



ecobreed
IMPROVING CROPS



Funded by European Union
Horizon 2020
Grant agreement No 771367

D 9.6 5th Annual meeting minutes



Antoaneta G. Kuhar,
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Lea Mlekuš,
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Ecobreed_5_annual meeting_May 2023

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DOCUMENT ID	Ecobreed_5_annual meeting_May 2023 Vienna_minutes

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

AGENDA

ECOBREED 5th Annual Meeting

University of Natural Resources and Life Sciences (BOKU) / Universität für
Bodenkultur Wien

Gregor-Mendel-Straße 33, 1180 Vienna, Austria

Hall / Festsaal & H31

31 May – 1 June 2023

Wednesday, 31 May | 08:30 - 18:00

08:30 – 09:00	Registration	
09:00 – 09:15	Welcome and introduction	Vladimir Meglič, project coordinator
09:15 – 09:45	Overall progress report	Vladimir Meglič, project coordinator Antoaneta G. Kuhar, project manager
09:45 – 10:30	WP6 session	Werner Vogt-Kaute, WP6 leader
10:30 – 11:15	WP7 session	Mario Pagnotta, WP7 leader
11:15 – 11:45	Coffee break	
11:45 – 13:00	WP8 and WP1 sessions	Antoaneta G. Kuhar, WP8 leader Vladimir Meglič, Task 1.3 leader
13:00 – 14:30	Lunch	
14:30 – 16:00	Parallel sessions WP2 and WP3	Heinrich Grausgruber, WP2 leader Peter Dolničar, WP3 leader
16:00 – 16:30	Coffee break	
16:30 – 18:00	Parallel sessions WP4 and WP5	Vuk Đorđević, WP4 leader Dagmar Janovská, WP5 leader
14:30 – 18:00	Individual consultations between KIS and partners on admin and financial issues (10' each, by appointment and coordinators' request)	Antoaneta G. Kuhar, project manager Matej Zlatnar, finances
19:00	Joint dinner	

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

Thursday, 1 June | 09:00 - 13:00

09:00 - 09:30	WP 2 report and wrap-up	Heinrich Grausgruber, WP2 leader
09:30 - 10:00	WP 3 report and wrap-up	Peter Dolničar, WP3 leader
10:00 - 10:30	WP 4 report and wrap-up	Vuk Đorđević, WP4 leader
10:30 - 11:00	WP 5 report and wrap-up	Dagmar Janovská, WP5 leader
11:00 - 11:30	Coffee break	
11:30 - 12:30	Scientific Advisory Group	SAG members
12:30 - 13:00	Conclusions of the meeting	Vladimir Meglič, project coordinator

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Vienna_minutes

Partners present in person: *see attached list of participants*

Partners not present: Primož Titan (RGA)

Guest present in person: Ferdinando Branca (UNICT)

5th Annual Meeting – 1st day

The meeting started 31 May at 9:15.

Welcome and introduction

Vladimir Meglič (KIS, project coordinator) welcomed all partners to the 5th annual meeting and thanked the organisers at BOKU and Saatgut Austria for organising the event and hosting the meeting.

Heinrich Grausgruber (BOKU, WP2 leader) welcomed everybody to BOKU and shared some information about the historic building and room where the meeting is held (the names of professors written on the ceiling, e.g. Prof. Haberlandt who was the first professor to work on soybean in Europe). He also explained all the logistics around the two-day meeting.

Vladimir Meglič (project coordinator, KIS) then had an introduction to the project achievements in the last reporting period and in the last year and about the progress made. The project is now in its 6th year and although there were some delays due to Covid, the work nevertheless is running smoothly. The project coordinator stressed the following:

- Development of material in the project that can be used in breeding programmes
- Increased knowledge of relevant traits important for organic production (through PPBs, extensive phenotyping of species core collections)
- MAS widely used in all ECOBREED materials and a lot of data available for future breeding programmes
- 5-15% higher yields under organic conditions identified compared to currently used varieties and/or available organic varieties
- Food industry – high grain protein content in the wheat material developed under ECOBREED
- Farming participatory breeding systems (PPB, CCP): many field days and demonstration event already performed; 62 farmers in 12 countries helping with trials and spreading information about organic farming.

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

ECOBREED provides an increased availability and quality of seeds and varieties suited to the specific conditions of organic and low-input farming. It will screen and provide germplasm for use in breeding programmes for the improvement of the 4 target crop species. Through the project we are providing extensive training, demonstration, dissemination, exploitation and communication activities to facilitate rapid technology transfer and introduction of innovations from the project into commercial practice.

The coordinator thanked everyone for their fantastic and successful work in the project and is looking forward to a great annual meeting.

Overall progress report

Antoaneta G. Kuhar (KIS, project manager, WP9 leader) presented the work plan for the next 6 months with all the deliverables and milestone still ahead. She stressed the importance of ECOBREED results finding their way to the market.

The project manager then reported about the activities in the past year: about the accepted amendment in 2022, the written and accepted Periodic Report 3 and the EB meetings organised in 2022 and 2023. She also reminded all partners that the minutes of the meetings are available in the ECOBREED intra-net webpage.

She then presented the financial condition of the project and funds still available. She also announced the individual consultation about the financial situation for all partners in the afternoon session of the meeting.

She announced that the internal financial reporting date (covering the period from 1. 10. 2022 to 30. 9. 2023) is due on 15 October 2023.

She then announced the last annual and final meeting of the project which will be organised in the middle of January 2024 (with fixed dates announced later in summer) in Ljubljana. The meeting will consist of the regular EB meeting, the General Assembly meeting and a 3-day conference. She reminded partners that at least one person from each partner must be present at the General Assembly meeting and that all still have funds available for that purpose. The ECOBREED conference will have 5 to 6 sessions with invited plenary speakers and a chance to present ECOBREED results.

She finished her presentation reminding everyone to respect deadlines, communicate any changes in time, and to keep all information about their institutions accurate in the EC Funding and Tender Portal.

