Geographical location:
Belgium

Main geographical location (NUTS3):
Arr. de Bruxelles-Capitale / Arr. van Brussel-Hoofdstad

Keywords:
Plant production and horticulture
Farming practice
Genetic resources
Biodiversity and nature management
Agricultural production system

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Project Identification:
Multi-actor project

Project type:
Research project

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2021

Project status:
Ongoing

Website:
LIVESEED website

Title (in English):
LIVESEED: Boosting organic seed and plant breeding

Objective of the project (native language):
N/A

Objective of the project (in English):
The objective of LIVESEED is to improve transparency and competitiveness of the organic seed and breeding sector, encouraging greater use of organic seed. Cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. As demand for organic food grows, so does the demand for organic seed and suited cultivars.
Description of activities (in English):

The 4-year project will help to establish a level playing field in the organic seed market across Europe, improve the competitiveness of the organic seed and breeding sector, and encourage greater use of organic seeds by farmers. LIVESEED will improve guidelines for cultivar testing and strategies for ensuring seed health. It will develop innovative breeding approaches suited to organic farming. Finally, it will investigate socio-economic aspects relating to the use and production of organic seed and their interaction with relevant (EU) regulations. The LIVESEED project is coordinated by IFOAM EU and consists of 35 partners and 14 third linked parties from 18 countries.

Short summary for practitioners

Practice abstract 1

Short title (native language):
How to access organic seeds in Hungary

Short summary for practitioners (native language):

Problems: In Hungary organic seeds are scarcely available, thus derogation for the use of conventional untreated seeds is still a major practice.

Solutions:
The organic seed database (http://portal.nebih.gov.hu/oko-vetomag [1]) is a tool for farmers to look for organic seeds available on the market. To increase the availability and transparency of seeds, farmers and seed companies should regularly use the database.
Certified Hungarian companies are willing to produce organic seeds, but only on explicit demand. Clear commitment of farmers to use organic seed will encourage them to invest in organic seed business.
Organic vegetable farmers ensure their seed supply mostly from international seed companies.
Farm-saved seeds
Farm-saved seeds are commonly used by organic cereal farmers (>90%) to reduce input costs and to use locally adapted material. However, the quality of farm-saved seeds often poses a major risk. Training courses, visits to best practice examples could help farmers to tackle these problems.

Practical recommendations: Researchers, breeders with the national authority should organise organic variety trials with farmer field days to showcase the advantages of organically produced seeds adapted to organic conditions, triggering organic seed production and use.

With the coordination of the Organic Agriculture Research Institute ÖMKi, involving all relevant stakeholders of the sector, a working group on organic seed should be established to facilitate strategic planning and harmonise actions.
Researchers should organise farmer trainings and capacity building in producing high quality seed.
Policy makers should establish incentives for organic seed use and organic seed production.
Practice abstract 2

Short title (in English):
Managing common bunt in wheat seed lots

Short summary for practitioners (in English):

Problem: In wheat and related cereals, common bunt can cause considerable damage in yield and grain quality. The disease is caused by seed-borne fungi, which can persist in soils as well. Practical recommendations: Seed analyses: A seed analysis, as performed by state-accredited labs for example, will confirm and quantify the infection of a seed lot with common bunt. Thorough seed cleaning: Thoroughly cleaning an infected seed lot with an air stream or similar gravity cleaning equipment can remove most of the intact bunt balls and some of the free spores. As a second step, brush-cleaning is very efficient to reduce the number of free spores in the seed lot. Seed treatments: Seed treatments are essential to prevent and control common bunt. Several seed treatments are authorized for organic farming, namely white vinegar, mustard powder, products based on antagonist microorganisms (e.g. Cerall (R)) and products based on copper (e.g. Copseed), depending on the country.

When harvesting...
If an infection with common bunt is suspected, harvest healthy wheat fields first and infected fields last. Then clean the harvester by harvesting crops which are not susceptible to common bunt, e.g. oats or any non-cereal crop (e.g. pea, soybean).

Further information:


Short title (native language):
Gérer la carie dans des lots de semence de blé

Short summary for practitioners (native language):

La carie du blé peut provoquer des pertes importantes de rendement et de qualité dans la production de blé et de céréales apparentées. Cette maladie est principalement transmissible par la semence, mais elle peut également subsister dans le sol. L’analyse des semences, telle qu’elle est réalisée par des laboratoires accrédités par exemple, confirme et quantifie la présence de spores de carie dans un lot de semences.

Un nettoyage rigoureux des semences infectées grâce à un nettoyeur-séparateur ou
autre trieur par gravité peut enlever la majorité des balles sporifères (ou « grains cariés », voir photo) et une partie des spores libres. Dans un second temps, le nettoyage par une brosse à blé est très efficace pour réduire le nombre de spores libres dans le lot de semences.

Un traitement des semences est essentiel pour prévenir et contrôler la carie. Plusieurs produits sont autorisés en agriculture biologique, notamment le vinaigre blanc, la farine de moutarde, des produits contenant des microorganismes antagonistes (exemple: Cerall®) et – dans certains pays d’Europe dont la France – des produits à base de cuivre (exemple: Copseed®).

Lors de la récolte, si vous craignez une infection de carie, moissonnez d’abord les parcelles saines, puis les parcelles supposées infectées. Ensuite, purgez le matériel de récolte en récoltant des cultures qui ne sont pas sujettes à la carie, telle que l’avoine ou une espèce non-céréalière (exemple: pois, soja).

Practice abstract 3

Short title (native language): Cooperatives a model to improve organic seed production

Short summary for practitioners (native language):

Problems: In several regions of Europe, mainly in Central and Eastern Europe (CEE), knowledge and facilities for high-quality organic seed production are less developed. Improvement at various levels is needed: knowledge and equipment at the farm, seed cleaning and storage facilities, marketing of seeds, and logistics of seed transport, good contact with seed certification authorities is important for successful seed production. A key question is how to fund all these activities, when no revenues are yet obtained from seed sales? Together these issues make it difficult to start organic seed production from scratch.

Solutions: Cooperatives can contribute to tackle some of these problems:
- Sharing knowledge among farmers – better cooperation
- Organising practical training – jointly hiring advisers
- Involving farmers hesitant to start organic production – joining a community
- Increasing market power - providing safety, insurance
- Building critical capacity and knowledge on seed quality and testing - develop new solutions
- Communicating with authorities and lobbying for improved seed regulations

Practical recommendations: Building cooperatives sounds easier than it is. Some general recommendations are:
- Build trust – an on-going process
- Define clear goals – common aims, clear rules
- Have a clear timeline – go step by step
- Communicate clearly – among members, with customers – to maintain trust
- Have the same starting point: 100% organic seed as basic requirement for all members - same values, same attitude
- Gain legal advice for establishing a cooperative in your country
Practice abstract 4

Short title (native language):
Creating dynamic and diverse populations Mixtures of landraces or old varieties

Short summary for practitioners (native language):
Problems: Lack of adapted varieties and availability of organic seed as well as decreasing agrobiodiversity, motivated farmers to develop their own dynamic populations with an intra-varietal diversity and higher adaptability. Landraces or old varieties might have lost their intrinsic diversity and have not been selected in the right conditions. Mixing a set of selected ones can offer good opportunities to create new diverse populations and to associate cultivar with complementary characters.

Solutions: The mixture of several populations (landraces, old populations from Gene banks or varieties bred according to organic principles) will evolve together as a dynamic population year after year under certain farm conditions. Collective organizations offer spaces for technical cooperation and seed exchanges among farmers, while re-creating the necessary specific knowledge. Researchers, processors, consumers can join the process to better reach objectives of the whole food chains.

Practical recommendations: Start a collection of diverse cultivars that fit to organic principles (avoid modern varieties obtained by biotechnology). Test and identify cultivars adapted locally; landraces are generally more robust with good nutritional and sensorial qualities; modern varieties could be productive but more fragile. Within a mixture, plants will have unpredictable susceptibility to diseases. Create the dynamic population by several cycles of multiplication. Selection will be done by the environment and by the farmer applying mass selection (positive or negative) in his own farm conditions.

Practice abstract 5

Short title (native language):
Managing on farm populations Mixtures of landraces or old varieties

Short summary for practitioners (native language):
Problems: Mixtures of populations will foster the organic sector, by diversifying available crops, fulfilling their ecological function and stimulating diversity at all levels. However, beside creation and breeding process of such crops (PA# 4), farmers should manage the economic and technological issues of the seed production.
Solutions: The mixture of several populations will evolve together as a dynamic population year after year in the conditions of the farm and will offer locally adapted cultivars to better reach objectives of the whole food chains. Farmers within local groups (operational groups, seed associations, community seed banks), will explore new market opportunities thinking about introducing the on-farm plant breeding activities in the cost of the products. For health issues, it is better to exchange or to sell small quantities of seeds in order to proceed to a first multiplication before producing on larger scale.

Practical recommendations: Selection should be applied by the farmer on farm under the usual practices to strengthen local adaptation. Selection may include: choosing an area representative of the desire conditions and well populated in the field, sorting seeds based on their size if necessary, selecting the most interesting plants or spikes in the field (at least 1000 spikes) to introduce in the next year seed lot.

Farmers should ensure access to local (collective or individual) technological means for seed preparation (sorting and calibration) and conservation.

A market for dynamic and heterogeneous populations must be identified (based on cooperation with local organisations/food chains).

### Practice abstract 6

**Short title (native language):**
The cell fusion-free vegetable list helps organic farmers to find suitable cultivars

**Short summary for practitioners (native language):**
Problem: Many organic farmers want to cultivate vegetables free of artificial cell fusion. Cell fusion is technically interfering below the cell level and combines genetic information of different plant species. Therefore the technique is rejected for ethical reasons, because it does not comply with principles of organic farming, and has been banned by several private organic labels. Though, especially in Brassica vegetables and some chicory species, many cultivars on the market were produced this way. Therefore, farmers have difficulties to find out which cultivars are cell fusion-free, because the techniques are excluded from the GMO regulation and don’t have to be labelled.

Solution: A consortium of FiBL, Bioland, Naturland, Bio Austria, Bio Suisse, Demeter and BNN now published a list of vegetable cell fusion free cultivars, suited for organic production for Central Europe. The list will be complemented with more cultivars, especially from the Mediterranean region.

Practical recommendation: By consulting the list, farmers can find out if the varieties they want to plant are included or if there are suitable alternatives.

The list can be downloaded for free in English, German, French, Spanish and Italian: [https://www.fibl.org/de/shop/1179-cf-free-varieties.html](https://www.fibl.org/de/shop/1179-cf-free-varieties.html) [5]


IFOAM position paper: Compatibility of Breeding Techniques in Organic Systems
Practice abstract 7
Short title (native language):
How to assess weed competitiveness in organic cultivar trials with wheat?

Short summary for practitioners (native language):
Problems: In many EU countries, weed competitiveness is not part of official variety testing protocols. Organic farmers that forego herbicides and conventional farmers that wish to reduce spraying, face the problem of identifying wheat cultivars which are suitable for their management system.

Solutions: Farmers can set up on-farm trials to test different wheat cultivars. The farmer can use the cultivar usually cultivated as a reference variety. Next to the field, 2 to 3 cultivars are sown in strips and compared to the reference. The same management practices are performed uniformly to the trial fields. Visual assessment of a combination of different plant physiological properties can be used for evaluating the cultivar’s weed competitiveness. Ideally, the trial is repeated over several seasons. Networking and discussion groups among farmers to share experiences, can help to give a good overview over a broad range of potential cultivars.

Practical recommendations: The plant physiology gives a good indication on the variety’s ability to compete with weeds. The handbook for Cereal Variety Testing for Organic and Low Input Agriculture recommends using a combination of different components:
Crop ground cover (%): measured at early tillering
Growth habit (e.g., inclination of leaf): measured at the start of tillering
Tillering capacity (No. of shoots/m2): should be combined with other measurements
Rapid early growth to stem extension (days or 1-9 scale)
Plant height (cm): should be combined with other measurements


Practice abstract 8
Short title (native language):
How to set up a simplified on-farm cultivar trial to assess broccoli?

Short summary for practitioners (native language):
Problems: Most commercial broccoli cultivars originate from conventional breeding and might not perform well under organic conditions. Cultivar trials, with a complete randomised block design and 3-4 repetitions, are often not feasible for organic farmers.
Solutions: Organic farmers can set up a simplified cultivar trial with different broccoli varieties. In order to evaluate varietal difference, the trial error (e.g. soil differences in the trial field) has to be minimised. To evaluate the trial error, a reference variety is planted in 2-3 randomly distributed plots (see Figure 1). When comparing the reference plots, differences in performance might indicate a trial error. The trial should be repeated over several years to increase its reliability. 

