, Soňa Gavurníková, Jana Hendrichová

Number of participants (trainees): There were 27 participants from Slovakia and of these, 4 were researchers, 6 farmers, 1 research assistants, 1 teaching, 5 breeders, 1 extension service, 3 seed multiplier, 4 national authorities and 2 media (TV).

Activities done: The activity "field day and participatory plant breeding training and the organic management" was organized to spread information about organic agriculture. Official national authorities presented new legislative changes and possibilities registration of new varieties. Breeder Peter Hozlár and his team presented a nursery of new varieties and in a practical demonstration. He explained and showed the methods of selecting varieties for crossing and the procedures for selecting offspring for finalizing a new variety. Soňa Gavurníková and Jana Hendrichová presented results of the evaluation of the quality of winter wheat varieties. Pavol Hauptvogel and Miroslava Fusková presented the achieved progress of the ECOBREED project.





**Fig. 30.** Trial visit in Slovakia in June 2022.

### Programme:

09:30-10:30 Visit of demonstration fields with the collection of Ecobreed and NPPC

wheat cultivars: Peter Hozlár, Pavol Hauptvogel

10:30-11:00 Transfer to the Masarykov dvor

11:00-11:20 Presentation of the project ECOBREED: Pavol Hauptvogel, Miroslava Fusková

11:20-11:40 Legislative changes in organic plant production: Dominika Mikušová, Michaela Tholtová

11:40-12:00 Registration of new cultivated plant varieties: Katarína Hanzelyová

12:00-12:20 Wheat breeding for organic farming: Peter Hozlár

12:20-12:40 Evaluation of the quality of winter wheat varieties in the Ecobreed

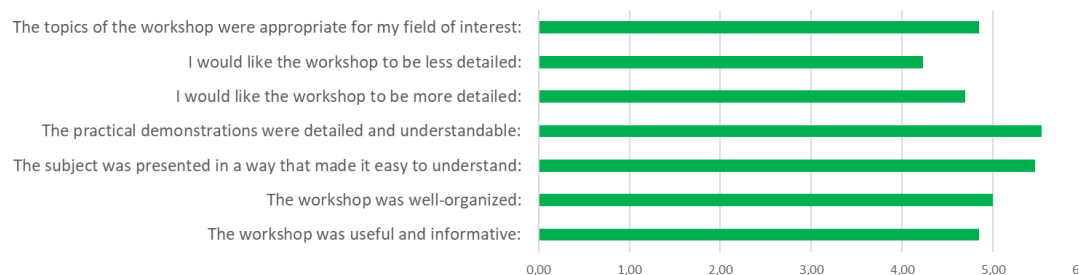
project: Soňa Gavurníková, Jana Hendrichová

12:40-13:00 Discussion

Material distributed: Questionnaire; PDF of some lectures; Information consent sheet

Description and results of the questionnaires: This training aimed to offer the experiences and discussion on management in organic systems. The results of the respondents showed that the workshop was very useful and informative with a very good organisation. The topics were presented in a way that made it easy to understand with detailed practical examples. The questionnaire was answered and returned by 27 participants. Questionnaires included 10 questions for 7 were required to give a score from 1 to 5 (5 being “strongly agree” and 1 being “strongly disagree”), while three were for open comments. The event was successful both in terms of participation and in terms of feedback. The workshop was useful and informative for most participants as well as the workshop was well-organized. For the comments, most of them would require an event in presence and would be very happy to follow future events. The answers received from the questions “I would like the workshop to be more detailed” and “I would like the workshop to be less detailed” we can conclude that the training was overall well equilibrated.

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**Fig. 31.** Scores of the questionnaire from NPPC event in June 2022.

All the scores were positive as indicated in the following text and graph.

- The workshop was useful and informative: 4.85
- The workshop was well-organised: 5.00
- The subject was presented in a way that made it easy to understand: 5.46
- The practical demonstrations were detailed and understandable: 5.54
- I would like the workshop to be more detailed: 4.69
- I would like the workshop to be less detailed: 4.23
- The topics of the workshop were appropriate for my field of interest: 4.85
- Are there any comments or suggestions you would like to comment about the workshop that would make it better? Expand lectures on EO
- What part of the workshop did you enjoy the most? OE field trials and breeding process
- What part of the workshop did you enjoy the least? -

Comments: a nationwide public television made a report about it.

<https://www.rtv.s.sk/televizia/archiv/13982/338286#2230>

### CRI and PRO-BIO – 1 (2022)

Location: Okrouhlice u Benešova, Czech Republic

Date: 29 August 2022

Number of trainers involved: Petra Hlásná Čepková (CRI) – leading trainer and Adam Brezáni (PRO-BIO) - trainer

Number of participants (trainees): 5 farmers and one seed industry trainee, all of them from CZ

Activities done: The main topic was the presentation of the ECOBREED project, its activities and how it would contribute to buckwheat breeding in Europe. This included a presentation of selected buckwheat varieties and their characteristics and differences. It was also presented and shown how to evaluate the varieties according to the descriptor agreed in the ECOBREED project. Results of FPTs were presented. Further, exploring the profitable buckwheat management and market advancement for organic common buckwheat production was presented.