WP6 session

Werner Vogt-Kaute (NATUR, WP6 leader) reported about the activities in WP6.

Task 6.1 Establishment and management of data-recording system

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

Results:

- The data management system at Newcastle University could not be established because of the cyber-attack.
- Data collection was done on excel sheets.
- ECOBREED farms 2021-2022 on ECOBREED published in Zenodo
- Milestone 23 reached (FTP data management system – published bulletin)

Ongoing work:

- FPT 2022 bulletin in preparation although one contribution from Slovakia is still missing (this will be communicated with the partner at this meeting – BIOMILA and NPPC must discuss within themselves who will write the information to the publication) but the bulletin should be published in the summer
- UK – UNEW must send grain quality wheat analyses. Paul Bilsborrow (UNEW) assured the WP6 leader that the analyses will be sent soon.

Task 6.2 Farmer Participatory Field Trials

Results: 61 farmers in 2022, 69 trials, 800 plots

Ongoing work:

- One potato trial in Hungary could not be carried out in 2022 and will be repeated in 2023.
- Several additional trials in 2023 (usually linked with Task 6.3. trials).
- Trials on seed treatments (UK, DE, AT)

Task 6.3 Participatory Plant Breeding (PPB)

Results:

Wheat:

- Total number of farms that have sown wheat CCPs: 18/21
- Total number of CCPs: 25/26
- The CCPs that were sown were:
 - Wakelyns: 4/2 (UK)
 - Liocharls: 3/6 (UK, AT)
 - Skagit 1109: 1/1 (UK)
 - Mv Elit CCP: 14/11 (AT, SK, HU, RS)
 - Mv Bio2020: 3/2 (HU)
 - NS Obi: 0/1 (RS)
 - Mix population: 0/3 (IT)

Soybean:

- Total number of farms that have sown soya CCPs: 10

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

- Total number of CCPs: 13
- The CCPs that were sown were:
 - NS pop: 10 (DE, AT, RS, SI, RO)
 - 3 CCPs from SZG: 3 (AT)

Buckwheat:

- Total number of farms that have sown buckwheat CCPs: 4
- Total number of CCPs: 4
- The CCPs that were sown were:
 - RGA pop: 4 (SI, CZ)

Potato:

- Total number of farms that have sown buckwheat early lines: 4/9
- Total number of early lines: 60/112
- The early lines that were sown were:
 - KIS: 42 (SI)
 - IHAR: 60 (PL)
 - MATE: 12 (HU)

Ongoing work:

- Problems with distribution of soya (parcel lost) and buckwheat (sent too late for some farms) CCPs.
- Milestone MS24 (formation and distribution of CCP to farmers) was reached on 28 September 2022.
- Trials with CCPs and potato early lines in 2023 on minimum 3 farms per country.
- One trial in Italy could not be sown because of bad weather conditions but farmers have the possibility to sow next autumn.
- Farmers participatory trials harvest 2023
 - Total number of farms: 44
 - Number of trials: 45

Open questions:

The WP6 leader suggested to the GA to publish a bulletin also for the 2023 trials as the information will be available for the final report (although at the time the project will be concluded). The GA agreed that this could be done and published.

Other comments:

Ferdinando Branca (SAG member) had a question regarding CCPs and the way they were produced. He stated that in the BRESOV project they had sowed a few types of dynamic populations and asked what the WP6 leader thinks about using mixed populations. The WP6 leader replied that this is being discussed but not all populations used in ECOBREED

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

are true CCPs as the GA agreed that this is not necessary. ECOBREED results can be used for analysis for environmental stability (populations, especially in wheat, that were used turned out to be as stable as the varieties that were tested). He also said that ECOBREED presents a good opportunity to let EU regulators know about problems within organic farming as varieties for organic agriculture need to be tested under organic conditions and this is not yet mentioned in EU regulations.

WP7 session

Mario Pagnotta (WP7 leader, UNITUS) presented the activities within WP7. Training partners involved within WP7 are KIS, BOKU, CRI, IFVC, UNEW, UNITUS, NATUR, IHAR, NPPC and MATE. He talked about the planned deliverables and activities until the end of the project. He will inform partners in time about information needed for the final report in WP7.

Task 7.1 and Task 7.2 – within these tasks, workshops from IFVC and KIS on advanced genotyping and phenotyping will be performed within the WSRC11 at the end of June in Vienna. For this, ECOBREED is also giving 11 bursaries to students in the form of paid registration fees. One additional workshop is planned by BOKU for bunt diseases in mid-June 2023. The advanced genotyping workshop from NPPC is postponed and currently has no set dates on when it will be organized. For these tasks there are still some bursaries available.

In **Task 7.3** a lot of FPT trainings have been completed, in total 17 trainings. One of the partners still needs to do trainings (MATE). The WP7 leaders urged all GA members to send the reports on all performed activities with the dates, programme, list of participants, photos etc. as soon as the event is finished.

He reminded all partners that trainings need to be announced in time and materials published in the ECOBREED website. He asked the partners to send training materials to Andreja Žibrat Gašparič (KIS) to publish on the website.

WP8 and WP1 sessions

Antoaneta G. Kuhar (WP8 leader, KIS) presented the activities within this work package. In this WP, only two deliverables are left to do, all milestones have been reached.

She presented the new look for the website and social networks for the project in 2023 as well as the successful social media campaign that was running in the past year. In communication in Task 8.6, most KPIs have already been reached, only events such as fairs, business events and events/links with other projects are still in low numbers.

For dissemination in Task 8.2, most of the KPIs were reached. Numbers are too low only for articles in industry/specialised magazines. She reminded GA, where each project

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

partner is obliged to publish at least such 2 articles within the project. Articles are missing from BIOMILA, GS, RGA, Saatgut, SMA and UNEW.

