



Practice Abstracts

| | |
|----------------------------|---|
| Deliverable number | 5.5 |
| Dissemination level | Public |
| Delivery Date | October 2020 |
| Status | Version 2 |
| Lead beneficiary | ÖMKi |
| Authors | Project partners, Editor: Judit Fehér, ÖMKi |



LIVESEED is funded by the European Union's Horizon 2020 under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation (SERI) under contract number 17.00090. The information provided reflects the views of the authors. The Research Executive Agency or the SERI are not responsible for any use that may be made of the information provided.



Document Version

| Version | Date | Contributor | Summary of Changes |
|---------|------------|-------------------|--|
| 1.0 | 25.05.2020 | Judit Fehér, ÖMKI | Version 1 |
| 2.0 | 15.10.2020 | Judit Fehér, ÖMKI | <ul style="list-style-type: none"> - Practice abstracts are assigned to four category groups: <ul style="list-style-type: none"> - A - Organic Seed Production, Seed Cleaning, processing and storage - B - Seed quality and health under organic management - C – Organic Plant Breeding and variety trials - D – Economics and Regulation of organic seeds (including contracting, certification and market issues) - Target audience was added to the heading of all Practice abstracts. - The Practical Recommendation section was reformulated in a more practice oriented way and targeted to the specific stakeholder groups in case of Practice abstract: 1, 5, 12, 13, 14, 15, 23, 27, 29. - The Practical recommendation section was added to Practice abstract 17 and 20. - The suggested improvements and corrections were done in case of Practice abstract: 6, 13, 18, 19, 37, 43, 53, 54, 55. |
| | | | |

Table of Content

| | |
|---|----|
| Document Version | 2 |
| Table of Content | 2 |
| Summary | 5 |
| 1. How to access organic seeds in Hungary | 6 |
| 2. Managing common bunt in wheat seed lots | 7 |
| 3. Cooperatives a model to improve organic seed production | 8 |
| 4. Creating dynamic and diverse populations Mixtures of landraces or old varieties..... | 9 |
| 5. Managing on farm populations Mixtures of landraces or old varieties..... | 10 |



| | |
|---|----|
| 6. The cell fusion-free vegetable list helps organic farmers to find suitable cultivars | 11 |
| 7. How to assess weed competitiveness in organic cultivar trials with wheat? | 12 |
| 8. How to set up a simplified on-farm cultivar trial to assess broccoli? | 13 |
| 9. How to set up an on-farm cultivar trial to score for leaf blight in carrots? | 14 |
| 10. How to minimise damage by aphids in organic faba bean production? | 15 |
| 11. How to identify potato cultivars which are resistant to late blight? | 16 |
| 12. How to improve organic seed availability in Bulgaria | 17 |
| 13. Organic seed from community seed banks | 18 |
| 14. The obligation to use organic seed – farmers’ awareness | 19 |
| 15. Seed treatments allowed in organic farming in certain countries (Input list) | 20 |
| 16. Guidelines for on-farm variety testing | 21 |
| 17. Towards ecological and societal resilience through systems-based plant breeding | 22 |
| 18. Breeding an organic forage crop variety | 23 |
| 19. Co-design of locally adapted wheat variety mixtures | 24 |
| 20. Assessment of locally adapted wheat variety mixtures | 25 |
| 21. The difference between certified organic seed and “untreated” conventional seed | 26 |
| 22. Values and benefits of organic seeds | 27 |
| 23. Legal limitations for the use of organic and new genetically diverse seeds in Spain | 28 |
| 24. Preservation of traditional varieties in the region of Valencia | 29 |
| 25. Proper seed storage | 30 |
| 26. How to improve organic cereal seed availability in Hungary | 31 |
| 27. Incentives to use organic seeds set by the supermarkets | 32 |
| 28. Seed health in potatoes | 33 |
| 29. Greening urban gardens with local vegetable varieties | 34 |
| 30. Seed vigour, keep it high! | 35 |
| 31. Biodynamic alternatives to CMS hybrids | 36 |
| 32. How to become an organic seed grower in Latvia | 37 |
| 33. Expert evaluation of varieties in the organic seed database – example of Denmark | 38 |
| 34. Calorespirometry – a phenotyping tool to assess pea germination efficiency under different temperatures | 39 |
| 35. Use of Near Infrared Spectroscopy (FT-NIR) to assess seed viability and varietal discrimination – Pisum sativum as a case study | 40 |
| 36. Italian Organic Seed Database | 41 |
| 37. Farm saved seed: what rules? | 42 |



| | |
|---|----|
| 38. Conservation Varieties in Italy | 43 |
| 39. Marketing of heterogeneous material: EU experiences | 44 |
| 40. Marketing a genetically diverse wheat: YQ in the UK..... | 45 |
| 41. Application of acetic acid as a seed treatment in organic cereal seed | 46 |
| 42. How to improve organic seed production for carrots and cauliflower | 47 |
| 43. How to evaluate weed competitiveness in cereals | 48 |
| 44. Pre-sprouting of potato seed tubers..... | 49 |
| 45. Heterogeneous spring barley populations in Latvia | 50 |
| 46. Special characters of varieties for organic farming in wheat | 51 |
| 47. How to produce organic heterogeneous material for sweet corn | 52 |
| 48. How to become a producer of certified organic seed in Romania | 53 |
| 49. Introduction of new varieties to the market | 54 |
| 50. Organic wheat variety testing by a network of farmers | 55 |
| 51. How to set up a community seed bank | 56 |
| 52. How to produce seed of heterogeneous populations of inbred cereals | 57 |
| 53. Tools to identify heterogeneous cereals 1: constitution | 58 |
| 54. Tools to identify heterogeneous cereals 2: traceability | 59 |
| 55. Tools to identify heterogeneous cereals 3: description | 60 |



Summary

28 partners contributed to the writing of the 55 Practice abstracts presented in this document. The titles together with an estimated deadline were collected on Sharepoint. Eight weeks before the deadline the authors received a reminder, with a template and guidelines to submit the first draft within four weeks. The review process was performed within two to four weeks by the Executive Committee. The final versions of the Practice abstracts are published on the LIVESEED website and will be uploaded to EIP-Agri platform as well as to Organic Eprints and Organic Farm Knowledge Platform after final validation. Four of the 55 Practice Abstracts is also available in the native language of the authors.



LIVESEED is funded by the European Union's Horizon 2020 under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation (SERI) under contract number 17.00090.



How to access organic seeds in Hungary

Problems

In Hungary organic seeds are scarcely available, thus derogation for the use of conventional untreated seeds is still a major practice¹.

Solutions

Database

The organic seed database (<http://portal.nebih.gov.hu/oko-vetomag>) 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.

National seed companies

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.

International seed companies

Organic vegetable farmers ensure their seed supply mostly from international seed companies, that offer a broad range of organic seeds via on-line marketing.

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

1. 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
2. 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.
3. Researchers should organise farmer trainings and capacity building in producing high quality seed.
4. Policy makers should establish incentives for organic seed use and organic seed production.

Further information

- [ECO-PB Workshop report \(2013\)](#)
- [A Seed Saving Guide for Gardeners and Farmers \(2010\)](#)

Authors: Dóra Drexler, Tina Kovács, Korinna Varga (ÖMKi)

Contact: dora.drexler@biokutatas.hu

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2018

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Managing common bunt in wheat seed lots

Problems

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).

The decision diagram on the next page summarizes all the necessary information when managing an infested seed lot.



Figure 1: Bunt balls, a mass of spores replace the kernels. (Photo: S. Klaedtke (ITAB))

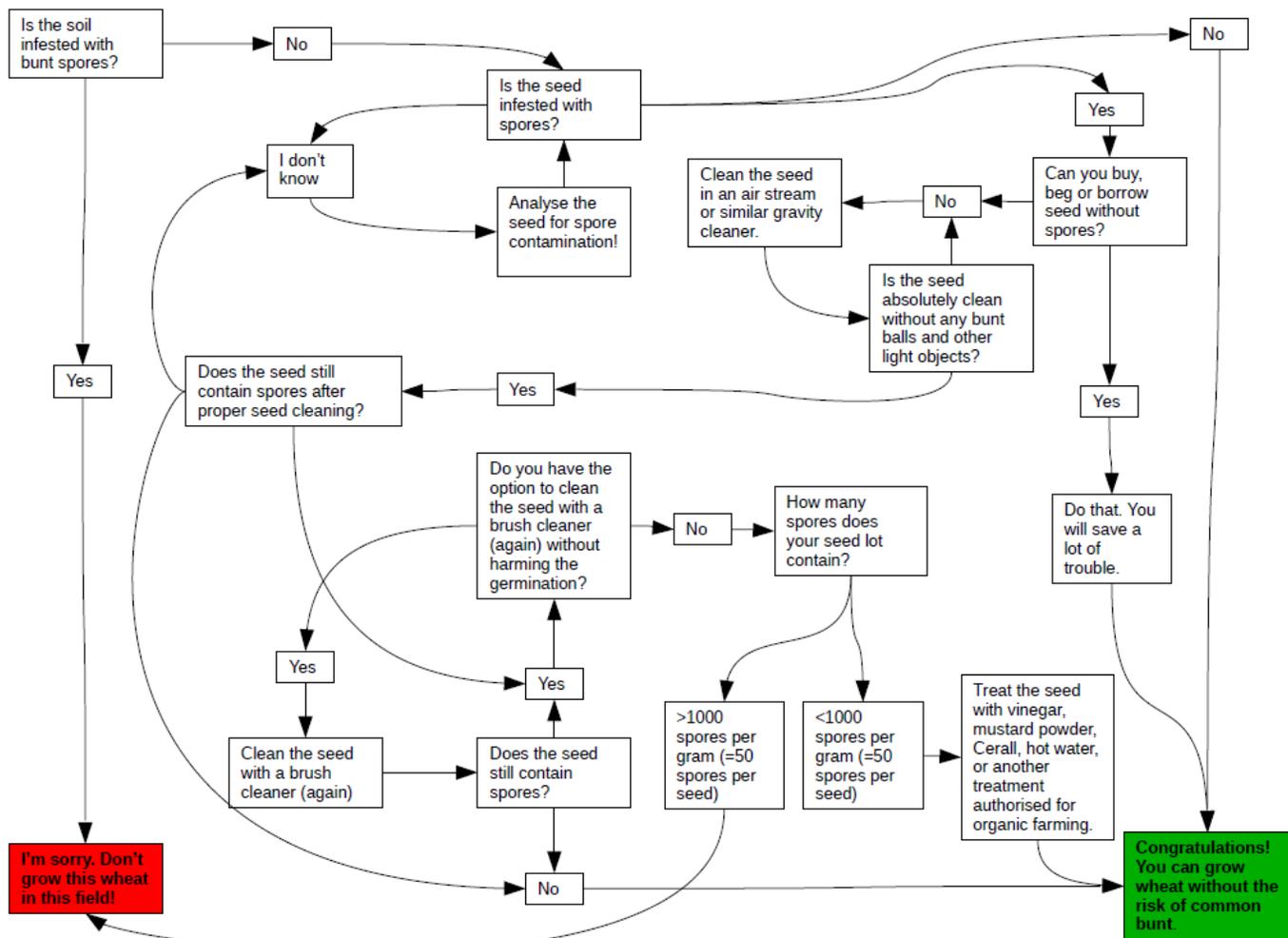
Further information

1. Matanguihan J.B., Murphy K.M., 2011. Control of Common Bunt in Organic Wheat. The American Phytopathological Society, Plant Disease Vol. 95 No. 2: 92-103. Available at: <https://doi.org/10.1094/PDIS-09-10-0620>
2. On brush cleaning in particular: Borgen, Anders (2005) Removal of bunt spores from wheat seed lots by brush cleaning. Seed Info, ICARDA, 29, pp. 13-15. Available at: <http://orgprints.org/3202/>





The following decision diagram summarizes all the necessary information when managing an infested seed lot.