#### Programme

10:00 - Petra Hlásná (CRI) and Adam Brezáni (PRO-BIO):



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- Objectives of the ECOBREED research project
- Opportunities for profitable production of common buckwheat and development of the organic buckwheat market
- Principles of farm participatory trials and evaluation of variety trials from 2021
- Evaluation of 12 promising varieties of common buckwheat and Tartary buckwheat from all over Europe

Material distributed: Leaflets with basic information about the ECOBREED project were prepared for the participants. Another document was a leaflet with descriptions of the different buckwheat varieties that were presented at the event. Also, the agreement for personal data manager was distributed.



**Fig. 32.** PPB training in the Czech Republic in 2022.

### CRI and PRO-BIO – 2 (2022)

Location: Soběkury, Czech Republic

Date: 30 August 2022

Number of trainers involved: Petra Hlásná Čepková (CRI) – leading trainer and Adam Brezáni (PRO-BIO) - trainer

Number of participants (trainees): 16 farmers and 1 seed industry

Activities done: The main topic was the presentation of the ECOBREED project, its activities and how it would contribute to buckwheat breeding in Europe. This included a presentation of selected buckwheat varieties and their characteristics and differences. It was also presented and shown how to evaluate the varieties according to the descriptor agreed in the ECOBREED project. Results of FPTs were presented. Further, exploring the profitable buckwheat management and market advancement for organic common buckwheat production was presented.

Programme:

10:00 - Petra Hlásná (CRI) and Adam Brezáni (PRO-BIO):

- Objectives of the ECOBREED research project



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- Opportunities for profitable production of common buckwheat and development of the organic buckwheat market
- Principles of farm participatory trials and evaluation of variety trials from 2021
- Evaluation of 12 promising varieties of common buckwheat and Tartary buckwheat from all over Europe

Material distributed: Leaflets with basic information about the ECOBREED project were prepared for the participants. Another document was a leaflet with descriptions of the different buckwheat varieties that were presented at the event. Also, the agreement for personal data manager was distributed.



**Fig. 33.** PPB training in the Czech Republic in 2022.

### IFVC (2022)

Location: Rimski šančevi, Serbia

Date: 2 September 2022

Number of trainers involved: Vuk Đorđević (WP4 leader, soybean breeder, “Uključivanje organskih proizvođača u proces oplemenjivanja soje za organsku proizvodnju – Participatory Plan Breeding Principles); Predrag Ranđelović (Participant in ECOBREED project, presentation of ECOBREED project)

Number of participants (trainees): 8 farmers, 1 Research/Education, 1 other (company)

Activities done: The training was held indoors, where a presentation on “Participatory Plant Breeding Principles” was presented, as well as the presentation on the main activities and expected results of the ECOBREED project. Training included all important information on organic seed, which soybean traits are important, and how to do the scoring at fields. Before the presentation, the Questionnaires were distributed to participants, and during the presentation trainers tried to answer and explain all the important steps in the breeding process and what the role of farmers is.

Programme:

13:00 – 13:30 | Registration



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13:30 – 13:45 | ECOBREED project MSc Predrag Ranđelović, research assistant, IFVC

13:45 – 14:45 | Plant Breeding principles Dr. Vuk Đorđević, Principal Research Fellow, soybean breeder, IFVC

14:45 – 15:00 | Conclusions

Material distributed: questionnaires

Description and results of the questionnaires: questionnaire results showed that following traits such as yield, yield stability and quality were assessed as the most important (8 to 10 positive answers). Additionally, traits such as height of lowest pod, lodging and maturity were scored with up to 8 positive answers. Through the questionnaire, main challenge in organic production is weed suppression (10 positive answers, 100%), but two out of 10 were not sure about the challenges on vegetative growth and canopy formation and suitability for human consumption.



**Fig. 34.** PPB training in Serbia in 2022.

### IHAR (2022)

Location: Połomia, Poland

Date: 29 September 2022

Number of trainers involved: Jarosław Plich (trainer/organiser), Beata Tatarowska (trainer/organiser), Michał Noworól (trainer/organiser)

Number of participants (trainees): 16 participants from Poland: 13 Farmers, 1 Extension service, 2 other



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**Fig. 35.** PPB training in Poland in 2022.

