Boosting organic seed and Plant breeding across Europe 2017-2021

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LIVESEED-ECOBREED-BRESOV Meeting with policy makers
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Aim: 100% organic seed of adapted cultivars

Figure 1: Schematic timeline to reach the goal of 100% organically propagated seed of suitable cultivars (light green) in short term and to foster cultivars specifically bred for organic farming systems (bright green) in the long term.
Over half of Europe’s organic farmland is in 4 countries.

The country with the largest area of organic farmland is in Spain, followed by Italy and France.

Ten countries have 10% or more of their agricultural land under organic management.

In 2017 over one million hectares more were reported compared with 2016.

Distribution of organic agricultural land by country 2017

Top 5 countries with the largest areas of organic agricultural land 2017

Top 5 countries, where more than 10 percent of the farmland is organic 2017

Growth of the organic agricultural land 1985–2017

Source: FiBL survey 2019 www.organic-world.net
New organic regulation put into force January 2021

- Phasing out of derogations to the use of non-organic plant reproductive material latest by 2036
- Regular update of national organic seed database
- In 2026 report on the availability of organic seed and reasons of a possible limited access of organic operators

→ LIVESEED assessed present derogation reports, national organic seed database, and estimated use of organic seed across Europe and collected best practice for policy implementation from different countries [www.liveseed.eu](http://www.liveseed.eu) > tools > booklets

→ Recommendations to improve implementation of organic seed use [www.liveseed.eu](http://www.liveseed.eu) > Results > WP1 > D1.9 report on political obstacles

→ Development of an EU wide router-database with interface to national databases
Production and Use of Organic Seed Transparency

• National Organic seed databases as basis for derogations:
  • Implemented as online, Excel or pdf
  • Only few are well developed, informative and user-friendly for farmers and seed companies
  • Most are not frequently updated, incomplete, not easy accessible
  • Not frequently used
  • Only few with interactive request for derogation and reporting

• Derogation reports on non-organic seed use
  • Reports are not easily available and not standardized across countries (e.g. different units, formats, often pdf, not interoperable)
  • Reports on crop species with general derogation are missing, data are not always accurate
  • Allow no monitoring of progress

www.LIVESEED.EU > Tools for Practitioners > Booklets
Implementation of derogation rules

- Annex on of crop species where no derogation is granted (Category I) across the EU is empty

→ National Annex of Category I defined in cooperation with expert groups is a successful model in several countries with higher percentage of organic seed

www.LIVESEED.EU > Tools for Practitioners > Booklets

Analysis of derogation reports

**FIGURE 2.2** Number of derogations per 1,000 hectares of organic arable land by EU geographical region over the 2014-2016 period.

**FIGURE 2.3** Number of derogations per 1,000 hectares of organic arable land by EU geographical region over the 2014-2016 period.
Attitude of farmes towards Organic Seed

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

Frequencies

Germination Problems
- 49% Yes
- 37% No
- 14% Difficult to judge

Seed Borne Pests and Diseases
- 55% Yes
- 35% No
- 10% Difficult to judge
Seed companies rating on policy measures

Policy Measures to Enhance Organic Seed Production

1. More research organic seed production economics
2. Phasing out derogations in the new organics regulation
3. Stricter derogation rules in the next 5 years
4. More information on organic seed market demand
5. Expand the range of organically allowed seed treatments
6. Introduction of subsidies to support organic seed production
7. Increase training on organic seed production

1 = STRONGLY DISAGREE  2 = DISAGREE  3 = NEUTRAL  4 = AGREE  5 = STRONGLY AGREE

FIGURE 4.6 Seed companies’ rating of policy measures addressing organic seed production bottlenecks
### Estimation of percentage of organic seed use