Authors: Anders Borgen (Agrologica), Stephanie Klaedtke (ITAB) and Angela Thueringer (AGES)

Contact: stephanie.klaedtke@itab.asso.fr

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: October 2019

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA is not responsible for any use that may be made of the information it contains



Cooperatives a model to improve organic seed production

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.

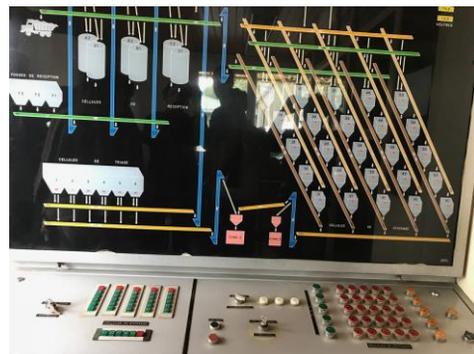


Figure: Scheme of seed cleaning of UBIOS cooperative in France

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

Further information

1. Organic Seed Production Tutorials <https://seedalliance.org/publications/7281/>
2. Organic seed cooperatives: in France <http://unionbiosemences.fr/>
3. In the UK <https://www.seedcooperative.org.uk/>

Authors: Edwin Nuijten (De Beersche Hoeve)

Contact: e.nuijten@louisbolk.nl

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2019

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Creating dynamic and diverse populations

Mixtures of landraces or old varieties

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.



Figure 1: Dynamic wheat population (Photo: INRAE)

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.

Further information

This practice abstract has been developed within the Cross-Visit in France in June 2018, and is based on the case of the farm of Vicent Lefevre.

More details in Booklet: [Experiences from LIVESEED Cross Visits](#)

Authors: Isabelle Goldringer (INRAE), Ion Toncea (NARDI), Antonio Lo Fiego, Alonso Navarro Chaves, Alexandra Fuss, Véronique Chable (INRAE)

Contact: isabelle.goldringer@inra.fr

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: March 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Managing on farm populations

Mixtures of landraces or old varieties

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. Even if the main aim is to provide adapted cultivars to farmers, in some cases and for some species, seeds can be sold (see new regulation about heterogeneous material), but farmers should take care about health issues, because dynamic population are bred to fit given local contexts and not for large adaptation.

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.



Figure: Farmers are collectively managing threshing and cleaning of seeds (Photo: INRAE)

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 desired 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).

Further information

1. PA#4 Creating dynamic and diverse populations
2. [Toolbox for identification and description of organic heterogeneous material](#)

Authors: Véronique Chable (INRAE)

Contact: isabelle.goldringer@inra.fr

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: March 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

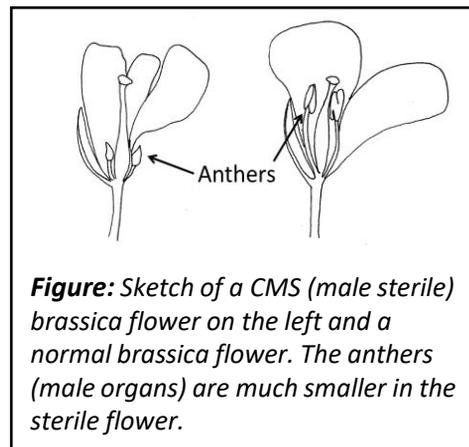
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA is not responsible for any use that may be made of the information it contains



The cell fusion-free vegetable list helps organic farmers to find suitable cultivars

Problems

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.



Solutions

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 recommendations

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>

Further information

- **FiBL breeding manual** <https://www.fibl.org/fileadmin/documents/shop/1202-plant-breeding.pdf>
- **IFOAM-strategy on artificial CMS**
https://www.ifoam.bio/sites/default/files/cell_fusion_replacement_strategy_2017_for_website_upload.pdf
- **IFOAM position paper: Compatibility of Breeding Techniques in Organic Systems**
https://www.ifoam.bio/sites/default/files/position_paper_v01_web_0.pdf

Authors: Thomas Kimmel, BNN; Martin Koller FiBL; Johanna Zellfelder, BNN;

Contact: zellfelder@n-bnn.de

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: July 2019

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



How to assess weed competitiveness in organic cultivar trials with wheat?

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 conditions.

Solutions

Farmers can set up on-farm trials to test different wheat cultivars. The farmer can use the cultivar which he usually cultivates 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.



Winter wheat trial at ATK Hungary
(photo: ÖMKi)

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 (number 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

Further information

1. Handbook for Cereal Variety Testing: <http://edepot.wur.nl/116544>
2. https://seedalliance.org/wp-content/uploads/2018/03/Growers-guide-on-farm-variety-trials_FINAL_Digital.pdf

Authors: Kaja Gutzen (IFOAM EU)

Contact: kaja.gutzen@ifoam-eu.org

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



How to set up a simplified on-farm cultivar trial to assess broccoli?

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, who wish to test the cultivar's suitability for their on-farm conditions.

Solutions

Field map:

| | | | |
|----|----|----|--|
| BR | BR | BR | Legend: Border row: BR Reference variety: 0 Varieties: 1-4 |
| BR | 0 | BR | |
| BR | 1 | BR | |
| BR | 0 | BR | |
| BR | 2 | BR | |
| BR | 3 | BR | |
| BR | 0 | BR | |
| BR | 4 | BR | |
| BR | BR | BR | |

Figure 1: Example for field map using a simplified design for on-farm trials.

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)



Figure 2: Purple sprouting broccoli (Photo: Organic Seed Alliance)

Further information

1. http://orgprints.org/30599/1/2016-BioGreenhouse_Research.pdf
2. <http://orgprints.org/9863/1/hb-1433-versuche-gemuesebau.pdf>
3. https://seedalliance.org/wp-content/uploads/2018/03/Growers-guide-on-farm-variety-trials_FINAL_Digital.pdf

Authors: Kaja Gutzen (IFOAM EU)

Contact: kaja.gutzen@ifoam-eu.org

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.



How to set up an on-farm cultivar trial to score for leaf blight in carrots?

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

1. <https://ecommons.cornell.edu/handle/1813/43265>
2. <https://ecommons.cornell.edu/handle/1813/42892>

Authors: Kaja Gutzen (IFOAM EU)

Contact: kaja.gutzen@ifoam-eu.org

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Figure 1: Carrot field attacked by carrot leaf blights (Gugino et al., 2004).



Figure 2: *Alternaria* leaf blight, *Alternaria dauci*, with insert showing leaf lesions (Gugino et al., 2004).



How to minimise damage by aphids in organic faba bean production?

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.



Figure 1: Different life stages of the cowpea aphid. (GRDC, 2017)

Solutions



Figure 2: Faba beans with symptoms typical for virus infection by PSbMV (GRDC, 2017)

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

1. [Nordic Field Trial System, Faba bean – varieties](#)
2. [Organic Seed Alliance, Variety Trial Planning Worksheet](#)
3. [Organic Seed Alliance, Variety Trial Evaluation](#)
4. [Organic Seed Alliance, The Grower's Guide to Conducting On-farm Variety Trials](#)

Authors: Kaja Gutzen (IFOAM EU)

Contact: kaja.gutzen@ifoam-eu.org

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.

How to identify potato cultivars which are resistant to late blight?

Problems

Late blight, caused by the fungus *Phytophthora infestans* (Fig. 1), represents one of the most important yield limiting factors in organic potato growing. Breeding for resistance is one important measurement 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.



Figure 1: Late blight infections on leaf surface, underside of the leaf and stem of potato plants (FiBL & ORC, 2017).

Solutions

| |
|--------------------|
| Cultivar 1 |
| Reference cultivar |
| Cultivar 2 |
| Cultivar 3 |
| Reference cultivar |
| Cultivar 4 |
| Reference cultivar |

Organic farmers can set up a simplified cultivar trial to identify potato cultivars which are resistant to late blight (see Fig. 2). 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 to late blight 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.

Figure 2: Example for a field map using a simplified design for cultivar trials.

Practical recommendations

Throughout the growing season, leaf surface, underside of the leaf and stems should be inspected for late blight infections (see Fig. 1). Traits which are useful to assess the cultivar's resistance against late blight are:

- 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 thereby, weather conditions are avoided which are favourable for late blight infestation.

Authors: Kaja Gutzen (IFOAM EU)

Contact: kaja.gutzen@ifoam-eu.org

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



How to improve organic seed availability in Bulgaria

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.

Further information

1. [Website with information](#) and literature about organic seed production
2. [Practice videos on organic seeds production](#) (2018-2020)
3. [Guide for the production of organic pea seeds](#) (2020)

Authors: Stoilko Apostolov; Petar Kirov (FOA Bioselena)

Contact: s.apostolov@bioselena.com

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Organic seed from community seed banks

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 neighbors. 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 multiactor 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.