In Task 8.4, there still need to be demonstration events organized to reach KPIs. Partners must organise 2 demonstration events. Currently, 11 events were already announced, but 11 more are still missing. She reminded the partners to send announcements of events to the KIS team as soon as possible, ideally at least 2 weeks before such a demonstration event. She also reminded them to include an invitation, information sheet, information consent, list of participants and questionnaire in organizing these events. After the event, the report must be sent to the Task 8.4 leader and KIS.

Helena Valas (KIS) then presented the results of Task 8.3 – exploitation. She first presented the IP activities report where the final stage of the project has been reached and now most of the focus is on the exploitable results. The IP Sub-committee interim meeting was held in February 2022 and the annual meeting was held in May 2022.

The first draft of deliverable D8.5 “Final plan for the use and dissemination of the foreground and exploitation agreement” that is being revised by the IP sub-committee is being prepared and will be send to revision and amendments to all project partners. We were planning to prepare 4 different Exploitation Agreements that would follow the 4 prepared business cases. As we are in the final stage of the ECOBREED project, it is becoming quite evident that the project will deliver more exploitable results that will extend post-ECOBREED project and partners need to form agreement on how they will continue to manage these results. The D8.5 is therefore containing the list of all exploitable results, including 4 business cases. Project partners are designing the rules of engagement and IPR management post-ECOBREED which includes all exploitable results. IP sub-committee members are reviewing the draft document that will be circulated at the annual meeting of EB and all the project partners.

Andreja Žibrat Gašparič (KIS) presented Task 1.3 (as Pavol Hauptvogel, WP1 leader, NPPC was not present at the annual meeting). The available data from EURISCO on varieties was prepared in excel sheets - PGR databases (WP1_W.Wheat collection list, WP1_W.Potato collection list, WP1_Soybean collection list, WP1_Buckwheat collection list). As some varieties are not in EURISCO, WP leaders need to specify which varieties have been evaluated in the ECOBREED project. WP leaders also need to check the correct names of varieties in the database. The excel sheets will be available to crop leaders through SharePoint.

Ferdinando Branca (SAG member, University of Catania) had a question regarding MTAs and about links to EURISCO. Dagmar Janovska (CRI) explained the procedures used in

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

ECOBREED. Peter Dolničar (KIS) asked about the deadlines for Task 1.3. It was decided that the database should be finished by end of October 2023.

IP sub-committee annual report

Helena Valas (KIS) briefly presented the main achievements in WP8 (intellectual property field) in Year 2022 and the overall progress report. ECOBREED is entering the final stage of the project and project partners are focusing on the exploitable results.

IP table shows the progress in year 2022 The main activities of the Year 4 were collection and analysis of the data from Business Questionnaires (distributed in March 2022). Based on Individual plans of exploitation and Business Questionnaires we prepared 4 Business Cases that present business plans on commercialisation of the most important project key exploitable project results i.e. 4 new crop varieties. The table of Key exploitable results is being amended in 2023. The 4 mentioned business cases and the table of key exploitable results are the basis for the final Agreement on the Use and Dissemination of the Foreground, including Exploitation. We are also finalising the Material Transfer Agreement for the four WPs that produced the key exploitable results i.e. new crop varieties: soybean, wheat, potato and buckwheat.

The overall progress in the past year is summarised in the table below:

IP category	Activity	Timeline
Ecobreed TM	registered	valid through 2022
Material Transfer Agreement	1 signed at WP2	June 2022
TM Licensing Agreement	1 signed	October 2022
WP8 IPR deliverables	D8.1, D8.2 approved	October 20
Business Case Questionnaires	7 received responses	December 2022
Table of Key Exploitable Results	under amendments	through 2023
Individual Plans of Exploitation	Contributions from all project partners	November 2021
IPR Exploitation	4 business cases and one partner agreement	Second half of 2022 through 2023

Review and amendments of 4 Business Cases

H. Valas presented the prepared presentations of the 4 business cases for new crop varieties suitable for organic farming. There is one presentation for each deliverable: wheat, buckwheat, soybean and potato. H. Valas has pointed out that there are still some data missing. As an example, H. Valas showed the business case for soybean, slide by slide.

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

Introduction challenge product range **market size assesment** business model go to market market forecastexploitation about

Market size assesment- 2023/24

We are reaching our market through production of basic and certified organic soybean seeds.

Seed production

	arable land in ha	seed production in tn
Austria		
Romania		
Serbia		

SIZE OF ARABLE LAND
?? ha

CERTIFIED SEEDS IN TN
?? tn

SOYBEAN SHELF LIFE
1 year

As pointed out, most of the missing data relates to the size of the arable land, estimated potential for crop production together with some market data. It would also be good if WP leaders check the whole data in presentations and correct or amend where needed. These 4 presentations are important for future commercialisation activities or obtaining future financing.

First draft of the final Exploitation Agreement

H. Valas reported on the ongoing activity of preparing the final Agreement on the Use and Dissemination of the Foreground, including Exploitation. The interim plan was to focus on the 4 new crop varieties and prepare 4 exploitation agreements. This plan is now put under question as it is becoming obvious that there will be far more exploitable results on top of the 4 new crop varieties. The ECOBREED project is delivering other exploitable results (trademark, training material, workshops, presentations, field days, etc...) and project partners need to agree on their exploitation. It would therefore be advisable to see what all the exploitable results are, include them in the table of Key Exploitable Results and prepare a common Exploitation Agreement for all results and all project partners. It is clear that not all partners will exploit all the results, but the agreed conditions will apply to all project partners.