Practical recommendations: The assessment of broccoli cultivars could include a combination of the following measurements:

- Time of harvest maturity and number of harvests
- Disease incidences, number of damaged spots
- Percentage of marketable plants
- Weight, size, firmness and colour of head

Favourable characteristics of broccoli cultivars for organic agriculture are:

- Adaptation to lower nitrogen supply, mechanical weed management and absence of chemical pesticides
- Low susceptibility to diseases such as downy mildew, verticillium wilt and broccoli bacterial rot
- Resistance to stress, such as heat (summer broccoli) or cold (autumn broccoli)

[http://orgprints.org/9863/1/hb-1433-versuche-gemuesebau.pdf](http://orgprints.org/9863/1/hb-1433-versuche-gemuesebau.pdf) [12]

Practice abstract 9

**Short title (native language):**
How to set up an on-farm cultivar trial to score for leaf blight in carrots?

**Short summary for practitioners (native language):**

Problems: In organic production, attack by carrot leaf blights (Fig. 1), caused by fungal (Alternaria dauci, Cercospora carotae) or bacterial pathogens (Xanthomonas campestris pv. carotae), can result in yield loss. The choice of resistant varieties is crucial; however, commercial varieties differ greatly in their susceptibilities. Additionally, official variety testing does not test for the suitability for organic growing conditions, and often takes place under ideal conditions on a limited number of locations.

Solutions: Organic farmers can set up a simple, on-farm cultivar trial to assess the varieties’ susceptibility to leaf blight. For this, different varieties are cultivated in 2-3 strips, distributed in the trial field, to minimise the influence of heterogeneous soil conditions. A variety with a well-known tolerance level serves as a reference. Farmers can use their own machinery for cultivation. Throughout the growing season, scoring of disease symptoms (Fig. 2) should be conducted.

Symptoms include:
- Spots at margin of leaves
- Lesions on petioles and stems
- Curling of leaves
- Defoliation
Practical recommendations: Other strategies, to manage carrot leaf blight, include:
Use of vigorous and decontaminated seeds
Avoid favourable microclimate through wider row spacing and planting on raised ridges
Crop rotation, with at least 2-3 carrot-free years in crop rotation
Use of organic fertilisation and irrigation if necessary, to reduce plant stress and
promote foliage development
Harvesting on time, to reduce crop loss
Ploughing of crop debris to avoid survival of inoculum

Further information: https://ecommons.cornell.edu/handle/1813/43265 [13]
https://ecommons.cornell.edu/handle/1813/42892 [14]

Practice abstract 10

Short title (native language):
How to minimise damage by aphids in organic faba bean production?

Short summary for practitioners (native language):

Problems: Aphids represent one of the key insect pests in organic faba bean production, where the use of aphicides is prohibited. Damage by direct feeding generally does not lead to crop failure. The main damage occurs by the transmission of viruses, causing virus mosaic and virus yellowing. Faba beans are most susceptible during seedling and vegetative stage.
Solutions: Control methods on the field:
Avoid early sowing. It might maximise yield but increases the exposure of crops to aphid flights.
Control weeds that host aphids.
Avoid sowing of faba beans next to other pulses and forages.

Cultivar choice:
Choose faba beans with a higher resistance to viruses. On-farm cultivar trials help to identify resistant cultivars (see practical recommendations).
Desirable traits in faba beans are earliness of flowering. If beans flower early, they will be less vulnerable to aphid attacks.

Practical recommendations: On-farm cultivar trials have to be planned carefully to avoid bias and errors. The Organic Seed Alliance provides worksheets for planning and evaluating trials. These worksheets collect information on:
Envisioning the trial: trial crop, trial goals, desired variety traits, trial varieties, standard check variety
Planning the trial: ideal planting date, plot size, number of replications, production methods, field assessment, trial layout
Evaluating the trial: evaluation criteria, evaluation timing
Further information: Nordic Field Trial System, Faba bean – varieties
Organic Seed Alliance, Variety Trial Planning Worksheet
Organic Seed Alliance, Variety Trial Evaluation
Organic Seed Alliance, The Grower’s Guide to Conducting On-farm Variety Trials
**Practice abstract 11**

**Short title (native language):**
How to identify potato cultivars which are resistant to late blight?

**Short summary for practitioners (native language):**

Problems: Late blight, caused by the fungus Phytophthora infestans, represents one of the most important yield limiting factors in organic potato growing. Breeding for resistance is important to reduce blight damage. However, conventional potato trials, which are conducted with the use of fungicides, do not provide organic farmers with any information on the cultivar’s resistance to late blight.

Solutions: Organic farmers can set up a simplified cultivar trial to identify potato cultivars which are resistant to late blight. In a simplified design, a reference cultivar (which is known to have a good resistance against late blight) is grown in 2-3 plots, randomly distributed in the trial field. Cultivars to be tested are grown in plots without repetition. If the reference cultivar displays a similar resistance in all repetitions, it can be assumed that environmental conditions uniformly influence the field trial. Thus, varietal differences in disease resistance, are likely to be the result of the genotype.

Practical recommendations: Throughout the growing season, leaf surface, underside of the leaf and stems should be inspected for late blight infections. Traits which are useful to assess the cultivar’s resistance:
- good yield performance in short growing period
- fast canopy development
- early tuber set and fast tuber bulking
- early maturity

It is recommended to use pre-sprouted seed potatoes in cultivar trials. Pre-sprouting is a measurement in which seed potatoes are exposed to conditions that promote the development of sprouts which emerge earlier after planting. As a result, the growing period is shortened, potatoes can be harvested earlier, and weather conditions are avoided which are favourable for late blight infestation.

**Practice abstract 12**

**Short title (in English):**
How to improve organic seed availability in Bulgaria

**Short summary for practitioners (in English):**

Problems: In Bulgaria, organic producers are obliged to use organic seeds and seedlings, in accordance with Regulation 834/2007. In reality, most organic farmers use untreated conventional seeds after a derogation granted by the control body. For many crops (cereals, vegetables), organic farmers declare that they use their own farm saved seeds.
There is no official data on the quantity and quality of farm saved seeds.
Solutions: The National organic seed database has been undergoing software upgrades and changes throughout the year. However, currently (as of 5th April 2020) the database is still an Excel sheet and contains only two suppliers. Some local seed companies and research institutes hesitate to start production of organic seeds. They are afraid not being able to fulfil organic standards. Literature and practical information/advice on this topic in Bulgarian language could improve this situation.

Farm saved seeds most often are used by vegetable and cereals growers. It is necessary to help farmers with information and advice for better seed quality.

Practical recommendations: All stakeholders must continue pressure in order to achieve a functional national organic seed database.

Bioselena, together with Bulgarian partner institutes*, engaged in LIVESEED project, should translate into Bulgarian and disseminate the outcomes of the project (practical information/research outcomes/videos) among stakeholders, especially seed companies and farmers.

Bioselena together with Bulgarian partner institutes*, should produce more educational material and organise educational events for farmers.

*Maritsa Vegetable Crops Research Institute; Agricultural University – Plovdiv, Biosem Bulgaria ltd, Opora Zaden ltd.

Short title (native language):
КАК да подобрим достъпа до биологични семена в България

Short summary for practitioners (native language):
В България биологичните производители са длъжни да използват биологични семена, посевен и посадъчен материал, съгласно Регламент 834/2007. В същото време големата част от био фермерите използват нетретирана конвенционална смена след разрешения от контролиращите лица. За много от културите (зърнени, зеленчуци) био фермерите декларират, че използват собствени семена. Няма официални данни за количеството и качеството на собствените смена, използвани в био фермите.

Националната база данни за биологични семена цяла година е в процес на подобряване и смяна на софтуер. В момента регистъра представлява таблица в Exel и съдържа само двама доставчици.

Всички заинтересувани стани трябва да продължават да настояват националната база данни да стане functionalan.

Няколко местни семенарски фирми и научни институти се колебаят дали да започнат производство на био семена, защото не са сигурни дали ще изпълнят био изискванията. Подходяща литература и практическа информация/съвети на български език могат да помогнат да се подобри положението.

Биоселена, заедно другите български организации включени в проекта LIVESEED трябва да направят усилия да произведат и разпространят литература и практическа информация/съвети/ видеофилми по темата на български език.

Да се разработят практически наръчници за производство на био семена във фермата за често използваните зеленчукови култури: фасул, грах, зеле, картофи. Да се напаряват кратки видеа с най-важните моменти при производството на био
Practice abstract 13
Short title (native language):
Organic seed from community seed banks

Short summary for practitioners (native language):
Problems: Organic growers often buy hybrids or commercial seeds, bred for intensive industrial agriculture, which are usually not suitable for organic and local growing conditions. Alternatively, they grow their own seeds, or they get seeds from neighbours. These seeds usually do not cover all crop and market needs, are of limited quantity and often of low quality.
Solutions: Community participatory selection
Good quality organically bred, locally suitable seeds are needed, that are compatible with organic standards and certification. Community seed banks safeguard landraces or heirloom varieties, farmers selections and obsolete varieties grown by farmers at local level. Participatory organic breeding is a tool for valorising agrobiodiversity in a sustainable way where farmers have the primary role and can benefit acting as custodians. Good seed, from best selected local traditional varieties means better quality products for consumers, more effective farming and low cost of production.
Practical recommendations: Agronomists can help and train farmers and community seed banks how to select their own best varieties and produce high quality seed. Farmers being members of community seed banks can contribute in selection and seed production. Researchers supporting farmers in multi-actor participatory organic breeding can help to improve suitable variety choice and meet market’s needs. Organic seed production initiatives can contribute to the sustainability of community seed banks on local level.

Practice abstract 14
Short title (in English):
The obligation to use organic seed – farmers’ awareness

Short title (native language):
Regelgeving rond biologisch zaadgebruik
Short summary for practitioners (native language):

Problems: According to European organic regulations, organic farmers must use organic seed when available. The availability and specific rules for derogations differ per member state. In the Netherlands, farmers converting to organic farming are often not aware of these rules. This causes a relatively high number of deviations during control visits by the certifier.

Solutions: Biodatabase: In the Netherlands, the availability of organic seed and vegetative propagating material can be found on the Biodatabase1 managed by the Naktuinbouw. Seed suppliers must inform the Naktuinbouw about changes in their offer.

National Annex: The Netherlands is one of the countries that implemented a National Annex listing crops and sub-crops for which sufficient organic seed is available in their territory and thus no derogation is granted. Based on seed availability per crop, crops are put on category I. (no derogation), II. (derogation possible) or III. (general derogation). Expert groups, consisting of seed suppliers and farmers, advise the government each year on the category classification.

Derogations: Farmers that want to use conventional seed or vegetative propagating material must request a derogation at the national certifier Skal. The reasons for derogation and additional rules for vegetative propagating material can be found on the national organic seed database.

Practical recommendations: Farmers are recommended to check the database in their country before asking derogation for a certain crop.

Farmers are recommended to ask their certifier if there are additional rules concerning organic seed use.

Practice abstract 15

Short title (native language):
Seed treatments allowed in organic farming in certain countries (Input list)

Short summary for practitioners (native language):

Problems: Seed treatments are not regulated in the EU regulation 834/2007 and 889/2008. Still there are several treatments that are promoted and used in organic farming. Farmers don’t have the security that the treatments they use are in compliance with the EU regulation and if the control body or control authority will accept it.

Solutions: Inputs list for Seed treatments

The Inputs List for organic farming in Germany is published by FiBL every year. All inputs such as plant protection agents, seed treatments, etc. that are allowed to use in organic farming in Germany are listed in there. Farmers can use the list to check if the product they want to buy and use on their farm is in compliance with the EU regulation. Further criteria are developed in coordination with German organic associations and define criteria that are not clearly regulated in the EU regulation.

For seed treatments the criteria for fertilisers are applied because the treatments are directly applied into the soil and support the seed in the first growth stage.
Practical recommendations: Farmers should consult the European Input List Website which lists the products that can be used for seed treatment for: Austria, Germany, Switzerland, Croatia, The Netherlands, Italy and International lists. Organic research institutes and national authorities should cooperate to establish a common list for all EU member states to support farmers in their product choice. In other countries where such lists do not exist yet, farmers must ask their control bodies to clarify if a product can be used for seed treatment or not. Further information: Inputs list for Germany: https://www.betriebsmittelliste.de/en/home.html [16] European Input List Website: https://www.inputs.eu/ [17]

Practice abstract 16

Short title (native language): Guidelines for on-farm variety testing

Short summary for practitioners (native language):

Problems: Choice of varieties well adapted to organic conditions are limited. In case of many varieties limited information is available on adaptedness to local conditions. Farmers are not always aware or may not have the know-how to do a comparison of varieties themselves.