Key message: Organic thrives when it lets agrobiodiversity to evolve

Further information

1. AEGILOPS Seed Schools: <http://www.aegilops.gr/>
2. Bioersity International: **Community seed banks: concept and practice** Facilitator handbook
https://www.bioersityinternational.org/fileadmin/user_upload/CSB_Vernooy_2017.pdf

Authors: Kostas Koutis, Christina Vakali (AEG)

Contact: info@aegilops.gr

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: July 2019

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Figure 1. Seed school (Photo: Aegilops)



Figure 2: On farm tomato evaluation (Photo: Aegilops)





The obligation to use organic seed – farmers' awareness

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 database¹

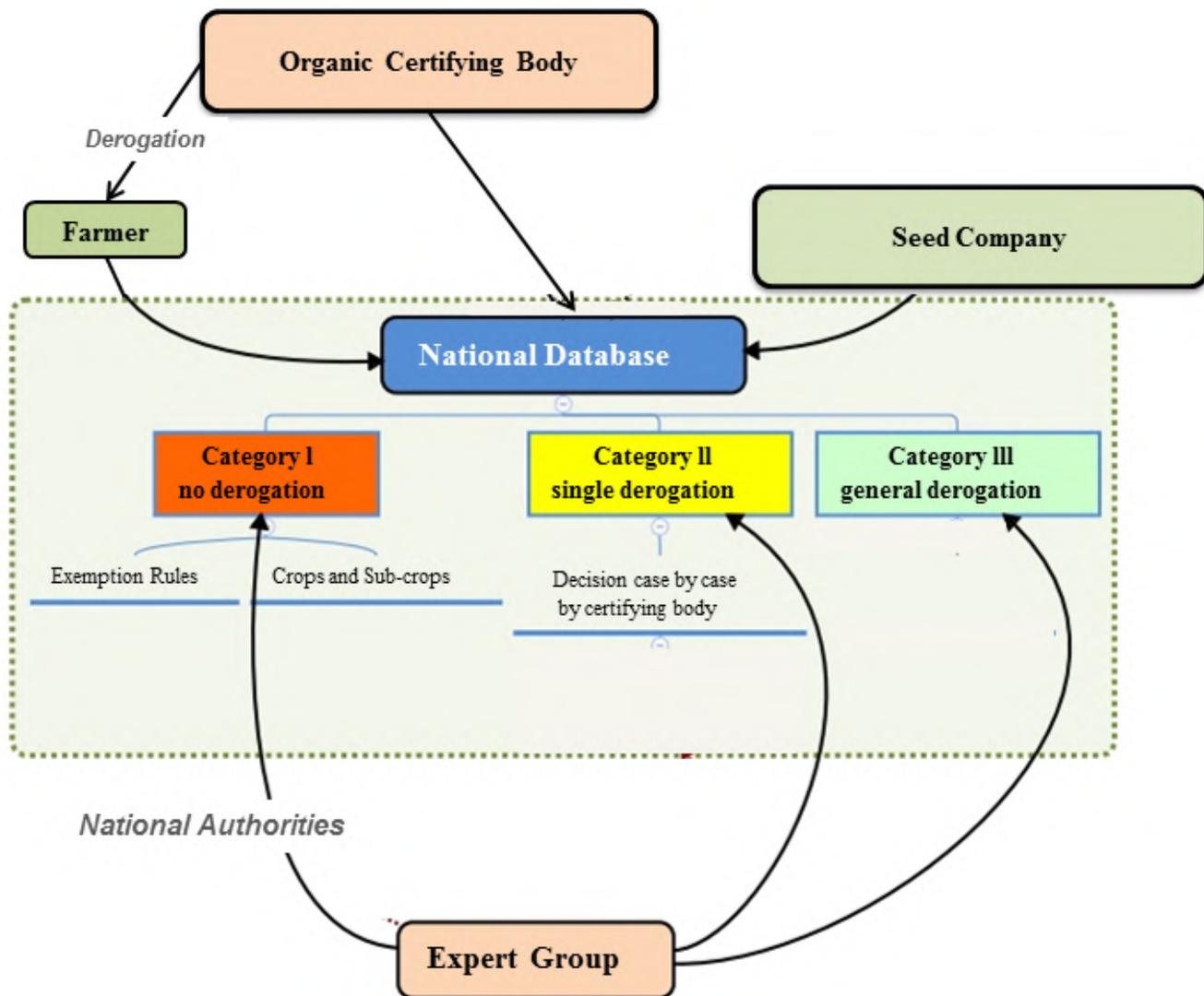
Practical recommendations

- Farmers are recommended to check the database in their country² before asking derogation for a certain crop.
- Farmers are recommended to ask their certifier if there are additional rules concerning organic seed use.

Further information

1. Dutch national organic seed database, including National Annex: www.biodatabase.nl/en
2. List of organic seed databases in Europe: <https://www.liveseed.eu/tools-for-practitioners/eu-organic-seed-databases/>





Schematic overview of the regulating system on organic seed use in the Netherlands

Authors: Niels Heining & Maaïke Raaijmakers (Bionext)

Contact: raaijmakers@bionext.nl

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Seed treatments allowed in organic farming in certain countries (Input list)

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.



Figure 1. Source: oekolandbau.de ©BLE, Bonn/ picture: Thomas Stephan

Solutions

Inputs list for Seed treatments

The Inputs List for organic farming in Germany is published by FiBL every year. All inputs such as fertilisers, plant protection agents, feed and seed treatments 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 and further criteria. Those further criteria are developed in coordination with German organic associations and umbrella organisations 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

1. Inputs list for organic farming in Germany: <https://www.betriebsmittelliste.de/en/home.html>
2. European Input List Website: <https://www.inputs.eu/>
3. Handbook on „[How to implement the organic regulation to increase production & use of organic seed](#)”

Authors: Xenia Gatzert, Jochen Leopold, Rolf Mäder, Freya Schäfer (FiBL)

Contact: xenia.gatzert@fibl.org

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: July 2019

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.

Guidelines for on-farm variety testing

Problems

Choice of varieties well adapted to organic conditions are limited. Farmers can try varieties available in other countries. 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. A few guidelines are provided here for two type of crops: direct-sown and planted.

When 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.

When transplanted:

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



Figure 1: On-farm variety trial of winter wheat (Photo: ÖMKi)

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?

Further information

1. https://seedalliance.org/wp-content/uploads/2018/03/Growers-guide-on-farm-variety-trials_FINAL_Digital.pdf
2. [PA#7 How to assess weed competitiveness in organic cultivar trials with wheat?](#)
3. [PA#8 How to set up a simplified on-farm cultivar trial to assess broccoli?](#)

Authors: Edwin Nuijten (De Beersche Hoeve)

Contact: enuijten@yahoo.com

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Towards ecological and societal resilience through systems-based plant breeding

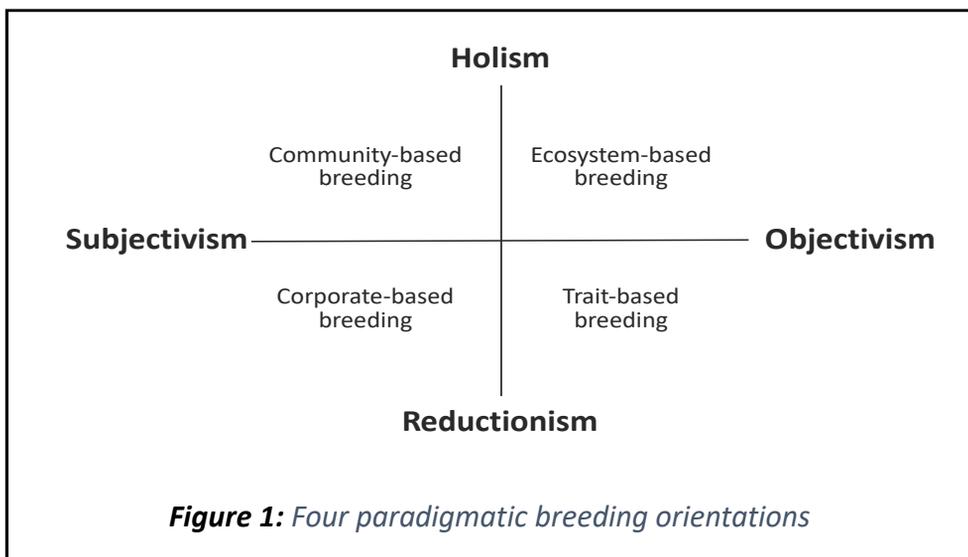
Problems

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, see Fig.1. 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 entrepreneurs, 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', see Fig.2. It maximizes the synergy between the ways of thinking of the four paradigmatic orientations. Based on this concept of systems-based breeding, we picture a perspective where breeders can be initiators of developments towards an ecologically and societally resilient crop production. Breeders can not do this alone, but need the help of policymakers, researchers and the whole value chain.

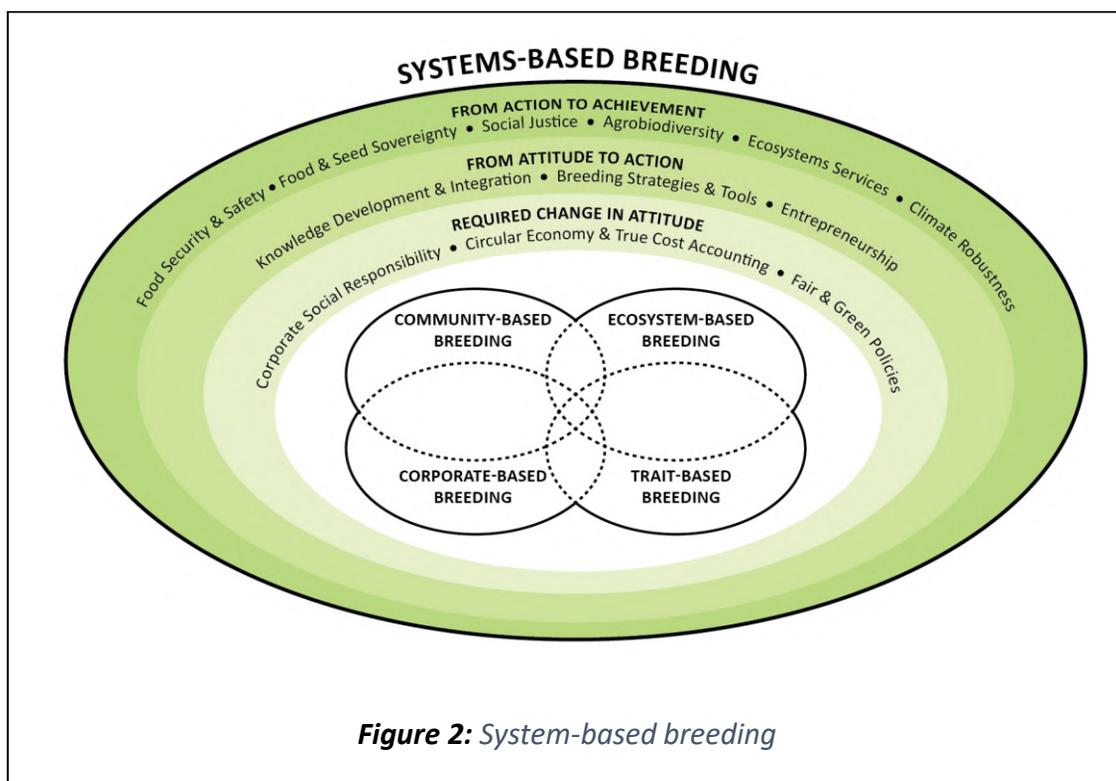


Figure 2: System-based breeding

Further information

Lammerts van Bueren, E.T., Struik, P.C., van Eekeren, N. et al. Agron. Sustain. Dev. (2018) 38: 42. <https://doi.org/10.1007/s13593-018-0522-6>