Based on farmer survey

<table>
<thead>
<tr>
<th>Crop</th>
<th>Organic seed purchased (Amount)</th>
<th>Organic seed saved seed (Amount)</th>
<th>Non-organic seed purchased (Amount)</th>
<th>Total organic seed demand (Amount)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GRAINS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat (t)</td>
<td>79,699 (57%)</td>
<td>27,366 (20%)</td>
<td>33,073 (24%)</td>
<td>140,138</td>
</tr>
<tr>
<td>Grain maize (t)</td>
<td>1,422 (52%)</td>
<td>556 (20%)</td>
<td>762 (28%)</td>
<td>2,740</td>
</tr>
<tr>
<td>Barley (t)</td>
<td>23,828 (55%)</td>
<td>8,393 (19%)</td>
<td>11,409 (26%)</td>
<td>43,630</td>
</tr>
<tr>
<td>Oats (t)</td>
<td>26,766 (55%)</td>
<td>12,002 (25%)</td>
<td>9,932 (20%)</td>
<td>48,700</td>
</tr>
<tr>
<td><strong>LEGUMES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lupine (t)</td>
<td>1,683 (47%)</td>
<td>667 (19%)</td>
<td>224 (34%)</td>
<td>3,574</td>
</tr>
<tr>
<td>Soybeans (t)</td>
<td>5,910 (60%)</td>
<td>1,291 (13%)</td>
<td>2,709 (27%)</td>
<td>9,910</td>
</tr>
<tr>
<td>Peas (t)</td>
<td>7,300 (55%)</td>
<td>1,434 (11%)</td>
<td>4,458 (34%)</td>
<td>13,192</td>
</tr>
<tr>
<td>Lucerne (t)</td>
<td>1,118 (50%)</td>
<td>370 (17%)</td>
<td>739 (33%)</td>
<td>2,227</td>
</tr>
<tr>
<td><strong>VEGETABLES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomatoes*</td>
<td>209,190,115 (58%)</td>
<td>103,287,061 (28%)</td>
<td>50,688,469 (14%)</td>
<td>363,165,645</td>
</tr>
<tr>
<td>Onions*</td>
<td>2,589,162,058 (75%)</td>
<td>307,885,817 (9%)</td>
<td>570,275,011 (16%)</td>
<td>3,467,322,886</td>
</tr>
<tr>
<td>Carrots (t)</td>
<td>15.1 (70%)</td>
<td>1.6 (8%)</td>
<td>4.8 (22%)</td>
<td>21.5</td>
</tr>
<tr>
<td><strong>FRUIT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APPLES*</td>
<td>1,834,124 (41%)</td>
<td>696,913 (16%)</td>
<td>1,915,808 (43%)</td>
<td>4,446,845</td>
</tr>
</tbody>
</table>

* denotes fresh produced on the farm.
Percentage of non-organic seed

Based on farmer survey
Percentage of non-organic seed

Based on farmer survey
Percentage of non-organic seed

Based on farmer survey
Development of EU wide router database

- Support transparency of available organic seed offers
- Simplify access to international organic seed markets
- Reduce administrative burdens for seed supplier
- Harmonize the use of databases in the EU
- Provide additional information (e.g. breeding process)
- With interface to national databases
- Pilot with organicXseeds which runs already in 8 countries (DE, CH, UK, BE, LX, SW, IR)
- If required central database for notification of organic heterogeneous material notification could be implemented
EU router database

SEED SUPPLIER
- Create seed offer
- Define country for delivery
- Keep seed offer up to date

SEED SUPPLIER
- Create seed offer
- Define country for delivery
- Keep seed offer up to date

SEED SUPPLIER
- Create seed offer
- Define country for delivery
- Keep seed offer up to date

NATIONAL COMPETENT AUTHORITY (or authority/body designated)
accepts or rejects seed offer

Transfer of accepted offer via API or manually

LOCAL SEED SUPPLIER
- Create seed offer
- Keep seed offer up to date

LOCAL SEED SUPPLIER
- Create seed offer
- Keep seed offer up to date

CONTROL BODY/COMPETENT AUTHORITY
Request derogation

ROUTER DATABASE MANAGER
Technical support and hosting of router database

FARMER

FARMER

EU router database

National organic seed database
Policy recommendations for organic seed use

• Harmonized and stricter implementation of derogation rules for non-organic seed
  • National Annex without derogation defined in collaboration with seed expert groups
  • Standardized monitoring on all non-organic seed use and synthesis across countries
  • National categorization of all crops or subcrops into 3 categories (1 = no derogation, 2 = individual derogation per farmer, 3 = general derogation without application)
  • Develop roadmap with timelines how to move from Cat. 3 to Cat. 2 and Cat. 1 and monitoring of progress
  • Announcement of crops that will move from Cat. 2 to Cat. 1 2-3 years in advance

www.LIVESEED.EU > Results > WP1 > D1.9 Report on Political Obstacles and Bottlenecks on the Implementation of the Rules for Organic Seed in the Organic Regulation
Policy recommendations for organic seed use

• Improved interactive national databases as basis for derogations
  • Interactive online frequently updated database with easy access to farmers and seed producers
  • Seed companies can update their offer without intermediaries
  • Farmers can apply for derogation via database
  • Farmers should notify use and quantity of non-organic seed for Cat. 2 and Cat. 3
  • National derogation reports need to be standardized to allow annual synthesis across Europe and proper monitoring