Solutions: Simple on-farm testing is possible with the guidelines provided here for two type of crops.

Direct sown:
Sow several beds / strips with one to three varieties in the middle of your variety you know best. In that way you have two references on each side. The size of the beds / strips depends on your farm machinery for sowing, weeding and harvesting.

Transplanted:
You can plant small plots (20-100 plants per plot depending on the crop) in several representative parts of the field, to have impressions of crop performance.

Practical recommendations: For a good comparison, use part of the field that has quite homogeneous soil and ensure that (partial) shading cannot affect plant growth. Ensure equal seed vigour of the varieties as much as possible; Seed vigour can effect differences in crop performance; Use fresh seed, and in the case of direct sown crops, make sure the plant density is the same.

Compare the crop stand several times throughout the season; Are there differences between the varieties: in speed of growth, growth habit, disease tolerance, earliness? Are the differences due to different variety performance or because of differences in soil conditions?

PA#7 How to assess weed competitiveness in organic cultivar trials with wheat?
PA#8 How to set up a simplified on-farm cultivar trial to assess broccoli?
Practice abstract 17

Short title (native language):
Towards ecological and societal resilience through systems-based plant breeding

Short summary for practitioners (native language):
Problems: Breeders need to develop – in a societally acceptable manner – high-yielding, good quality, resource-efficient cultivars that are climate-robust, culturally acceptable and contribute to ecosystem services. We analysed several challenges towards ecological and societal resilience given the current and future climatic, agronomic, economic and societal environment, which a single approach in plant breeding alone cannot solve.

Solutions: We identified four paradigmatic breeding orientations: community-based, ecosystem-based, trait-based, and corporate-based. These orientations differ because they have different ways of thinking, values and economic models. Each approach has significant value and impact, such that no approach alone will achieve all relevant sustainability targets:
- food security and safety,
- food and seed sovereignty,
- social justice,
- agrobiodiversity,
- ecosystem services,
- climate robustness.

Practical recommendations: Achieving these targets requires i) knowledge development and integration, multiple breeding strategies and entrepreneurships, but also a change in attitude ii) corporate responsibility, circular economy and true cost accounting, and fair and green policies. We therefore define a new approach: ‘systems-based breeding’. It maximizes the synergy between the ways of thinking of the four paradigmatic orientations.

Breeders cannot do this alone, but need the help of policymakers, researchers and the whole value chain.


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Practice abstract 18

Short title (native language):
Breeding an organic forage crop variety

Short summary for practitioners (native language):
Problems: In Switzerland and the EU, if available, organically bred varieties (e.g. Cat. 1 and 2 according to the classification developed by Bio-Suisse) should be preferred over conventional ones. However, only few organic forage crop varieties exist, and their seed availability is scarce.
Solutions: Being courageous and define new breeding aims
Organic forages must compete well during establishment (no chemical weed control) and should efficiently utilize nutrient resources (no mineral fertilizer). Quickly establishing stands of legume-grass mixtures are most appropriate, as they adequately suppress weeds and fix atmospheric nitrogen. In case of high legume ratios in the mixture, it is important to breed legumes with a low content of undesirable ingredients for animal nutrition, like phytoestrogens. For best performing mixtures, it is important to select the components directly together in order to maximize positive interactions for yield, nutritional quality, etc. One example is the selection of spaced alfalfa plants in an under-sowing with tall- and red-fescue.
Practical recommendations: Start an organic breeding program in your target selection environment, collect information about organic certified areas including their “cultivation history” (e.g. weed infestation from previous years)
Mimic future cultivation system in the nursery, e.g. by combining spaced plants of target species by under-sowing with the right companion species.
Do preventive measures for avoidance against pests and weeds in advance, e.g. reduce seed stock of weeds via repeated hoeing.
Identify important traits (e.g. early vigour to enhance weed suppression) for organic cultivation and put special focus on them in your selection.

**Practice abstract 19**

**Short title (native language):**
Co-design of locally adapted wheat variety mixtures

**Short summary for practitioners (native language):**

Problems: A growing number of organic farmers cultivate variety mixtures for their ease of use and their ability to buffer stress and environmental heterogeneity. Farmers have to choose the varieties for designing their mixtures, but few guidelines have been proposed so far. In the case of winter wheat, mixtures are usually assembled primarily based on yield. It is advised to mix varieties with complementary levels and sources of foliar disease resistances and to maintain homogeneity of maturity to ensure good quality.

Solutions: To guide farmers with optimised composition mixtures, the approach is to identify assembly rules for combining mixtures components (Figure). A participatory approach, based on workshops, is particularly suitable for designing locally adapted mixtures. Gathering farmers, researchers and technical experts to exchange knowledge allows many and varied ideas to emerge on how to favour complementarities and synergies between varieties within mixtures.

Farmers’ point of view, especially in organic farming, is very important for designing assembly rules in accordance with farmers’ practices and production contexts.

Practical recommendations:
Limit disease development by keeping proportion of susceptible varieties < 30%, and by using varieties able to compensate through high tillering ability or high TKW (thousand kernel weight).
Increase weed control through wheat competitive ability by using varieties with early...
vigour or high tillering ability, diversifying varieties for earliness, height and growth habit.
Face nitrogen stress by tolerating an early deficit, by complementarity in time of nitrogen demand (diversified earliness), or for nitrogen use efficiency.

Practice abstract 20

Short title (native language):
Assessment of locally adapted wheat variety mixtures

Short summary for practitioners (native language):

Problems: A growing number of organic farmers cultivate variety mixtures for their ease of use and their ability to buffer stress and environmental heterogeneity. Farmers have to choose the varieties for designing their mixtures, but few guidelines have been proposed so far.
In the case of winter wheat, mixtures are usually assembled primarily based on yield. It is advised to mix varieties with complementary levels and sources of foliar disease resistances and to maintain homogeneity of maturity to ensure good quality.
Furthermore, variety mixtures could also offer the possibility to finely tune the varietal choice to local context.
Solutions: Co-design of assembly rules
To guide farmers with optimised composition mixtures, the approach is to identify assembly rules for combining mixtures components. A participatory approach based on workshops is particularly suitable for designing locally adapted mixtures. (→ see Practice Abstract #19)
Co-design and on-farm evaluation of farmers’ mixtures
The assembly rules are then mobilised for co-designing farmers’ mixtures, in accordance with farmers’ practices and local environmental conditions. To test for adequacy with farmers’ needs, the mixtures are assessed in on-farm trials.
Practical recommendations: Stripe design allows for comparisons with the corresponding varieties in pure stand and this type of trial is easy to manage on farm by farmers.
Stripes can be divided into three or four to provide replicates.
Further information: The assembly rules are currently being validated and integrated in a multi-criteria assessment tool to help farmers designing mixtures tailored to their terroirs: http://moulon.inra.fr/optimix/ [19]

Practice abstract 21

Short title (native language):
The difference between certified organic seed and “untreated” conventional seed

Short summary for practitioners (native language):
Problems: Many organic farmers do not know the difference between certified organic seed and “untreated” conventional seed. Therefore, they are not motivated to buy organic seed, which is usually more expensive.

Solutions: Organic seed production

Organic seeds are multiplied in an organic environment. This is very challenging, especially for biennial crops such as carrot or leek (see figure) that need to overwinter in the open field. Disease and weed pressure in combination with lower yields, make organic seed production more expensive than conventional seed production. Climate change is increasingly leading to crop failures and makes some of the classic seed growing areas unsuitable. Dry organic production areas with good ventilation (wind) are most suitable but scarce.

Certified organic seed

Certified organic seeds are produced according to the European Union’s organic production rules. The multiplication period depends on the crop and can vary from 4 months for annual crops like spinach up to a year and a half for biennial crops like onion and cabbage. The quality standards for certified organic seed are the same as for conventional seed. Seeds that meet both requirements can be registered in one of the national organic seed databases.1

Untreated conventional seed

Untreated conventional seeds are multiplied in a conventional environment. During the production chemical substances and fertilisers are used. “Untreated” means only that the seed is not treated with chemical substances after the harvest of the seed.

Practical recommendations: Organic farmers should be educated about the advantages of organic seed:

- Produced in an organic environment
- No chemical treatments during production
- Lower risk of residues

Practice abstract 22

Short title (native language):
Values and benefits of organic seeds

Short summary for practitioners (native language):

Problems: Some stakeholders in the organic sector are not aware of the values and benefits of organic seeds. Therefore, unless required, they are not motivated to use or promote organic seed. Especially since organic seed is usually more expensive than conventional seed.

Solutions: Organic integrity: Seed production is part of the production process and takes a lot of effort and time.

Live up to consumer expectations: Consumers expect organic farmers to use organic inputs. This is one of the reasons for the European Commission to tighten the EU organic rules on seed use. Derogations allowing the use of conventional seed and vegetative propagating material should expire in 2035.

Lower risk of residues: Unlike conventional seeds, organic seeds are propagated in an organic environment. This reduces the risks of chemical residues on the seed. In addition
there are indications that some residues persist into the seedlings and even into the final product. For instance in the case of plants with low mass growth during cultivation (e.g. fresh herbs) or in organic fruits originating from conventional plants.

Practical recommendations: Educate stakeholders in the organic sector about the values and benefits of organic seeds. Create demo fields with varieties of which organic seed is available. Organic seeds are the first step towards organic breeding. By buying organic seed, you stimulate seed producers to select and develop varieties that are better adapted to organic growing conditions.

Further information: PA#21 The difference between certified organic seed and “untreated” conventional seed

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**Practice abstract 23**

**Short title (native language):**
Legal limitations for the use of organic and new genetically diverse seeds in Spain

**Short summary for practitioners (native language):**

Problems: Spanish Regulation for the Registration of varieties limits the use of genetically diverse seeds and establishes higher requirements for their registration than for genetically homogeneous material.

Solutions: Specific Regulation for genetically diverse varieties
Specific regulation for organic and genetically diverse varieties (traditional and new) should be developed according to the Plant Genetic Resources Law. They shouldn’t have to comply with the Commercial Varieties’ Regulation for registration, production and marketing.

Practical recommendations: To develop an Action Plan to Stop Genetic Erosion that includes investing in research on genetically diverse and organic seeds, promoting their production and use and allowing their exchange and commercialization.

Create a work group of the organic sector, bringing together national and regional competent authorities for organic farming and for seed legislation.

Create regional registers for traditional plant varieties including those that are in process to be registered in the National Plant Variety Office, and test acceptance among producers and consumers.