Authors: Edwin Nuijten (De Beersche Hoeve)

Contact: enuijten@yahoo.com

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: July 2019

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Breeding an organic forage crop variety

Problems

In Switzerland and the EU, if available, organically bred varieties (e.g. Cat. 1 and 2 according to the classification developed by Bio-Suisse¹) should be preferred over conventional ones. However, only few organic forage crop varieties exist, and their seed availability is scarce. Breeders need to be encouraged to develop organic forage crop varieties.

Solutions



Figure: Alfalfa-grass mixture
(Photo: Agroscope)

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)². 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 (see Figure).

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 species³
- 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 selection²

Further information

1. [Standards for the Production, Processing and Trade of 'Bud' Products](#)
2. Crespo-Herrera L.A and Ortiz R. Plant breeding for organic agriculture: something new? [Agriculture and Food Security](#) 4 (25): 1-7.
3. Sanderson M.A., Brink G., Ruth L. and Stout R. 2012. Grass–Legume Mixtures Suppress Weeds during Establishment Better than Monocultures. *Agronomy Journal* 104 (1): 36-42.

Authors: Katharina Kempf, Franz Xaver Schubiger, Christoph Grieder (Agroscope)

Contact: christoph.grieder@agroscope.admin.ch

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.

Co-design of locally adapted wheat variety mixtures

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**.

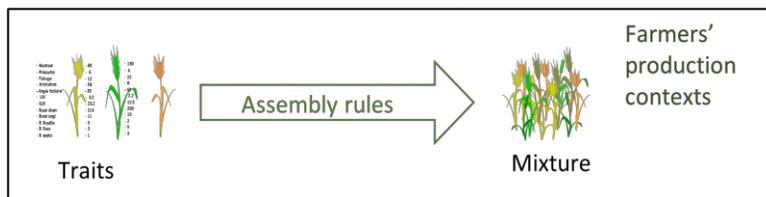


Figure: Designing assembly rules to combine traits within mixtures

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 (i) using varieties with early vigour or high tillering ability, (ii) diversifying varieties for earliness, height and growth habit.
- **face nitrogen stress** by (i) tolerating an early deficit, by complementarity (ii) in time of **nitrogen demand** (diversified earliness), or (iii) for **nitrogen use efficiency**.

Further information

The assembly rules are currently being validated and integrated in a **multi-criteria assessment tool**:

<http://moulon.inra.fr/optimiz/>

1. Barot et al 2017. Designing mixtures of varieties for multifunctional agriculture with the help of ecology. *Agron. Sust. Dev.* 37: 13.
2. Wheatamix project: https://www6.inra.fr/wheatamix_eng/
3. CASABio project: https://www6.inra.fr/basc_eng/Research/Innovation-in-partnership/CASABio
4. Emma Forst 2018 (PhD thesis): <https://tel.archives-ouvertes.fr/tel-02114929>

Authors: Emma Forst & Isabelle Goldringer (INRAE)

Contact: forstemma@gmail.com, isabelle.goldringer@inra.fr

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.



Assessment of locally adapted wheat variety mixtures

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. **Other varietal characteristics** might be considered, but very little is known about plant interactions within mixtures.

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 components¹. 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 (Fig.1) and this type of trial is easy to manage on farm by farmers. Stripes can be divided into three or four to provide replicates.



Figure: Stripe experimental design

Further information

1. 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/>
2. Barot et al 2017. Designing mixtures of varieties for multifunctional agriculture with the help of ecology. *Agron. Sust. Dev.* 37: 13.
3. Wheatamix project: https://www6.inra.fr/wheatamix_eng/
4. CASABio project: https://www6.inra.fr/basc_eng/Research/Innovation-in-partnership/CASABio
5. Emma Forst 2018 (PhD thesis): <https://tel.archives-ouvertes.fr/tel-02114929>

Authors: Emma Forst & Isabelle Goldringer (INRAE)

Contact: forstemma@gmail.com, isabelle.goldringer@inra.fr

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



The difference between certified organic seed and “untreated” conventional seed

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.



Figure: organic leek seed production in Italy (Photo: Vitalis)

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 seed²:

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

Further information

1. Link to all the EU organic seed databases: <https://www.liveseed.eu/tools-for-practitioners/eu-organic-seed-databases/>
2. PA#22 Values and benefits of organic seeds and vegetative propagating material
3. Video of organic cucumber seed production: www.youtube.com/watch?v=Rb33u9HV0gc

Authors: Maaike Raaijmakers (Bionext), Marcel van Diemen (Vitalis)

Contact: raaijmakers@bionext.nl

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](https://www.facebook.com/LIVESEED)] & Twitter [[@LIVESEEDeu](https://twitter.com/LIVESEEDeu)]



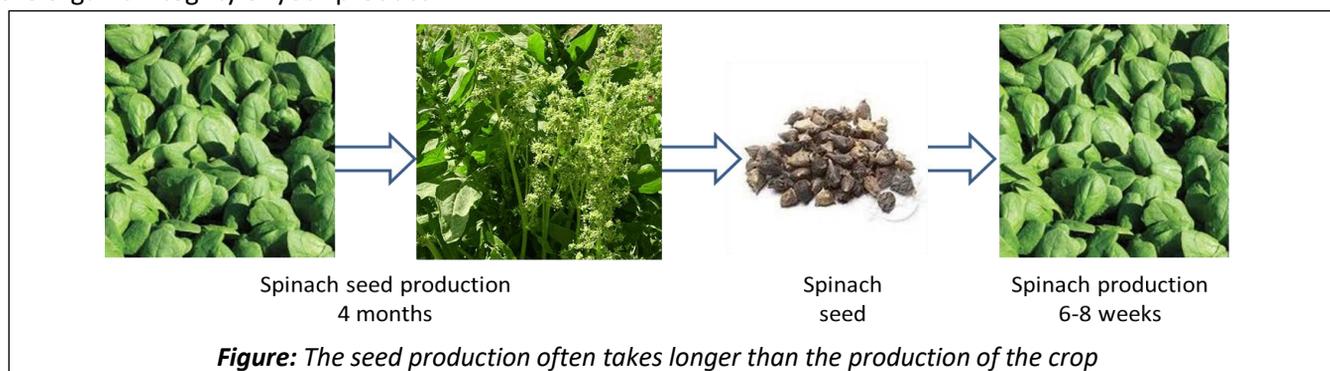
Values and benefits of organic seeds

Problems

Some stakeholders in the organic sector are not aware of the values and benefits of organic seeds. Therefore, unless required to do so by regulation, 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 time¹ (figure). Starting the organic production cycle with organic seed or vegetative propagating material as an input, increases the organic integrity of your product.



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 2035.²

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.³

Practical recommendations

- Educate stakeholders in the organic sector about the values and benefits of organic seeds⁴.
- 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

1. PA#21 [The difference between certified organic seed and “untreated” conventional seed](#)
2. Organic regulation (EU) 2018/848
3. https://orgprints.org/34877/1/Poster_Speiser_Bernhard_2018-phosphonate_strawberries.pdf
4. Why use organic seed ? www.liveseed.eu/tools-for-practitioners/videos

Authors: Maaike Raaijmakers (Bionext)

Contact: raaijmakers@bionext.nl

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Legal limitations for the use of organic and new genetically diverse seeds in Spain

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.



Figure: Genetically diverse varieties (Photo: SEAE)

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.

Further information

1. Further information on organic agriculture:
<https://www.mapa.gob.es/es/alimentacion/temas/produccion-eco/>
2. National regulation on seed registration:
<https://www.mapa.gob.es/es/agricultura/legislacion/Legislacion-nacional-semillas.aspx>

Authors: CALAFAT, A., SERRANO, S. (SEAE)

Contact: international@agroecologia.net

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.



Preservation of traditional varieties in the region of Valencia

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.

CATÀLEG
VALENCIÀ
DE VARIETATS
TRADICIONALS
D'INTERÉS
AGRARI



Figure: Catalogue of traditional varieties in the region of Valencia

Practical recommendations

- Inform local farmers about the catalogue and loaning services.
- Encourage producers to multiply and produce these seeds organically.
- Inform consumers about on 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

1. 1st Valencian Plan for Organic Production: <http://www.agroambient.gva.es/es/web/desarrollo-rural/plan-de-produccion-ecologica>
2. Valencian Catalogue of Traditional Varieties <http://www.agroambient.gva.es/documents>
3. SEAE's Ae Journal. "Promoting traditional seeds' preservation among farmers", J. Roselló, Valencia's Service for Organic Production, Innovation and Technology.
4. National Registry of Seed and seedlings: <https://www.mapa.gob.es/es/agricultura/temas/medios-de-produccion/semillas-y-plantas-de-vivero>

Authors: Víctor gonzález (SEAE)

Contact: comunicacion@agroecologia.net

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.



Proper seed storage

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 (Fig 1). 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, where 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' (Fig 2).

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.