• Eu-wide router database linked to national databases
  • Seed companies can offer their seed to several countries in only one database → larger choice for farmers, higher transparency, less administration
Policy recommendations for organic seed use

• Improved data collection and monitoring on production and use of organic seed
  • Assess amount of organic / non-organic seed during certification process at farm level including farm saved seed
  • Assess amount of organic seed produced in cooperation with European Seed Certification Association Agencies who already collect statistic data on certified seed per crop and country, but only few differentiate between organic and non-organic seed
  • Synthesis of standardized national derogation reports for all crops and countries
    → improved data source on organic seed across Europe
    → solid datasource to restrict derogations
    → allows proper monitoring to achieve 100% organic seed in reasonable time
Policy recommendations for organic seed use

- Improve percentage of organic seed usage to 100%

  **Perspective of farmers**
  - Provide broader choice of cultivars that are locally adapted, suited for organic farming and meet quality requirements → Breeding, cultivar testing
  - Availability for novel types of cultivars like organic heterogeneous materials, organic bred varieties and populations, farmers’ selections
  - Improve quality and health of seed at similar price → Breeding, improved seed production and seed health strategies, seed treatments
  - Accept farm saved seed as organic seed in all countries
  - Support farmers or farmers cooperatives to engage in organic seed entrepreneurship → training, infrastructure, subsidies

  **Perspective of seed companies**
  - National Cat. 1 and stricter implementation (and phasing out) of derogations rules provides security for seed companies to invest in organic seed as organic market is constantly growing in Europe
  - Transparency on European organic seed market and implementation of organic regulation
  - Enable and ease market access of novel types of cultivars
New organic regulation put into force January 2021

- Definition of organic heterogeneous material and their use in organic farming for all crops
  - Only notification, no DUS or VCU, no seed certification
  - Broader definition compared to temporary experiment
  - Development of delegated acts for organic heterogeneous material presently ongoing

→ LIVESEED analysed running experiment on marketing heterogeneous populations of cereals and developed toolbox for characterization and description of organic heterogeneous material

→ [www.liveseed.eu](http://www.liveseed.eu) > Results > WP2 > Milestone 2.8 Main outcomes and SWOT of experiences from marketing populations under the Temporary Experiment into the commercialization of heterogeneous populations

→ Deliverable 2.8: Proposal for a toolbox for identification and description of organic heterogeneous material finalized by December
Novel Cultivar Types

- Definition of organic plant breeding
- Definition of organic heterogeneous material for all crops
- See Liveseed Milestone Report M2.8 ‘Main outcomes and SWOT of experiences from marketing populations under the Temporary Experiment into the commercialisation of heterogeneous populations in the European Union’ for an update on 2014/602/EU

www.liveseed.eu > Results > WP2
Organic Heterogeneous Material

Tools vary for different types of OHM

- **FARMER SELECTIONS:** selection by a farmer from a population or landrace. They have a lot of genetic and phenotypic diversity so do not comply with DUS.

- **DYNAMIC POPULATIONS:** developed from a mixture of large numbers of breeding lines and cultivars (understood in a broader sense than officially released varieties, landraces, less homogeneous populations, niche varieties...) cultivated together and seed saved. After a few generations, the mixtures outcross and adapt to local conditions. The process is important for the definition.

- **Composite Cross Populations (CCPs):** the result of targeted crosses that are then left to evolve together under natural conditions. This category is different from synthetic varieties/populations which are reconstructed to be stable.

Open list of elements to consider in order to describe ‘farmers selection’:
- Origin
- Region of development

Open list of elements to consider in order to describe ‘dynamic population’:
- Parents
- Breeding process
- Phenotypic traits when possible
- Traceability
- Breeding conditions and location
- Breeding objective

Open list of elements to consider in order to describe ‘CCPs’:
- Parents
- Breeding process/methods, selection methods
- Traceability
- Cultivation Environment
- Breeding conditions and location
- Breeding objective

www.liveseed.eu > Results > WP2 > D2.8 ‘Proposal for a toolbox for identification and description of organic heterogeneous material’
Organic Heterogeneous Material

The populations complies with the general definition of Organic Heterogeneous Material (EU 2018/848, art. 3(18))

**Parents** were obtained with breeding methods in line with organic principles

**Breeding methods** comply with organic principles

**Development** (natural or human selection) happened under organic conditions for at least three (annual crops) or five (perennial crops) years