### Programme:

- 13:00 Welcoming the participants.
- 13:10 Organic potato – focus on resistance breeding.
- 13:30 Visit to ecological field with cultivars and breeding lines of ECOBREED project.
- 13:45 Demonstration parts – harvesting of cultivars and breeding lines from ECOBREED project.
- 14:15 Coffee break
- 14:30 Practical parts – characteristic cultivars destined to organic farming.
- 15:30 Discussion
- 16:00 Closure of the training

Material distributed: ECOBREED Consent Form; Information sheet for Voluntary Participation in ECOBREED Training; Questionnaire “How to improve the supply of organic seeds”; The scheme of potato breeding

Description and results of the questionnaires: The questions regarding the Organic seeds demonstrate a strong interest in this material. The answers indicate that the price of OS is too high. Most of the answers consider it important to improve the organic seeds' availability and breeding activities. They consider also important the seeds health and the final yield.

### **KIS - 2 (2022)**

Location: KIS IC Jablje, Mengeško polje, Slovenia

Date: 12 October 2022

Number of trainers involved: Peter Dolničar, potato breeder and researcher

Number of participants (trainees): 4 farmers, which are interested in co-operation in organic potato breeding programme

Activities done: Evaluation of yield and potato tubers of 223 advanced potato clones





**Fig. 36.** Observation of foliage of potato clones from organic breeding program at KIS in IC Jablje.

### Programme:

The event took place in the field trial of organic potato breeding and selection of the Agricultural Institute of Slovenia in IC Jablje (Mengeš, Slovenia), where 223 advanced potato clones from breeding years 2011 to 2018 were grown for selection under organic conditions. The questionnaire was provided to the farmers. After filling out the questionnaire, the instructions and basic training on the evaluation of potato tubers were provided to the farmers. In the afternoon the farmers evaluated the tuber yield, the appearance, and the health status of tubers of all 223 advanced potato clones, directly every single clone in the field using farmer eyes and preferences.

Material distributed: A questionnaire was provided to each farmer. The questionnaire was divided into three parts: the first part where the farmer provided us with information about their farm; the second part where the farmer told the organisers what they think are the most important traits for organic potato cultivation a third part where the farmer got the information about the evaluation of the potato breeding clones in the field.

### **NATUR (2023)**

Location: Hohenbercha, Germany

Date: 10 February 2023

Number of trainers involved: Naturland e.V. in cooperation with Bavarian State Research Institute and Secobra seeds. Trainers: Werner Vogt-Kaute (NATUR), Markus Herz (LfL), barley researcher and breeder, Lucia Holmer (LfL), rye researcher, Barbara Eder (LfL), maize and population researcher, Christine Riedel (LfL), soya researcher and breeder, Nadine Bauer (Secobra), wheat breeder

Number of participants (trainees): The event was attended by 5 farmers, one seed trader, 2 breeders, 5 researchers.

Activities done: The event took place in-person.



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### Programme:

Introduction about ECOBREED  
 Spring barley  
 Winter rye  
 Maize and breeding of populations  
 soya  
 winter wheat

Material distributed: Questionnaires, presentations

### Description and results of the questionnaires:

1. Attitudes towards organic seed (OS) in your county. Rank the five-point scale for each statement (1 – strongly disagree; 2 – disagree; 3 – neutral; 4 – agree; 5 – strongly agree)

OS is easily available for varieties that I want to use	4.0
Price for OS is accessible	4.5
Availability of OS has improved in the last 5 years	4.75
The quality of OS that I use is high	4.5
I'm encouraged to use OS by my certifier	4.5

2. Organic seeds availability. Rank the five-point scale for each crop (1 – enough in the market; 2 – occasionally available; 3 – not available; 4 – depending on the variety; 5 – I use home saved seeds). Multiple Choice possible.

Wheat	1.0
Soybean	1.75
Potatoes	2.0
Buckwheat	2.0
Corn	1.0
Vegetables	3.0
Small grains	2.75
Grain legumes	2.75
Oilseeds	2.5
Fodder plants	2.5
Cover crop mixes	2.0

3. What are important traits for an organic variety on your farm/region? Rank the five-point scale for each statement (1 – most important; 2 – important; 3 – average importance; 4 – not important; 5 – least important)

Yield	1.75
Yield stability	1.5
Weed suppression	1.25
Quality (e.g. baking quality)	1.5
Lodging	2.25
Maturity	2.75
Taste	3.25
Diseases resistance (if possible, please give examples): mildew, fusarium, rust, common bunt, loose smut	1





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4. Rank the five-point scale for your willingness to grow composite cross populations (CCP) on your farm (1 – strongly disagree; 2 – disagree; 3 – neutral; 4 – agree; 5 – strongly agree)

CCP (write down the crop you are interested in):	
Cereals _____	4.0
Corn _____	4.0
Oil seeds _____	2.0



**Fig. 37.** PPB training in Germany in 2023.

### MATE - 1 (2023)

Location: Breeding garden of the MATE Potato Research Centre, Keszthely, Hungary

Date: 29 June 2023

Number of trainers involved: 1 trainer/organiser

Number of participants (trainees): 7 participants from Hungary; 6 farmers, 1 research/education



**Fig. 38.** PPB training in Hungary in 2023.



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### Programme:

16:45 – 18:00 Presentation of main breeding goals and quality traits necessary for the production of potato varieties suitable for organic farming.