National regulation on seed registration: [https://www.mapa.gob.es/es/agricultura/legislacion/Legislacion-nacional-...](https://www.mapa.gob.es/es/agricultura/legislacion/Legislacion-nacional-...) [21]

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**Practice abstract 24**

**Short title (native language):**
Preservation of traditional varieties in the region of Valencia

Short summary for practitioners (native language):

Problems: The Mediterranean region has a rich traditional agriculture with many crop varieties. We need to recover their use in the fields to ensure the future of the agrarian sector and stop the loss of biological diversity in the agrarian systems.
Solutions: Valorization of traditional varieties
Valencia’s Agriculture Department aims to valorise local traditional non-commercial varieties via consumer awareness and a Traditional Varieties’ Catalogue and a seed loan system.
The Catalogue is a participatory online tool, where farmers can find information on the whole range of already identified traditional varieties of the Region of Valencia and can also add information on cultural and growing aspects and share information on varieties that still haven’t been included.
Multiplying, saving and exchanging organic seeds
Public experimental stations in collaboration with organic farmers multiply and exchange organic seeds.
Practical recommendations: Inform local farmers about the catalogue and loaning services.
Encourage producers to multiply and produce these seeds organically.
Inform consumers about the importance of traditional varieties.
Create a regional traditional plant varieties’ register to include also those that are in process to be registered in the National Plant Variety Office.
Further information: 1st Valencian Plan for Organic Production: http://www.agroambient.gva.es/es/web/desarrollo-rural/plan-de-produccion... [22]
Valencian Catalogue of Traditional Varieties http://www.agroambient.gva.es/documents [23]

Practice abstract 25

Short title (native language): Proper seed storage

Short summary for practitioners (native language):

Problems: Seed quality is very important for the start of a crop. Accumulation of damage during storage can result in abnormal seedlings or even failure of emergence. To avoid too much ageing, seeds need to be stored in the most optimal way.
Solutions: What causes seed ageing?
Seed ageing is caused by oxidation of the cell membranes, mitochondria, DNA, RNA and proteins in the seeds. This oxidation is stimulated by four factors: seed moisture level, temperature, oxygen and time. The main factors stimulating this ageing are moisture and oxygen.
How to reduce ageing
Keep sealed commercial seed packages closed until use, to avoid moisture uptake from the air. Never store an open package in a cold place like a refrigerator, were the humidity is high and the seeds will absorb moisture. If not all seeds are used, store the remainder in a dry environment. For this we developed an easy system with a ‘seed drying and storage box’.
The principle is an airtight transparent box. In the box is a bag with silica gel and a relative humidity (RH) meter. The optimal RH is between 20 and 40%. Home produced seeds can also be dried in the box. If the RH surpasses the 40%, the silica gel needs to be regenerated in an oven at 100 °C. The dried silica gel can be cooled down in a closed clean jam jar or alike. It is possible to store the airtight box with seeds in a cooler place, to reduce ageing further. For larger amount of seeds the box could be replaced by a large vacuum bag, as available for storage of clothes.
Practical recommendations: To reduce seed quality loss you need to store seeds under dry and cool conditions.
The seed drying box is a tool to keep the seeds dry and can be home made from readily available material.
Further information: http://library.wur.nl/WebQuery/wurpubs/534005 [24]

Practice abstract 26
Short title (native language):
How to improve organic cereal seed availability in Hungary

Short summary for practitioners (native language):
Problems: Although the Hungarian organic cereal seed production is significant, the seeds are primarily produced on contract basis for export, thus they are not available on the domestic market. Organic propagation material of other cultivated species are also seldom found in Hungary.
Knowledge on variety performance in organic fields is insufficient.
Solutions: In order to facilitate strategic planning and harmonise actions, it is crucial to set up a working group on organic seed, involving all stakeholders of the sector (seed producers and retailers, organic certification bodies, researchers, national authorities and policymakers, organic farmers’ associations). Experts of the national working group will be able to address the right questions and suggest effective and applicable solutions to boost the organic seed sector.
Practical recommendations: For a better cooperation and efficiency, regular meeting of the organic seed working group is suggested.
Important steps:
Restructure the national organic seed database to have a user-friendly and informative service for farmers.
Organic seed producers and retailers keep the database up-to-date and retain seed lots for domestic market.
Post-registration performance trials help the variety recommendation: one of the state’s variety testing nurseries is converted to organic (2020). Further locations are included through a cooperation with organic farmers operating in the proximity of other state
nurseries, in a way that plots are managed with the machinery of the authority. Certain breeding institutions also host these trials to reach the sufficient number of sites. Further information: Hungarian organic seed database: http://portal.nebih.gov.hu/oko-vetomag [1]

Practice abstract 27

Short title (native language): Incentives to use organic seeds set up by the supermarkets

Short summary for practitioners (native language):

Problems: Preferably, organic farmers cultivate their fruits and vegetables using certified organic seeds, however the desired varieties are not always available. The higher price and the absence of real incentives for farmers to use only organic seeds, lead to a low demand for certified organic seeds.

Solutions: Incentives for organic farmers

Nowadays, the main supermarket chains have a quite complete offer of organic products, while medium size supermarkets have at least several organic products on their shelves. If all the supermarkets would ask their organic producers to ensure, that the seeds used are organic, the demand for organic seeds would likely increase. Such request from supermarkets can stimulate farmers to use organic seeds, but only on the condition that long-term contracts between organic farmers and supermarkets, simultaneously ensure a stable and healthy trading relationship.

As an example, the Spanish company Biovegs, with 150 hectares of organic field, producing potato, broccoli, carrot and wheat, exports 90% of their production. The 3.5 million kilograms of broccoli produced yearly, is fully sold to well known Belgian, German and French organic supermarkets, that require from the producer to use organic seeds.

Practical recommendations: All parties involved, such as consumers and supermarkets, should request organic farmers to use organic seeds for the cultivation of organic products.
Supermarkets must give attractive contracts to organic farmers, in which they ensure fair prices and durable conditions.
Supermarkets should not decide which varieties organic farmers grow. Instead, supermarkets should support farmers to use the best varieties suitable for their specific growing conditions.

Practice abstract 28

Short title (native language): Seed health in potatoes

Short summary for
Problems: The potato crop is susceptible to many pathogens. Potato virus and bacterial soft rot are most actual - but definitely not the only - problems in seed production. Yield losses can go up to 50-70% or complete crop failure.

Solutions: Organic seed potatoes
A typical variety for organic farming allows for moderate fertilization levels, has a stable product quality under stress conditions, is broad resistant against Late Blight and virus and has a short field period.

Virus
Potato virus X and Y are spread by aphids or by cross-contamination. They can show symptoms, like ‘squeezed’ or rolled leaf growth, yellowing or mosaic patterns, mostly on top of the plant. However, the expression is dependent on variety, crop maturity and growing conditions. Rogueing basic seed lots is key, which takes experience. A diseased plant can be missed, particularly in varieties that show no symptoms; causing ‘secondary disease’ next season.

Bacterial soft rot or blackleg
Pectobacterium and Dickeya (Erwinia): plants fall due to stem rot or wilting, with creamy tuber spots and a fishy smell. Virus rogueing is a notorious path for Erwinia spread. Like virus, infested tubers may be symptomless, enabling ‘invisible’ spread through a seed lot. Farm hygiene is the only control measure.

Practical recommendations:
grow a virus resistant variety
rogue diseased plants, don’t rogue in a wet crop
rogue from ‘healthy’ to diseased plots
remove diseased plants (marginal effect) and all tubers
aphid control (in OF, one has to rely on natural predators)
remove ‘Solanaceae’ weeds and ‘volunteers’
a diseased seed crop may go for consumption
at harvest: remove suspicious tubers
allow rotten tubers to dry in storage

Practice abstract 29
Short title (native language):
Greening urban gardens with local vegetable varieties

Short summary for practitioners (native language):
Problems: In urban areas most people have no access to low cost, high quality, and diverse food. Precious local vegetable varieties are facing extinction and amateurs are discouraged to grow them in small gardens and produce their own food. Furthermore, in lack of seed of selected local varieties, organic gardeners use expensive hybrid seed, which increases the production cost.

Solutions: Organic seed from local vegetable varieties
Growers and consumers in urban areas need to be encouraged to use local vegetable
varieties, which are more adaptable to organic and local conditions. To this end, high quality organic seed of locally selected varieties with special taste and nutritional value is needed. Incentives could be introduced to support the use of proper seed, produced at lower cost.

Practical recommendations: Farmers with support from researchers should create community seed banks, community gardens and school gardens in urban areas. Farmers and gardeners can be trained to join participatory organic breeding to select the best varieties and produce seed. Using seeds of local varieties could be strengthened by Community Supported Agriculture (CSA) schemes and cooperatives between producers and consumers. Researchers with farmers should organise open field days and community events to help bringing local varieties back to urban gardens, to local markets and tables of citizens.

Further information: Video on how you preserve local Greek vegetable varieties: (https://www.youtube.com/watch?v=Lgq5RHj_O4s [25]) Information about products from Greek vegetable landraces: (https://www.aegilopslocalfood.gr/katigories/itemlist/category/6-laxanika [26])

Practice abstract 30

Short title (native language):
Seed vigour, keep it high!

Short summary for practitioners (native language):

Problems: Seeds are living organisms and sensitive to stress during storage or treatments, which can result in reduction of seed vigour. Vigour can be seen as the tolerance of seeds to emerge under non-optimal conditions. Low vigour seeds give upon sowing in the field no or weaker seedlings.

Solutions: What causes seed vigour loss?

When seeds are dry, they slowly oxidise, as every organic material. Oxidation can also be induced for instance by a hot water, steam or air treatment. Damage repair can only start once the seeds are getting wet, as enzyme activity is needed for this and enzymes need water. More oxidation results in more damage and weaker seeds and seedlings. These seedlings will emerge slower or not at all and are more sensitive to drought stress and pathogens (see picture).

How to reduce vigour loss

Harvest seeds with maximum stress tolerance, dry them well, keep them stored under optimal conditions and be cautious with physical seed sanitation treatments.

Practical recommendations: Harvest the seeds, if possible, at full maturity, since less mature seeds are more sensitive to induction of damage.

Dry the seeds soon after harvest, preferably to an equilibrium with 30 -40% relative humidity and keep them dry.

Store the seeds under optimal conditions: 30-40% RH, cool and preferably without oxygen. Do this also with left-over seeds.
Be careful with sanitation treatments. Perform test treatments with a small sample.
Speed of germination is a good indicator of seed vigour. More damage needs more time for repair.
Further information: Read more on seed storage and vigour:
http://library.wur.nl/WebQuery/wurpubs/534005 [24]

**Practice abstract 31**

**Short title (native language):**
Biodynamic alternatives to CMS hybrids

**Short summary for practitioners (native language):**

Problems: The use of cell-fusion derived CMS hybrids violate the principles of organic agriculture, and calls for alternatives.
Solutions: Developing alternatives
The replacement of classical, inbreeding based hybrids of kohlrabi by pollen-sterile CMS hybrids led Friedemann Ebner to start working on the crop. Through letting early hybrids and early, open-pollinated varieties blossom together, he developed an open pollinated variety for commercial cultivation, comparable to the hybrid varieties in terms of rapid growth and high yield. Enrico is a white, flat-round variety with compact foliage, and has found a firm place among the wholesale growers and exporters in Italy.

Fridolin, the second new variety of kohlrabi, was developed by Julian Jacobs. For him, taste is an important selection criterion. He has been part of a group of breeders researching on methods to support plant development, and is interested in the impact plant health could have on human well-being.
He deployed a combination of treatment methods like seed bath, tones and eurythmy.
The breeding line treated thus showed the highest quality in the biocrystallization tests. Fridolin is noticeable for its robustness, as well as its uniform, well-formed and healthy stem tubers.
In 2019, after two years of DUS testing, the German Federal Plant Variety Office approved the two new varieties of kohlrabi.
Further information: Enrico and Fridolin at Bingenheimer Saatgut
Aus der Arbeit von Kultursaat. Zwei neue Kohlrabi-Sorten mit Charakter (German)
Neu aus unserer Züchtung, Kultursaat Einblicke 2019 (German)
BÖLW (2018): Position paper on organic plant breeding (German)
List of Kultursaat varieties
Kultursaat e.V.

**Practice abstract 32**

**Short title (in English):**
How to become an organic seed grower in Latvia
Problems: According to the principles of European Regulation 834/2007 (Art 4) organic farming should use organic inputs. Consequently, vegetative propagating material and seed used in organic agriculture should also be organic. However, the amount of organically produced seeds and vegetative propagating material in Latvia is still insufficient.

Solutions: Expanding the network of organic seed growers will increase the availability of organic seeds and vegetative propagating material on the market.

Remember: Only certified seeds may be sold!

Essential things in seed production:
Seed stock of high quality, provided by the breeder or representative of breeding company;
precise and scrupulous work on the field, in seed preparation facilities and in warehouses;
good equipment for seed cleaning and preparation.

Practical recommendations: Read the regulations on Seed production and marketing. Take into account the regulations of the Cabinet of Ministers on the procedure of monitoring and control of organic farming.
Register with the State Plant Protection service as a seed producer.
Get informed about the varieties and decide which varieties will be suitable for your farm.
Enter into a licensing agreement with the breeder or his representative. This will give you the right to multiply and market seeds of the selected varieties.

Further information: List of binding Regulations
Latvia plant variety catalogue
http://www.vaad.gov.lv/sakums/registri/aju-skirnes/latvijas-aju-skirne... [28]
Tirgot drīkst tikai sertificētas sēklas!
Sēklaudzēšanā svarīgs ir:
kvalitatīvs sēklas izejmateriāls;
precizitāte un rūpīgs darbs uz lauka, kaltēs un noliktavās;
labs sēklu sagatavošanas aprīkojums - tīrītāji, šķirotāji u.c

Iepazīsties ar sēklaudzēšanas un sēklu tirdzniecības noteikumiem
Ņem vērā MK noteikumus par Bioloģiskās lauksaimniecības uzraudzības un kontroles kārtību
Registrešies Valsts augu aizsardzības dienestā kā sēklaudzētājs
Iepazīsties ar šķirnēm un izlem, kura šķirne būs piemērota Tavai saimniecībai
ENoslēdz licences īgumu ar šķirnes selekcionāru vai tā pārstāvi. Tas dos tiesības pavairot un pārdot sēklu izvēlētajai šķirnei

Practice abstract 33

Short title (native language):
Expert evaluation of varieties in the organic seed database – example of Denmark

Short summary for practitioners (native language):

Problems: Some countries struggle with an excess of derogations for use of non-organic seed. Farmers seek security in choice of variety and variety performance. Authorities handling derogations might lack agronomic knowledge to determine if derogations are needed. Seed companies might lack knowledge of the needs of organic farmers or seek insurance that they can sell their organic seed.