**Production** of plant reproductive seeds is carried out under organic certified conditions

Figure 2. Checklist in successive steps of the general provisions for registration of “Organic Heterogeneous Material”.

www.liveseed.eu > Results > WP2 > D2.8 ‘Proposal for a toolbox for identification and description of organic heterogeneous material’
Organic Heterogeneous Material

• All crop species can be OHM
• Production of OHM means development (human and/or natural selection) under certified organic conditions for at least 3 / 5 years. Evidence and traceability is provided via organic certification
• Breeding methods should comply with organic principles (at least respect to natural crossing barriers)
• Simple notification procedure in collaboration with national authorities
• No intellectual property rights
• Production of plant reproductive material (PRM) (seed multiplication) of OHM should also be conducted under certified organic agriculture
• Seed health and quality parameters should be defined (germination, disease etc.)
• No quantity restriction
• Truthful labelling throughout

www.liveseed.eu > Results > WP2 > D2.8 ‘Proposal for a toolbox for identification and description of organic heterogeneous material’
## Organic Heterogeneous Material

<table>
<thead>
<tr>
<th></th>
<th>Farmers’ selection</th>
<th>Dynamic population</th>
<th>CCP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
<td>Highly relevant Original population</td>
<td>Highly relevant List of parents</td>
<td>Highly relevant List of parents</td>
</tr>
<tr>
<td><strong>Region of cultivation</strong></td>
<td>Highly relevant in terms of e.g. geographical origin</td>
<td>Medium relevance as related to natural selection during development</td>
<td>Medium relevance as related to natural selection during development</td>
</tr>
<tr>
<td><strong>Breeding method 1: constitution</strong></td>
<td>Not relevant</td>
<td>Low relevance as the starting point is always a physical mixture</td>
<td>Highly relevant for the methods used in the initial crosses</td>
</tr>
<tr>
<td><strong>Breeding method 2: development (pre-notification)</strong></td>
<td>High Relevance to describe which selection has been applied</td>
<td>Medium relevance if direct selection is applied, otherwise related to region of cultivation specifying management</td>
<td>Medium relevance if direct selection is applied, otherwise related to region of cultivation specifying management</td>
</tr>
<tr>
<td><strong>Breeding method 3: production / multiplication (post-notification)</strong></td>
<td>Medium relevance, and it may change significantly according to the species life cycle</td>
<td>Medium relevance and might change if self- or cross-pollinated species</td>
<td>Low relevance as progeny is supposed to be multiplied as bulk</td>
</tr>
<tr>
<td><strong>Phenotypic traits</strong></td>
<td>High relevance as advised by the ‘breeder’</td>
<td>Medium relevance if direct selection is applied as advised by the ‘breeder’</td>
<td>Medium relevance if direct selection is applied as advised by the ‘breeder’</td>
</tr>
<tr>
<td><strong>Traceability</strong></td>
<td>Low relevance</td>
<td>Medium relevance as also keeps track of natural selection</td>
<td>High relevance as also keeps track of natural selection</td>
</tr>
</tbody>
</table>
- Presentation of rational why to work with heterogeneous populations
- Experience for describing heterogeneous populations from CREA
- Overview of survey among 15 countries on set up of organic variety trials
- Adjustment of official release for organic bread varieties for new temporary experiment

www.LIVESEED.EU > Results > WP5 and WP6 > Conferences and Workshop Material
New organic regulation put into force January 2021

- Definition of organic plant breeding included

- Temporary experiment to foster research and to develop organic varieties suitable for organic production shall be established adapted DUS and VCU, as well as the definition of the production and marketing conditions for that material (2021 up to 2027)
  - The experiment should start in Mid 2021
  - Implementing act for the upcoming temporary experiment will be developed in 2020

→ LIVESEED developed overview on current organizational modes on variety testing for organic agriculture including post-release VCU testing www.liveseed.eu > Results > WP2 > Deliverable 2.1
Preface

(39) In order to meet the needs of organic producers, to foster research and to develop organic varieties suitable for organic production, taking into account the specific needs and objectives of organic agriculture such as enhanced genetic diversity, disease resistance or tolerance and adaptation to diverse local soil and climate conditions, a temporary experiment should be organised .... for a term of seven years,... It should help to establish the criteria for the description of the characteristics of that material and to determine the production and marketing conditions for that material

[Start Mid 2021]
Article 3 – Definitions

(19) ‘organic variety suitable for organic production’ means a variety as defined in Article 5(2) of Regulation (EC) No 2100/94 which:

(a) is characterised by a high level of genetic and phenotypical diversity between individual reproductive units; and

(b) results from organic breeding activities referred to in point 1.8.4 of Part I of Annex II to this Regulation.