Figure 1. Seed quality test with fresh and aged barley seeds



Figure 2. Box for seed drying and storage

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

Read more on seed storage: <http://library.wur.nl/WebQuery/wurpubs/534005>

Authors: Steven P.C. Groot (Wageningen University & Research)

Contact: steven.groot@wur.nl

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: March 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](https://www.facebook.com/LIVESEED)] & Twitter [[@LIVESEEDeu](https://twitter.com/LIVESEEDeu)]



How to improve organic cereal seed availability in Hungary

Problems

Although the Hungarian organic cereal seed production is significant, the seeds are primarily produced on contract basis for export, hence 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 this national working group will be able to address the right questions and suggest effective and applicable solutions to boost the organic seed sector.



Figure 1: Organic seed expert group meeting in Hungary (photo: ÖMKi)

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 (incl. variety recommendations) service for farmers.
- Organic seed producers and retailers keep the database up-to-date and retain seed lots for domestic market.
- Circulating and propagandizing the new database by the Hungarian Seed Association and the certification bodies.
- 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

1. Hungarian organic seed database: <http://portal.nebih.gov.hu/oko-vetomag>

Authors: Judit Fehér (ÖMKi), Péter Mikó (ATK)

Contact: judit.fehér@biokutatas.hu

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Incentives to use organic seeds set by the supermarkets

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.



Field visit to Biovegs (16 April 2018, Sevilla)

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.

Authors: Ángela Morell Pérez (ECOVALIA)

Contact: ecovalia.international@ecovalia.org

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Seed health in potatoes

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. Roguing 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** roguing 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.



Figure 1: Crinkled leaves with chlorotic spots due to Potato virus Y.



Figure 2: Bacterial soft rot causing black stem rot and stem wilting.

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) plus 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

Further information

1. <https://wiki.groenkennisnet.nl>
2. A. Mulder and L.J. Turkesteen (Eds.), 2005. Potato Diseases. Den Haag, The Netherlands. ISBN 90-802036-4-5

Authors: Abco de Buck (LBI)

Contact: a.debuck@louisbolk.nl

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Greening urban gardens with local vegetable varieties

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.



Figure 1. Greek pepper diversity
(Photo: Greek Genebank)

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.



Figure 2: Salad from traditional vegetable varieties (Photo: Aegilops)

Key message: Let agrobiodiversity green and feed cities

Further information

1. Video on how you preserve local Greek vegetable varieties:
(https://www.youtube.com/watch?v=Lgq5RHj_O4s)
2. Information about products from Greek vegetable landraces:
(<https://www.aegilopslocalfood.gr/katigories/itemlist/category/6-laxanika>)

Authors: Kostas Koutis, Christina Vakali (AEG)

Contact: info@aegilops.gr

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.



Seed vigour, keep it high!

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>

Authors: Steven P.C. Groot & Jan Kodde (Wageningen University & Research)

Contact: steven.groot@wur.nl

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



*Carrot seedlings exposed to spores of *Alternaria radicina* (Black rot disease). Upper picture is from high vigour seeds. Bottom picture from seeds of the same seed lot but stored at higher humidity and temperature.*



Biodynamic alternatives to CMS hybrids

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.



Kohlrabi Enrico and Fridolin. (Photo: Kultursaat e.V.)

Further information

1. [Enrico](#) and [Fridolin](#) at Bingenheimer Saatgut
2. [Aus der Arbeit von Kultursaat. Zwei neue Kohlrabi-Sorten mit Charakter](#) (German)
3. [Neu aus unserer Züchtung](#), Kultursaat Einblicke 2019 (German)
4. [BÖLW \(2018\): Position paper on organic plant breeding](#) (German)
5. [List of Kultursaat varieties](#)
6. [Kultursaat e.V.](#)

Authors: Michael Fleck, Dorothee Pfirrmann and Omkar Gopalakrishnan (Kultursaat e.V.) **Contact:** info@kultursaat.org

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]





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.**

According to the new Organic Regulation 2018/848 that will enter into force in 2021, only organic seed should be used by the 1st of January, 2036.

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

1. List of binding Regulations <http://www.vaad.gov.lv/sakums/normatvie-akti/seklu-sertifikacija.aspx>
2. Latvia plant variety catalogue <http://www.vaad.gov.lv/sakums/registri/augu-skirnes/latvijas-augu-skirnes-katalogs.aspx/>





Basic requirements for organic seed producers



Authors: Ilze Dimante, Ilze Skrabule (AREI)

Contact: ilze.dimante@arei.lv

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Expert evaluation of varieties in the organic seed database – example of Denmark

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

How it works

- 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)



Figure: Variety trials are used in expert evaluation of varieties. (Photo: Tove M. Pedersen, SEGES)

Practical recommendations

Farmers: It is important to always check the availability of organic seed 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.

Further information

1. www.organicxseeds.dk
2. [Veiledning om økologisk jordbrugsproduktion](#) (Danish)

Authors: Tove Mariegaard Pedersen (SEGES)

Contact: TMP@seges.dk

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Calorespirometry – a phenotyping tool to assess pea germination efficiency under different temperatures

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.

Solutions

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.



Figure: MultiCell Differential Scanning Calorimeter (TA Instrument).
(Photo: UÉVORA)

Authors: Lénia Rodrigues, Amaia Nogales, Lee Hansen, Fátima Santos, Steven Groot, Ana Elisa Rato, Hélia Cardoso (UÉVORA)

Contact: hcardoso@uevora.pt

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



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

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 composed by different molecules or different content on specific molecules, ii) during germination new molecules are synthesized and some differences could differentiate phenotypes.

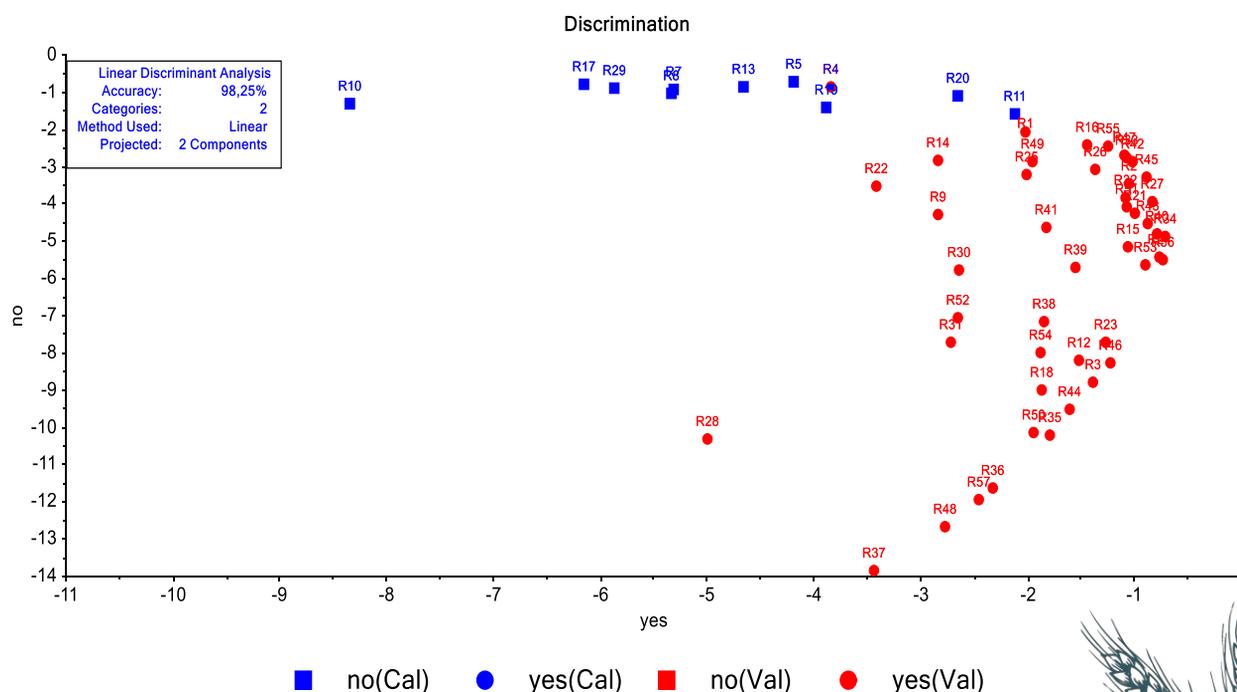


Figure 1: Results of Linear Discriminant Analysis (LDA) revealing the applicability of FT-NIR on seed viability prediction.

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

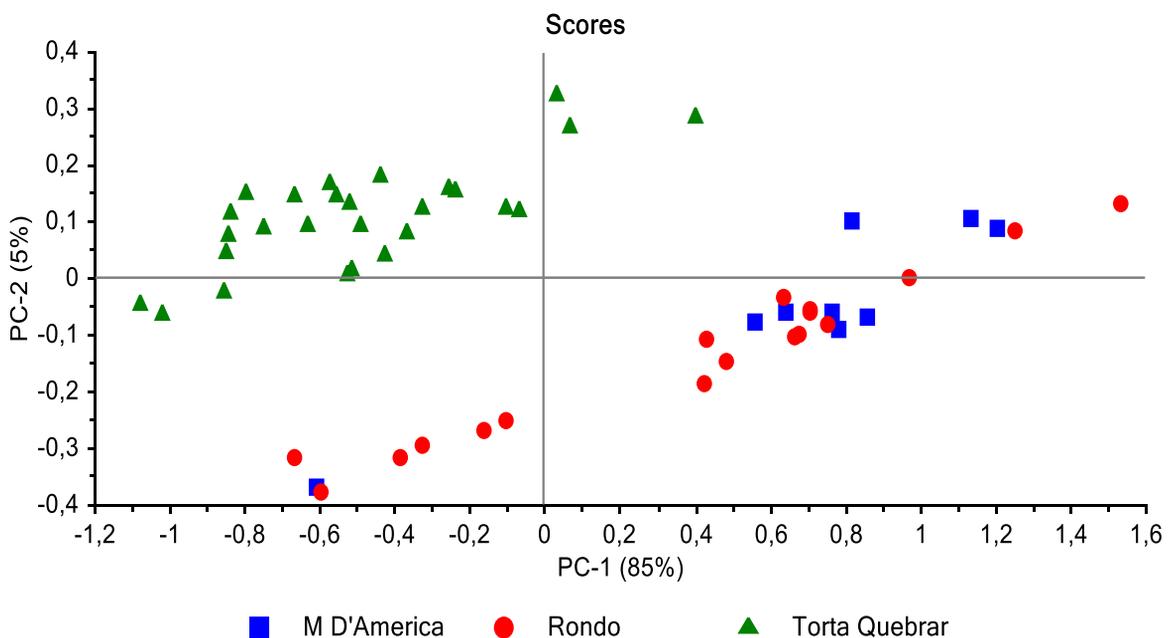


Figure 2: Results of Principal Components Analysis (PCA) revealing the applicability of FT-NIR on cultivars discrimination.

