



ecobreed
IMPROVING CROPS



Funded by European Union
Horizon 2020
Grant agreement No 771367

SECURITY (DISSEMINATION LEVEL)	Confidential
CONTRACTUAL DATE OF DELIVERY	31.08.2022
ACTUAL DATE OF DELIVERY	10.10.2022
DELIVERABLE NUMBER	D 9.5
TYPE	Deliverable
STATUS AND VERSION	Final
NUMBER OF PAGES	55
WP CONTRIBUTING TO THE DELIVERABLE	WP 9 / WP 8
LEAD BENEFICIARY	KIS
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KEYWORDS	4 th Annual Meeting, minutes
ABSTRACT (FOR DISSEMINATION)	The document contains minutes and report on the fourth ECOBREED annual meeting held at ATK, Hungary from 31 May to 1 June 2022; SAG meeting; IP sub-committee annual meeting; MS32 (4 th IP exploitation report).
DOCUMENT ID	D 9.5 Project annual meeting 4

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AGENDAS

ECOBREED 4th Annual Meeting

Martonvásár, Hungary, 31 May – 1 June 2022

Tuesday, 31st of May | 08:30 - 18:00

08:30 – 09:00 | Registration

09:00 – 09:15 | Welcome and introduction

09:15 – 09:45 | Overall progress report

09:45 – 10:30 | WP6 session

10:30 – 11:15 | WP7 session

11:15 – 11:45 | *Coffee break*

11:45 – 13:00 | WP8 and WP1 sessions

13:00 – 14:30 | *Lunch*

14:30 – 16:00 | Parallel sessions WP2 and WP5

16:00 – 16:30 | Coffee break

16:30 – 18:00 | Parallel sessions WP3 and WP4

14:30 – 18:00 | Individual consultations between KIS and partners on admin and financial issues

19:00 | *Joint dinner*

Wednesday, 1st of June | 09:00 - 17:00

09:00 – 09:30 | WP 2 report and wrap-up

09:30 – 10:00 | WP 5 report and wrap-up

10:00 – 10:30 | WP 4 report and wrap-up

10:30 – 11:00 | WP 3 report and wrap-up

11:00 – 11:15 | Conclusions of the meeting

11:15 – 12:00 | *Coffee break*

12:00 – 13:30 | Visit to the organic field and ECOBREED small plot trials

13:30 – 15:00 | *Lunch*

15:00 – 15:45 | Parallel visits of Cereal Quality Lab and Phytotron climate chambers

15:45 – 17:00 | Visit to the Agroverzum Agro-science exhibition

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AGENDA

ECOBREED 4th Annual SAG Hybrid Meeting

Centre for Agricultural Research (ATK) / Agrártudományi Kutatóközpont
Brunszvik u. 2, 2462 Martonvásár, Hungary
Small lecture room /main building

<https://us06web.zoom.us/j/86111123509?pwd=OGxVeFBKZm05eHZQeittNVUvU2VqQT09>

Meeting ID: 861 1112 3509

Passcode: 551248

Thursday, 2nd of June | 09:00 - 12:30

09:00 – 09:15 | Welcome and introduction

Vladimir Meglič, project coordinator

09:15 – 10:45 | Overall progress report of WP1 – WP9 (10' each WP leader)

10:45 – 11:00 | *Break*

11:00 – 12:30 | Feedback on the progress report

Scientific Advisory Group members

EC representatives, TBC

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4th ANNUAL IP MANAGEMENT SUB-COMMITTEE MEETING

Written session, 24 to 30 June 2022

Introduction and decision process:

This years' IP Management Sub-Committee session was held in written form, open from 24 to 30 June 2022. Members of the IP Sub-Committee received the agenda with supporting documents on Friday, 24 June. The decision process is in writing. Members submitted their written responses by Thursday, 30 June 2022 via e-mail to helena.valas@inveniam.si. The MS32 in the form of the 4th IP exploitation report is attached to D9.5.

1. Progress report for the Y4
2. Amended Material Transfer Agreement (MTA) and progress report for WP2
3. Three party Trademark Licensing Agreement
4. IP Management report for past year
5. Plans for Y5
6. Scientific publications

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1. EXECUTIVE SUMMARY

The document contains minutes and reports of the project's fourth annual meeting and the annual IP sub-committee meeting, as well as the project's fourth IP exploitation report (MS32).

After a three-year interruption due to the Covid-19 pandemic, the fourth annual meeting of the project was held at the premises of Agrártudományi Kutatóközpont (ATK) in Martonvásár, Hungary. An important part of the annual meeting was the field trials visit.

The meeting with the Scientific Advisory Group (SAG) was hybrid on June 2, 2022 with Executive Board member on site in Hungary and SAG members with representatives of the European Commission online. The annual IP subcommittee meeting was both held in person during the annual project meeting and completed in written form at the end of June 2022.

With the exception of P11-UNITUS, P14-IHAR and P21- GS, all partners were present at the annual meeting. The purpose of the meeting was to report on progress made and discuss ongoing and future activities. Specific objectives were:

- Recap ongoing activities for each work package and progress made by each partner.
- Discuss future submission of 3rd periodic report.
- Getting to know the newcomers, changes within the partnership.
- Obtain feedback from members of SAG.
- Discuss and respond to any outstanding questions or concerns.

The annual IP sub-committee meeting was attended by all members; past and current IP issues were discussed.

2. Minutes of the 4th annual meeting

Present in person: the ECOBREED annual meeting was attended by 53 participants (see List of participants in the attachment).

Welcome and introduction

Vladimir Meglič, the project coordinator, welcomed everyone and noted that the last face-to-face meeting was in Prague in year 2019 and how nice it is to see everyone again in person after the many meetings in between. He sees many similarities between Prague and Martonvásár, and staying in these beautiful places makes these meetings even more enjoyable. He also congratulated ATK for their organisation and scientific work. He wished all participants a good annual meeting and hoped that after the meeting everyone will be up to date with the obligations that still need to be fulfilled.

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Gyula Vida, Director General of ATK, said it was a great honour to welcome all the participants of the meeting. He hopes it will be a successful meeting, and ATK is glad to be involved in the ECOBREED project. Organic breeding is becoming more and more important, and therefore scientific work on this topic is crucial. He presented some information about the institute, which was founded in 1949 and ATK was established in 2012 and has been part of the research network in Hungary since 2020. The building itself is a historical building from the 18th century and he wished that everyone would find the time to have a look at the building and the park surrounding the institute. He wished all participants a pleasant stay in Martonvásár.

Péter Mikó (ATK) is the head of the Cereal Breeding Department and presented some information about the research work at the Institute. In 1953, the first European hybrid maize seed plant was established, a new phytotron was built in 1972, and genomics was introduced at the institute in 1992. The institute has 160 selected cereal lines, with emphasis on winter wheat, but also barley, spelt, einkorn and emmer. The market share of wheat varieties is between 30 and 50% in the last 20 years. They export to 20 countries. Every year 1000 new generations of crosses are produced, for which numerous research facilities are available (nurseries, 7 ha of organic fields, field machinery, greenhouse, phytotron with 50 chambers, technological quality laboratory, molecular laboratory, gene bank with 14,000 accessions, special IT background - software breeder). Organic breeding and research includes a 7 ha certified organic nursery. The main goal is to increase diversity in breeding of einkorn, emmer and spelt, pre-breeding, crossing populations and breeding of wheat under organic conditions from 2020. They are part of the VSZT organic seed working group. Organic agriculture in Hungary covers 300,000 ha of organic cultivated land, of which 2.6% is arable land, 10% fruit and 25% meadows. The land is cultivated by 6,000 farmers. The Hungarian government wants to achieve the following goals by 2027: 10% organic cultivated area, doubling of income in the organic sector, 20% organic cultivation in public catering, use of organic seeds on 90% of organic cultivated area and more funds for organic research. At the end of his presentation, he wished everyone a successful meeting in Martonvásár.

Overall progress report

The coordinator presented the results and progress of the project. Currently, the team is in the fifth year of the project and he recalled that ECOBREED was selected by the European Commission for its potential to increase the competitiveness of the organic sector. Hopefully, the results of the project will be in this sense.

The consortium includes 25 partners from 15 countries, although one partner from Greece had to leave the consortium due to problems related to the Covid 19 pandemic. The consortium includes 14 universities and institutes, 9 private companies, and 2 associations.

Some changes in the WP management were mentioned: Marjana Vasiljević (IFVCNS) in WP7 Education instead of the Greek partner, Péter Mikó (ATK) takes over from Maria Meygeri (previously ATK) and Vuk Đorđević (IFVC) takes over WP4.

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Completed work: Despite the difficulties related to the Covid-19 pandemic, the consortium has done a good job under these conditions. The results show progress in achieving the intended impact:

Identification of germplasm - a tremendous amount of work has been done;

Identification of traits and trait combinations for the development of new varieties - also successfully underway;

- Training for farmers - started in 2021 based on wheat populations;
- Comprehensive phenotyping of core collections of species under a range of different pedoclimatic conditions - resulting in a detailed phenotypic description of currently commercially available varieties, advanced breeding lines, and landraces and/or populations (i.e., genetically heterogeneous material);
- Breeders have already made new crosses with genotypes from ECOBREED material that would not have occurred without the project;
- DNA polymorphism in all four crops for disease resistance genes, quality, and agronomic traits;
- Farmer participatory trials have been conducted on more than 60 farms in the project partner countries; advanced breeding lines have already been incorporated into ECOBREED nurseries;
- Trainings have started and will provide the knowledge needed to manage, evaluate, select and breed varieties that are better suited to farmers' needs and organic farming; the first scholarships have been awarded, starting with training in advanced genotyping and advanced phenotyping;
- CAAS partner from China is responsible for genotyping buckwheat germplasm and partner WSU from the U.S. is involved in phenotyping and field trials to assess phosphorus mineralization potential;
- Meeting with farmers and educating them are important parts of the project.

Management report

Antoaneta G. Kuhar, project manager, presented the management progress report. She expressed her joy at being able to meet everyone in person again after years of Zoom meetings. Face-to-face meetings are very important for such a big project in terms of content, but good management in the background is also important and at KIS this task is taken very seriously. Most of the KIS project management staff were introduced during the annual meeting.

The project is in M49 and there are only 22 months left, so she urged the participants to focus and organise their work so that everyone can be proud at the end of the project.

The last 3 years have been very dynamic and all this was captured by the most recent amendment that contains the following:

- GEO partner left us,
- there were changes at the Hungarian partner UP that was transferred to SZIU and later partially taken over by MATE,

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- project was prolonged for 10 more months to finish and evaluate the harvest year 2023,
- more time to evaluate and exploit the results,
- extension of PR3/RV3 and PR4/RV4,
- budget shifts among partners,
- new GA members: Nadine (SECOBRA) and Jovica (GS),
- some changes in the deputy heads of the WPs,

In addition, NPPC was selected by the European Court of Auditors to be audited for PR2 and there has been appointed a new financial officer.

The end of the project is now February 29, 2022. This means that PR3 now ends on September 30, 2022 and the financial reports are due in early October.

She reminded that partners were asked to submit interim financial reports in May 2022 and all have submitted; EU Commission has accepted all costs claimed for PR1 and PR2; prediction is that 20% of costs will go to PR3 (report submission is due by end of November 2022). Antoaneta announced that the partners utilization of funds will be discussed in the afternoon individual meetings with the project manager and partners in person. She asked to schedule a meeting at the registration desk.

What is planned next is:

- Completion of the amendment by July 4, 2022.
- GEOKOMI final report due by June 20, 2022.
- CA Amendment due June 2022
- PR3: Technical and financial reports due by mid-October 2022.