Solutions: Expert groups: In Denmark expert evaluation of varieties for the organic seed database is carried out by crop expert groups in vegetables, agricultural and fodder crops.
Criteria for evaluation (for cultivation in Denmark)
Acceptance to National List
Results from national variety trials (registration and post-registration)
Trial results from comparable areas in other countries

For harvested crops farmers get security in variety choice as they are not obliged to use varieties that are not suitable (visible in seed database)
Authorities use expert evaluations for the derogation process and only grant derogations if no equivalent and suitable varieties are available
Seed companies are mostly warned one year in advance if a variety is no longer suitable (observation list)
Practical recommendations: Farmers: It is important to always check the availability in the organic seed database, and only apply for derogation if none of the available varieties are suitable for the given purpose.

Authorities: Active use of expert evaluations in the derogation process makes decisions for or against derogations easier.
Seed companies: Preparations for next season can be supported by the use of expert evaluations and assortment kept updated, resulting in availability of organic seed of more healthy and well performing varieties.

**Practice abstract 34**

Short title (native language): Calorespirometry – a phenotyping tool to assess pea germination efficiency under different temperatures

Short summary for practitioners (native language):

Problems: Quality of pea seeds has a direct impact on sustainable crop production. The ordinary practices of seed quality evaluation are usually performed by germination tests and can be followed by vigour tests and seedling growth characteristic measurement. However, such methods take a long time and are laborious.

Solution: Calorespirometry appears as a solution to develop a fast-performing technique for seed viability phenotyping. This technique measures simultaneously the heat and CO2 rates. Considering that seed germination involves the activation of several metabolic pathways, including cellular respiration to provide the required energy, this technique was proposed and validated as a phenotyping tool to identify and select pea genotypes with different seed germination performance upon a range of temperatures.

Practical recommendations: Seeds must be imbedded in paper/cotton moistened with sterilized water during 12 hours at selected temperatures under dark conditions. A MultiCell Differential Scanning Calorimeter (see Figure) is required to perform measurements. Calorespirometric measurements must run as isothermal at selected temperatures.

**Practice abstract 35**

Short title (native language): Use of Near Infrared Spectroscopy (FT-NIR) to assess seed viability and varietal discrimination – Pisum sativum as a case study

Short summary for practitioners (native language):

Problems: Quality and viability of pea seeds is significant from the aspects of both sustainable crop production and nutritional efficiency. The ordinary methods of seed quality evaluation are usually laborious, take a long time and can destroy the seed.

Solutions: Near Infrared Spectroscopy (FT-NIR), as fast, non destructive and easy handle technique could be a promising tool on seed phenotyping. FT-NIR spectrometers can detect with high accuracy specific molecules in which the principal chemical bonds are CH, OH, NH, SH or C = O. It was hypothesized that i) different genotypes could be
Practical recommendations: Seeds can directly be used (no imbedding required) for spectral data acquisition; Per seed three spectra need to be measured; Linear Discriminant Analysis (LDA) in Fig. 1 and Principal Components Analysis (PCA) in Fig. 2 must be performed with a minimum of 50 samples.

Practice abstract 36

Short title (native language): Italian Organic Seed Database

Short summary for practitioners (native language):

Problems: According to the European Organic Regulation all organic plant reproductive material (PRM) shall be listed on the National databases of the Member States. Solutions: The Italian organic seed database (BDS) has been updated to a fully interactive database. Since 1st January 2019 all certified organic farmers are required to register on the database to consult organic seed offers and apply for derogation when seed of the varieties needed is not available. Farmers are advised to complete the registration process in good time to ensure everything is working and become familiar with the tool. Practical recommendations: The database allows to search available organic certified PRM, according to supply levels set by seed companies. Crop species are categorised following a traffic light system:

GREEN LIGHT – no organic seed available: derogation always granted;

YELLOW LIGHT – some organic seed available: the farmer must send a request of interest to the seed supplier via the database system. This shall lead to a seed sale, or a derogation request if the interaction wasn’t successful.

RED LIGHT – organic seed available in ample quantity. No derogation possible.

A dedicated function is available to request a derogation for experimental/research purposes. This is particularly relevant to farmers engaging in field trials or wanting to test non-organic germplasm, obtained from gene banks. Further information: CREA-DC is the public agency responsible for the maintenance of the Italian BDS. Their staff provides technical support:

http://scs.entecra.it/biologico-indice/biologic-2019.html [29]

Organic seed in Italy: problems and perspectives:

Practice abstract 37

Short title (native language): Farm saved seed: what rules?

Short summary for practitioners (native language):

Problems: According to LIVESEED’s survey on organic seeds use (LIVESEED booklet The State of Organic Seed in Europe), organic farming still relies on farm saved seed (FSS) as a mean to get obtain organic seed for the next sowing. However, the rules on FSS are not always clear. May farmers reproduce their own seeds? For which crops? Do they have to pay royalties on FSS?

Solutions: FSS is regulated by Council Regulation n. 2100/94 (art. 14 and 15) and Commission Regulation 1768/95 with regards to the definition of the “farmers’ exemption” (see Fig. 1). In practice, farmers are allowed to save and re-sow protected varieties of only certain species, but then they have to pay the so-called “equitable remuneration”, that could be on individual basis or derived by a contract between farmers’ and rights holders’ organizations.

Practical recommendation: When you are re-sowing your own seeds please be aware that:

Conservation varieties, landraces, heritage varieties, heterogeneous materials are in public domain, so no royalties are due;

Not all modern varieties that are listed in the EU common variety catalogue are protected by Plant Breeders’ Rights (PBR), please check out on the CPVO database;

Farmers, like breeders, can use protected varieties for on farm breeding;

If you are a small farm, according to art. 7 reg. 1768/95, you are exempted to pay the royalties (see Figure).


CPVO public PBR database: https://online.plantvarieties.eu/#/publicsearch [32]

Practice abstract 38

Short title (native language): Conservation Varieties in Italy

Short summary for practitioners (native language):

Problems: A growing number of farmers and growers (including home gardeners) are seeking local varieties or cultivars with a higher level of intra-varietal diversity,
compared to those normally available on the market (Distinct Uniform and Stable varieties).

Solutions: The 1998 EU directive 98/95 introduced a new category of plant propagation material: conservation varieties (CV). This was done to expand the seed market and include historical varieties and increase the level genetic diversity. In 2008 the rules for the marketing of conservation varieties were defined:

- Directive 62/2008/CE on field crop species
- Directive 145/2009/CE on vegetable species, divided among conservation varieties and varieties with no intrinsic value
- Directive 60/2010/CE on feed crops

CVs exist only for those species, for which registration on the European Common Catalogue is mandatory. It is therefore not possible to have CVs of einkorn (Triticum monococcum), as the seed of this species can be marketed without registration on a variety list. CVs are registered on a dedicated section of the National variety list.

Practical recommendation: In Italy there are: 42 CV of vegetables, 16 vegetable varieties with no intrinsic value and 80 CVs of field crop species;

You can find CVs on seed companies’ catalogues;

CVs are of public domain: no Plant Breeders’ Rights (PBR) apply and farmers are free to save their own seed;

CVs can represent a resource for organic agriculture due to their agronomic traits and less homogeneous genetics.

Further information: Italian National variety list: https://www.sian.it/mivmPubb/autenticazione.do [33]
RSR Notiziario #21: https://www.semirurali.net/notiziari [34]

Practice abstract 39

Short title (native language):
Marketing of heterogeneous material: EU experiences

Short summary for practitioners (native language):

Problems: A temporary experiment on the marketing of genetically diverse populations of wheat, barley, oats and maize was granted under the EU implementing decision 2014/150/EU. This has allowed EU countries to register populations and market their seed to determine how identification and traceability requirements may need to be adapted for seed production of populations.

Solutions: We identified which countries have registered populations as part of the experiment and collated their experiences in a report. In summary:

- 31 populations have been registered across Europe
- Four European countries have marketed populations for barley, bread wheat (winter and spring), durum wheat and maize. Trials are also underway in Denmark and the Netherlands.

Seed certification is possible in collaboration with the national authorities

By following the official seed certification process within each country, traceability and seed safety have been possible regardless of the ability to identify individual batches of seed following DUS protocols.
100 ton of heterogeneous material has been successfully marketed
Seed companies have facilitated the sale of seed to farmers. The largest volumes have been sold in Italy (65T of bread wheat from three populations) and the UK (12T of bread wheat from one population).
Innovation within the cereal value chain
The variable nature of population grain has led to innovations by end-users. Alternative routes to market have been key to the success of initiatives marketing heterogeneous material.

Practice abstract 40

Short title (native language):
Marketing a genetically diverse wheat: YQ in the UK

Short summary for practitioners (native language):
Problems: It has been possible to market genetically diverse populations of cereal seed under the EU implementing decision 2014/150/EU. However, cereal processors can be cautious of the variability found in such populations. It is also necessary for grain markets to develop and create demand for the seed.
Solutions: ORC Wakelyns Population is a genetically diverse wheat that has been bred under organic conditions in the UK to maximise both yield and quality parameters. This has earned it the nickname ‘YQ’. Interest in the ‘story’ of YQ grain, beyond standard quality measures such as protein content, has allowed an added-value market to develop with one bakery leading the way on wholegrain sourdough bread production. YQ grain is now integral at the bakery and an alternative grain movement has grown in the UK, in part inspired by YQ.
Practical recommendations: When developing a genetically diverse crop, it is important to consider its function and value across the whole value chain. Collaboration with seed companies, grain traders, millers and bakers is necessary for successful marketing. This can create reliable interactive processes, yet official monitoring of quality and safety remain important.
The rise of an alternative grain movement in the UK: Guardian newspaper article
The UK Grain Lab

Practice abstract 41

Short title (native language):
Application of acetic acid as a seed treatment in organic cereal seed

Short summary for practitioners
(native language):

Problems: Common bunt is a devastating seed borne disease in wheat. If a seed lot is contaminated with just a few spores, there is a high risk that the disease will develop and reduce yield and quality of the crop. Acetic acid is very effective to control common bunt in wheat, but there is a high risk of negative effects on germination. Therefore the procedure of application is crucial for a successful treatment.

Solutions: The crucial point in seed treatments with acetic acid is to make sure that the entire seed surface is covered, to affect all bunt spores. It is crucial that the application is as uniform as possible and as fast as possible. It is easier to cover all the kernel surface with acid, if a higher amount of acid are applied, but if so, the seed needs to be dried after 30 to 60 seconds to avoid negative effects on germination.

Practical recommendations: Small seed samples (0-2kg) can be treated in a box with high amounts of acetic acid (<20ml/kg) and drying with a hair dryer or similar after 30 seconds. Seed samples of 5-20kg can be treated in a cement drum by applying acetic acid just enough to make the seed humid. 20ml/kg is optimal, but a slightly higher amount can be applied if the seed after treatment is spread on a clean surface in the sun or wind for drying. If huge amount of seed need to be treated, it is crucial not to exceed the limit of 20ml/kg, as it will be difficult to dry the seed quickly enough after treatment before germination is affected. If you are uncertain whether your treatment is optimal, it is better to use a lower dose, and then repeat the treatment after the seed has been properly dried.

Practice abstract 42

Short title (native language):
How to improve organic seed production for carrots and cauliflower

Short summary for practitioners (native language):

Problems: The production of organic vegetable seed is under high pest and disease pressure and there is a lack of effective methods for control. This regularly leads to complete yield failure of the seed crop or low germination rates and thus higher seed prices. In this practice abstract, we focus on carrots and cauliflowers.

Solutions: In order to mitigate the above laid out challenges in organic seed multiplication, especially for biennial crops like carrot and cauliflower, there is a need to invest further into research for pest and disease management in organic seed production systems. However, some practical solutions are listed below.