Authors: Lénia Rodrigues, Hélia Cardoso, Fátima Santos, Amaia Nogales, Steven Groot, Lee Hansen, Julio Nogales-Bueno, Ana Elisa Rato (UÉVORA)

Contact: aerato@uevora.pt

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](https://www.facebook.com/LIVESEED)] & Twitter [[@LIVESEEDeu](https://twitter.com/LIVESEEDeu)]



Italian Organic Seed Database

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

1. 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/biologico-2019.html>
2. Organic seed in Italy: problems and perspectives: <http://scs.entecra.it/biologico-indice/indice-convegno-bio.html>





SIAN SISTEMA INFORMATIVO AGRICOLO NAZIONALE
Banca Dati Sementi

Utente: [redacted]

tipo: QUALIFICATO

Funzionalità per fornitore/venditore

- Gestione disponibilità
- Gestione disponibilità vite

Funzionalità per operatore [Richiesta deroga]

- Ricerca disponibilità [Richiesta deroga]**
- Ricerca disponibilità vite [Richiesta deroga]
- Consultazione deroghe
- Richiesta Deroga per Ricerca / Sperimentazione

Home

Elenco Specie/Varieta

La ricerca ha prodotto i seguenti risultati:

Specie: FRUMENTO KHORASAN - Triticum turgidum subsp. turanicum (Jakubz.) A. Love & D. Love ([xS0040708])

Codice Fiscale: PLSSFN69A01B983C

| Varieta | Varieta Equivalente | Colore | Richiedente | Fornitore | Quantita | Data Disponibilita | Zona di Consegna | Richiesta Interesse Inviata | Richiesta Interesse Scaduta | Presenza Risposta Fornitore | Presenza Deroga | Sel. |
|----------------------------------|---------------------|--|-------------|-----------|----------------------|--------------------|------------------|-----------------------------|-----------------------------|-----------------------------|-----------------|-----------------------|
| TRITICUM TURGIDUM SPP. TURANICUM | |  | | | <input type="text"/> | | | NO | | NO | NO | <input type="radio"/> |

Un record trovato.
Pag. 1

Figure: Interface of the Italian organic seed database

Authors: Matteo Petitti, Riccardo Bocci (RSR)

Contact: matteo.petitti@semirurali.net

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Farm saved seed: what rules?

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 recommendations

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).

Further information

1. Workshop on FSS: <https://cpvo.europa.eu/en/news-and-events/conferences-and-events/farm-saved-seed-seminar-4-march-2020-tartu-estonia>
1. CPVO public PBR database: <https://online.plantvarieties.eu/#/publicsearch>



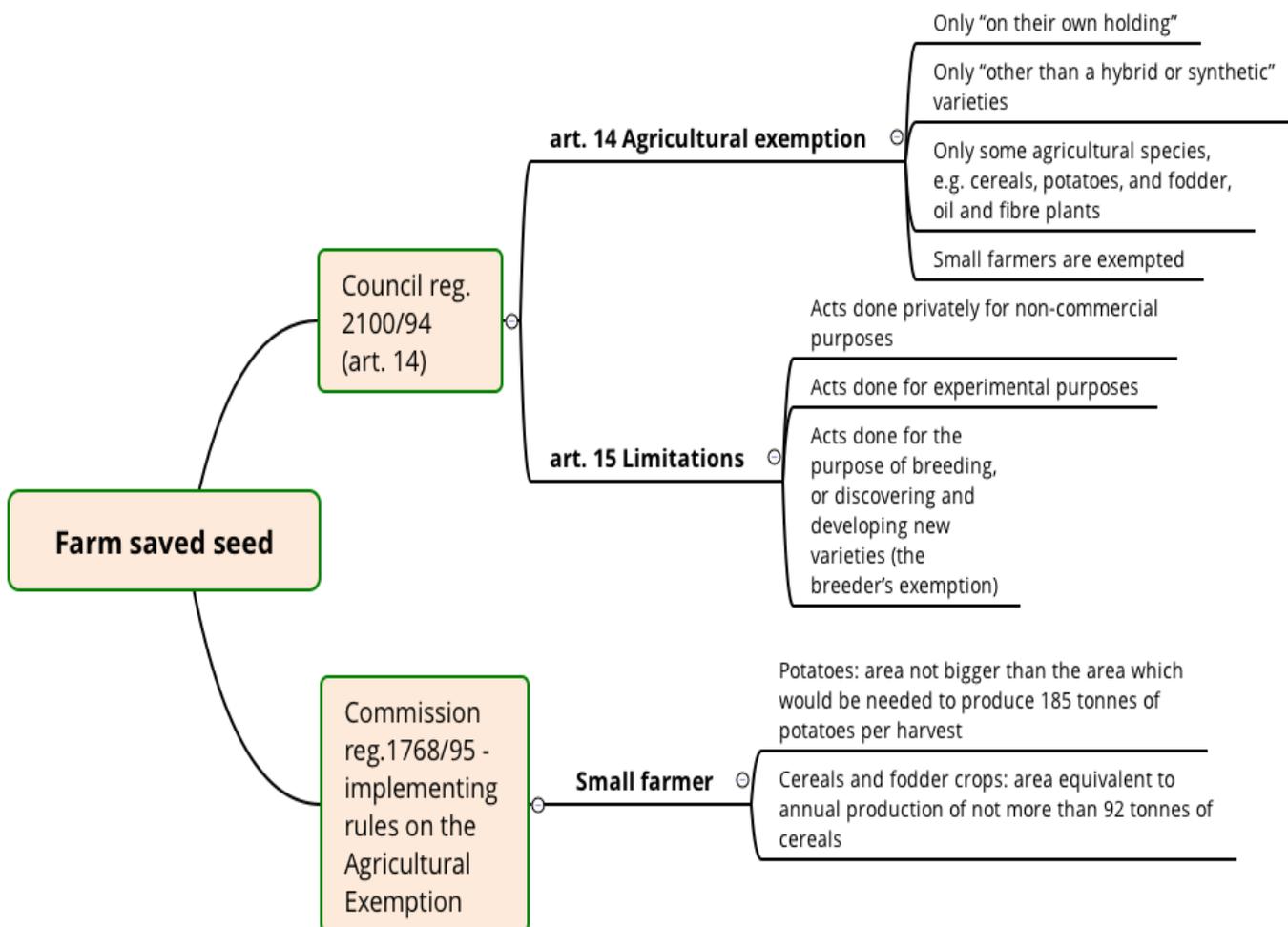


Figure: Plant Breeders' Rights royalties' exemptions for farm saves seeds

Authors: Matteo Petitti, Riccardo Bocci (RSR)

Contact: matteo.petitti@semirurali.net

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Conservation Varieties in Italy

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 recommendations



Figure: Example of labels of a vegetable CV (ARCOIRIS, Italy)

- 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

1. Italian National variety list: <https://www.sian.it/mivmPubb/autenticazione.do>
2. RSR Notiziario #21: <https://www.semirurali.net/notiziari>

Authors: Matteo Petitti, Riccardo Bocci (RSR)

Contact: matteo.petitti@semirurali.net

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.



Marketing of heterogeneous material: EU experiences

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. What happened?

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.

Table 1: Overview of the crops with populations registered as of December 2017

| Crop | Country | Number of registered populations | Contact organisation |
|--------------|----------------|----------------------------------|---|
| Barley | Italy | 1 | University of Perugia |
| Durum wheat | Italy | 4 | Rete Semi Rurali and University of Florence |
| Maize | Germany | 5 | Dottenfelderhof and GZPK |
| Spring wheat | Germany | 8 | Dottenfelderhof and GZPK |
| Winter wheat | France | 2 | UBIOS |
| | Germany | 7 | Dottenfelderhof and GZPK |
| | Italy | 3 | Arcoiris and Rete Semi Rurali |
| | United Kingdom | 1 | The Organic Research Centre |

Further information

- [Text of the Commission Implementing Decision 2014/150/EU](#)
- [Liveseed report on the Marketing of Heterogeneous Material](#)
- [Liveseed booklet on How to Implement the Organic Regulation to Increase Production & Use of Organic Seed](#)

Authors: Charlotte Bickler (ORC)

Contact: charlotte.b@organicresearchcentre.com

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.



Marketing a genetically diverse wheat: YQ in the UK

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.



Figure: Attendees at the UK Grain Lab 2017 learn how to make wholegrain sourdough bread with ORC Wakelyns Population flour. (Photo: ORC)

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.

Further information

1. Bickler et al. (2018) Marketing of a genetically diverse wheat (ORC Wakelyns population): Lessons learnt and routes forward. [SYMPOSIUM ON BREEDING FOR DIVERSIFICATION Abstract Booklet P22 \(P. 122 – 124\)](#).
2. [The rise of an alternative grain movement in the UK: Guardian newspaper article](#)
3. [The UK Grain Lab](#)

Authors: Charlotte Bickler (ORC)

Contact: charlotte.b@organicresearchcentre.com

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.



Application of acetic acid as a seed treatment in organic cereal seed

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.



Figure: Vinegar treatment in a cement drum
(Photo: Matteo Petitti)

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.

Further information

1. Borgen, A. og B.J.Nielsen 2001: Effect of seed treatment with acetic acid in control of seed borne diseases. In: Proceedings from BCPC Symposium No. 76: "Seed Treatment: Challenges & Opportunities", eds. A. J. Biddle. BCPC, Farnham, 135-140.
2. [PA#2: Managing common bunt in wheat seed lots](#)
3. [LIVESEED video on bunt treatment methods](#)

Authors: Anders Borgen (Agrologica)

Contact: borgen@agrologica.dk

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



How to improve organic seed production for carrots and cauliflower

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 poly-tunnels.
- 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](#)

Authors: Eva winter, Carmen Kummer (FiBL CH)

Contact: eva.winter@fibl.org

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Figure 1: Carrot seeds. Photo: John Alan Elson



Figure 2: Purple cauliflower. Photo: Nellie Bly



How to evaluate weed competitiveness in cereals

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)



Figure: Two different Austrian wheat varieties: the left one a good and the right one has a bad weed competitiveness (@ Flamm)

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.