Take-home messages:

- Meet deadlines and submit deliverables and papers with high quality.
- Provide advance notice of any changes, audits, etc.
- Keep your organisation's contacts updated in the portal.
- Do not visit active processes in the portal (reports and amendments).
- Monitor your finances, inform in advance of any discrepancies and ask for approval.

The project manager thanked everyone for their cooperation and looked forward to the individual meetings in the afternoon.

WP6 session: Farmer Participatory Trials and Breeding

Werner Vogt-Kaute (NATUR), WP6 leader, informed that in WP6 the trials were performed normally despite Covid-19 restrictions and the activities are good in line with the planned events.

Current status:

- The data management system is available
- Cyber-attack in Newcastle University
- Data in excel sheets (some quality data missing)

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- Bulletin for farmers
- Second version uploaded to Zenodo (by Heinrich Grausgruber, BOKU)
- Farmers participatory trials harvest 2021 – 62 total number of farms (7 farms with 2 crops, one farm with 3 crops), 71 trials, 689 plots, 3 farms in the US
- Problems: no bulletins from Slovakia (Pavol, NPPC now has sent the data) and Romania for 2021; some quality data is missing, and he will send an email inquiring about the missing data in the excel sheet.

Farmer participatory trials for the 2022 harvest - info:

- WSU left,
- but additional trials in Hungary, Serbia, Czech Republic, Austria and Germany
- data collection is ongoing (please use the same excel sheets again; use it in the way the WP leader has sent them)
- trials with seed treatment in UK, Germany and Austria
- demonstration events (part of WP8 – but it is important to mention this more times during the meeting – each partner has to perform at least 2 demonstration events)
- trainings events (similarly, all partners need to make training events – certain templates need to be used for the different types of events)
- other field visits and field days – can be conducted outside the procedures and can be put in the reports but the other events need suitable ECOBREED documentation.

Results 2021:

- total number of farms that have sown CCPs – 18
- total number of CCPs – to be recalculated
- The CCPs that were sown were: Wakelyns: 4 (UK), Liocharls: 8 (UK, AT), 1109: 1 (UK), Mv elite CCP: 14 (AT, SK, HU, RS), Mv Bio2020: 3 (HU)

Results 2022:

- one problem in customs so the Serbian soya population did not arrive on Slovenian farms yet
- new populations: wheat population in Serbia, soya populations in Austria and in Romania
- the Serbian soya population needs a name – maybe can be decided in this meeting

NATUR Germany in 2022: 5 soya trial and additional potato trial.

ATK activities in 2022: new subpopulations by participation of farmers; most experience in selecting populations; winter wheat varieties; two populations (Mv Elit CCP and Mv Bio2020); evaluation by farmers; assessment of agronomic traits; breeder's visit; harvest; sample sending to ATK.

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Slovenia: same trials as last year; buckwheat will be sown later (sown as a second crop in Slovenia).

Task 6.2 – soybean DEMO farm 2022 map – in progress:

- Austria: wheat trials stay the same and starting training events
- Serbia: Task 6.2 and Task 6.3 planned; also, wheat trials are planned
- Italy: durum wheat trials are also ok and in process
- UK: trials on wheat and buckwheat are also happening
- Czech Republic: ongoing buckwheat trials and one on wheat
- Austria: soybean – new farmer participating for the populations.

Plans for 2023:

- If a trial has failed it can be repeated
- WP 6.3 (PPB/CCP) will continue
- At least 3 farms (for each partner for next year)
- Less varieties? (number of varieties can be discussed; minimum of 8 varieties written in GA) – obligatory to have populations
- WP6 publications – start thinking about publications which is difficult as the scientific value is not that high (publishing in farmers' magazines, presenting at conferences, Serbian colleagues offered a possibility to publish a special issue in their journal)
- ECOBREED trademark - organic heterogeneous material (OHM) and organic varieties (starting 1 January 2022; no variety protection at the moment – a problem for breeders; the ECOBREED trademark could be some protection); the trademark could also be used for advertising
- organic plant breeding program – could be an additional outcome of the ECOBREED project; this could also happen within the EU legislation – this can be discussed with the WP6 leader.

WP7 session: Training

Marjana Vasiljević, deputy WP7 leader, presented the work in this work package.

Task 7.1 – Advanced genotyping training

- work done:
 - Production of materials for improved genotyping training, finished D7.1
 - Two workshops were done in 2021 (by BOKU and UNITUS)
- work planned:
- Planned IFVC summer school in December 2022 and NPPC summer school planned for September 2022.

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Task 7.2 – Advanced phenotyping training

- work done:
 - Production of materials for improved phenotyping training (D7.2) distributed to the trainees
 - Three events at NPPC
 - UNEW workshop
- work planned:
 - BOKU summer school planned for July 2022
 - UNEW workshop planned for July 2022
 - KIS workshops planned for June and September 2022

Task 7.3 – Participatory Plant Breeding training

Materials are produced and trainings organised; the invitation has to be prepared according to the ECOBREED template for training events.

- work done:
 - production of materials for PPB and FPT training (D7.3)
 - BOKU meeting
 - NATUR organic plant breeding
 - UNITUS one event at farmers' field
- work planned:
 - events are planned for 2022 at KIS, IFVC, UNITUS, CRI, IHAR, UP, NATUR and NPPC.

The task leader said that it is important to distribute training material, properly announce the event, take update the WP7 leader on the ongoing activities; official ECOBREED templates and procedure; attendance lists are obligatory; main topic of the event is ECOBREED. Good practices are available in the ECOBREED website (training for farmers and workshops).

There are challenges to organise the training – all changes must be shared with WP leader.

The coordinator added that these events need to be planned properly and that informing the WP7 leader and deputy leader is very important; especially if bursaries are planned, this needs to be planned carefully.

WP8 session: Dissemination, exploitation and communication

Antoaneta G. Kuhar, WP8 leader, advised colleagues that it is important to share their results and communicate them with different target groups. This is also an investment in the researchers' future careers. Within WP8, many people are working together. The ECOBREED project is recognised as one of the best communicated projects.

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Deliverables in this WP: 5 out of 9 were already approved by the EU Commission, 1 was submitted recently and is waiting to be evaluated within PR3, and 3 are to be submitted by the end of the project.

Communication

The project manager introduced Špela Kodre (KIS) who is communicating the project through Facebook, Twitter, the website, etc. The ECOBREED website was updated with a new crop (this year it is soybeans, and she thanked the Serbian team for providing the photo for this year). The Facebook and Twitter accounts were also updated with a new photo. The Twitter account is very well followed and viewed. A YouTube channel was also created for the project's videos.

Take-home messages for communication:

- New Social Media campaign starting June 1 (at least 2 posts every week or 2 posts per partner per year)
- Press conferences: who, when? (one is planned in the Czech Republic in autumn); but other conferences can be planned
- Articles in local newspapers: critical (some partners are not active enough in communication)
- Fairs, business events: very critical (only 50% reached)
- Events with other projects: very critical (only 50% reached).

Dissemination

She thanked the project partners for reporting on dissemination activities every 3 months. Everything is going well and as planned (e.g., in attending and organising conferences or workshops).

For Task 8.4, only 24% of events were reached – each partner needs to organise at least 2 demonstration events per GA. There is a package of documents that need to be translated into national languages (some are still missing: Italian, Slovak, Serbian, Romanian). Mandatory documents include a list of participants, invitations in national languages and EN, a questionnaire and consent forms. The events must also be announced on the website. Each event is presented in the D8.3 report, so all this information is required. Failure to comply with these requirements may have financial consequences.

There are 3 other dissemination activities underway and most of the goals have been met. However, organisers need to be careful to distinguish between field days (Task 8.2), demonstration events (Task 8.4) and training events (in WP7) and prepare and communicate this accordingly.

More articles need to be published in journals, as only a small number of articles have been published so far. The number of PhD, MSc and BSc theses is also critically low. This goal has also not yet been achieved.

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The WP leader then introduced her colleague Andreja Žibrat Gašparič (KIS) who will help with dissemination and exploitation. She will manage the dissemination articles and send a to-do list for dissemination activities to all partners.

Take away messages:

- Prepare translations for demonstration event templates (Task 8.4) (Italian, Romanian, Slovak, Serbian)
- Obligatory documents to prepare: list of participants, invitation in local and EN language, questionnaire, consents
- Each project partner is obliged to publish at least 2 articles in industry/professional journals per GA
- Critically low number of PhD, MSc and BSc theses
- Each partner will receive a to-do list of outstanding commitments in WP8.

Exploitation

The WP leader pointed out that too few peer-reviewed articles are published in the field of exploitation and that more practice abstracts are needed. These will also be communicated and coordinated with the help of Andreja Žibrat Gašparič, who explained to the project members that all articles must be prepared and sent to the IP sub-committee for evaluation before submission to a journal. In addition, all records must be deposited in Zenodo (ECOBREED community) - for this purpose the records must be sent to Heinrich Grausgruber (BOKU), who is an administrator for this community. All peer-reviewed articles must be published in open access, for which funds are already available in the budget of the project partners. After publication, the articles have to be deposited in Zenodo. In addition, project partners are asked to produce more practice abstracts, as this is also a requirement of GA.

Helena Valas then presented the intellectual property in exploitation.

WP8 – Intellectual Property - timeline:

- BCQ distributed in September 2021
- by October 2021 we received 4 responses
- follow-up mail in January 2022 (response deadline end February 2022)
- Plan to have 4 business cases by June 2022

Exploitation Agreement:

- Selection of project partners planning to exploit & commercialize project results (September 2022)
- Finalization of business cases with selected project partners (November 2022)
- Drafting first proposal of Exploitation Agreement (December 2022 to January 2023)
- Open questions:
 - Which project partners will lead the commercialization phase?
 - Territories?
 - Timeline to commercialization

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- Costs related to commercialization
- IPR questions – background knowledge
- License fee?
- ECOBREED TM Licensing?

Three Party ECOBREED TM Licensing Agreement:

- Some project partners will use the seed distribution companies to sell & distribute the ECOBREED seed varieties
- All ECOBREED seed varieties should be traded under the same registered TM, which means that seed distributor will need to have the right to use the registered TM
- We have drafted a three-party Licensing Agreement to this purpose. It is distributed for your inspection and feedback by end of June 2022.

Background knowledge – MTA agreements

- Project partners at WP2 are in the final stages of background knowledge clearance, which means they have prepared the table of all the background in-put and will sign the MTA.
- ECOBREED project partners need to be aware if there are any expectations from background owners that could affect commercialization phase.
- Please contact H. Grausgruber and H. Valas for further info.

The WP leader then thanked everyone contributing to WP8.

WP1 session: Creation of working collections and seed multiplication

Pavol Hauptvogel, WP1 leader:

Task 1.1 was completed, but data compiled will be used for Task 1.3.

The inventory for each target crops from WPs 2-5 will be linked to the website.

Task 1.3 starts in M49 and the plan is to establish a portal of the core collection.

The information system should have the following criteria: easy accessibility for users via a web browser; user-friendly application interface, possibility of multi-criteria germplasm search, export results. First internal part of IS (back office) a system for data preparation by responsible for WPs 2-5 (passport and descriptive descriptors). The second external part of the IS (front office) with the presentation part.

The coordinator closed the morning session and invited all the participants to take a group photo in front of the institute.

WP2 wheat group meeting: outcomes

Heinrich Grausgruber, WP2 leader:

Task 2.1 - Screening of genetic resources and breeding material

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Different maturity trials. For durum we already have 3 years, for late and early varieties only 2. Year 2022 would be in most cases final year for field trials; still have small trial of spring wheat in Austria, Czech Republic, Germany.

Nikolaos Volakakis (GEO) left the consortium; he worked on durum and aestivum wheat. The material will be included in durum (in Austria and Italy); still need to decide whether to test the material again in season 2023.

ADVPHENO trials were done in Slovenia, Slovakia, and the UK in 2021 and 2022.