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

Table of the key exploitable results in May 2023:

Key exploitable results	Metrics	Target audience
Pre-breeding of elite varieties of potato, wheat, buckwheat and soybean	4 early adopters	farmers, farm advisors, organic sector bodies, breeders, processors, consumers, policy makers
Foreseen new potato, wheat, buckwheat and soybean organic varieties	4 varieties	farmers, farm advisors, organic sector bodies, breeders, processors, consumers/consumer associations, policy makers
New technological methods/processes for potato, wheat, buckwheat and soybean	2	farmers, farm advisors, breeders, processors, policy makers, researchers
Traits and combinations of traits suited to organic and low-input production environments	4	farmers, farm advisors, breeders
CCP	2	farmers, farm advisors, breeders
Metrics for farmers to assess organic production systems / rotation backgrounds	3	farmers, farm advisors, breeders
Training manual for Advanced Genotyping	1	farmers, farm advisors, breeders, researchers
Training manual for Advanced Phenotyping	1	farmers, farm advisors, breeders, researchers
Data recording and management system	1	farmers, farm advisors, organic sector bodies, breeders, processors, policy makers
Efficient, ready-to-use farmer participatory breeding systems	4	farmers, farm advisors, organic sector bodies, breeders, processors, policy makers

Update of the MTA agreements post-ECOBREED projects (pricing)

H. Valas presented an issue related to Material Transfer Agreements. So far, all project partners have been exchanging the genetic and other materials for free as background knowledge needed for the foreground. The question is what happens when the project is over and project partners will still need access to those materials for research or commercialisation purposes? What if third parties ask for access to those materials?

WP2 parallel session

Heinrich Grausgruber (WP2 leader, BOKU) presented the activities within this work package. There are two deliverables due at the end of June (i.e. D2.3 and D2.5). The present partners discussed which traits will be presented in this phenotyping deliverable and who will prepare the statistics (BOKU, UNITUS, KIS). The UK data will probably not be available in time for the deliverable. He also informed SELGEN that they need to send data for analysis from their repeated trials of frost tolerance. In **Task 2.1** the data from

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

NPPC was finally sent and now needs to be recalculated, e.g. values for protein content (to 14%) and wet gluten content and sedimentation. The WP2 leader will do the recalculations and send them to partners.

The WP2 leader encouraged the partners to publish their research and if possible, also to publish results with limited scientific novelty in view of methodology but new results related to the used germplasm at least in Open Research Europe (<https://open-research-europe.ec.europa.eu/>) to make the results publicly available.

The winter wheat analyses have been performed, but data from Serbian partner IFVC will be excluded from D2.5 as trials were carried out with low-input fertilisation on not certified organic land. Bojan Jockovic (IFCV) said that they had grain yields of 17 t/ha in “commission trials” but in the low input treatment of the ECOBREED trial the grain yields were at maximum 8.8 t/ha in 2022. The WP2 leader added that in organic farming only crop rotation or organic manure can be used and no synthetic fertilisers. And as the yield is much too high for organic farming, indeed even nearly 2 times higher than the national (conventional) mean, these results cannot be reported as organic. Bojan Jockovic agreed but also emphasized that the soils in the Novi Sad region are very fertile and by far the best in Serbia. It was agreed to check the available data in detail and probably include them in overall statistical analyses if they don't represent significant outliers.

Task 2.2 is finished. UNEW and BOKU will write some publications on these results, especially on the mycorrhiza results as the field experiments with certain strains had clearly different results as the pot experiments for some varieties. UVIGO did in vitro assessment of 35 varieties (in agar and the in soil) and observed that in the field the situation was significantly different than in the laboratory (huge variability). This could also be linked to mycorrhizal colonisation. The WP leader agreed that the bacteria on seeds was probably different and had therefore a different effect on germination, but also soil microbes could work against the microbes from the plant. As the same results were not observed for buckwheat at UVIGO, this will be interesting to analyse why the differences happen in wheat. The WP2 leader agreed that this is still an open topic and should be studied in future projects.

Task 2.4 – Marker assisted selection: markers for *Bt* resistance genes/QTL were developed and BOKU is preparing publications. ATK also has a lot of rust resistance genes and data available. The discussion was then about the yellow rust epidemic currently underway in most countries. ECOBREED varieties do not have many resistance genes to this disease. The partners from ATK agreed to make screenings for these genes from material still in the field. Then the possible varieties that could show resistance to rust genes were discussed and how to distribute them between partners. The WP2 leader informed partners that BOKU has a lot of material from crosses free for distribution and

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

is available to all. BOKU also screened for cadmium accumulation genes in durum wheat and the landraces from Crete had generally the low accumulation allele which was interesting.

There are two MAGIC populations available (early and late maturity lines) and the material is currently multiplied in Austria and Hungary. The partners discussed how to harvest and share this material between partners in September or October after harvest. BOKU can only send spikes (add H. Grasgruber, 28. 8. 2023: we harvested both spikes and bulks and we will be able to provide both), ATK can send bulks. The WP2 leader encouraged partners to keep this networking alive event after the end of the project.

The Material Transfer Agreement (MTA) will be given to partners at the end of the project. For MTAs, which crosses are available and which are being shared, needs to be communicated.

RGA is working on perennial wheat but no information was presented on the latest status of the material. RGA reported some crosses between intermediate wheatgrass and common wheat but no names the used common wheat varieties included in these crosses were communicated. The WP2 leader will need to discuss these results with the partner. WSU sent some perennial wheat seed to BOKU and NATUR. NATUR has planted 300 hectares of perennial wheat, but yield is much lower compared to annual wheat. ATK expressed interest in these seeds.

The WP2 leader then informed partners about the excel sheet for Task 1.3 and the procedure how to add data. He will send the excel sheet to partners to fill out and then add the data to SharePoint as only crop leaders will work in the shared documents.

He thanked everyone for their work and discussions and closed the session.

WP3 parallel session

Peter Dolničar (WP3 leader, KIS)

Task 3.1 – field work was mostly completed. Selected potato genotypes planted for phenotyping at 4 locations (Slovenia, Hungary, Poland, UK) in 2020, 2021 and 2022. KIS will do additional trials with 8 new varieties, considering the special conditions in Slovenia.

An agreed list of descriptors was used for assessment of morphological and phenological traits and quality.