*BBCH-scale is a system for uniform coding of phenologically similar growth stages of all mono- and dicotyledonous plant species. Further details: <https://www.politicheagricole.it/flex/AppData/WebLive/Agrometeo/MIEPFY800/BBCHengI2001.pdf>

Further information

1. BAES (2019): 12_Cereals in organic farming (available only in german). In: Austrian Descriptive list of varieties 2019 – Agricultural species. <https://bsl.baes.gv.at/pdf-version/>
2. Kruepl C., S. Hoad, K. Davies, N-O. Bertholdsson & R. Paolini (2006): Weed competitiveness. In: *Susvar Handbook: Cereal variety testing for organic and low input agriculture*. Eds. Donner, D. & A. Osman, COST 860 – SUSVAR, pp.W1-W16.

Authors: Clemens Flamm (AGES)

Contact: clemens.flamm@ages.at

Publisher: ÖMki Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]





Pre-sprouting of potato seed tubers

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.

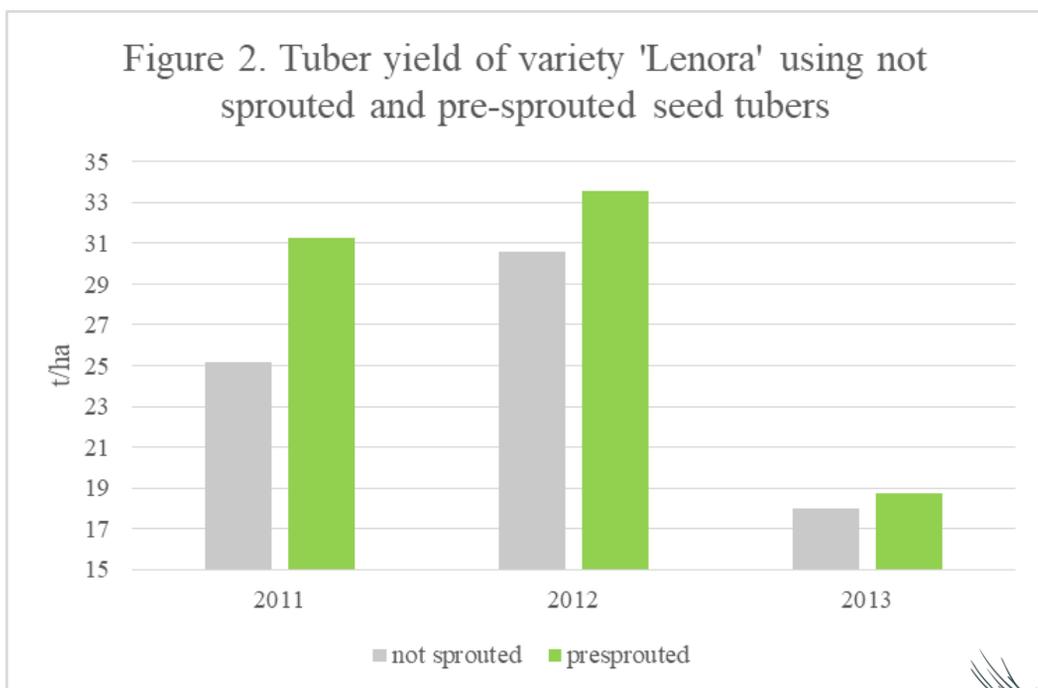
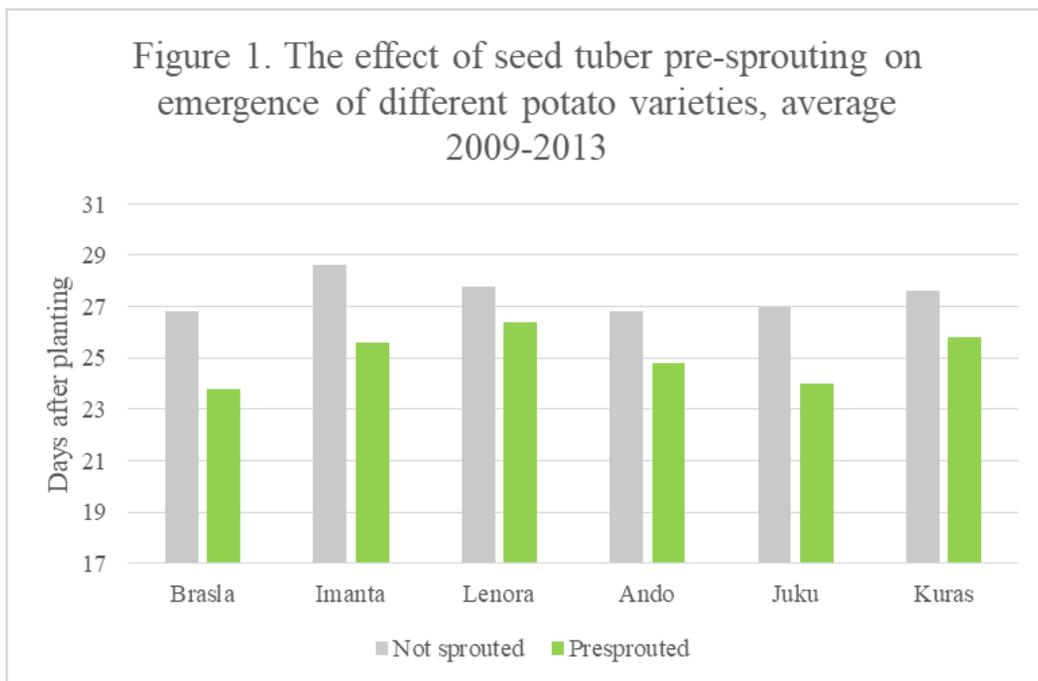
Practical recommendations

- 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.

Further information

1. [Möller, K. & Reents, HJ. Impact of agronomic strategies to control late blight on tuber growth and yield in organic potato crops, Potato Res. \(2007\) 50: 15.](#)
1. http://www.baltorgpotato.com/sites/default/files/Joint%20testing_Priekuli_Jogeva_FinalReport.pdf





Authors: Ilze Skrabule (AREI)

Contact: ilze.skrabule@arei.lv

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Heterogeneous spring barley populations in Latvia

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 (see figure).

Broadening of diversity within a crop/field is needed to buffer against environmental fluctuations and make crop performance more efficient.

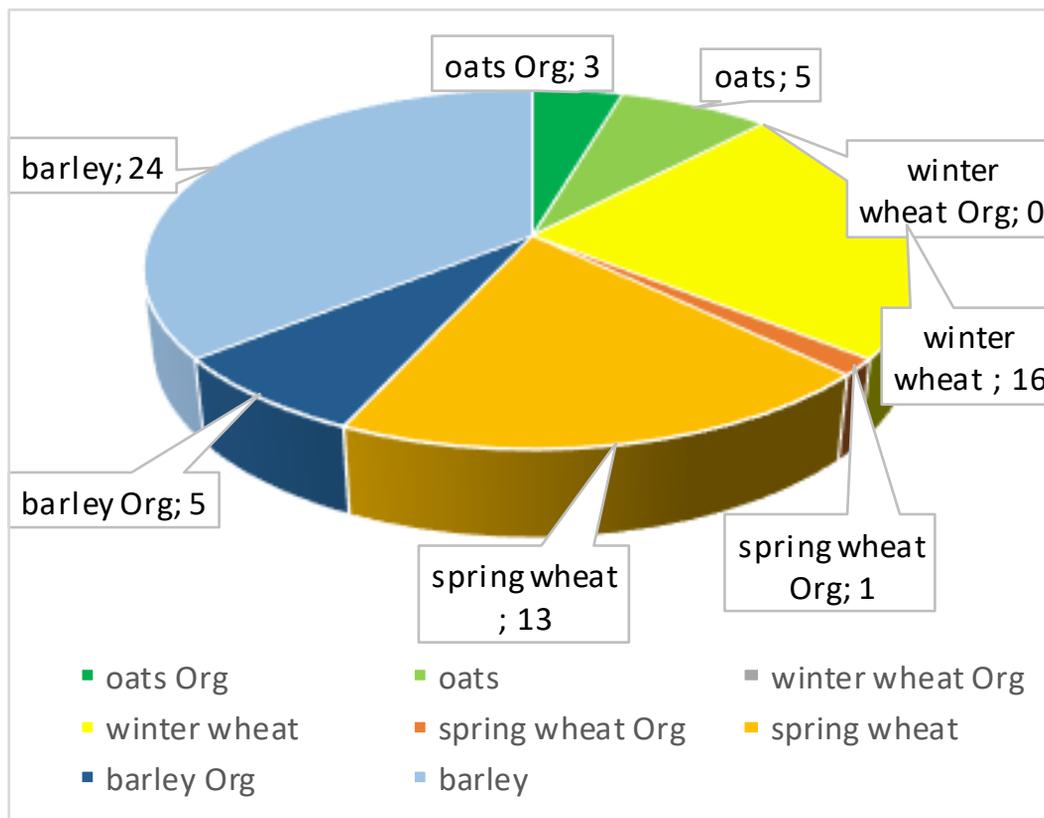


Figure: Arable crop varieties in the Latvian Plant Variety Catalogue





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.

Further information

1. [European Commission \(2014\). COMMISSION IMPLEMENTING DECISION of 18 March 2014 on the organisation of a temporary experiment](#)
2. Ločmele I., Legzdina L., Gaile Z., Kronberga A. Assessment of spring barley populations in comparison to homogenous varieties. Research for Rural Development 2019, Jelgava, Latvija, 15.-17.05.2019., in press.

Authors: Linda Legzdina, Indra Ločmele (AREI)

Contact: linda.legzdina@arei.lv

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Special characters of varieties for organic farming in wheat

Problems

Variety testing under organic conditions is performed differently in the European countries. If an organization is planning to introduce or to modify the testing system, it is important to know about well-approved characters in order to describe the adaptation of a variety to organic farming conditions in the best way.

Solutions

In Austria knowledge has been accumulated in variety testing under organic conditions in wheat since 1995. Many characters are important under organic as well as under conventional conditions. The descriptions of organic tested varieties could influence the importance of the characters for the conventional varieties, too.

Practical recommendations

The following tests have been originally introduced in Austria exclusively for organic varieties:

- Weed suppression: the rate of ground coverage, the plant height during stem elongation and the leaf inclination are important.
- Nitrogen efficiency: the ability of the crop to produce as much protein as possible with the offered nitrogen: measured by the grain protein yield (dt/ha).
- Resistance to *Tilletia caries*: seed of the varieties inoculated by a mixture of spores of different origins.