A few results were shown at the conference in Gumpenstein 2021. It was not really organic field, but only a field that was treated as organic – yield is therefore quite high.

Ongoing trials: few problems were reported – in Slovenia, very late decision by Primož Titan (RGA) that he will not sow, KIS will sow but very late. Emergence was very poor, stem is very thin, not normally developed. In Slovenia there was very low yield in 2021. In Austria and Romania, they reported drought, very dry fall and winter. In Crete there is a challenge with off-types. Mario Pagnotta (UNITUS) and Heinrich Grausgruber (BOKU) have to decide if and how to purify it.

TO DO:

- forward data to the WP leader Grausgruber, in form of excel with all the metadata included in the first sheet; traits should be in sheet 2 (traits abbreviated according to D2.1 + date), the field plan in sheet 3. If there are some specific arrangements, it would be good to include the field data. Forward the data as soon as possible, additional data later;
- sample delivery – as soon as possible to NPPC for quality analysis;
- in 2023: manuscript writing – input from each partner is needed (e.g., methodology);
- in late spring the quality analyses will be updated; all partners did some quality analysis – important to add this data;
- statistical analyses – manuscripts should be prepared mainly by people who contributed with quality analyses;
- the WP leader does not have all data from partners - last years and this year's data should be merged and used for another publication; the more data we have, the better analyses we can do.
- salt and drought stress: finalise ongoing experiment (candidate genes for tolerance) and data analysis; UNITUS is in charge for manuscript writing;
- advanced phenotyping trials in Slovenia and UK – done by Uroš Žibrat and Aleš Kolmanič (both KIS) – 3 wheat plots; more reliable results with barley as competitor than with naturally weedy plots; other phenological stages; imaging in time series; field trials will not continue in 2023; large data set of pot experiment of winter wheat from PSI – still missing analyses of remote sensing data;

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- to arrange and pass all the data to Uroš Žibrat (KIS), who can help with analysis; Pavol Hauptvogel (NPPC) agreed to send data to Uroš, who will check the data.

Task 2.2 - AMF compatibility

Pot experiment with 40 varieties was done at BOKU and UNEW, field experiment only at BOKU. Old versus modern varieties (wheat vs. rye), compare organic and conventional. Natural mycorrhiza flora was collected and sent to analysis. Results shows that the best in the pots were not the best in the field. Quite high mycorrhiza inoculation on organic field. No effect of breeding was seen. Species effect – rye has 50% more inoculation.

TO DO: finish second screen at UNEW, processing of sequencing data at BOKU, combined analysis – AMF community data and biometric data (BOKU and UNEW data). No responsible partner for manuscript writing yet.

Task 2.3 - Allelopathic activity screening

Only two partners in this task, UVIGO and UNEW. One presentation was done in Gumpenstein, another in process. Austrian varieties were quite successful with affecting germination of *Lolium rigidum* and *Portulaca oleracea*. Chemical analyses also revealed genotypic differences.

Chemical metabolites – few are enriched, few reduced. New results are confirming the previous ones. Phenolic compounds – vanillin and salicylic acid are exuded only after co-culture with *P. oleracea*. Content of most phenolic acid in the roots is reduced after co-culture with *L. rigidum* but increased after co-culture with *P. oleracea*. Root exudation was specially increased after co-culture with *P. oleracea*.

TO DO: 15 varieties failed in germination (germination and growth bioassays, chemical analyses; raining experiments – in greenhouse – simulating rain – we see how much inhibited/stimulated are weeds, quantification of compounds follows from soil solution; at the moment, they are doing this on 5 varieties.

Task 2.4. - Marker assisted selection

Screening for Lr and Sr resistance genes and wheat rye chromosome translocations (ATK, NARDI) were presented, as well as screening for some other genes at NARDI.

Seed multiplication was done at BOKU - 500 hundred seed for population, for partners for field trials for the next season. There will be enough seeds. 50 durum and Crete genotypes were screened for Cd accumulation.

Every spike that was affected was only partly infected. One of the explanations – resistance mechanism – flowering was successful before the germination; several varieties with very good bunt resistance.

First field screening of BOKU populations for common bunt were done: Pop A, Pop B and Pop C in 2021. Only A population are screened in another location by Veronica.

Some results that are contradictory. Some of the Romanian material which was excellent – it looks like resistance comes from variety that was used for crossing once there. We must look into that.

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TO DO: Magdalena will do some publications for her thesis; lot of multiplication was already done and distributed among partners and breeders and this is also planned for 2023.

Task 2.5. – Development of new wheat germplasm for organic farming

Creation of MAGIC population – on the field currently two populations at ATK and BOKU (early and late); we have to multiply it to have enough seeds for next seasons and to discuss how to multiply it (to bulk or separately); 11 CCPs from RGA – please check if the number is correct and inform the WP leader (also about the names); at BOKU, quite a lot multi-parent crosses currently in the field trial.

Specific ECOBREED crosses – we need them in early spring 2023 – ongoing update of inventory of available crosses. To strengthen the competitiveness is important to share materials. The task for the partners to discuss and convince authorities that we can strengthen if we include them and use the results of such a project.

Perennial wheat – growth is very good, but seed yield is very poor. Work done by RGA (ongoing selection in three populations), at BOKU (ongoing small-plot trial and multiplication of 2 crosses), at NARDI and NATUR; in 2022/2023, additional crosses/back-crosses need to be done, access to material within consortium has to be clarified.

Discussion

NATUR – spikes came from Washington University.

NARDI – Cristina-Mihaela MARINCIU – keep updated what is going on.

The quality of the data is very variable. NPPC did very good work, they evaluated nearly all traits. Other partners – most essential ones, from few partners very limited data. If there is nothing to score, please report per email that there were no things to check; also make notes if some variety is suppressing weeds; if you clean field before harvesting, please also note that and note how much time you spent for that – this information is needed for comparing varieties.

Pavol Hauptvogel (NPPC) kindly asked that partners sent him clean accessions.

Accession names (new name) have to be updated; it is good to use the same number of samples that were in the list (because there are duplicates). A range of varieties that were released and were before breeding line and now are registered as varieties – please inform the WP leader about the change of name so he can update the sheet in the excel data.

Long lasting topic - very important that we can finalise it; for all this material that was transferred, we must make material transfer agreement; we tried to combine all the agreements from different countries; the last page with signatures will be printed out, all the partners will give the signature.

Very important thing – there are two different Annexes (Annex 1 – where the provider was the owner, Annex 2 – multiplier of released third-party varieties (lists of used varieties)) - if you want to use this varieties you used for ECOBREED, you must negotiate again with provider; agreement was that these could be used for single-crosses (this was an exception): if you used it, just announce it (breeder ethics) as everything else is prohibited.

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Agreement can be upgraded; you can add appendixes. The WP leader will send out the list of all the exchanges, and partners will check if everything is correct, after that he will prepare all the agreements and send them around for getting signatures.

Comment about publishing papers – quite a lot of papers from this project were published in MDPI (with high IF); raised questions about the scientific quality in these journals (publication policy – review process is sometimes not very strict, lots of self-citations for raising IF etc.; they do not really care about the editing; very short time between submission and publication). It would be appreciated if at least in this WP transcripts are not published in MDPI.

Also, all the data should be accessible. It is important to have raw data in shape to upload on Zenodo. Access is restricted to ECOBREED community until publishing. After publishing it will be also available for others. They can use it in meta-analysis.

WP3 potato group meeting: outcomes

Peter Dolničar, WP3 leader, presented the results.

Task 3.1 – Screening of genetic resource and breeding material

The working collection includes 65 potato cultivars.

In Poland, the field experiments are finished in Młochów (years 2019–2021); two replications – 30 bushes from each cultivar; he presented the mean values of rAUDPC for the resistant potato cultivars evaluated in field experiments in years 2020–2021; in 2019 we did not observe *P. infestans* in the field.

Potato Virus S (PVS) assessment with strip tests in 2021 showed that from 65 cultivars in the work collection, 16 cultivars were resistant to PVS (e.g., Karlana, Salome, Wega, Twinner, Anuschka etc.).

The WP leader then presented the results of mean values of rAUDPC for 65 potato cultivars evaluated in field experiments in Boguchwała (years 2020 and 2021), the mean values for tuber yield in kg/bush in individual years and maturity groups, yield traits in individual maturity group for 65 potato cultivars, contribution of variance G, E, GxE, RxE, R for phenotypic traits evaluated in years 2019–2021.

Tubers defects for 65 cultivars: external defects (secondary growth, growth cracking), internal defects (hollow heart, black heart, internal rust spot, vascular discoloration).

The WP leader also presented the results on tubers taste for 65 potato cultivars in years 2019–2021 and darkening of tubers after 10 minutes for all the cultivars; also, total carotenoid content (TC) was presented (the highest TC detected in Mayan Gold, Otolia, Tajfun, Caprice and Anuschka). The highest vitamin C content was in cultivars Twinner, 12-LHI-6, TINCA, Levante and Kelly.

MATE results:

- 2019: field trial of 65 varieties (core collection) – trial failed due to agrotechnical problems
- 2020: successful trial: evaluation was accomplished for all wanted characters

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- 2021: successful trial: evaluation was fulfilled for all characters
- 2022: trial was set up with 34 selected varieties based on previous year's results
- evaluated the tolerance /resistance to naturally occurring biotic/abiotic stresses (PVY, late blight, early blight, tuber size/marketable yield, tuber defects – cumulated defects such as malformation, cracking, common scab)

KIS results:

Results on advanced phenotyping trials in 2021:

- 2x Multispectral imaging
- Georeferencing, orthorectifications, mosaicking, reflectance calculation
- Pipeline for year 2022

Variety classification:

- Dimensionality reduction and visualization (PCA, kPCA , PLS, tSNE)
- Extreme gradient boosting classification
- 70/30 test train split , 5 times repeated 10 fold cross validation
- Hyperparameter tuning using a grid search
- Overall accuracy (68 classes): 97.1% (CI 93.8 % 98.9 %)

Advanced phenotyping trials in 2022:

- Multispectral imaging in time series
- 8 varieties in 4 repetitions
- Georeferencing, orthorectifications , mosaicking , reflectance calculation
- 40 spectral features (probably more)
- 8 cultivars included (plot site 4x18 plants = 72 plants), 4 repetitions
- Phenotyping – remote sensing (3-5 x multispectral imaging)
- Phenotyping – physiological parameters (measurements with Li-600, LAI)
- Planned assessments of morphological and phenological traits (growth stages, shoot habit, number of shoots, plant height, yield and its characteristics, dry matter, assessment of naturally occurring pathogens/diseases)
- Currently: potatoes were planted in the field in April 2022, now already emerging

UNEW results:

- 2021 – 7 flights were done, but only 3 have flight data. Similar to what was done in Slovenia.
- 2022 – first flight was already done, on 30. 5. 2022.
- Data for 2 years of organic and for 1 year of conventional fields.
- Commercial phenotyping in 2021 and 2022.

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Task 3.2 – Potato AMF varietal evaluation

- 20 potato varieties were screened for AMF colonisation using 3L pots (1 tuber per pot) with 5 replicate pots/variety.
- Two control varieties (Cara and Casablanca) were also used with sterilised soil (48 hrs in the oven at 105 °C).
- Soil was taken from the 2020 potato phenotyping trial located at Nafferton Farm and sieved prior to transportation to the greenhouse.
- The trial was run for about 10 weeks through to mid-May 2021.
- Varieties were selected for variation in maturity date and for early and late blight levels recorded in the field in 2019.
- This assessment determined mycorrhizal colonisation in the whole root system (AMF frequency (F %), AMF intensity (M%), Arbuscule intensities (A%)) as well as in single mycorrhized root fragments (Mycorrhizal intensity m%, Arbuscule intensity a%).
- The INOQ Calculator Advanced extends this method to determine Vesicle abundance (V%, v%) and intensities of intraradical hyphae (H%, h%).
- Sarpo Mira and 12 LHI 6 have the highest frequency of colonisation while Salome the lowest. The majority of mycorrhiza that appear in the root fragments are Arbuscules and hyphae while the frequency of vesicles is low. From initial evaluation of the data there is no influence of maturity type and or late blight resistance.
- Organic fields had high natural mycorrhizal colonisation – from genetic screening, 20 species were detected.