UNEW discussed that publications should be prepared for these results and stressed the importance of joint publications and joint results for all four countries. Paul Bilsborrow (UNEW) urged the partners to prepare their separate reports and then start combining results and preparing publications. The report will be kept separate for the four countries

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

as deliverables and could be joined together and presented as coordinated result in peer review journals.

The WP3 leader stressed that two deliverables for this task are due in December (D3.3 and D3.6) and that deadlines should be respected.

Task 3.2 was finished and the deliverable submitted. Results:

- 2nd potato AMF screen set up 2021 using 20 varieties with soil used from 2020 potato trial at Nafferton Farm
- Low levels of natural mycorrhizal colonisation across most varieties, though some cultivars were significantly better than others at forming mycorrhizal associations
- Most varieties showed greater levels of mycorrhizal intensity than the two controls used, Cara and Casablanca
- Sarpo Mira had the greatest mycorrhizal intensity and abundance across all cultivars
- Late cultivars showed better potential for AMF colonisation which warrants further investigation

Task 3.3 – The trials concluded in 2022. Joint publications should also be planned for these results.

- Successful experiments for improving seed tuber quality and vigour via the use of cover crop (CC) experiments set up at UNEW in 2021-22 and 2022-23 and at KIS in 2020-21 and 2021-22.
- Differences in yield found among cultivars and CC at both locations.
- Tuber quality analyses from CC trial at KIS in the 2021-22 season showed differences among cvs. and CC and especially there were improvements in tuber quality of CC compared to the control with bare ground.

Task 3.4 – mostly completed and deliverables submitted to the European Commission.

- KIS: Colorado potato beetle (CPB) trials set in years 2021 and 2022 using different bioinsecticides.
- Results in 2021 revealed that among the tested bioinsecticides both treatments with spinosad provided better control of larval populations
- A reduction of CPB larvae achieved by the azadirachtin, combination of *B. bassiana* + azadirachtin and by RNA-i treatment
- MATE: effect of Biomit on CPB population studied in 2021 and 2022; not efficient enough to prevent severe damage on potato foliage
- IHAR: big differences in CPB damage among 65 cultivars in 2021, 2022 there was low CPB damage, so additional trial was set up in 2023

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

- In 2020 and 2021: 2 wireworm trials each year at KIS.
- Bioinsecticides based on entomopathogenic fungi effective in reducing damage on potato tubers caused by wireworms

Task 3.5 – results:

- Marker assisted selection for late blight (LB) and PVY used within breeding programmes of all 3 breeding partners (KIS, IHAR, MATE)
- New crossings with late blight resistant parents - cultivars from EB working collection
- KIS: 3000 to 4000 seedlings of LB resistant breeding populations, all PVY immune, planted in the greenhouse every year
- MATE: 3100 and 5900 single hills with LB resistance genes evaluated under field conditions in 2021 and 2022
- Advanced LB resistant progenies evaluated in the field, advanced clones selected
- IHAR – 2022:
 - marker assisted selection for screening of 884 potato clones from 8 populations (EB 19-20 x Carolus; EB 19-98 x Carolus; Levante x Carolus; Alouette x Carolus; EB 19-20 x Levante; EB 19-98 x Levante; Bzura x Carolus; Otolia x Levante)
 - ECOBREED working collection tested in field conditions and in LB lab in T3.1 screened for the presence of *R2*, *R8*, *Rpi-phu1* and *Rpi-*chc1** genes using molecular markers
- organic selection site established at KIS, advanced clones tested under organic conditions in 2021 (229 clones - 31 LB resistant - from crossing years 2011-2017 planted and 75 selected), in 2022 (177 clones planted and under evaluation) and in 2023 (94 advanced clones)
- Candidate potato cultivars entered VCU tests in Slovenia
- First new ECOBREED candidate potato cultivar from MATE breeding programme (proposed name Balatoni sarga) entered VCU tests in Hungary: medium LB resistance, immunity to PVY, high field resistance to PLRV, common scab and golden cyst nematode

Task 3.6 – results:

- MATE: breeding program based on the pyramiding of resistance genes against biotic and abiotic stresses; 2022: 6 progenies screened by several molecular markers
- IHAR – 2021: all progeny clones from 2 populations (15-V-271 x 15-V-54 and 15-V-255 x 15-V-54) combining the genes *Rpi-phu1* and *R8* were planted in the field. The clones

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

15-V-271 and 15-V-255 are donors of *Rpi-phu1*; 2022: clones from 9 populations were evaluated in the field in Młochów

- KIS - 2022: 26 successful combinations between LB resistant parents (from the EB WC and other LB resistant sources) with multiple R genes; most commonly used EB advanced line A179 (10 times) has two R genes: *R8* and *Rpi-chc1* and produced progenies with 3 LB resistance genes (*Rpi-phu1*, *Rpi-chc1* and *R8*); 2021: selection of 97 LB resistant clones (with multiple R genes) from the crossing year 2017 started on organic soils, 37 selected; in 2022: 37 advanced LB resistant clones were grown on organic soil; 2023: 28 advanced LB resistant clones selected last year is grown on organic soil

Deliverables and milestones still pending:

- D3.3 –final report on phenotyping: due date in M68
- D3.5 – seed tuber quality and vigour: due date in M70
- D3.6 – statistical analyses of phenotyping results: new due date in M65 (end of September)
- D3.7 – final report on MAS: new due date in M66 (end of October)
- D3.8: due date in M70
- MS17 – advanced breeding lines available for partners: due date in M68.

The project partners also discussed possible publications and resistance genes in some varieties (e.g. White Lady). The WP3 leader stressed that a lot of data and results are available for publication and this has a lot of potential.

For Task 1.3, the WP3 leader will send the excel to partners to gather data and will then add it to the shared documents on SharePoint. The database needs to be finished by October. IHAR will check if photos are available to present data also as a catalogue.

He thanked everyone and closed the sessions.

WP4 parallel session

Vuk Đorđević (WP4 leader, IFVC) presented the results for this work package.

Task 4.1 - Screening of genetic resources and breeding material

Task almost finished – data analysis still in progress as well as the preparation of deliverable D4.2.