Nowadays all varieties are classified in their nitrogen efficiency.



Figure: The kernels of wheat are replaced by bunt balls full of teliospores of *Tilletia caries* (© Oberforster)

Further information

1. BAES (2019): 12_Cereals in organic farming (available only in German). In: Austrian Descriptive list of varieties 2019 – Agricultural species. <https://bsl.baes.gv.at/pdf-version/>
2. Levy L., A. Osman, I. Felix & M. Oberforster (2006): Setting up variety trials for organic and low input agriculture. In: Susvar Handbook: [Cereal variety testing for organic and low input agriculture](#). Eds. Donner, D. & A. Osman, COST 860 – SUSVAR, pp.GTS1-GTS8.

Authors: Clemens Flamm, Michael Oberforster (AGES)

Contact: clemens.flamm@ages.at

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



How to produce organic heterogeneous material for sweet corn

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 composite cross population.

For better performance, constant maintenance and improvement is needed.

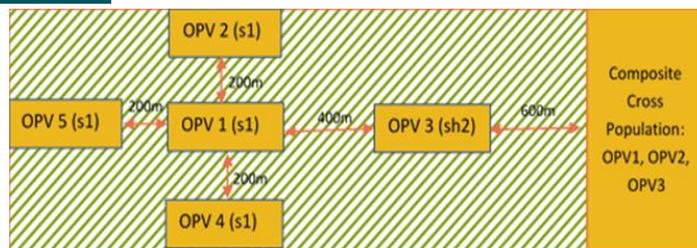


Figure 1: Simplified Design of a Sweet Corn OPV Seed Production and Composite Cross Population

 Other crop than corn, preferably tall

Min 200 plants/OPV; Min 200m between field edges for the same population type and 400m between different gene types.

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



Figure 2: Organic comparative trial of corn populations at NARDI Fundulea

Further information

1. [Publications and References about organic sweet corn breeding and seed production](#)
2. [Hallauer, A. R., Russell, W. A., & Lamkey, K. R. \(1988\). Corn breeding.](#)

Authors: Victor Petcu (NARDI)

Contact: victor.petcu@incda-fundulea.ro

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.



How to become a producer of certified organic seed in Romania

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 database² 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

1. Romanian seed legislation: <http://www.incs.ro/incshome.htm>
2. <https://www.madr.ro/agricultura-ecologica/baza-de-date-seminte-ecologice.html>
3. LIVESEED Cross visit at organic French seed producers: <https://www.youtube.com/watch?v=XEpbyDjrn80>

Authors: Victor Petcu (NARDI)

Contact: victor.petcu@incda-fundulea.ro

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: April 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.





Introduction of new varieties to the market

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)



Figure: Retailers, farmers and breeders sign the Dutch Potato Covenant, July 2017 (Photo: Bionext)

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.

Further information

1. [Understanding the obstacles and opportunities for successful market introduction of crop varieties.](#) Nuijten et al., 2018
2. [Blog on Agricolgy.co.uk](#) on the Dutch potato covenant
3. [Info sheet](#) on the Dutch potato covenant on the Bionext website

Authors: Niels Heining & Maaïke Raaijmakers (Bionext)

Contact: Heining@bionext.nl

Publisher: ÖMKI Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.



Organic wheat variety testing by a network of farmers

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

Authors: Ambrogio Costanzo (ORC)

Contact: ambrogio.c@organicresearchcentre.com

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Figure 1: Strips of wheat cultivars with different weed suppressive ability on a farm participating to the network. (Photo: ORC)



Figure 2: Farmers place white pegs on their preferred cultivar on the plot-scale trial (Photo: ORC)



How to set up a community seed bank

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



Figure: Preparing seeds for storage
(Photo: RSR)

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 <math><15^{\circ}\text{C}</math> and relative humidity <math><40\%</math>. Seed losing germinability quickly should be stored <math><4^{\circ}\text{C}</math>.

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/>

Authors: Matteo Petitti, Riccardo Bocci (RSR)

Contact: matteo.petitti@semirurali.net

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



How to produce seed of heterogeneous populations of inbred cereals

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

- 1. 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.).
- 2. 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.
- 3. 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.



Figure: ICARDA/SOLIBAM Floriddia bread wheat population, Peccioli, Italy 2017
(Photo: RSR)

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

Further information

Murphy, et al. (2005). Breeding for organic and low-input farming systems: An evolutionary-participatory breeding method for inbred cereal grains. *Renewable Agriculture and Food Systems*, 20(1), 48-55. DOI: [10.1079/RAF200486](https://doi.org/10.1079/RAF200486)

Authors: Matteo Petitti, Riccardo Bocci (RSR)

Contact: matteo.petitti@semirurali.net

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](https://www.facebook.com/LIVESEED)] & Twitter [[@LIVESEEDeu](https://twitter.com/LIVESEEDeu)]



Tools to identify genetically heterogeneous cultivars 1: constitution

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 (Table 1).

Table 1: SWOT analysis conducted on tools documenting the constitution of populations in 2014/150/EU: 'Breeding goal' ; 'Breeding method' ; 'Parent Varieties'

| STRENGTHS – Information on constitution can: | WEAKNESSES – Information on constitution can: |
|---|--|
| <ul style="list-style-type: none"> ● give an overview of the intended purpose of the population as breeding goal ● provide full and transparent information on the origin and genetic history of a population as breeding method and parent varieties ● prevent breeders from registering varieties with off-types or variety mixtures as populations | <ul style="list-style-type: none"> ● as a breeding goal, be hard to translate into reality ● provide a breeding goal insufficiently detailed on end-use, or be too generic, without a quantifiable/qualifiable target ● insufficiently document parent varieties, especially for progenies of heterogeneous parents e.g. landraces |
| OPPORTUNITIES – Information on constitution might: | THREATS – Information on constitution might: |
| <ul style="list-style-type: none"> ● be verified in respective performance trials and also provide information on intended use, if the breeding goal is precisely defined ● inform end-users, that want to ensure the seed they use complies with their standards in terms of breeding methods and parent varieties ● provide information about a population's change over time, if description of 'breeding methods' includes a description of selection environments and multiplication methods/conditions | <ul style="list-style-type: none"> ● be misleading to end-users, if they assume that breeding goal is identical to the performance characteristics of the population ● be too limiting if only registered varieties are allowed as a population's parent varieties ● encounter breeders' unwillingness to declare breeding methods |

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

1. [Text of the Commission Implementing Decision 2014/150/EU](#)
2. [Main outcomes and SWOT of experiences from marketing populations under the Temporary Experiment into the commercialisation of heterogeneous populations in the European Union](#)

Authors: Charlotte Bickler (ORC)

Contact: charlotte.b@organicresearchcentre.com

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230 and by the Swiss State Secretariat for Education, Research and Innovation under contract number 17.00090. The information contained in this communication only reflects the author's view. REA or SERI are not responsible for any use that may be made of the information it contains.



Tools to identify genetically heterogeneous cultivars 2: traceability

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 (Table 1).

Table 1: Summary of the SWOT analysis conducted on tools documenting the traceability of population in 2014/150/EU: 'region of production'; 'paper trail'; 'representative sample'

| STRENGTHS – Information on traceability can: | WEAKNESSES – Information on traceability can: |
|---|---|
| <ul style="list-style-type: none"> provide evidence of a population's history in the light of natural selection help end-users understand the optimal context of production guarantee certain qualities and be of reference in case of commercial conflicts | <ul style="list-style-type: none"> be confusing in terms of 'region of production' – spatial and temporal variation in environment does not relate to geographical boundaries provide insufficient information to understand population performance be inappropriate, relying on a sample, to represent the whole population |
| OPPORTUNITIES – Information on traceability might: | THREATS – Information on traceability might: |
| <ul style="list-style-type: none"> outline the agro-climatic context of a populations' breeding and multiplication and inform what environment it might be better fit to provide a paper trail to guard against development of parallel market help tracking of individual seed lots, rather than entire populations | <ul style="list-style-type: none"> limit the evolutionary potential of a population and limit access to material if the region of production is too restrictive generate high administrative burden and lack of clarity on who is responsible for record keeping leave room for development of fraudulent paper work if only relying on this mechanism |

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](#)

Authors: Charlotte Bickler (ORCID)

Contact: charlotte.b@organicresearchcentre.com

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]



Tools to identify genetically heterogeneous cultivars 3: description

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 (Table 1).

Table 1: Summary of the SWOT analysis conducted on tools for description of populations in 2014/150/EU: 'degree of heterogeneity' and 'performance testing'

| | |
|---|--|
| STRENGTHS – population description can: <ul style="list-style-type: none"> ● recognise the variable nature of populations ● provide farmers and end-users with information on performance and hence align with national list protocols ● provide a reliable reference of what to expect from a population | WEAKNESSES – population description can: <ul style="list-style-type: none"> ● bear risk of parallel market, as it can be hard to distinguish populations from one another ● be confusing in terms of which traits and parameters to measure ● insufficiently describe performance as it changes over space and time due to evolutionary pressures |
| OPPORTUNITIES – population description might: <ul style="list-style-type: none"> ● outline the agro-climatic context of a populations' breeding and multiplication ● bear potential to link to on-farm trials and end-use ● provide advice on environmental conditions for optimal performance (e.g. soil, climate, management) | THREATS – population description might: <ul style="list-style-type: none"> ● be met by limited testing capacity especially in and for organic farming ● become overly prescriptive and limit the potential use of the population ● become exponentially complex from an administrative point of view if number of populations, actors and/or users increases significantly |

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

1. [Text of the Commission Implementing Decision 2014/150/EU](#)
2. [Main outcomes and SWOT of experiences from marketing populations under the Temporary Experiment into the commercialisation of heterogeneous populations in the European Union](#)

Authors: Charlotte Bickler (ORC)

Contact: charlotte.b@organicresearchcentre.com

Publisher: ÖMKi Hungarian Research Institute of Organic Agriculture

Date: May 2020

LIVESEED: Boosting organic seed and plant breeding across Europe. LIVESEED is based on the concept that cultivars adapted to organic systems are key for realising the full potential of organic agriculture in Europe. Research project 2017-2021.

Social Media: Facebook [[LIVESEED](#)] & Twitter [[@LIVESEEDeu](#)]