Task 3.3 – Improving seed tuber quality and vigour via the use of cover crops

A cover crop trials were set up in UK at Nafferton Farm and in Slovenia at Infrastructural centre Jablje in August 2020 and 2021. The species were drilled at the following rates:

- *Brassica juncea* (brown mustard) 10 kg/ha
- *Raphanus sativus* (oilseed radish) 15 kg/ha
- *Medicago sativa* (Alfalfa /lucerne) 25 kg/ha
- *Avena strigosa* (black oat) 25 kg/ha
- *Vicia sativa* (vetch) 25 kg/ha
- Species mixture was prepared by mixing 2 kg of 1, plus 2 kg of 2, plus 1 kg of 3, plus 1kg of 4 and 1 kg of 5 to give a total of 7kg of seed which was then drilled at 15 kg/ha.
- UNEW –trial destroyed due to weeds in 2021
- KIS: potato trial was planted and evaluated in 2021
- Current status: UNEW and KIS – cover crop trials at UNEW and KIS successfully overwintered; potato was planted in April 2022; two varieties on both locations:

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Alouette, Carolus; in UK they should have used 2 KIS varieties, but they did not have enough seed, instead they used one of Sarpo varieties - Paul will check and update Peter; cover crop trial is planned for Autumn 2022 and will be repeated at UNW in 2023.

Task 3.4

Wireworm control strategies:

- Testing the efficacy of 6 treatments against wireworms:
 - Force chemical insecticide
 - Attracap - granular biological insecticide based on entomopathogenic fungus (EPF) *Metarhizium brunneum*
 - EPF's are known to cause infection and death of wireworms, therefore one of the treatments were potato tubers soaked in fungal suspension (2020) and fungi colonized on rice (2021);
 - Potato tubers soaked in fungal suspension and fungi colonized on rice
 - Control
 - Publication for this part is in preparation

Colorado potato beetle control strategies:

- Evaluation of some innovative CPB control strategies in potato fields:
 - Repetition of an experiment from 2022 randomized block design with 6 replicates on Slovenia n Potato variety KIS Kokra
 - 30 plants /plot = 3 rows with 10 plants row.
- Testing the efficacy of 7 bioinsecticides and their combinations) against CPB larve: Spinosad, EPF Beauveria bassiana (KIS isolates 2300 and 2121), Spinosad + B. bassiana, azadirachtin, azadirachtin + B. bassiana, RNAi, Bacillus thuringiensis var. tenebrionis; first experiment was done in 2021, this year (2022) is the 2nd experiment.
- Results: There were no significant differences in tuber yield between different treatments.
- MATE: field experiments in 2020-2021, 4 replication, 30 plants/plot, variety Botond; treatments: Spinosade, Novodor in 2020, Spinosade and Biomit in 2021; results: leaf damage with Spinosade – 25%, Novodor – 35% in 2020; leaf damage with Spinosade – 20% and Biomit – 70% in 2021; they will repeat experiment this year.
- IHAR: Colorado potato beetle in 2021 – range for all cultivars from 0-90%.

Task 3.5 – Marker Assisted Selection in organic breeding

KIS:

- Crossings: Parental resistant plants are grown on the brick at the Agricultural Institute of Slovenia. The crosses between resistant parents for production of

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advanced breeding lines were made in 2020 and 2021 and will also be made in 2022.

- Molecular markers applied: Molecular markers for resistance genes against PVY and late blight were applied on all families with resistant parents from crossing years 2013 to 2018 in 2020, 2021 and 2022. Altogether 155 advanced clones of different years were tested with markers.
- Planting populations from previous years in Slovenia in 2021: Breeding populations containing R8 and other resistance genes from previous years were evaluated and harvested in single hills from the crossing 2019, four hills plots from the crossing year 2018, ten hills plots from the crossing year 2017 and plots from the crossing year 2016.
- In April 2022 seed tubers of 238 clones from crossing years 2018 to 2011 were planted in organic field for selection in organic conditions. Some of the advanced clones are late blight resistant proved by molecular markers. All of them are also PVY extreme resistant. At all generations 4 tubers per clone were planted together with standard varieties KIS Slavnik, Alouette, Carolus and KIS Kokra.

IHAR:

- Screening of work collection potato cultivars with DNA markers linked with R-genes against LB – some markers linked with particular R-gene can show false positive results (screening of CC with more than one marker linked with the same R-gene; amplification of whole sequence of particular R-gene).
- Screening of unselected progenies: 44 clones transferred to Task 3.6; crosses Otolia x Levante, Alouette x Carolus, Levante x Carolus, EB 19-20 x Carolus etc.

MATE:

- Applied markers: late blight, PVY, PVX, G. rost. – few hundred individuals tested per year; in 2022, 500 genotypes from 5 families (100 plants each).

Task 3.6 – Production of elite varieties or advanced breeding lines

KIS:

- Crossings: Parental resistant plants are grown on the brick at the Agricultural Institute of Slovenia (as explained in T 3.5). The crosses between resistant parents for production of advanced breeding lines were made in 2020 and 2021 and will also be made in 2022.
- Molecular markers applied: Molecular markers for resistance genes against PVY and late blight were applied on all families with resistant parents from crossing years 2013 to 2018 in 2020, 2021 and 2022.
- Field selections: From the crossing year 2017 over 2100 seeds of 12 resistant families were sown and seedlings produced in 2018. Molecular markers listed before were applied at seedling stage and 327 late blight resistant genotypes with at least two R genes (late blight or PVY) were selected in years 2018 and 2019. 92 of them were selected on the field in 2020 for planting in 2021. In 2021 from 92

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clones 36 LB resistant clones were selected and planted in conventional and organic field for further selection in 2022.

- Advanced breeding lines: 44 clones transferred from Task 3.5 to Task 3.6
- New arrivals: 10-15 best clones from each population (Otolia x Levante, Alouette x Carolus, Levante x Carolus, EB 19-20 x Carolus, EB 19-20 x Levante, EB 19-98 x Carolus, EB 19-98 x Levante, Bzura x Carolus).

MATE:

- For three years: 15,700 seedlings were produced, 14,800 single hills, planted and evaluated, 915 A and B clones (evaluated), 122 advanced clones (evaluated), 1 variety candidate was entered for registration.

WP 3 – deliverables and milestones overview:

- MS 38 Sharing molecular data and bioinformatic protocols for joint analysis (potato) - achieved
- MS 17: Advanced breeding lines available for further selection and varietal development
- D3.2 Final report on AM compatibility evaluation
- D3.4 Final report on Colorado potato beetle and wireworm control strategies
- D3.3 Final report on phenotypic characterisation of potato
- D3.6 Statistical analyses of phenotyping results
- D3.5 Final report on improving seed tuber quality and vigour via the use of cover crops
- D3.7 Final report on MAS in potato
- D3.8 Final publishable report on WP3

Practice Abstracts have to be prepared (one per task). We will have online meeting next week to discuss this. One publication was prepared by Eva Blatnik (marker assisted selection).

WP4 soybean group meeting: outcomes

Vuk Đorđević, WP4 leader: The WP4 leader greeted everybody and expressed his joy to meet everybody in person. This forum is meant for discussing different topics. He also presented the plan how this group meeting will be conducted.

Activities

M48 currently and less than 2 years to finish the project; 6 partners involved in this WP.

Task 4.1 (M12-M70) – identification of useful traits

- Screening of soybean genotypes was completed during the two-year trial in 2020 and 2021

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- Data of important agronomic traits as well as morphological biological and growth characteristics of the analysed genotypes were collected
- Result of the canopy cover was presented: canopy cover is important in organic breeding; unfortunately, in 2020 they had only two locations (RO trial 2020 fail), last year they had all 3 locations; heritability and other parameters will be still calculated for the canopy cover, but the group did a good job with interesting results
- Yields were 2-4 tonnes and 1-3 tonnes in 2020 and 2021 respectively.

Maria Bernhart (SZG) reported on results from Austria: 2nd season for screening of early (160) and late (120) cultivars in 2021; struggles – shipment of samples to IFVCNS for quality tests; 2022: re-test of the 20 best out of the two years' trials.

The task leader commented that all maturity groups matured in Austria, and this is a surprising and good result.

Maria Bernhart (SZG): 3 locational traits: Maturity groups OOO – II: in both trial years all varieties reached maturity (harvest at end of October / early November).

Ion Toncea (NARDI): Diversity of genotypes – maturity group, vegetation indexes, weed – everything is very high.

Željko Milovac (IFVC) reported on abundance of mites:

- Monitoring during 2018 to 2020; at 3 localities; counting number of adult mites on leaves; 3 varieties (Galina, Sava, Rubin); at field edge at 20m, 40m, and 60m within the field; greatly influenced by weather conditions (temperature and precipitation); the lowest abundance had variety Galina (0 MG); Rubin had the highest number of mites on leaves
- research on southern green stink bug *Nezara viridula* – 2018/2020/2021 on five soybean varieties; the introduced 5 stink bugs per plant into isolation cages; they observed various parameters; protein and oil content was also analysed; greatly influenced by time of introduction, e.g., phase of plant growth

The task leader commented that all these stink bugs can destroy whole soybean crops and we have to be prepared for this.

Jovana Krstić (IFVC) presented her research on weed competitiveness and relation to soybean:

- Trial with split-split-plot design with four blocks; 3 different soybean varieties; 3 weed species (*Abutilon theophrasti*, *Abrosia artemisifolia*, *Xanthium strumarium*); 5 density of weeds; results – values of soybean plant dry matter measured 12 weeks after soybean emergence – *Xanthium strumarium* was the strongest competitor and influenced to reduce the dry matter of all genotypes; in 2022 they started soybean genotypes (sowing weeds and soybean varieties); using more competitive soybean genotypes we can be useful for organic farmers in general and as additional weed management strategy;

The task leader added that it is important to find soybean varieties that are more tolerant to weeds.

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- Screening of genetic resources and breeding materials: soybean genotypes evaluated for resistance to stem canker; there are some problems – resistance to southern stem canker exists, but not to northern stem canker as published in the literature;

Ion Toncea (NARDI): identification of useful traits and level of local adaptation of soybean genotypes; type of experimental design: augments complete block design; total 160 plots; 7 accessions and 105 unknown accessions.

Summary of Task 4.1: done most of the trials; still need to do process all the data and go to publications

Task 4.2 (M25-M68)

Abiotic stress:

- IFCV: The analysis of drought tolerance during the 2020 and 2021 trials; 206 different genotypes were analysed, 117 were classified as early and 89 as late; to assess the drought effect on analysed genotypes we collected the data on agronomic important traits, morphology, seed quality and other; yield – drought had greater effect in yield for late genotypes compared to early ones; drought caused a yield decrease in both years; protein content – early genotypes had a higher protein content compared to late ones in both drought and control trials;
- Werner Vogt-Kaute (NATUR): Chilling tolerance in youth development and chilling tolerance during flowering: 3 dates of sowing, 40 varieties, 3 reps, germination of first plants; first batch: significant differences; in germination (0-28%, average 10,2%);
- Ion Toncea (NARDI): tested 17 genotypes in abiotic stress trials; the yield was zero due to strong drought.

Summary of Task 4.2: majority of work already done; planned some additional trials and publication.

Task 4.3 (M13-M62) Professor from BOKU not present at the meeting. All experiments are done. Publication pending.