- 2022: 3rd season for re-test of the 20 best genotypes out of the two years trials
- 2023: Re-test of the 20 best genotypes and material development (Task 4.6)

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

- Severe drought and heat stress in Austria during July and August
- Severe Diaporthe incidence due to heavy raining period in September before harvest
- High occurrence of the green stink bug (*Nezara viridula*)
- *Identification of useful trait* (variation) and level of local adaptation of soybean genotypes (Type of experiment design: Augments complete block Design); Sowing date: 11 May 2022
- *Weed competitiveness trial*: 3 different soybean varieties and 3 weed species (*Abutilon theophrasti*, *Ambrosia artemisiifolia* and *Xanthium strumarium*), 5 density of weeds (0; 0.5; 1; 5 and 10 weeds per m⁻¹ of soybean row); Assessment and measurement time: 6, 8, 10, and 12 weeks after soybean emergence; Variety Fortuna showed higher dry biomass than other varieties in all treatments; Due to the deficit of precipitation in 2022, in the second part of the growing season, there were no significant differences between the yield of soybean varieties, except in treatments with *A. artemisiifolia*, where the variety Fortuna showed the highest grain yield.

Task 4.2 – Abiotic stress

- The initial set of 206 soybean genotypes was tested in 2020 and 2021 for drought tolerance.
- Drought negatively affected plant development and led to yield decrease.
- Some genotypes were more tolerant to unfavourable growing conditions than others.

Werner Vogt-Kaute (NATUR) then presented the chilling tolerance:

- 2022: 3 dates of sowing (16 Apr, 2 May, 18 May); 40 varieties, 3 reps; 1st batch: highest differences in germination (0%-28%, average 10,2%). Very dry weather conditions in 2022: Germination did not improve in 2nd and 3rd batch; Additional trial in cooling chamber of Bavarian State Research Institute; 7 days with 6°C. 20 seeds each.
- Germination higher than 80% in several genotypes; some had bad germination in control. Comparison with field data together with 2nd year.
- 2023: 3 dates of sowing (21 Apr, 4 May, 18 May): 40 varieties, 3 reps; Spring was very wet so sowing could not start before 21 April.

The WP4 leader then presented the remaining activities within this task: field trials, data analysis and deliverable 4.3.

Task 4.3 is completed.

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

Task 4.4 is completed. Ion Toncea (NARDI) presented the results from this task that were already published in 2023 (*Screening soybean germplasm for presence of Cda1 allele involved in low cadmium accumulation using molecular markers*).

Task 4.5 - Improving seed multiplication via the use of cover crops and seed inoculants
Marjana Vasiljević (IFVC) presented the task. The trials are finished, and data evaluation is in progress. Also, deliverable D4.4 is being prepared on recommendations for improving seed multiplication via the use of cover crops and seed inoculation treatments. She presented the results of cover crop trails in 2022. The seed inoculant trial involved 4 treatments on 2 soybean varieties and had 4 replications. In 2022 the nodulation was sufficient. But there was no significant difference between treatments. In this task, field trials, data analysis, publication preparation and one deliverable are still in progress.

Task 4.6 - Production of elite varieties and advanced breeding lines

The WP4 leader continued with the results for Task 4.6. Cultivation of 4 segregating populations (F5) for on farm selection and breeding in Austria and Serbia (WP6 farmer participatory trial, FS Güssing, Čurug, Šuljam, Rimski šančevi. The remaining activities:

- Continuation of elite material development: multiplication and selection of segregating material.
- New material development based on results obtained in T4.1
- Validation of breeding results

At the end, the WP4 leader showed which deliverables are still pending in this work package – 5 deliverables still need to be prepared and submitted to the EC.

He also showed the certificate of the new registered soybean variety NS ECOB at national level in Serbia. With this achievement, milestone 40 was reached (Advanced breeding lines available for further selection and varietal development - soybean).

He thanked everybody for their contributions.

WP5 parallel session

Dagmar Janovská (WP5 leader, CRI) presented the activities within WP5.

Task 5.1 – 54 common genotypes and additional in AT, SI and CZ – together 216 genotypes, 27 traits in fields, compounds analyses (55208 analyses); Slovenian results cannot be used.

Task 5.3 – CZ, SI and US field experiments; spring and summer sowing 2019 to 2022; repeated spring trials; 2 different terms of inoculation of 2 Fusarium species (2019-2021)

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

on 11 varieties of common buckwheat and one on Tartary. Milestones finished and deliverable D5.2 achieved.

There are still 5 deliverables to be prepared, the first is due end of June. The WP5 leader will send the final version as soon as possible. The partners then discussed the deadlines for the other remaining deliverables and the responsible institutions for these documents. They agree that the final deliverable which needs to be a public document should not be written in a too scientific language.

Then the WP5 leader presented the planned publications and asked Slovenian partners if they agree that their data will not be used. Aleš Kolmanič (KIS) agreed to this.

The WP5 leader also urged the partners to prepare practice abstracts with general information for each task. Vladimir Meglič (KIS) mentioned that practice abstract should not be written in a too scientific language and all partners agreed. There was a short discussion on topics for these practice abstracts (e.g. on phosphorous uptake, breeding, genotyping, buckwheat varieties, phosphorous mineralisation). All agreed to prepare the practice abstract by November 2023. The first PA will be prepared by UVIGO by end of June, then one by CRI at the end of August. KIS and CAAS will prepare a PA on breeding by end of August. Aleš Kolmanič (KIS) will prepare the PA on phosphorous.

The WP5 leader also presented the deadlines for the preparation of the final report:

- First draft by end of November 2022
- Second draft around middle of December 2023
- Final version by 31 January 2024 (but ideally before the final conference of the project).

Adela Sanchez Moreiras (UVIGO) presented the results of **Task 5.2** on allelopathic activity screening.