Practical recommendations: Some practical measures to improve pest and disease control in organic seed production are the following:

Elite carrot seed can be produced indoors to reduce pest pressure. For outdoor carrot seed production, netting in of multiplication area can significantly reduce pest pressure.
Further for carrots, establishing a mixed crop seed production system can reduce pest and disease pressure. For cauliflower, organic seed multiplication can be done in greenhouses and polytunnels. A further advantage can be to multiply in temperate sea climate, where temperature fluctuations are kept to a minimum. Further information: D4.2 Report describing three crop case studies investigating in detail the socio-economic factors influencing the behaviour of various stakeholders regarding the use of organic seed

Practice abstract 43

Short title (native language): How to evaluate weed competitiveness in cereals

Short summary for practitioners (native language):

Problems: The selection and the description of cereal varieties for competitiveness against weeds under organic conditions requires the identification of relevant crop characteristics and the development of routine methodologies to measure them. Weed suppression cannot be attributed to one single characteristics but is the result of the interaction between several parameters.

Solutions: In Austria, knowledge has been accumulated in variety testing under organic conditions in wheat since 1995. Three main tools of weed control are: plant physiology, allelopathy and harrowing. The differences between varieties are mostly described in their plant physiology. The following parameters are important to specify: crop ground cover, growth habit, tillering capacity, rapid early growth to stem elongation, plant height, inclination of leaves and leaf area index.

Practical recommendations: In the Austrian official VCU-tests the following parameters are used to describe the weed competitiveness of the varieties as they are fast to be collected:

- Crop ground cover (in percentage at BBCH 28, BBCH 31-32, BBCH 34-47)
- Canopy height (in cm at BBCH 31-32, BBCH 34-47)
- Frequency of plants with recurved flag leaves (scale 1-9 at BBCH 37-47)

The tillering capacity is not regarded because it is included in the crop ground cover. The measuring of leaf area index (LAI) was abandoned in 2010 because measuring with special devices is very time consuming.

Further information:


Practice abstract 44

Short title (in
Pre-sprouting of potato seed tubers

Short summary for practitioners (in English):

Problems: For potato and seed potato production in organic farming, it is recommended to shorten the growing period under field conditions, in order to reduce disease attack during development and mitigate the potential damage, achieving good quality and certification of organic seed potato.

Solutions: The most effective way to shorten potato growing period under field conditions is pre-sprouting or chitting tubers by light or elevated air temperature before planting. This provides earlier plant emergence in field, faster tuber initiation and bulking and formation of bigger tubers, compared to planting tubers early in cold soil. Often higher tuber yield can be obtained and earlier harvesting can be conducted. It also helps to prevent late blight, rhizoctonia and other disease damages. Reducing risk of aphid attack is important, as aphids are vectors of several viruses. Light sprouts are more resistant to soil borne diseases, when tubers planted in cooler soil. Practical recommendations: 2 to 8 weeks before planting, place seed tubers in the light, avoiding direct sunlight. Longer exposure to light causes bigger tuber size of new yield, while shorter exposure promotes higher tuber number. Split seed tubers in shallow boxes with higher corners, stack filled boxes, leave space between stacks OR pour seed potatoes in net-bags and hang them up. Favorable temperatures are 12-15 °C during the day and 4-5 °C during the night. Make sure the tubers are protected against night frost. Strong and short light sprouts will appear on tubers, they will be durable to mechanical damages. Potato planters can be safely used. Lower night temperature tempers the sprouts.

Short title (native language):
Kartupeļu sēklas bumbuļu diedzēšana

Short summary for practitioners (native language):

Kartupeļu sēklaudzēšanā bioloģiskajai lauksaimniecībai ļoti svarīgi ir samazināt kartupeļu audzēšanas laiku uz lauka. Isākā audzēšanas periodā kartupeļu augiem ir lielākas izredzes izvairīties no slimību un kaitēklu bojājumiem, līdz ar to pieaug iespēja iegūt kvalitatīvus ražas bumbujus sertificētai bioloģiskajai kartupeļu sēkai. Kartupeļu audzēšanas laiku uz lauka visvieglak saisināt, pielietojot sēklas kartupeļu diedzēšanu gaismā vai paaugustināta temperatūrā pirms stādišanas. Diedzēti kartupeļi agrāk sadīst vīrs augsnēs, jaunās ražas bumbūju veidojas un aug straujāk un tie ir lielāki, salīdzinot ar tādā pašā periodā augdzētiem. Diedzētu bumbujus var stādīt agrāk, kamēr augsnē vēl nav iesilusi, jo diedzēti gaismas asni ir izturīgāki pret augsnes patogēniem. Jauno ražu var plānot novākt agrāk un bieži tā ir lielāka, nekā stādēto nediedzētus bumbujus. Ātrāka augu attīstība palīdz izvairīties no rizotokonijas, lakstu puves un citu slimību izplatības. Īpaši nozīmīgi sēklaudzēšanā, ka isākā augšanas periodā samazinās iespēja laputu, nozīmīgāko vīruslimību pārņēmējumu, invāzijai uz lauka. Divas līdz asoņas nedēļas pirms plānotās stādišanas sēklas bumbuļu jānovieto gaismā,

Practice abstract 45

Short title (native language): Heterogeneous spring barley populations in Latvia

Short summary for practitioners (native language):

Problems: Currently only homogenous varieties, produced for conventional farming, are used by organic farmers in Latvia. Such varieties perform well under high input conditions, but in organic system they might lack stability and resilience. Only few varieties recommended for organic systems are included in Latvian Plant Variety Catalogue. Broadening of diversity within a crop/field is needed to buffer against environmental fluctuations and make crop performance more efficient. Solutions: Creation of heterogeneous composite cross populations (CCPs), involving diverse genetic material of 6-12 local and foreign varieties/lines with traits valuable for organic cultivation. Several spring barley CCPs are available at Institute of Agricultural Resources and Economics (AREI) and being tested in LIVESEED and other research projects. Creation of spring and winter wheat CCPs have been started and research on improvement of CCP breeding is going on. Spring barley CCP ‘Mirga’ is included in EC Temporary Experiment on marketing of populations and is cultivated on two organic farms. Practical recommendations: AREI is open to cooperate with farmers interested in populations. Trial results on CCPs in comparison to homogeneous varieties show: good yield stability and similar yield potential; yield advantage under drought stress conditions; lower severity of leaf disease net blotch; no notable differences in respect to ability to suppress weeds. Results indicate a trend to local adaptation. Therefore seeds of populations in early generations are recommended to be sent to farmers for growing on particular farms.

Practice abstract 46

Short title (native language): Special characters of varieties for organic farming in wheat

Short summary for

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**Practice abstract 47**

**Short title (native language):**
How to produce organic heterogeneous material for sweet corn

**Short summary for practitioners (native language):**

Problems: Organic certified sweet corn crops are produced usually with untreated seed from conventional agriculture. The period for seed production is longer, compared to crop production, in the case of sweet corn.

Solutions: Save seeds from Open Pollinated Varieties (OPV) and make new Heterogeneous Material

The easiest way to start organic seed production is to keep old varieties isolated and save ears from them for the next years.

It is very important to select only the kernels that have a translucent appearance, because the common opaque ones show a higher starch level, typical for non-sweet corn varieties.

This can be done in a field, where different populations are pollinating themselves, or through controlled hand pollination. At least 5 cycles are required to obtain a stable...
Practical recommendations:

In case of controlled hand pollination, make a detailed plan adapted to your objectives and resources – it is important to perform the pollinations in less than 2 weeks.

Select, note, mark and save the ears that fit your goals.

To reduce time, you can harvest the ears at physiological maturity and store them in a ventilated place.

Store different OPV seeds separately from each other.

Eliminate the seeds that are not typical for sweet corn.

Prepare in advance materials for pollination (paper bags, clips, scissors, markers, sanitizer) and a Field Notebook for your data input and traceability.

Further information:

Publications and References about organic sweet corn breeding and seed production:

Practice abstract 48

Short title (native language):
How to become a producer of certified organic seed in Romania

Short summary for practitioners (native language):

Problems: In Romania many farmers are also seed producers. A bottleneck is the lack of certified organic seed on the market. Organic farmers are not motivated to become a registered seed producer.

Solutions: Organic seeds are the basis of organic farming. Using organic seed is part of a fair trade for organic consumers. Conventional untreated seed use in organic farming reveals, that organic agriculture is not independent yet. This is a temporary solution that will not exist after 2035.

Organic certified seed is a simple way to add value to farmer’s product. Organic growers already have the most important resource to become seed producer: organic seed!

In addition, seed conditioning equipment, storage, extra labour and time, also learning about seed certification rules are essential. In Romania, in order to become an official seed producer, processor or depositor, one has to take an exam on current seed legislation1, at the local national agricultural authority. When a farmer is registered as a seed producer, the field is inspected, the seed quality is tested and the seeds are certified.

Organic seed database

The organic seed database is the official marketplace for organic seeds, where organic seed producers have the opportunity to list their seed offer.

Practical recommendations: Plan and negotiate your contracts in advance – most organic seed companies contract farmers to produce seeds 2 years in advance.

Start producing seeds of crops that you are familiar with.

Keep fields clean of weeds.

Further information: Romanian seed legislation: [http://www.incs.ro/incshome.htm](http://www.incs.ro/incshome.htm)
Practice abstract 49

Short title (native language):
Introduction of new varieties to the market

Short summary for practitioners (native language):

Problems: Breeding new organic varieties can only be successful, if these varieties find their way to the market. Introducing unknown varieties to the retail sector and consumers is a challenge, thus it is a risk for the breeders.

Solutions: Sharing risks
Disease resistance is an important trait for organic farmers, but not necessarily for traders, retailers and consumers. Informing the whole supply chain about the problem (crop disease) and the solution (resistant variety) is important to get new varieties accepted. Knowing in advance that the retail sector is willing to market the new variety reduces the investment risk for breeders and farmers.(1)

Dutch Potato covenant
In 2016, potato late blight caused major problems for Dutch organic growers. Bionext involved breeders, farmers and retailers in the solution to this problem; the use of Phytophthora resistant varieties.
Twenty-eight parties throughout the supply chain signed a covenant to speed up the breeding, growing and market introduction of new resistant potato varieties. The aim: 100% organic potatoes from resistant varieties in 2020. This ambitious goal has almost been achieved in 2019, with twenty-two resistant varieties covering 80% of the Dutch organic table potato market.(2,3)

Practical recommendations: Traits that might be beneficial to farmers are not necessarily beneficial to traders and consumers. Therefore, communication with retailers should start in an early stage.
A covenant between the relevant partners in the supply chain can help to introduce new varieties to the market.
Short supply chains can support the introduction of new varieties.

Practice abstract 50

Short title (native language):
Organic wheat variety testing by a network of farmers

Short summary for practitioners (native language):

Problems: In the absence of formal organic variety testing mechanisms, British organic farmers struggle to reliably predict the best performing cereal cultivar to grow on their
farm. This jeopardises organic arable production in terms of yield, quality and reliability, with a shrinking acreage and a shortage of UK-grown organic cereals, especially wheat. Solutions: A network of British organic wheat growers has been testing winter wheat cultivars at a field-scale since 2017. Each farmer is allocated a subset of cultivars to grow as strips in their commercial winter wheat field. Yield from each strip is measured and grain samples are tested for grain quality. At wheat anthesis, crop and weed cover, crop height, disease severity and ear density are assessed by researchers. A plot trial including additional cultivars supports the network with more precise information on diseases and with highlights about new cultivars to test at a field scale. Practical recommendations: A control cultivar is included in all farms. Each farm replicates one cultivar in two strips. The experiment follows an incomplete block design and can be statistically analysed through mixed-effect models. Besides farmers, results can inform seed producers about varieties to multiply organically and breeders about traits relevant to low-input farming. Documentation of the cropping systems in use, sheds light on their impact on crop and cultivar performance. Data from the farm network can have important secondary uses for crop modelling and monitoring. Further information: Overview on the current organizational models for cultivar testing for Organic Agriculture over some EU countries LIVESEED D2.1

Practice abstract 51

Short title (native language): How to set up a community seed bank

Short summary for practitioners (native language):

Problems: Continuous loss of agricultural biodiversity / genetic erosion Difficulty to access seed adapted to local and organic conditions through the market Solutions: Community Seed Banks (CSB) are a powerful tool for farmers and gardeners to cooperate in the management of seed diversity. Seed selection, production and management by farmers could be a collective action, in which shared actions allow to face technical problems and to find new solutions. CSB could provide organic varieties and heterogeneous material to farmers seeking cultivars adapted to local conditions. Practical recommendations: Location: A CSB should have separate rooms for acquiring seed checking, cleaning and seed storage. Clear entry and exit routes need to be established. Good hygiene and regular surface cleaning with alcohol are important to avoid contamination. Avoid wood or porous material surfaces. For storage ideally temperature should be <15°C and relative humidity <40%. Seed loosing germinability quickly should be stored <4°C. Equipment: A CSB can operate with very basic equipment. The minimum are sieves with mesh appropriate to the seed being handled, plastic buckets and containers, vacuum packing machine and weighing scale. For pre-storage temperature treatments, a deep freezer (-20°C) and an air dryer (e.g. food dryer) are essential.
Data management: All seed entering and leaving the CSB should be recorded. It’s important to record the origin of the seed, local name, who grew it, harvest year. Data can be recorded on paper or digitally, ideally both. For seed distributed outside the CSB it’s advisable to use the Standard Material Transfer Agreement.