Task 4.4 already finished, and publications submitted and planned to be published next year. Low Cd genotypes are identified. Data processing of molecular data and linking with phenotypic data.

Task 4.5

Marjana (IFCVNS) presented the study on cover crops used to improve quality and production of soybean; soil analyses – soil microbiology, determination of soil compaction; determination of specific soil quality; morphological traits were observed; followed by the quality analysis of seeds; yield was around 3 tonnes; protein content, oil content and seed parameters were observed and gave good data for the tested varieties; in one trial they had 2 cover crops and 2 soybean varieties; 3 experimental years; the results will be presented at a conference in June 2022; they can now explain how to best use cover crops; one Practice abstract (PA) was already submitted on this topic, but also two scientific papers will also be prepared and published.

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Maria (SZG): Seed inoculation trial (5 treatments, 2 soybean varieties, 4 replications); in 2021 the nodulation was not good; there was no significant difference between treatments; the inoculations usually led to an improvement in yield.

Ion: improving seed multiplication via cover crops and soil inoculants; 3 soybean genotypes were tested in randomized block design in 2022; in WP6 he introduced 3 combinations with 3 varieties; main problem in 2022 – attack of pigeons during emergence of soybean seeds, then weeds and drought; nevertheless, they expect good results as they do not have that many weeds.

Summary: sample preparation for quality analysis and shipment to IFCVNS planned for SZG; publications also planned for all partners.

Task 4.6

- Cultivation of 4 segregating populations (F4) for on-farm selection and breeding in Austria – WP6 farmer participatory trial, Farmer Jugovits.
- 2022: continuation of elite material development and new material development.

Discussion: Vuk (IFCVNS) started the discussion on how all the obtained data can be used. One of the strategies can utilize existing genetic diversity for definition of soybean isotype for organic production: e.g., decrease flowering time and maturity date, have high canopy cover, increase plant height, decrease lodging and shattering, increase yield – this should be our direction in trials. How should this ideal type of genotype look like? Vuk asked the audience for feedback.

Maria (SZG) added that you need younger seeds, stem determination – select types that are indeterminate and could be more favourable.

The task leader hopes that in the future new ideal types will be found.

Ion Toncea (NARDI): of course, we want ideal varieties and agrees with that Maria said about the characterisation of plants. Yield is also very important. One additional remark about the first pod height.

Summary: already crossed some populations; continuing preparation of segregating populations for farmers trials; new material development based on results obtained in Task 4.1

Deliverables

- D4.1 was submitted already; D4.2 – D4.8 still need to be made (IFCV needs to produce 4 deliverables, GS one deliverable and BOKU another deliverable).
- The task leader also showed the topics and timelines for all the deliverables.
- He also asks for good interaction and communication between the partners to make these deliverables.

Publication plan

- The task leader listed another 6 publications that are planned for this year from Miloš, Jovana, Goran, Željko, Predrag, Ion, Victor and Vuk. Two papers by Johann and by Jelena, Dragana and Vuk have submitted publications. All the others are in

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draft version. Some publication will postpone in several months, due to problems with seed shipment and some need more time for data processing.

- Publications when prepared for submission must be send to IP sub-committee to check, only after that it can be sent to a journal. If we do not follow this, then we cannot claim this as a project cost.

WP5 buckwheat group meeting: outcomes

Dagmar Janovská, WP5 leader, thanked all participants for coming and for the work in last 12 months as this was a huge amount of work done.

Task 5.1

Objectives:

- extensive phenotyping in field trials in 4 countries (Czech Republic, Slovenia, Austria, US, China)
- extensive phenotyping in CN
- analyses of selected compounds
- selection of 96 accessions for T5.4

Results:

- SZG, KIS and CRI results:
 - 54 common genotypes
 - additional: Austria – 16, Slovenia – 26, Czech Republic – 120, i.e. 216 genotypes together
 - 27 traits in fields
 - compounds analyses
 - total 55,208 analyses were performed
 - manuscript preparation from Austrian and Czech Republic results only used – more than 40 genotypes for 3 years' evaluation; decision on the last meeting that results from those 2 countries will be used first;
 - due to the cyberattack at CRI servers not all the analyses have been finished yet, but they should be finished before the summer
- WSU results (presented by Rachel Breslauer):
 - 2020 were the first trials
 - W of the Cascade mountains – location for trials; soil type: well-drained silt loam, neutral (pH 6.6)
 - 52 buckwheat lines were grown – showed the phenotyping results for these lines
 - 2022: moving trials to target environment of west Washington state (same as 5.3)
 - assessing an additional 47 lines from the United States Department of Agriculture germplasm bank
- CAAS results:

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- 1287 common buckwheat accessions were phenotyped
- very diverse buckwheat in China
- results of phenotyping traits exhibit great variation in different buckwheat germplasm resources

Task 5.2

UVIGO results were presented by Iftikhar Hussein.

Portulaca oleracea

- Vychodoslovenská krajová, Monori and Prego seems to be the most promising varieties against *P. oleracea*.
- Sarasín a Ployes and Harpe are highly stimulatory for *P. oleracea*
- Monori decreases germination, plant weight and root length
- Vychodoslovenská krajová decreases germination and leaf and root length
- Prego decreases all parameters
- Aelita, Doris and Špačinska1 stimulated at least one of the parameters

Lolium rigidum

- buckwheat reduces the germination of ryegrass following co-growth with most of the varieties
- *L. rigidum* grows weaker and shorter with most of them
- Sarasín a Ployes and 2223 stimulated the growth of ryegrass
- Vychodoslovenská krajová, Skorospelaya, 2316, Monori and Iwate zairai strongly decreased germination, plant weight, and leaf and root length of *L. rigidum*.
- Aelita and Ballada induced also decreases in plant weight, leaf length and root length of *L. rigidum*

Some phenotypes were additionally analysed:

- variety Gema: shoots – when Gema was co-cultured with *L. rigidum*, P-CA, SA, and PTA increased in shoots, but LU, QE, VN, ECAT, OR and VIT decreased following Gema co-growth with both weeds; roots exudation was the less affected parameter; roots – QE, VN, ECAT, VIT were reduced in roots, and DA and P-CA increased in root of Gema after co-culture with both weeds;
- variety Kora: shoots generally phenolic compounds were decreased with both weeds; DA, FA, P-CA, LU, QE etc. were decreased in roots after co-growth with *L. rigidum*; root exudation of DA, FA, P-CA, SA, M-TA etc. completely disappeared after co-culture with *L. rigidum*; while DA, M-TA, LU etc. increased;
- variety Eva: shoots following co-cultured with *L. rigidum* and *P. oleracea* the concentration of VA, DA etc. was increased; in the root exudates was the same or even decreased for some compounds when EVA was grown together with *Portulaca*; Eva was phytotoxic against *Lolium* than *Portulaca* in the phytotoxic bioassays.

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The WP leader asked whether we know how big differences were in the water solution of root exudates of *Lolium* and *Portulaca*?

Iftikhar Hussein answered that they found that the genotypes increased the root exudation; Eva is more phytotoxic with *Lolium* than *Portulaca*. These results will be published in a new paper that they are preparing.

UNEW results:

40 buckwheat varieties screened for allelopathic effects of straw in 20x20 variety screens. *Lolium perenne* and *L. multiflorum* were also used.

The genotypes were from the Czech Republic and Slovenia field trials, and we are now waiting for their results.

Task 5.3

- field experiments in 3 countries (Czech Republic, Slovenia, US)
- characterisation of buckwheat varieties – 10 common buckwheat, 1 Tartary buckwheat (in Czech Republic additional Zamira and from 2021 also Pyra)
- we used the same design and structure for evaluation as before.

KIS & CRI results:

- spring and summer trials;
- variety Hruszowska was not germinating in both trials in Slovenia and lower germinations of Bamby and Doris in the spring trial. Seeds of Bamby and Doris were replaced for the summer sowing trial;
- all samples were sent to CRI for analyses – P, K, Mg, Ca content in soil, biomass and grains;
- results of trials show in Slovenia – La Harpe genotype can receive most P from all the genotypes; in Slovenia, ammonium acetate was used for evaluation of P content in soil; in Czech Republic, fresh soil is used for analyses and in Slovenia dried soil samples are analysed;
- Zamira was the most promising variety in the Czech Republic in 2020;
- analyses of sum of mycotoxin content of additional field trials with the same varieties as used in P-mineralization field trials with artificial inoculation of buckwheat in flowering stage with two *Fusarium* species (*F. oxysporum*, *F. verticillioides*) were presented.

WSU results were presented by Rachel Breslauer:

- field trials in 2021 & 2022
- soil - pre-plant Bray phosphorous incredibly high - 123 ppm
- soil type: flood plain silt loam, 6x% organic matter, moderately acid (pH: 6.3)
- planting was done in dry spring – despite this there was enough precipitation
- 3 weeks after planting there was a heat wave, but buckwheat can be quite tolerant to this (expect for the flowers)

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- water-extractable P levels – no significant differences across the varieties
- yield: some varieties had low yield, but some had high variability (KIS Eva & La Harpe); KIS Doris had high potential.

The WP leader asked whether they could exclude Doris from evaluation and check the numbers again and whether they use bees.

Rachel Breslauer answered that they will check the numbers without Doris. They use natural pollination, not added beehives.

Task 5.4

Genotyping objective: identifying underlying genetic response to abiotic and biotic stresses together with quality traits.

KIS results (presented by Barbara Pipan):

- challenging shipping samples to China and vice versa;
- they optimised the form of the non-viable plant material procedure for shipment (they sent freeze-dried pellets – they were the most suitable);
- providing all the documentation needed for the Chinese custom along the samples successfully sent to CAAS;
- optimised the DNA extraction protocol; tested commercial seeds; CTAB extraction protocols and vegetation phases of plants used for DNA extraction; freeze-dry protocols for DNA;
- magnetic extraction was unsuccessful;
- real DNA extraction – 96 common buckwheat accessions selected from the ECOBREED buckwheat collection as it is in T5.1;
- extractions performed on young, fresh plant material grown under controlled conditions in a greenhouse at KIS;
- the originated volume in each tube was 74 µl containing between 3.16 µg of DNA as lyophilized powder;
- all protocols followed the tested and agreed methodology.

CAAS – providing CC from China (presented by Barbara Pipan):

- combining phenotypes and SSR markers, 462 Chinese accessions were chosen as a primary core collection of common buckwheat;
- phylogenetic analysis of 618 accessions revealed that ACCs mostly European/some worldwide clustered as group I, which means they have a closer relationship with accessions from NW China;
- we propose a possible migration route of common buckwheat from the NW China to other countries;
- 7 genotypes were removed after the filter of valid SNPs;
- comparative genome analysis: FAR-RED impaired response 1 (FAR 1); 34 transcription factor families were compared between common and Tartary

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buckwheat; only 33 FAR genes of common buckwheat were clustered with Tartary buckwheat and *Arabidopsis*;

- 115 common buckwheat FRAs were clustered independently;
- in order to identify genetic loci associated with important agronomic and quality traits of common buckwheat, we performed GWAS analysis for 462 core accessions (distribution association of this trait is equally distributed across all the chromosomes in the growth period; for plant height the genes are placed at chromosome 4; total flavonoids content the genes are also equally distributed across all the buckwheat genome);
- there are no geographic associations found among genotypes according to phylogenetic analysis/PCoA/genetic structure – this lack of distribution pattern according to the origin; so, they screened a different tool at KIS;
- they assessed all the collection within ECOBREED on phenotypic (40 descriptors for buckwheat) and genotyping level (on SSRs markers – using population genetics approach) – this will be a good complementary study to test the distribution of genotypes in the collection;
- testing the agronomic performance and varietal purity/stability of the Slovenian variety Čebelica within 10-year period;
- she also presented the new equipment in the KIS laboratory (robotic system).