Annex II: 1.8.4. For the production of organic varieties suitable for organic production, the organic breeding activities shall be conducted under organic conditions and shall focus on enhancement of genetic diversity, reliance on natural reproductive ability, as well as agronomic performance, disease resistance and adaptation to diverse local soil and climate conditions.

All multiplication practices except meristem culture shall be carried out under certified organic management.
## Organic Variety Trials

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Survey among 15 European Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity of trials</td>
<td>From simple trials with few repetitions to randomised block designs with several repetitions</td>
</tr>
<tr>
<td>Locations</td>
<td>On-station or on-farm trials, 1-40 locations in extensive networks</td>
</tr>
<tr>
<td>Trial protocols</td>
<td>Different levels of assessments for organic traits</td>
</tr>
<tr>
<td>Assessments</td>
<td>Done by farmers, researchers, advisors, trial technicians</td>
</tr>
<tr>
<td>Plant material</td>
<td>Pre-release, post-registration and under registration in supplementary VCU-trials</td>
</tr>
<tr>
<td>Choice of varieties</td>
<td>Expert groups with several actors, or combinations of researchers, breeders, seed companies, farmers, advisors</td>
</tr>
<tr>
<td>Dissemination</td>
<td>From dissemination in closed groups to public available online results</td>
</tr>
<tr>
<td>Funding</td>
<td>Public funding, projects, applicant fee, membership fee, voluntary work</td>
</tr>
</tbody>
</table>
Adjusted protocols for the release of organic varieties

- LIVESEED wants to develop guidelines for adjusted protocols for organic DUS and VCU testing for variety release and governance models for post-release testing
- Start in 2020 with case studies in cooperation with interested Examination offices for adjusted DUS and VCU to test feasibility
- Prepare in collaboration with CPVO and the INVITE Project
  Workshop on 4th February 2020 in Brussels
  → provide input for implementing acts for temporary experiments on varieties suited for organic agriculture (2021 – 2028)
Adjusted protocols for DUS

• Proper implementation of DUS for OPV, correct references, own category for testing
• Take more emphasis in D and S instead of Uniformity
• **Restrict the uniformity levels to a minimum required for product quality and use** to allow higher adaptation and yield stability
• Use less parameters for assessment of US
  • restrict to only morphological traits with no effect on yield stability
  • Restrict homogeneity to only xx % of the defined traits
• Accept higher tolerance levels for U
  • Defined standard deviation or frequencies of traits for OPV that allows for certain variability
• Allow more parameters including marker analysis for D
Example: *carrots for bundling*

<table>
<thead>
<tr>
<th>UPOV Nr.</th>
<th>UPOV characteristics</th>
<th>relevance of utility for</th>
<th>importance for selection</th>
<th>ECO-PB proposal for adapted protocol</th>
<th>characteristics to be considered mandatory</th>
<th>characteristics to be considered optionally on request (or recommendation) of the applicant</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Leaf: attitude</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4 (*)</td>
<td>Leaf: division</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6 (*)</td>
<td>Leaf: anthocyanin coloration of petiole</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>14 (*)</td>
<td>Root: external colour</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>Root: extent of green colour of skin of shoulder</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>Root: ridening of surface</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>19 (*)</td>
<td>Root: diameter of core relative to total</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>22 (*)</td>
<td>Root: colour of cortex</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>25 (*)</td>
<td>Root: extent of green coloration of interior longitudinal</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**characteristics in total:**

- Carrots for bundling: 31
- Characteristics to be considered optionally: 20
- Characteristics to be considered mandatory: 11
Adjusted protocols for VCU

• Option to test organic bred cultivars under organic farming systems (=target environment)
• Also allow for testing under mixed cropping systems e.g. pea – cereal which is very common in organic agriculture
• Adjusted parameter assessed under organic VCU that reflect specific traits needed in organic farming (e.g. weed competition, seed born diseases, early vigor)
• Seed of all cultivars should be organically propagated to avoid bias due to different seed source (e.g. untreated conventional seed versus organic seed)
• Optional VCU for arable crops for speciality markets (e.g. triticale for breadmaking)
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 (SERI) under contract number 17.00090. The information contained in this communication only reflects the author’s view. Neither the Research Executive Agency nor SERI is responsible for any use that may be made of the information provided.