Further information: [https://www.communityseedbanks.org/](https://www.communityseedbanks.org/) [38]

**Practice abstract 52**

**Short title (native language):**
How to produce seed of heterogeneous populations of inbred cereals

**Short summary for practitioners (native language):**

Problems: Organic cereal seed production of heterogeneous populations may appear simpler than uniform varieties, however to produce quality seed of locally adapted cereal population, skills and attention are needed.

Solutions: Maintain the original source: It’s good practice to grow a plot of the original population large enough to ensure seed for a field. 1,000 m² should provide enough seed for 1 ha the following year. Within this nucleus carry out quality controls: remove plants of foreign species and carefully check for diseases. Take every precaution at harvest to avoid contamination with external seed (combine, thresher, etc.).

Foster local adaptation: Start off with the highest possible level of intra-population diversity, avoid excessive selective pressure during first crop cycles, keep a backup of last year’s seed in case of severe reduction in yield. As seed is bulking up, move towards your target micro-environment and allow the crop to naturally evolve.

Select new cultivars: Select the best plants in the field but harvest only the top half of the ear to avoid removing genetics from the original source. Promising pure lines can be kept separate or mixed together to create multi-line mixtures.

Practical recommendations: Keep a seed sample for each year

Avoid practices that are too selective (i.e. removing small seeds at cleaning stage)

Record crop performance and climate data in a field book


**Practice abstract 53**

**Short title (native language):**
Tools to identify genetically heterogeneous cultivars 1: constitution

**Short summary for practitioners (native language):**
Problems: In a variety, one individual plant can represent the whole plant grouping, making univocal identification possible, whereas in organic heterogeneous material (OHM) an individual plant cannot represent the population, and therefore a range of description and identification metrics is needed. Hence, seed registration and certification of OHM relies on information on the constitution, traceability and description of the OHM seed.

Solutions: A temporary experiment on the marketing of genetically diverse populations of wheat, barley, oats and maize was granted under the EU implementing decision 2014/150/EU, where tools to identify and describe genetically diverse populations were tested. Tools to document the constitution of population were set out as (i) the breeding goal, (ii) the breeding method and (iii) the parent varieties. A SWOT analysis of these tools was performed to inform future developments of the legality of OHM.

Practical recommendations: For breeders: it is good practice to clearly outline the intended use of a population as a breeding goal. A measurable/verifiable breeding goal it can help in identification and performance testing.

For OHM, which sits under the Organic Regulation, information on parent varieties and breeding methods are key tools to prove compliance with organic standards.

Further information: Text of the Commission Implementing Decision 2014/150/EU. Main outcomes and SWOT of experiences from marketing populations under the Temporary Experiment into the commercialisation of heterogeneous populations in the European Union.

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Practice abstract 54

Short title (native language): Tools to identify genetically heterogeneous cultivars 2: traceability

Short summary for practitioners (native language):

Problems: In a variety, one individual plant can represent the whole plant grouping, making univocal identification possible, whereas in organic heterogeneous material (OHM) an individual plant cannot represent the population, and therefore a range of description and identification metrics is needed. Hence, seed registration and certification of OHM relies on information on the constitution, traceability and description of the OHM seed.

Solutions: A temporary experiment on the marketing of genetically diverse populations of wheat, barley, oats and maize was granted under the EU implementing decision 2014/150/EU, where tools to identify and describe genetically diverse populations were tested. Tools to document the traceability were set out as (i) the region of production, (ii) the registration of actors / “paper trail”, and (iii) the representative sample. A SWOT analysis of these tools was performed to inform future developments of the legality of OHM.

Practical recommendations: Traceability tools are necessary to provide evidence of population development and history and to prevent parallel markets. Keeping a record of region of production for seed lots can inform understanding of the evolutionary history of a population.
Documenting where a seed lot was multiplied should not limit where the seed lot can be grown.

Further information: Text of the Commission Implementing Decision 2014/150/EU Main outcomes and SWOT of experiences from marketing populations under the Temporary Experiment into the commercialisation of heterogeneous populations in the European Union

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**Practice abstract 55**

**Short title (native language):**
Tools to identify genetically heterogeneous cultivars 3: description

**Short summary for practitioners (native language):**

Problems: In a variety, one individual plant can represent the whole plant grouping, making univocal identification possible, whereas in organic heterogeneous material (OHM) an individual plant cannot represent the population, and therefore a range of description and identification metrics is needed. Hence, seed registration and certification of OHM relies on information on the constitution, traceability and description of the OHM seed.

Solutions: A temporary experiment on the marketing of genetically diverse populations of wheat, barley, oats and maize was granted under the EU implementing decision 2014/150/EU, where tools to identify and describe genetically diverse populations were tested. Tools to describe the populations were set out as (i) degree of heterogeneity and (ii) performance testing. A SWOT analysis of these tools was performed to inform future developments of the legality of OHM.

Practical recommendations: Description of the degree of heterogeneity and population performance can be useful in advising on the management and use of the population. Detailed description is likely to be difficult to implement, so it is not recommended as a legal requirement in the next stage of regulation for heterogeneous material.

Good practice would be that developers/breeders maintain and share clear and transparent records on the parameters relating to the description and use of their population.

Further information: Text of the Commission Implementing Decision 2014/150/EU Main outcomes and SWOT of experiences from marketing populations under the Temporary Experiment into the commercialisation of heterogeneous populations in the European Union

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**Practice abstract 56**

**Short title (native language):**
How to create diversified variety mixtures based on gene bank resources

**Short summary for practitioners**


**Problem:** More than one million accessions are kept in European gene banks. However most of these cultivars have a very low intrinsic genetic diversity. In contrast, many farmers are trying to create diversified populations suitable to organic agriculture, that are more adaptable and resilient.

**Solutions:** A simple but effective strategy to generate a diverse population of a crop is combining different cultivars into a mixture. Around 200 accessions of the chosen species are requested from European or international gene banks, these are multiplied and their agronomic features observed (e.g. lodging, earliness, disease resistances). After 2 to 4 years of multiplication, collectives of farmers can receive mixtures of these cultivars. The farmers can choose the characteristics of the mixtures they receive, based on the traits and qualities observed during the multiplication process. Practical recommendations: Mixing numerous varieties coming from gene banks compensates their low intra-varietal diversity. Creating populations based on phenotypical and agronomical traits accelerates the selection process for farmers. This method requires a multiplication and observation phase of the individual accessions on single plots for a period of 2 to 4 years. It can be done by farmers’ associations and/or researchers both on-farm and in research stations.

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**Practice abstract 57**

**Short title (native language):**
Comparison of two breeding strategies for soft wheat populations

**Short summary for practitioners (native language):**

Problems: For many years, French farmers have developed diversified soft wheat farm cultivars for organic farming, by using mass selection, mixtures (called dynamic populations) or manual crosses (CCP). How do we determine which method is best between manual crosses and mixtures? What is the influence of the breeding strategy on the agronomical behavior of populations and their phenotypical diversity? Solutions: Two populations have been created in 2015: the first one results from the manual two by two crossings of six parents from different populations, whereas for the second one, the six parents were mixed without crossings. The populations were cultivated and observed on two sites for several years and were compared by observing several characteristics, such as phenotypical diversity or agronomical traits. The first results seem to show that after five years of evolution, in different location and under natural and farmer selection, the breeding method had a smaller effect on the agronomical behavior and the phenotypical diversity of a population, than location adaptation and human selection. Practical recommendations: Manual crossings do not seem to create more diversity than mixtures in the case of wheat. The breeding method chosen to create populations does not seem to have an influence on the agronomical behavior of the populations. Manual crosses can be challenging for farmers and practitioners. Therefore, it is easier and more interesting to start creating diversified population by mixing cultivars, rather than crossing them with one-another.
**Practice abstract 58**

**Short title (native language):**
Influence of location and human selection on two soft wheat populations

**Short summary for practitioners (native language):**

Problem: For many years, French farmers have developed farm varieties for organic farming with high diversity, by using mixtures (dynamic populations) or crosses (CCP). What are the factors that influence the agronomical behavior and the phenotypical diversity of the populations created thanks to those two methods? Solution: Two populations coming from two different breeding strategies (mixture and manual crossing) both were cultivated in two different farms since 2015. Manual crossings were conducted two by two for each variety, meaning that every variety was used as male and as female in the creation of the populations. Each population has undergone a mass selection by farmer and two bakers in 2018, each one of them choosing 60 spikes with their own criteria. The agronomical behavior of the populations and their phenotypical diversity were followed, based on criteria such as the height of the straw and spikes, the color of the spikes, the number of fertile spikelets or the yield. Practical recommendations:

This experiment shows that the environment of a population is a more important factor than the breeding strategy (manual crossing or mixtures). It is even more important in organic farming where we do no seek for a homogenized environment. Human selection (as it was conducted by the actors involved in this experiment) seems to be the most important factor on the evolution of a population, at least for the first year after the selection. Mass selection can enhance the agronomical criteria without reducing the diversity of a population.

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**Practice abstract 59**

**Short title (native language):**
Treating wheat seed with vinegar against common bunt

**Short summary for practitioners (native language):**

Problem: Common bunt is a devastating seed borne disease in wheat and related cereals. Starting from just a few spores in a seed batch, the disease can develop in the crop reducing grain yield and especially quality. Solutions: Acetic acid is very effective to control common bunt in wheat. Seed treatments with white vinegar can easily be applied on-farm, but germination can be harmed if it is not applied properly. A vinegar treatment will protect seeds from bunt spores on the seed, but not in the soil. It is efficient after proper seed cleaning. Can be used to protect related (hulled) cereals
(such as spelt and emmer) from bunt, but might be less effective, or greater quantities are needed. For 100 kg seed approx. 1.7 l of vinegar (4%) (If the concentration is more than 4%, dilute with cold water to reach 4%. According to practical experience, 1.7 l of liquid for 100 kg of seed is usually enough to treat all seeds without wetting them too much, but you may need to adjust according to seed humidity.)

On-farm, you can use a cement drum to treat seed batches. For small seed quantities (e.g. in collections), you can simply use a hand-sprayer for treating, while shaking the seeds in a small container.

Avoid using high concentrations: beyond 5% acetic acid, germination rates are reduced in some experiments.

Dry quickly and thoroughly the seeds after treating to preserve seed quality.

If the treated seed is actively dried after treatment (e.g. by a hot airstream), let the vinegar work on the seed for approximately a minute before drying.

Make sure that the entire seed surface is covered! It is crucial that the application is as uniform as possible, as fast as possible, to avoid the acetic acid from evaporating and the seed from imbibing too much liquid.

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Practice abstract 60

Short title (native language):
Usability of results from conventional trials for organic rye cultivation

Short summary for practitioners (native language):

Problems: Winter rye was cultivated in Austria 2019 on 15.899 ha on organic farms. That corresponds to an area of 36.4 % of the total cultivated rye area. Since 2015, this percentage increased continuously from 29.3%. Nevertheless, not in all regions results of organic trials are available. Solutions: In Austria, organic trial results from randomised plots are available in the “Waldviertel”, in the Northern foothills, in the Carinthian basin and in alpine regions of Styria. In other regions sometimes conventional trials are performed. The research question was, if those trials could be used as a decision base for organic farming as well. That is why organic and conventional trials of two sites in the “Waldviertel” from 2016 to 2020 were taken into the correlation analysis. Practical recommendations: The data showed that:

The level of the observed parameters are mostly different between organic and conventional.

For several parameters the varieties behave nearly in the same way: date of heading, date of ripening, plant height, yield, protein content, amylograph values.

The behaviour of other parameters are moderately to largely comparable between the two systems: lodging, thousand kernel weight, hectolitre weight, falling number.

The occurrence of diseases was not able to be compared between the two systems.