Task 5.5

Production of elite varieties and advanced breeding lines

Maria Bernhart (SZG):

- crossing and breeding of buckwheat;
- started in 2020 (manual crossings);
- 2021 regrown in isolation cages; 900 F2 seeds successfully harvested in October 2021;
- continuation of the selection and multiplication.

Primož Titan (RGA; joined the session online via Zoom):

- improvement of grain yield and harvest index are two important breeding goals also in buckwheat breeding;
- two breeding approaches for the buckwheat improvement are considered in the project: the use of wide crosses for the improvement of buckwheat fertility;
- heterosis breeding associated with the superiority of first filial generation over the parental generation;
- use of wide crosses.

The WP leader asked him if he will repeat crosses between common and Tartary buckwheat and warned him that it is impossible to cross those two due to natural barriers. She also asked him not to do write about these crosses within the ECOBREED

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project. She also asked about the seed of buckwheat synthetic population for field trials that have to be sent to involved partners in WP6.

Primož Titan replied that he sent it and that the deliver is expected next week.

The WP leader then presented the milestones and outlook for WP5.

Milestones

- MS 28 finalized – Genotyping of buckwheat collection completed.

Outlook for WP5:

- amendment extension
- milestones
 - MS36 - Sharing molecular data and bioinformatic protocols for joint analysis (buckwheat) (M60 – CAAS)
 - MS41 - Advanced breeding lines available for further selection and varietal development (buckwheat) (M60 – RGA)
- deliverables
 - D5.4 - Genetic diversity analyses of common buckwheat genetic resources (M64 – CAAS)
 - D5.5 - Phenotypic characterisation of common buckwheat genotypes (M66 – CRI)
 - D5.6 - Buckwheat crosses (F1, F2, BC1 and BC2 generations), providing a starting point for the production of buckwheat cultivars suitable for organic farming (M68 – RGA)
 - D5.7 - Final publishable report on WP5 (M69 – CRI)
- publication of results:
 - T5.1 – Czech Republic already published, in progress in Austria and Czech Republic data together, Slovenian data will be analysed;
 - T5.2 - UVIGO is still analysing some genotypes, but they are planning publications; the WP leader informed the participant that the report of at least 40 genotypes must be prepared as promised in the project proposal; Iftikhar Hussein (UNITUS) will send the list of all accessions used in the analyses with descriptions what was done and why the given genotypes were chosen for further analyses or excluded, the manuscript will be prepared in the next two months and firstly be sending to the IP sub-committee of ECOBREED;
 - T5.3 – publication in summer 2023 planned; field trials are still ongoing;
 - T5.4 – in progress; CAAS is preparing a manuscript;
 - T5.5 – ? RGA? (Primož wasn't present anymore at the meeting, so no feedback).
- Practice abstracts (PA):
 - T5.1 – CRI will prepare a PA after publication of Austrian and Czech data – M53;

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- T.5.2 – UVIGO must also prepare a PA after manuscript submission; the coordinator added that PA must be suitable for farmers to understand it means simple and easy understandable language;
- T.5.3 – also planned for the summer 2023;
- T.5.4 – Barbara Pipan (KIS) will prepare a PA for Slovenia;
- T5.5 - ? RGA? (Primož wasn't present anymore at the meeting, so no feedback).

Rachel Breslauer (WSU) added that 5.3 publication plans should be discussed.

The WP leader replied that firstly field trials need to be completed, then we will see how to publish the data and compare it with the European data and then publish the results together.

Important: Periodic Reports PR3 must be finished by 30 September 2022

Important deadlines:

- 15 August 2022 – all samples for CRI analyses
- 31 August 2022 – all data analyzed completed
- 15 September 2022 – all data sent to CRI to Dagmar
- 20 September 2022 – 1st draft
- 30 September 2022 – 2nd draft
- 15 October 2022 – final version must be finished and sent to Antoaneta G. Kuhar (KIS)

Individual consultations between KIS and partners on admin and financial issues

- IFVC - more details in the description of costs needed. The percentage of other direct costs compared to personnel costs is very high. Timesheets need to be archived (signed), they explained they have them archived and accessible at any time. The project office is about to be established – they don't have any new information on that.
- GS – there is no problem with personnel costs, but there is a problem with reporting other direct costs. 24 tons of organic fertilizer and fuel consumption are too high compared to the size of the experiment. It is recommended to remove spare parts. This amount and the cost of fuel also cannot be claimed. IFVC representatives said they would talk to GS representatives and help them correct the reports, and they would also assist them with time sheets.
- MATE - a better more detailed description of costs is requested. For the travel (there is a conference planned in Krakow), the paper's abstract should be sent to KIS in advance. There is a problem with employing new people.
- NARDI – the budget shift was included in the recent amendment that is now with EC and should be returned by the 4 July 2022 at the latest. Two demonstration events should be organized, specially dedicated to ECOBREED topics (T8.4). The

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announcement, invitation, participants list, photos, report in English, and questionnaire should also be prepared. Practice abstract need to be written. All tasks that left should be accommodated within the money that left. At least two PAs are expected.

- NATUR – funds planned for subcontracting in Part B should be reported accordingly.
- SZG – no comments and recommendations.
- SEL – internal invoicing is not an option. Better descriptions of costs are needed. Advance planning of events and costs is strongly recommended.
- PRO-BIO – advance planning of events and costs is strongly recommended. Better explanations of costs is needed.
- UVIGO – the most expensive work has already been done. All future activities should be accommodated within the remaining funds.
- CRI – Viterbo costs are not claimed because they were incurred after the reporting period. Low remaining budget - they are aware that they only have this amount left.
- BOKU – subcontracting expenses are too high due to increased prices on the market.
- BIOMILA – well prepared financial reports.
- NPPC – 5 people fully employed for one year is too much compared to their tasks. There is only 34,000 EUR left, and that is very critical.

WPs reports and wrap-up

WP 2 report and wrap-up

Heinrich Grausgruber (BOKU, WP2 leader) presented the results of the WP2 session.

Task 2.1 – a lot of nurseries still on the field and will be harvested in 2022 and this is the last year for field trials. Some of the results were already published and they are available in Zenodo.

Problems: late sowing and emergence in Slovenia, drought in Romania, off-types in CRETE nursery, lodging in CRETE.

To do: data must be delivered as soon as possible after harvest; statistical analyses planned for 2023, manuscript writing for publications also planned for 2023 for each of the partners. Quality analyses will be made at NPPC and this will also be published.

Lot of partners are doing quality analyses themselves.

To do in 2022: salt and drought stress durum wheat, finalise ongoing experiment and data analyses, then manuscript writing for publication (UNITUS).

Ongoing field trials in advanced phenotyping trials: georeferencing, dimensionality reduction and visualization, cross validation, hyperparameter turning; multispectral

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imaging in time series. In 2022 still to do: data analyses of PSI greenhouse trials, and of field trials, the also manuscript writing.

Task 2.2 – several experiment at BOKU and UNEW with 40 varieties.

To do: analyses of second screen at UNEW, processing of sequencing data at BOKU, combined analysis (AMF community data and biometric data; data from UNEW and BOKU) and also manuscript writing (there was some discussion who will do the manuscript writing on this task).

Task 2.3 – first results showed genotypic differences in germination and biomass production in the presence of two weeds; some genotypes failed to germinate so they have to pre-germinate them (15 varieties). This will be followed by data analysis and manuscript writing.

Task 2.4 – screening for Lr and Sr resistance genes and wheat rye chromosome translocations at ATK and NARDI finished for early; screening for some other genes at NARDI; 50 DURUM and CRETE genotypes screened for Cd accumulation; seed multiplication at BOKU (Gpc-B1 at NARDI and ATK for two populations); first field screening of BOKU populations for common bunt; some lines of PopC also screened at CRI.

To do: finalise ongoing experiments at BOKU and CRI, data analyses, manuscript writing (Magdalena's PhD and paper by Veronika et al.); trials in 2023 and seed multiplication – distribution of material (this still need to be discussed).

Task 2.5 – creation of MAGIC populations and CCPs (2 MAGIC populations under seed multiplication at ATK and BOKU), 11 CCPs from RGA were tested in SI and HU, several BOKU multi-parent crosses currently in the field trial.

Specific ECOBREED crosses: ongoing update of inventory of available crosses (as some were meanwhile deleted etc.).

To do: a list of additional crosses; clarify access to material with consortium.

Perennial wheat: some crosses *Triticum aestivum* and *Thinopyrum intermedium* etc. made at RGA; BOKU has ongoing plot trial with *Th. intermedium* Kernza multiplication of two *xAegilotriticum* crosses; NATUR: trials with sowing dates; NARDI: 4 crosses with BOKU Blk.1.

Peter Miko asked about the *xAegilotriticum* crosses which Heinrich explained which crosses they used and why at BOKU.

WP 3 report and wrap-up

Peter Dolničar (KIS), WP3 task leader, presented the report on the session of partners in WP3 (KIS, UNEW, MATE, IHAR).

Task 3.1 – screening of genetic resources – 65 potato cultivars; tubers defects and tuber taste was also tested; measured darkening, vitamin C in potato tubers, microelements; weed resistance important – evaluated to late blight and early blight resistance; resistance to naturally occurring biotic and abiotic stresses were tested.

There was some discussion on the results: how to combine all the data with different cultivars. Advanced phenotyping – trials in 2021, 2x multispectral imaging at KIS,

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georeferencing, orthorectifications etc., variety classification; multispectral imaging in time series with 8 cultivars in 4 repetitions planned for 2022 (KIS and UNEW).

Conclusions – finished with phenotyping; remote sensing still another year of observation at UNEW planned; a set of experiments at KIS with remote sensing; publications planned.

Task 3.2 – 20 potato varieties were screened for AMF colonisation using 3L; the task is finished.

Task 3.3 – cover crops trials set up in UK 2020 and 2021, species were drilled at rates: brown mustard, oilseed radish, Alfalfa etc. There are some trials still planned for 2022 in 4 different potato varieties.

Task. 3.4 – wireworm control strategies: experiments are finished (2 experiments in Slovenia); Colorado beetle control strategy: testing efficiency of individual bio-insecticide in plant defoliation; trials still planned in KIS and IHAR in Poland in 2022 and 2023.

Task 3.5 – marker assisted selection in organic breeding – 3 institutions in this task; identifying resistant varieties; at KIS every year different crosses are tested, and molecular markers are tested; also, field selection still ongoing in Slovenia in 2022; IHAR: screening of WC potato cultivars with DNA markers linked with R-genes against LB; screening of unselected progenies; MATE: marker assisted selection – they have one variety gene candidate entered for registration.

Task 3.6 – KIS crosses between resistant parents for production of advanced breeding lines; in 2021, 92 clones 36 LB resistant clones were selected and planned in conventional and organic field for further selection in 2022; IHAR – similar test; up to 15 best clones from each population; MATE – similar test done.

Results for T3.5 and T3.6 – utilized R genes for resistance to late blight, PVY, PVX, nematodes; new crossings for both tasks every year, selection of older progenies on the field every year; new progenies and variety candidate clones at T3.5; new advanced LB resistance clones with multiple R genes at T3.6.

Finished milestone MS38. Some milestones and deliverables still must be finished.

WP 4 report and wrap-up

Vuk Đorđević, WP4 leader, presented the soybean discussion and results of the WP4 group.

Task 4.1 – identification of useful traits for breeding; more than 200 soybean genotypes were analysed; canopy cover change during vegetation period – the results of this trial were presented; some problems with shipment of samples to IFCVNS for quality tests.

Highlights: All varieties reached maturity in all locations. Observation of increased occurrence of the green stink bug also in Austria – suction damage to the seeds was detected. Weed control also very important in organic production of soybeans – there are ongoing trials on three weed species. Similarly, soybean genotypes were evaluated for resistance to stem canker.