18:00 – 18:20 Discussion of breeding goals and activities; answering the questions of farmers.

18:20 – 19:00 Presentation of the breeding garden and the new breeding lines at MATE.

Material distributed: ECOBREED Consent Form; ECOBREED Information Sheet; potato breeding scheme.

### UNEW (2023)

Location: Thornton Farm, Berwick upon Tweed, UK

Date: 11 July 2023



**Fig. 39.** PPB training in the UK in 2023.

Number of trainers involved: Paul Bilsborrow (UNEW) – aim of FPT together with management and data recording, results from the previous 2 growing seasons, covering disease levels, grain yield and quality. Anna Pearce (SMA) – organic seed production and management. Werner Vogt-Kaute (Naturland) – organic regulations and OHM

Number of participants (trainees): 16 participants (i.e. 12 Farmers, 2 Researchers, 2 Arable advisors/traders) all UK based.

### Programme:

- Walk around the Wheat and Buckwheat FPT at Thornton Farm whereby Anna Pearce (SMA)
- Introduction to Thornton Farm LC Smales & Son Ltd, organic seed business
- Introduction to the ECOBREED H2020 project
- Paul Bilsborrow (UNEW) gave an insight into data recording and monitoring of wheat FPT trials at the 5 sites in 2023, data recording together with some of the FPT results from the previous 2 years in the UK;



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- Werner Vogt-Kaute (NATUR) gave an insight into the new regulations regarding OHM and the potential use and value of CCP's to farmers
- Visit the winter wheat and buckwheat ECOBREED field trials
- Visit the spring bean & spring oat LIVESEEDING trials
- A look at compaction & soil management
- Establishment, Management and Recording in Farmer Participatory trials

Material distributed: Summary sheet of 2022 wheat FPT results.

### MATE - 2 (2023)

Location: Breeding garden of the MATE Potato Research Centre, Keszthely, Hungary

Date: 19 October 2023

Number of trainers involved: 1 trainer/ organiser and 1 trainer

Number of participants (trainees): 10 participants from Hungary, 5 farmers, 2 research/education, 3 other.

Programme:

10:15 - 10:40 Evaluation criteria of potato breeding lines.

10:40 - 11:00 Tuber diseases and physiological changes, their effects on the yield.

11:00 - 12:00 Field demonstration of yield evaluation on new potato breeding lines.

Material distributed: ECOBREED Consent Form; ECOBREED Information Sheet; potato breeding scheme



**Fig. 40.** PPB training in Hungary in October 2023.





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### BOKU (2023)

Location: HLBLA St. Florian, Austria

Date: 14 November 2023

Number of trainers involved: 4 (2 of ECOBREED); Martin Ziegler (EZG Biogetreide) – Consequences of common bunt in wheat for grain marketing; Heinrich Grausgruber (BOKU) – Symptoms, distribution of pathogenic isolates and disease cycle of common bunt; Magdalena Lunzer (BOKU) – Genetics and resistance breeding; Martin Fischl (LK NÖ) – Control and mitigation strategies

Number of participants: 30 trainees divided into categories: 18 Farmer, 4 Seed industry, 4 Extension service, 2 Research/Education, 2 Processor. All from Austria.

Programme:

Lectures and practical exercises (checking wheat harvest samples by visual scoring and olfactory sensing)

Material distributed: Slides of presentations (digital via download) and wheat samples

Description and results of the questionnaires: No questionnaires were distributed – very specific topic; very vivid discussion on possible mitigation strategies as the problem appeared to be severe in 2022 and 2023; fear of farmers that wheat cultivation in some regions might be impossible in a few years due to extremely high contamination of soils with common bunt spores.



**Fig. 41.** PPB training in Austria in 2023.





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### UNEW (2023)

Location: Marshall Meadows Hotel, Berwick on Tweed, UK

Date: 14 December 2023

Number of trainers involved: Paul Bilsborrow (UNEW); Tom Fairfax (External)

Number of participants: 9 (5 farmers, 1 Agronomist, 3 Researchers)

Programme:

Management and recording of wheat FPT trials

Data collection

Results ( disease, grain yield and grain quality) from the 3 years of wheat FPT in the UK focusing on:

Performace of varieties and CCPs

Use of seed dressings/biostimulants

Varietal mixtures

In addition, Tom Fairfax from Mindrum Mill, near Wooler (Northumberland) gave a presentation on soil health with a particular focus on amendments to improve soil health linked to fungal:bacterial ratio.



**Fig. 42.** PPB training in the UK in 2023.