Futher information: BAES (2020): 12_Cereals in organic farming (available only in German). In: Austrian Descriptive list of varieties 2020 – Agricultural species. [35]

Practice abstract 61

Short title (native language):
Usability of results from conventional trials for organic triticale cultivation

Short summary for practitioners (native language):

Problem: Winter triticale was cultivated in Austria 2019 on 17.293 ha on organic farms. That corresponds to an area of 28.9 % of the total cultivated rye area. Since 2012, this percentage increased continuously from 17.6 %. Nevertheless, not in all regions results of organic exact trials are available. Solutions: In Austria, organic trial results from randomised plots are available in the “Waldviertel”, in the Northern foothills, in the Carinthian basin and in alpine regions of Styria. In other regions often solely conventional trials are performed. The research question was, if those trials could be used as a decision base for organic farming as well. That is why organic and conventional trials of two sides in the “Waldviertel” and one of the Northern foothills from 2016 to 2020 were taken into the correlation analysis. Practical recommendations: The data showed that:

The levels of the observed parameters are lower in organic than in conventional farming. For several parameters varieties behave nearly in the same way: date of heading, date of ripening, plant height, lodging, thousand kernel weight, hectolitre weight. The behaviour of other parameters are comparable between the two systems: yield, brown rust, Rhynchosporium, falling number, protein content. The lowest correlations were found in protein yield, protein content and yellow rust. However conventional results of those parameters can be a good information source for the organic farming, too.

Practice abstract 62

Short title (native language):
Susceptibility of winter wheat cultivars to various isolates of common bunt (Tilletia caries)

Short summary for practitioners (native language):

Problem: Common bunt (Tilletia caries) is a damaging fungal disease, which especially impacts organic farming. Winter wheat is most frequently affected. Several races of the fungus have been identified, each of which has different pathogenicity. Solutions: Given the limited options to treat seeds under organic farming conditions, it is desirable to increase the resistance of organic crop plants to seed-transmitted diseases. Several race-specific, effective resistance genes to bunt have been identified (Hoffmann and Metzger 1976, Goates 2012). It would be possible to achieve broadly effective resistance by
pyramiding several Bt resistance genes. Practical recommendations: The wheat cultivars ‘Capo’ (without bunt resistance), ‘Tillexus’ (Bt10), ‘Tilliko’ (BtZ) and ‘Tillsano’ (Bt5 group; Borgen A., Loeschenberger F., pers. communication) were included in the study. Seeds were artificially inoculated with 10 spore isolates of common bunt (3 g per kg). These are not single spore isolates. The spores originated from naturally infected spikes collected from different regions of Austria. The trials were carried out using a randomised block design with 2 replicates. The cultivar ‘Capo’ was heavily infected by all spore isolates (65.7–81.9%). Because ‘Tillexus’, ‘Tilliko’ and ‘Tillsano’ displayed varying reactions, this confirms that they carry different resistance genes. The cultivars reacted similarly to spore isolates 1, 4 and 7 and 2, 6, 9 and 11, respectively. Isolates 3 and 5 or 4 and 8 also elicited similar reactions from the cultivars. ‘Tillexus’ was more strongly infected by six and ‘Tilliko’ by two spore isolates. ‘Tillsano’ showed good resistance to all isolates (3.0–8.5% infected spikes).

Practice abstract 63

Short title (native language):
Farmers’ perspectives on the use of organic seed in European organic agriculture

Short summary for practitioners (native language):

Problem: The European Organic Regulation 2018/848 aims to phase out derogations for the use of untreated non-organic seed by 2036, but the use of organic seed by farmers in Europe is still low. How realistic is this target and what factors drive seed choice?
Solutions: A survey was conducted to identify the factors affecting the use of organic seed, with a sample of about 750 organic farmers in Central, Eastern, Northern and Southern Europe.
Our results show that:
Farmers in Central Europe use more organic seed than in the other regions.
Farm saved seed plays an important role in the coverage of organic seed, especially in Eastern and Southern Europe.
Organic seed use is highest in the vegetable sector, followed by the arable, forage and fruit sector.
Organic seed is mainly used by farms in short and specialised supply chains.
The share of organic seed used on farm decreases as farms get larger and more recently converted.
The main issue reported by the farmers is the availability of organic seed for the varieties they need.
Decision to use organic seed is influenced by perception of societal expectations, particularly from the consumer and the organic certifier. Practical recommendations:
The supply of organic seed for a large range of crops species and cultivars should be improved to meet farmers’ demand, so that crop and market diversification is not at risk. From the demand side, the communication of societal expectations in the public discourse can stimulate organic seed use.
Practice abstract 64

Short title (native language):
How to increase the efficiency of cultivar choice in organic farming

Short summary for practitioners (native language):
Problem: All farmers are searching for the best performing varieties, but there is still lack of knowledge on how to choose these cultivars in organic agriculture. Additionally, there is a strong limitation in the annual number of cultivars that can be tested with current on-farm trial systems. Solutions: The introduction of small plot trials into on-farm testing environment as an initial screening trial, would greatly increase the number of cultivars that could be examined on the targeted organic farm. Cooperations between farmers and nearby research institutions would give the possibility to establish small plot trials on farmers’ fields with research machinery. Practical recommendations: First step is the examination of cultivars in replicated randomized small plot trials for 2 years, assessing the most important traits like yield, disease resistance and quality. Based on the rank of cultivars, the best performing ones could be tested on large farmer plots for 1 more year, implementing a more detailed assessment protocol. Rapid NIR measurement is adequate to define a rank regarding quality traits. In the case of winter wheat, the best (in NIR protein and gluten) and worst (in grain yield) performing group of cultivars are the same in the on-farm testing system and the small plot trial, thus effective selection can be carried out. Testing of such preselected cultivars under farming conditions (mainly for yield) would help to choose the most reliable wheat cultivar(s) for the target field. Further information: Eucarpia-LIVESEED 2021 conference abstract/poster on winter wheat by Mikó et al.

Practice abstract 65

Short title (native language):
On-farm breeding for wheat mixtures

Short summary for practitioners (native language):
Problem: In recent years farmers showed a growing interest in cultivating wheat variety mixtures, and in selecting on-farm populations that are adapted to the local context. However, many practices exist for creating and breeding for mixtures: from mixing a small number of carefully chosen cultivars, to mixing a large diversity which perform well in the farm, selecting within cultivars before mixing, selecting within the mixture, adding cultivars over the years. Understanding the impact of different selection practices on mixtures behavior, should help farmers breed their own adapted mixture on farm. Solutions: Three selection practices were identified and compared using a 3-year experimental design: two years of selection within components before mixing (M1); one year of selection within components, mix these selection and one year of selection within this new mixture (M2); and two years of selection within the mixture. The selected
mixtures were compared to the non-selected mixture (M4). Each farmer created mixtures from the components of his/her choice. Results showed a larger response to selection for some productivity and morphological traits when selecting within the mixture (M3), with a tendency to conserve more diversity when selecting within components before mixing (M1). Gains obtained with selection depended mostly on farmers’ selection intensity.
Grow different cultivars, landraces and populations over two or three years to choose the ones adapted to your objectives.
Identify the assembly rules and practices that are adapted to your breeding goals and constraints: select within the mixture to obtain a quicker response to selection or select within components if your goal is to conserve more diversity.

**Practice abstract 66**

**Short title (native language):**
Organic seed for forage crops: recommendations for a level playing field

**Short summary for practitioners (native language):**

Problem: Forage crops are the fertility engine of the organic sector, accounting for 45% of organic farmland in Europe (Willer et al. 2020). At present the use of organic seed for forages is scarce. Also, forage crops are normally sown as mixtures, but there is not a common rule across Europe: some countries consider the organic content in the seed mixture as a whole, whilst others consider the organic content of each seed component individually. Solutions: The number of derogations is lower in countries where an established share of seed in the mixture as a whole has to be organic. This share is often set at 70%, as shown in Table 1. Some countries using the whole component approach have successfully managed to gradually increase the threshold of organic seed required, (e.g. from 30% to 70% in the UK). On the other hand, the number of derogations is higher in countries where farmers need to apply for derogations for every individual component of the seed mixture (in other words all components of the mixture have to be organic). In this case, derogations are the only option whenever a particular component is not available organically. This occurs especially when farmers want to use a highly diversified mixture. Expert groups should establish a minimum share of seed in the forage mixture that need to be organic. Although this threshold should gradually increase over time, it is advisable that a certain amount of conventional seed is allowed. This way farmers can diversify and include in the mixture minor crops for which it is currently very difficult to find organic seed. With such an approach, it would also be easier to harmonise the composition requirements across countries, ultimately resulting in a level playing field on trade in forage mixtures.

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Further details
Links to other website(s):
Twitter @LIVESEEDeu
Facebook @LIVESEEDeu

Audiovisual material:
LIVESEED Project video

Description of the context of the project:
LIVESEED will boost the production and use of organic seed aiming to reach 100 % organic seed and vegetative propagation material. Although the EU Regulations 834/2007 and 889/2008 clearly state that organic seed shall be used in OA, there is still a tremendous lack of organic seed on the market and hardly any progress in some countries (Döring et al., 2012; ECO-PB, 2013; Rey et al., 2013; Padel et al., 2014). Organic producers easily obtain derogations to use non-organic untreated seed impeding level playing fields for organic producers in the EU. LIVESEED will progress beyond the state-of-the-art towards greater use of organic seed by (i) raising overall awareness for its need and improving transparency on its availability, (ii) harmonizing the implementation of the regulation, (iii) promoting different incentives and models to use organic seed and (iv) reducing the bureaucratic burden of the seed market. A survey of 1000 farmers across the partner countries will identify their needs in relation to production, trade and use of organic seeds. LIVESEED will work on installing functioning organic seed databases and establishing national expert groups in the Member States. The amount of organic
seed as well as the choice of main crop cultivars on a European level should be increased. These ambitious goals will be achieved by building on experience and existing networks of the LIVESEED multi-actor partners and stakeholders. The coordinator (IFOAM EU) with members from the organic sector in all EU member states has significant experience in ensuring (i) active participation of local contacts needed for EU-wide surveys and implementation and (ii) facilitation of knowledge exchange with national and European authorities and policy makers.

Additional information:

Specific objectives
1) Provide a level playing field regarding the use of organic seed across Europe (WP1) by (i) analysing the determinants of the current production and use of organic seed, (ii) identifying breeding gaps of crops and sub-crops where suited cultivars are missing, (iii) increasing transparency of the EU organic seed market, (iv) improving the implementation of legislative requirements in close collaboration with national authorities, and (v) developing an EU-wide router database tool for organic seed.

2) Increase the volume and quality of organic seeds derived from cultivars suited for organic farming (WP2) by (i) developing and improving efficiency of cultivar testing models under organic farming for the identification of suited cultivars, (ii) developing adjusted protocols for DUS and VCU examination suited for the official variety registrations, (iii) sharing of knowledge and training on smart practices for organic seed multiplication across countries, and (iv) investigating novel seed health strategies and technologies focusing on the vitality of organic seed.

3) Accelerate the breeding process and adoption of new cultivars (WP3) by (i) developing novel and holistic breeding concepts and approaches, from trait based to system based breeding, (ii) delivering new breeding tools based on better scientific understanding of the biological basis of crop resilience and product quality, plant-plant, and plant-microbe interactions, (iii) strengthening small breeding initiatives and stimulating collaboration among actors to close breeding gaps for the five main crop categories: legumes, cereals, vegetables, fruit trees and fodder crops

Additional comments:

4) Improve the competitiveness of the organic seed sector (WP4) by (i) identifying gaps and bottlenecks in the market development of organic seeds and breeding through stakeholder consultations, (ii) analysing the organic seed market supply chain, (iii) developing business and governance models including all actors of the supply chain (breeders, seed producers, farmers, processors, retailers and consumers, (iv) performing case studies on the socio-economic impact of upscaling organic seed and (iv) studying consumer attitudes to the use of new breeding techniques.

5) Enhance greater uptake of organic seed (WP5) by (i) knowledge sharing and disseminating of LIVESEED results (i) building the capacity of breeders, seed producers, farmers, retailers, researchers, and other actors of the food value chain through training and networking, and (iii) raising awareness of policy-makers regarding the importance of using organically bred seeds in organic farming. 6) Foster seed and breeding related innovation in the organic sector (WP6) by (i) coordinating and ensuring scientific exchange between WPs and other related Seed Projects, (ii) fostering strong collaboration between academic and non-academic actors along the food value chain including competent authorities and policy makers and (iii) synthesising project results and developing joint-up recommendations.