To do: finalization of data collection and manuscript writing (publications).

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Task 4.2 – abiotic stress (draught) tolerance – caused differences in yields (decreasing yield), but also protein content; for Northern part of Europe chilling tolerance in youth development and during flowering was observed as this is more important than drought in these regions. Data processing is already done for this task.

Task 4.3 – task was finished, data processing done.

Task 4.4 – task finished and closed with already submitted publications.

Task 4.5 – using cover crops: seed quality is important, and this is being studied with the use of cover crops; seed inoculation trials still ongoing in SZG in Austria; one publication pending, but data processing is finished.

Task 4.6 – 4 segregating populations, crosses were done at the beginning of the project, now they will start to collect the first material; multivariate genotype-ideotype distance index (MGIDI) is used. To do: publications.

Some deliverables still need to be done and 9 publications are planned in this WP.

WP 5 report and wrap-up

Dagmar Janovská, WP5 leader, thanked all the WP5 colleagues for the big load of work they did.

Task 5.1 – we have three parts of localities – some in Europe, but also in China and the US. One manuscript is being prepared from data from Czech Republic and Austria. In total, 55208 analyses were done at CRI as all data is sent there for genotyping (except data from China).

WSU – did 52 buckwheat lines and they have results ready for phenotyping; they will add 47 lines from the US germplasm bank.

CAAS – sowed 1287 buckwheat accessions at three localities.

Task 5.2 – elucidate alleopathic effect of buckwheat secondary metabolites; *Portulaca oleracea* and *Lolium rigidum* – there are some promising varieties against these two weeds; phenolic profile was also checked and there are exudates in water (variety Eva is phytotoxic against *Portulaca oleracea*).

UNEW – screening for alleopathic effects with 40 buckwheat varieties also tested. They are now waiting for statistical analyses.

Task 5.3 – assessment of bioavailability of P for following crops. Field experiments in 3 countries (Slovenia, Czech Republic, US) with common buckwheat and Tartary buckwheat varieties, but also Pyra variety from Czech Republic. Best P accumulation in Slovenia was variety La Harpe, in Czech Republic the best was Zamira for last year trials.

CRI – also did inoculation of two different dates on *F. oxysporum* and *F. verticilloides*; they have now 3 years results; T2 and HT2 toxin greatest amount in buckwheat variety was in 2019 and 2020; WSU – send soil analyses to CRI.

Task 5.4 – genotyping from European and Chinese data. There were some problems sending the material to China. Now the first results are already available which show a clear difference between Chinese and European data. This will now be published.

KIS – phenotyping under 40 descriptors for buckwheat.

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Task 5.5 – crossing done with 2 partners; there are a lot of combination being tested; RGA successful in crossing *F. esculentum* and *F. homotropicum*.

They achieved the M28 milestone. There are still some milestones and deliverables to be reached in 2022 in 2023.

Heinrich Grausgruber (BOKU, WP2 leader) asked in which plant organ did they analyse P and how do you do DNA extraction.

Dagmar Janovská (CRI, WP5 leader) replied that they take three samples to analysed P in plants - one from the soil, one from biomass and one from the grain.

Barbara Pipan (KIS) explained that one plant was used in genotyping: 4 individual samples per accession.

Conclusions and closure of the meeting

Vladimir Meglič, project coordinator, thanked all the WP leaders who presented their data, results and discussions. The coordinator is glad that it was finally possible to hold the annual meeting in person again, as this is better for discussions and open questions

There is now a large amount of data from the project that now needs to be analysed. He is glad that data sharing is taking place between all project partners. Several processes have already been carried out and new ECOBREED varieties have been developed. And this will be our big contribution to the EU.

He urged the project partners to follow the rules of intellectual property and all the paperwork of the exchange. And not to forget to provide the material to the IP sub-committee ECOBREED as well.

He reminded the participants again about PR3 - the draft of PR3 is due in early October 2022.

Finally, he stated that a location for next year's meeting needs to be determined. Since the World Soybean Research Conference (June 18-23, 2023) has been moved to Vienna next year and this is an important conference for ECOBREED, he proposed the project members to hold the 5th annual meeting in Vienna/Tulln on June 15-16, 2023, just before the conference. Full details about the meeting will be announced around the turn of the year.

He closed the annual meeting and thanked everyone for coming, for sharing data and for the discussions, and the organisers for a great stay and hospitality.

Visit of the field trials

On Wednesday, 1 June 2022, the participants of the 4th ECOBREED annual meeting visited the ATK Cereal Quality Lab and the Phytotron climate chambers after the morning session. Later, the participants visited the organic field and ECOBREED small plot trials of the institute as well as the Agroverzum Agro-science exhibition in the afternoon.

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Scientific Advisory Group (SAG)

On June 2, a special hybrid meeting was organised with EB and SAG members and with representatives from EC. All members of EB and SAG (Monika Messmer, Ferdinando Branca and Steven Jacobs) were present, as well as Ms. Patrizia Pitton and Laurence Bonafos from DG AGRI.

The coordinator welcomed all present and presented the agenda of the meeting. The leaders of the working groups (EB members) presented the progress of the work done in the last year.

WP2 Q&A

Laurence Bonafos's questions:

Q: Can you explain more about the MAGIC population and perennial wheat presented during WP2?

A: Heinrich Grausgruber (WP2 leader) explained that MAGIC stands for Multi-parent Advanced Generation Inter-Cross; in our case we developed two 8-parent MAGIC populations, one within the early maturity group, another one within the late maturity group. Perennial wheat was developed during the 20th century from interspecific crosses between wheat and intermediate wheatgrass and/or other wheat wild relatives; originally the transfer of resistance genes was in the focus, nowadays the perenniality of this germplasm is of interest with respect to avoiding soil erosion, increase the (root) biomass in the soil, carbon sequestration, etc. This material is not an alternative to wheat with respect to grain yield and end-use quality, but can be an alternative for specific agricultural systems, e.g. dryland farming.

WP3 Q&A

Monika Messmer's questions:

Q: Cover crops: do you have results on whether there is a significant improvement in tuber?

A: Peter Dolničar (WP3 leader) responded that of the 4 environments studied (2 sites x 2 seasons), only 1 has been completed and only initial and preliminary data analysis has been done, so it is much too early to draw trends or conclusions

Q: Are you planning to release organic potato varieties: Would you register from the time-limited trial?

A: Peter Dolničar (head of WP3) answered that we do not have enough seeds to release them, but in 3 to 5 years we would have first candidates for registration.

Ferdinando Branca's questions:

Q: Cover crops: there are some brassicas that could be toxic to the plants; have you noticed a difference?

A: Peter Dolničar (head of WP3) answered that there was not much difference between cover crops in the successful experiment. Paul Bilsborrow added that we need more data and more years, but it is a very interesting question; it is too early to tell from our experiment. Again, of the 4 environments evaluated (2 sites x 2 seasons), only 1 has been

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completed and only an initial and preliminary data analysis has been done, so it is really way too early to draw any trends or conclusions. We have grown oil radish and mustard as cover crops in this study. So it will be interesting to see if we can detect any effects in response to those crops, but it's way too early to tell. We know that brassicas have general biofumigant properties as cover crops, but we are not aware of any negative effects on plants from the role of glucosinolates.

Q: Colorado beetle: which Bt variant was used in the experiment, have you tried other pathovars that may work better?

A: Peter Dolničar (head of WP3) answered that we did not test different Bt. The most suitable Bt variant was selected, i.e. the Bt variant in the commercial bioinsecticide Novodor, which is registered in Slovenia.

WP4 Q&A

Monika Messmer's questions:

Q: What is the biggest problem with weeds: early or late competition? A project in Switzerland has had very good results with weed mixtures and soybean competitiveness.

A: Vuk Đorđević, WP4 leader, answered that we are testing early competition, which is the biggest challenge in soybean cultivation. Late competition is usually a lesser and isolated problem. We tested competition individually, taking into account the different biology of the weeds.

Q: Is cold tolerance at flowering a big problem depending on the year (when the temperature drops below 13°C)? Did you do the tests in the field or also under control conditions? There are quite good protocols for testing in the chamber (available in the publication).

A: Vuk Đorđević answered that we grow in the field in Germany (NATUR).

Laurence Bonafos's questions:

Q: Have you studied the protein content (e.g. certain amino acids) and the oil content?

A: Vuk Đorđević answered: yes, we have the data in the Diversity Panel. The protein content was between 33% and 45%. We did not analyse the individual amino acids. This is an expensive analysis for a large number of samples and usually correlates well with the total protein content.

WP6 Q&A

Patrizia Pitton's questions:

Q: When you talk about treatment, what exactly do you use?

A: Werner Vogt-Kaute (leader of WP6) answered that there are mixtures, for example in the UK (mycorrhiza), but it is not possible to test them all.

Monika Messmer's questions:

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Q: Will the data you have collected from farmers be publicly available? In the new LIVESEEDING project, we will develop a central database. So it would be interesting to integrate your data into the new database.

A: Werner Vogt-Kaute (WP6 leader) answered that the data is already publicly available in the Zenodo project community

Steven Jacob's questions:

Q: Do you take into account the cultivation history?

A: Werner Vogt-Kaute (WP6 leader) answered positively and said that we are collecting some basic data from the farm.

WP7 Q&A

Ferdinando Branca's questions:

Q: Are the topics of the future trainings already known?

A: Mario Pagnotta (leader of WP7) answered that one of the topics is related to advanced genotyping, the other to advanced phenotyping and the third to farmer training.

Monika Messmer's questions:

Q: Are there any trainings planned for 2023? Also, I would like to draw your attention to the work of the H2020 project INVITE, which deals with training on advanced phenotyping, and I could link you to that. One of the possibilities would be Francois Laurens from INRAe.

A: Mario Pagnotta (WP7 leader) replied that there will be 2023 events and asked to connect us to the INVITE project.

CONCLUSIONS:

All members of SAG and representatives of EC present thanked for the interesting presentations and presented the progress of the work. **Steven Jacobs** emphasised that he is interested in the following: cultivation history; volume of seed production - and over what time period; identification of market routes - milling quality, etc. **Monika Messmer** added that she was very impressed and needed to digest the information. The project is on a good track and it is positive that there is an extension of the project to complete all planned activities. Great progress has been made since last year. The **Coordinator** thanked all the members of SAG and the representatives of EC for their willingness, contribution, encouraging words and guidance and concluded by saying that the next annual meeting is scheduled for June 15 and 16 in Tulln, Austria and will be associated with the World Soy Congress, which will involve several partners of ECOBREED. This was already an invitation to you and asked them to mark the date so that we can meet in person next year.

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3. IP sub-committee 4th annual meeting: minutes

Overview of the exploitation activities & IP

In the Year 4 ECOBREED and the IP sub-committee focused on the following areas:

Negotiating and signing of the IPR agreements

Period from September 2021 till July 2022 was dedicated to drafting a three-party Trademark Licensing Agreement and negotiation and signing of the first three-party Licensing Agreement and Material Transfer Agreements in WP2.

a) MATERIAL TRANSFER AGREEMENT

WP2 leader prepared excel spreadsheet with all the background knowledge of project partners. Second step was finalizing the MTAs and signing the agreements between all WP2 project partners. The genetic material input is now settled between the partners and they managed to negotiate and sign 13 MTAs by the mid-June 2022. WP3, 4 and 5 need to clear the background knowledge as well. The signed agreements serve as a basis for building business case and final Exploitation Agreement for results in WP2 – wheat organic seeds.

b) TRADEMARK LICENSING AGREEMENT

Project partners informed the IP sub-committee that in some cases the trademark needs to be licensed out to their seed distribution companies that are not project partners. IP sub-committee drafted a three-party Trademark Licensing Agreement, final version was confirmed at the interim IP sub-committee meeting and project partners received a draft in February 2022. First three-party TM Licensing Agreement is in the negotiation phase in August 2022 with expected signature in September 2022. The agreement allows for seed distribution company to use the registered TM ecobreed IMPROVING CROPS under the same conditions as the project partners.