- 37 buckwheat varieties vs. *Lolium rigidum* and *Portulaca oleracea* (from Europe and USA and Asia); first experiments in vitro bioassay (10 days buckwheat growing alone and 1 week of co-culture with each weed). Measured indexes SVI, SPL, SIC/RIC.
- Results for common buckwheat – mainly affected development of *L. rigidum* induced a reduction in some parameters when compared to *P. oleracea*; higher number of common buckwheat accessions affected more SIC of *L. rigidum* than *P. oleracea*; higher number of common buckwheat accessions showed ability to control *L. rigidum*.
- Tartary buckwheat – almost no difference between *L. rigidum* and *P. oleracea*.

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

- Greenhouse bioassay – 2 times of raining, manual irrigation and simulated rain; results – almost all lost ability to inhibit; some assessments showed a similar trend to the in vitro bioassays therefore the in vivo bioassays are essential.
- Presented the papers that were published and submitted or in preparation for publication about their results.

Meiliang Zhou (CAAS) presented the results of **Task 5.4** (Genotyping of buckwheat):

- Reference genome assembly and annotation (genome of *F. homotropicum*, wild relative of common buckwheat was sequenced).
- Compared genomes of common and Tartary buckwheat: 1048 annotated metabolites were characterised, 572 common buckwheat accessions from 33 countries (433 Chinese and 117 European).
- EU accessions are one cluster and has a strong diversity picture compared to Chinese accessions (PCA and model-based clustering analysis (K=2) supported this structure).
- Genome assembly of golden buckwheat and resequencing of Tartary buckwheat – 2 Chinese articles on these topics already published.
- Prepared database for buckwheat (www.buckwheat-gpdb.cn)

Barbara Pipan (KIS) presented the add-on activities which have been done at KIS within Task 5.4. associated to genotyping on 24 SSR loci, KIS group performed the phenotyping in a pot experiment recording 37 traits for 152 accessions of common buckwheat and 52 accessions of Tartary buckwheat. Kruskal–Wallis test showed that 10 out the 12 quantitative traits were found significantly different between species. Three pheno-clusters were generated for both, *F. esculentum* and *F. tataricum* collections. The Bayesian clustering showed the presence of two genetically distinct clusters that differentiate between *F. esculentum* and *F. tataricum*. For the molecular data, AMOVA revealed, although most of genetic variation was explained by the differences within accessions (78.09%), significantly high amount of variation occurred between the two species (21.09%), whereas no variation was detected between accessions within species, indicating considerable genetic differentiation between the two species.

The WP5 leader closed the session and thanked everyone for the discussion.

Individual consultations

Antoaneta G. Kuhar (project manager, KIS) had individual consultations about the budget and financial questions with all partners present at the annual meeting.

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

The meeting ended on 31 May at 18:15.

5th Annual Meeting – 2nd day

The meeting started on 1 June at 9:00.

The project coordinator opened the second day of the meeting and had some introductory words about the agenda.

WP 2 report and wrap-up

Heinrich Grausgruber (WP2 leader, BOKU) presented the work that still needs to be finished by the end of the project within this work package. Two deliverables need to be finished by end of June 2023. He thanked Uroš Žibrat (KIS) for his help in phenotyping as he analysed a lot of available data and this will be crucial to add to the deliverable. He also thanked NPPC to finally send the quality data and it is already being recalculated. Aleš Kolmanič (KIS) with Uroš Žibrat is drafting a paper on advanced phenotyping in this task.

Tasks 2.2 and 2.3 are finished and deliverables submitted. Only some chemical analyses remain for allelopathy. Manuscripts need to be drafted for publication.

Task 2.4 - Marker Assisted Selection (MAS) – there is a yellow rust epidemic from Germany to South Europe in wheat which is currently a problem. Within WP2 it was decided to check for gene resistance as ECOBREED material does not have a lot of resistance genes. On a similar topic, BOKU will soon publish a paper on bunt disease and resistance genes in ECOBREED material.

Task 2.5 - Development of new wheat germplasm for organic farming - 3 populations of crosses and will be available for distribution and will distribute only artificial level of infection that is low.

The bunt workshop in Vienna in the middle June 2023 will be available in-person and online and so everybody can access the program.

Germplasm distribution and sharing – an agreement between all partners to continue the cooperation in the future and maybe within a follow-up project. Bulks will be distributed to interested partners and they will be growing it (only limited selection) and they want to see how they evolve. It is not clear the status of the RGA crosses as there is limited information from this partner. NATUR received perennial wheat material from

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

WSU (pre Ecobreed) – they have 300 hectares under production but the problem that in the third year the yield is very low.

This was followed by a short discussion on perennial wheat and its shortcomings.

WP 3 report and wrap-up

Peter Dolničar (WP3 leader, KIS) presented the results of the discussion from yesterday's discussion with partners in WP3.

Task 3.1 - All trials finished. Only smaller trial at KIS remains. Manuscripts will be prepared for publication. Phenotyping trials – remote sensing at KIS and UNEW – additional experiment with 8 varieties in 2023 in Slovenia.

Task 3.2 – finished, deliverable submitted.

Task 3.3 – one experiment underway at UNEW, finished experiments at KIS; differences in yield found among cultivars and CC at both locations.

Task 3.4 – experiments using bioinsecticides at MATE and KIS against CPB- reduction of CPB larvae achieved by azadirachtin and by RNA-I treatment; manuscripts are being prepared; wireworm trials were finished last year (2020 and 2021 trials at KIS).

Task 3.5 – Marker assisted selection in organic breeding: crossing done with late blight resistant parents; IHAR screened the set of 884 potato clones from 8 populations; KIS started selection on organic fields, advanced clones planted under organic conditions; candidate potato cultivars entered VCU tests in Slovenia; first new ECOBREED candidate potato cultivar from AMTE (proposed name Balatoni sarga) entered VCU tests in Hungary – medium LB resistance, immunity to PVY, high field resistance to PLRV, common scab.