In the reporting period for Year 4, there is a total of seventeen (17) signed IPR agreements. The table is periodically updated. This activity is picking up the momentum since project partners started preparing business cases as a basis for the upcoming Exploitation Agreement.

Table 1: ECOBREED template IPR agreements signed

Title	Parties	Date
Material Transfer Agreement	KIS and IFVC	February 2021
Material Transfer Agreements	13 project partners collaborating in WP2 – 15 agreements signed	May 2022
Three-party Trademark Licensing Agreement	KIS, Naturland e.V. and Marktgesellschaft der Naturland AG	Negotiations in August 2022, signing in September 2022

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Table of IP property management

The IP Sub-committee introduced the ECOBREED IP property management table for the whole consortium. It will enable project partners to focus on the project results and overall progress with business development and exploitation plans. IP sub-committee will regularly check the progress made. The table of IP property management serves as a support to the table of key exploitable results, as submitted in the deliverable D 8.2. The updated tables show development of exploitable results and management of those results through business case preparations.

As shown in the table 2 there is significant increase in signed Material Transfer Agreements as part of background clearance in WP2.

Another success is negotiation and signing of the ECOBREED trademark licensing agreement between KIS, Naturland e.v. and Marktgesellschaft der Naturland AG. The trademark will be used in the exploitation phase of the project results – organic seeds for perennial wheat. The seeds will be sold under “ecobreed IMPROVING CROPS” trademark and brand with the aim of creating presence of the trademark, raising awareness and adding value to the project results. It is also important as a show case to all project partners that will use the trademark ECOBREED in exploitation phase.

Table 2: IP property management

IP category	Activity	Timeline
Ecobreed TM	registered	valid through 2022
Material Transfer Agreement	14 signed	June 2022
TM Licensing Agreement	1 signed	September 2022
Business Case Questionnaire	6 received	July 2022
Table of Key Exploitable Results	contributions	through 2022
Individual Plans of Exploitation	submitted	December 2021
IPR Exploitation	supervision	through 2022

Business Case Questionnaire

In December 2021 the project partners started a follow-up phase following the Individual Plans of Exploitation survey. The results of the said survey showed which partners are planning to protect the project results with IPRs and how do they plan to exploit the project results in the commercialization phase. Following the survey, the IP Sub-committee started working with project partners on a more focused and individualised manner, through Business Case development. The presented Business Case Questionnaire serves as a specific data collection from project partners that are planning to use project results in the exploitation phase. At the time of this report 6 partners already submitted the filled in questioners. It is evident that project partners intend to exploit and commercialize project results although they will invest additional funds to IPR protection and registration of seed varieties. The timeline for project results to reach the market is closely related to the timeline of new variety registration and IPR protection

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processes. Important information is also the fact that respondents are interested in using the registered ECOBREED TM for the project results. Enclosed in the text is a sample Business Case Questionnaire. The received responses are archived at the ECOBREED project coordinator.

Table 3: Business Case Questionnaire

Individual Business case questions	Responses
Description of the Exploitable Result	
What is the problem that you are addressing	
What is the current solution	
Predicted market size you plan to address (hectares of land/number of farms/tones of certificated seed)	
In which countries are you planning to commercialize the new varieties?	
How do you plan to reach the market (through licensing or production of certificated seed for farmers)?	
What are the legal conditions for production of ecological seed varieties in the markets you are planning to commercialize	
Who are your competitors?	
Cost of implementation (time line, field trials, registrations, marketing, ...)	
When will the new seed varieties be listed in the EU or other countries' variety list?	
Cost of PVP (Plant Variety Protection)	
Status of IPR background and results – collaboration agreements, joint IPR, MTAs	
Are you interested in using the ECOBREED registered TM?	

Preparation of individual plans of exploitation

Project activities in Year 4 are not at the stage that would result in filled PVP or patent applications, but project partners are preparing business cases that include exploitation and IPR protection plans. Project partners are starting to prepare the individual plans of exploitation, based on the filled in Business Case Questioners. It has been agreed by project partners to have four business cases developed, namely for each new variety one. It is also becoming clear which of the project partners are willing and financially able to bring project results to the market and therefore to the exploitation phase. As mentioned in Year 4, interested project partners submitted business case questioners although the timeline to submit the data is open till October 2022 and we can expect some more

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submitted responses. So far KIS, SECOBRA, BOKU, NATURLAND are showing serious plans of exploitation.

The IP Sub-Committee will continue to work on the preparation of business cases with the project partners that show most interest to commercialize project results. The activities in the second half of 2022 will focus on clearance of background in WPs 3,4 and 5 and in finalization of business cases for the new seed varieties.

ECOBREED exploitation activities

There is **one significant exploitation activity** in Year 4. ECOBREED project has so far developed results that fall in two intellectual property categories:

- copyright: scientific and general publications, developed database, webpage.
- industrial property rights: registered trademark “Ecobreed IMPORVING CROPS” (hereinafter TM).

In the Year 4 the TM is used for project dissemination, communication and licensing. The trademark will be commercially exploited through three party TM Licensing Agreement signed by KIS, Naturland e.V. and Marktgeseellschaft der Naturland AG. It is a first agreement dedicated to commercialization and exploitation of the registered TM “ecobreed IMPROVING CROPS”. TM is used as a general trademark in use in commerce with newly developed perennial wheat seeds. The terms of the licensing agreement provide for the quality control for the use of the registered TM and will serve as a basis for other three-party licensing agreements in cases where project partners exploit project results through seed distribution companies.

Monitoring of the dissemination and publication activities

In the Year 4 the IP sub-committee was monitoring and evaluating all scientific publications and other forms of dissemination. All dissemination materials have to be approved by the IP sub-committee prior to publication. All results/technologies with commercial potential or intellectual property issues are reported (a) to the project coordinator and (b) to the IP sub-committee. The list of all publications of the Year 4 is enclosed at the page 8 of this report.

4. MS32: 4th IP exploitation report

All publications have been evaluated by the IP sub-committee. Altogether 11 publications have been published, of which: 6 articles in the peer-reviewed journals, 2 books, 1 thesis, and 2 other types of publications. Details are presented in the table below.

Table 4: List of publication for the period M38-M50 of the ECOBREED project

Type	Title	Authors	Title of the Journal/Proc./Book	Number, date or freq. of the publication	Year of publication	Is it peer-reviewed?	Is it open access?	DOI	repository link
article in journal	Rezultate preliminare privind caracterizarea unor soiuri de grâu testate la I.N.C.D.A. Fundulea în sistemul de agricultură ecologică.	Marinciu, Cristina-Mihaela, Serban, Gabriela, Manda, Vasile, Galit, Indira, Ciuca, Matilda, & Cristina, Daniel	Analele Institutului Național de Cercetare-Dezvoltare Agricolă Fundulea	90(1)	2022	yes	gold	doi.org/10.5281/zenodo.6513541	https://doi.org/10.5281/zenodo.6513541 https://incda-fundulea.ro/anal-e/anale90.html
article in journal	Weed pressure determines the chemical profile of wheat (<i>Triticum aestivum</i> L.) and its allelochemicals potential	M Iftikhar Hussain, Yedra Vieites-Álvarez, Paz Otero, Miguel A Prieto, Jesus Simal-Gandara, Manuel J Reigosa, Adela M Sánchez-Moreiras	Pest Management Science	78(4)	2022	yes	gold	https://doi.org/10.1002/ps.6779	https://zenodo.org/record/6524280#.YrQXQOpBwuV
article in journal	Soybean seed scanning for size, genotype color and Cercospora blight detection	Petcu, V., Radu, L., Gradila, M., Stanciu, V., Barbierui, A.	Scientific papers. Series A. Agronomy	64(1)	2022	yes	gold	http://agronomyjournal.usamv.ro/pdf/2021/issue_1/Art70.pdf	https://doi.org/10.5281/zenodo.6668677
article in journal	Ubiquitin Proteins and the Orchestration of Transcription Factors Activity	Yuqi He, Kaixuan Zhang, Milen I. Georgiev & Meiliang Zhou	Critical Reviews in Plant Sciences	40(4)	2021	yes	no	https://doi.org/10.1080/07352689.2021.1951491	https://zenodo.org/record/6597469#.YqHHpepBwuU

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article in journal	Testing Virulence of Different Species of Insect Associated Fungi against Yellow Mealworm (Coleoptera: Tenebrionidae) and Their Potential Growth Stimulation to Maize	Praprotnik, Eva, Jernej Lončar, and Jaka Razinger	Plants	10(11)	2021	yes	gold	https://doi.org/10.3390/plants10112498	https://zenodo.org/record/5785791#.YqHFeepBwuU
book	3rd European Buckwheat Symposium, 14-15 Sep 2021, Book of Abstracts	Janovska, D. (ed.)	3rd European Buckwheat Symposium, 14-15 Sep 2021, Book of Abstracts		2021	no	gold	doi.org/10.5281/zenodo.5521318	https://doi.org/10.5281/zenodo.5521318
book	Plant breeding for the 'Green Deal'	Vereinigung der Pflanzenzüchter und Saatgutkaufleute Österreichs; Brandstetter, A. & Grausgruber, H. (eds.)	Proceedings of the 72nd Conference of the Austrian Association of Plant Breeders and Seed Merchants, 22-24 November 2021, Online C	annual	2022	no	gold	doi.org/10.5281/zenodo.5667799	https://doi.org/10.5281/zenodo.5667799
thesis/dissertation	Markergestützte Selektion auf Steinbrandresistenz bei Winterweizen für den ökologischen Landbau	Pfatrish, Kilian, & Sternbauer, Martina	Bachelor thesis		2022	no	gold	doi.org/10.5281/zenodo.5035332	https://doi.org/10.5281/zenodo.5035332
other	Efektívnosť pestovania pšenice ozimnej v konvenčnej a ekologickej výrobe v Slovinsku	Kolmanič, A., Sinkovič, L., Meglič, V.	Naše pole	5	2021	no	gold	doi.org/10.5281/zenodo.4963666	https://doi.org/10.5281/zenodo.4963666
other	Az ökológia kalászos gabona nemesítés elmélete és gyakorlata Martonvásáron	Megyeri, M., Mikó, P., Vida, G.	Biokultura	2+3	2021	no	gold	doi.org/10.5281/zenodo.5820977	https://doi.org/10.5281/zenodo.5820977
article in journal	The Distribution and Sustainable Utilization of Buckwheat Resources under Climate Change in China	Wen Wen; Zhiqiang Li; Jirong Shao; Yu Tang; Zhijun Zhao; Jingang Yang; Mengqi Ding; Xue-Mei Zhu; Mei-Liang Zhou	Plants / Special Issue Breeding Buckwheat for Nutritional Quality Volume II	Issue 10(10)	2021	yes	gold	https://doi.org/10.3390/plants10102081	https://zenodo.org/record/4462137#.YrWUvepBwuU

Appendix 1: Photos



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ECOBREED 4th Annual Meeting

31 May – 1 June 2022, Martonvásár (Hungary)

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54.				
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56.				

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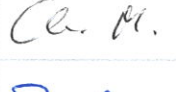
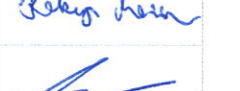
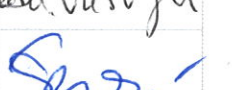

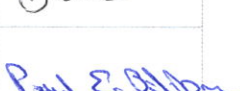




Funded by European Union
Horizon 2020
Grant agreement No 771367

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