Task 3.6 – MATE breeding program based on pyramiding resistance genes against biotic and abiotic stresses, 6 progenies screened by several molecular markers; IHAR had clones from 9 populations evaluated in field in 2022; KIS – 26 successful combinations between LB resistant parents with multiple R genes (37 advanced LO resistant clones grown on organic soil in 2022, 28 advanced LB resistant clones selected last year grown in 2023 on organic soil).

All tasks done and now deliverables and publications need to be prepared. 5 deliverables need to be finished – new date for D3.6 is now end of September (want to finish that before end of project as data is available and to not have all deliverables at the end of the project). New date for D3.7 is now set to end of October 2023.

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

Milestone 17 still needs to be achieved by end of December 2023. Each partner will provide 5-10 advanced potato breeding lines for partners.

Task 1.3 – potato database will be done by end of September.

WP 4 report and wrap-up

Vuk Đorđević (WP4 leader, IFVC) presented the results about WP4 soybean. He thanked partners for the discussion yesterday and decisions made for the next 6 months. Two tasks already finished (Tasks 4.3 and 4.4).

Task 4.1 identification of useful traits; working on data analysis; yield+protein+oil (trials 2021) – similar results for late material; in 2023 re-test of 20 best genotypes and material development (T4.6); similar work done in Romania; all statistical analysis of this data will be done; severe drought and heat stress in Austria during July and August and severe Diaporthe incidence due to heavy raining period in September before harvest & high occurrence of green stink bug (*Nezara viridula*); paper on *Nezara viridula* and mites submitted; key for soybean production under organic is also weed competitiveness. Remaining activities: data analysis, publication of results, deliverable D4.2.

Task 4.2 – abiotic stress; canopy cover at flowering and thousand seed weight; chilling tolerance (Germany) – dry weather more influential at germination; majority of work done; to do: data analysis, deliverable D4.3.

Task 4.3 – deliverable D4.5 submitted.

Task 4.4 – article published in 2023 (NARDI).

Task 4.5 – deliverable D4.4 in preparation; trials finished, data evaluation is ongoing; experiment with cover crops in 2022; also seed inoculant trials (inoculants are effective); to do: publication of results and D4.4.

Task 4.6 – production of advanced breeding lines – produced CCP for WP6 – registered one variety for organic soybean production; deliverable D4.6 submitted to coordinator.

NS ECOB variety registered at national level in Serbia – name is a tribute to ECOBREED project; triple zero variety, easily grown in northern parts of Europe and in the south as the second crop; high protein content in seeds.

WP4 researchers will have several presentations at the WSRC11 in Vienna in late June 2023.

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

This was followed by a short discussion about inoculants in ECOBREED trials.

WP 5 report and wrap-up

Dagmar Janovská (WP5 leader, CRI) – presented the results for this work package.

Task 5.1 – 54 common genotypes and additional in AT, SI and CZ.

Task 5.2: 37 buckwheat varieties vs. *Lolium rigidum* and *Portulaca oleracea*; results for common buckwheat – mainly affected development of *L. rigidum* induced a reduction in some parameters when compared to *P. oleracea*; higher number of common buckwheat accessions showed ability to control *L. rigidum*. Tartary buckwheat – almost no difference between *L. rigidum* and *P. oleracea*.

Task 5.3 – CZ, SI and US field experiments; spring and summer sowing 2019 to 2022; repeated spring trials; 2 different terms of inoculation of 2 *Fusarium* species (2019-2021) on 11 varieties of common buckwheat and one on Tartary. Milestones finished and deliverable D5.2 achieved.

Task 5.4 - Reference genome assembly and annotation (genome of *F. homotropicum*, wild relative of common buckwheat was sequenced). Compared genomes of common and Tartary buckwheat: 1048 annotated metabolites were characterised, 572 common buckwheat accessions from 33 countries (433 Chinese and 117 European). CAAS prepared database for buckwheat (www.buckwheat-gpdb.cn).

Presented the papers that were published and submitted or in preparation for publication about their results. There are still 5 deliverables to be prepared.

There was a short discussion about the exchange of material with China and about allelopathic activities and compounds used.

Scientific Advisory Group

Ferdinando Branca (University of Catania, project BRESOV) congratulated the consortium about the project results. He stressed the importance of preparing a list of how many accessions were used for each crop as this is key for dissemination of research results. He explained that in the already finished H2020 project BRESOV they have a one-year embargo on their data and used it for preparing publications. He then presented the results of their project (a lot of genotyping studies on Brassica, green pea, tomato; genes studies for MAS). They developed new breeding genomic techniques and Italy has already approved the use of these techniques. He also stresses the importance of delivering good quality products to consumers. He also talked about the importance of a multi-actor

Ecobreed_5_annual meeting_May 2023

Vienna_minutes

approach in the project as well as made suggestions on deliverables and publishing data in Zenodo. He thanked ECOBREED partners for their friendship between both projects and their cooperation.

Vladimir Meglič (project coordinator, KIS) thanked Prof Branca for his continued support.

Conclusion of the meeting

Vladimir Meglič (project coordinator, KIS) in the conclusion reminded everyone present about the trials that need to be finished this year and about all events that still need to be organised in 2023.

Important dates for the next months:

- 15. 10. 2023 – internal financial report
- 22.-26. 1. 2024 – final meeting and conference in Ljubljana announced but due to the post meeting re-evaluation of availabilities, new dates proposed: **16.-19. 1. 2024**
- 25. 4. 2024 – submission of final report

Thanked everybody for their readiness for cooperation. He also thanked the team at BOKU and Saatgut for organising the annual meeting. He wished everybody good harvest and a nice summer and closed the meeting.

Meeting finished at 12:15

Ecobreed_5 annual meeting_May 2023

Vienna_minutes



5th ECOBREED annual meeting

31 May – 1 June 2023, Vienna, Austria



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IMPROVING CROPS



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5th ECOBREED annual meeting

31 May – 1 June 2023, Vienna, Austria

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