Boosting organic seed and Plant breeding across Europe 2017-2021

Bram Moeskops IFOAM EU, Project Coordinator
Monika Messmer, FiBL-CH, Scientific Coordinator, & Head of European Consortium for Organic Plant Breeding

Monika.Messmer@fibl.org

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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.
Main objectives

**Policy & regulation**
Provide a level playing field for the use of organic seed and variety registration across Europe

**Research & development**
Innovative approaches in organic plant breeding and improve quality of organic seeds

**Socio-economics**
Increase accessibility of organic seed and adoption of new cultivars

**Economy & market**
Improve the competitiveness of the organic seed supply chain

**Communication & network**
Enhance knowledge & raise awareness on the benefits of organic plant breeding and seed
WP1 Regulation & Policy Framework on organic seed

- National visits of competent authorities for implementing organic regulation with respect to seed followed by national stakeholder workshops in 10 countries
  - Organic seed database
  - Derogations for untreated conventional seed
  - Measures to improve organic seed production and use (expert working groups, national list with crops without derogation, incentives for farmers, seed producers, stricter implementation of organic regulation, phasing out of derogation in new Organic regulation, seed declaration)
- Booklet on implementing organic regulation
- Seed supplier survey to assess status quo of production of organic seed and bottlenecks
- Farmer survey to explore reasons why farmers use or not use organic seed
- Development of an EU router seed database
- Recommendations how to improve reporting to EU
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.liveseeds.eu](http://www.liveseeds.eu) > tools > booklets

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

→ Development of a EU wide router-database with interface to national databases
How to implement the organic regulation to increase production & use of organic seed

documentation recommendations for national and regional authorities

Contents

Introduction 3

Part One - Policy Measures 4

1.1 Measures to stimulate organic seed production and use 4
1.1.1 Training 4
1.1.2 Subsidies 4
1.1.3 Access to cleaning facilities for organic seed producers 5
1.1.4 Organic cultivar trials 5
1.2 Derogation Rules 7
1.3 National Annex 8
1.4 Equivalent cultivars 10
1.5 Vegetative propagating material 11
1.6 Expert Groups 12
1.6.1 Role and mandate of Expert Groups 12

Part Two - Organic Seed Databases 14

2.1 Upload of seed offers on national databases 15
2.2 Features and operation of national organic seed databases 15
2.3 EU Router database 16

Part Three - Alternative sources of organic seed 18

3.1 Traditional cultivars & farm saved seed 18
3.2 Populations and Organic Heterogeneous Material 20

Aim of LIVESEED: Develop a EU-router database to link national organic seed databases

**EU Router database**

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

**LOCAL SEED SUPPLIER**
- Create seed offer
- 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

**National organic seed database**

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

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

**ROUTER DATABASE MANAGER**
Technical support and hosting of router database

**FARMER**

**CONTROL BODY/COMPETENT AUTHORITY**
Request derogation
The State of Organic Seed in Europe

Contents

Introduction 4
Booklet Outline 5
Part One - Comparative analysis of European organic seed databases 6
1.1 Organic seed databases in Europe: an overview 6
1.2 Derogation categories included in the organic seed databases 9
1.3 Effectiveness and efficiency of current databases 11
Part Two - Use of non-organic seed in EU Members States & Switzerland 12
2.1 Quantifying non-organic seed use in Europe 12
Part Three - Use of organic seed from farmers’ perspective 15
3.1 Nate of organic seed and seed sources on organic farms 15
3.2 Farm/farmer characteristics and use of organic seed 16
3.3 Attitudes toward and experience of organic seed 17
3.4 Priority actions identified by the farmers 18
Part Four - Organic seed production from the seed suppliers’ perspective 19
Part Five - Estimating the potential of the organic seed market in Europe 22
Conclusions and recommendations 25
Political Framework

**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 > Results > WP2 > Milestone 2.8](http://www.liveseed.eu) 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 2019
New definitions with new organic regulation, put into force January 2021

- Definition of organic plant breeding
- Definition of organic heterogeneous material and their use in organic farming 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
Characterisation of heterogeneous populations

<table>
<thead>
<tr>
<th>Identification (Art. 5)</th>
<th>Population authorisation (Art. 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Species and denomination</td>
</tr>
<tr>
<td>Parent germplasm</td>
<td>Breeding objective(s)</td>
</tr>
<tr>
<td>Breeding scheme</td>
<td>Breeding and production methods (selection)</td>
</tr>
<tr>
<td>Region of production</td>
<td></td>
</tr>
<tr>
<td>Degree of heterogeneity</td>
<td>Description of how the population was generated e.g. 5 parent CCP</td>
</tr>
<tr>
<td>Characteristics (trial results)</td>
<td>Characteristics (trial results)</td>
</tr>
<tr>
<td></td>
<td>Representative sample</td>
</tr>
<tr>
<td></td>
<td>Applicant details and declaration</td>
</tr>
</tbody>
</table>

www.LIVESEED.EU > Results > WP2

Organic Research Center, UK
Common requirements for OHM

• All crop species can be OHM
• Production of OHM means development (human and/or natural selection) under certified organic conditions for at least 3 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
Common requirements for 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.

**Tools vary for different types of OHM**

**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
Toolbox for description of different types of OHM

Common characteristics - requirements

- Production of OHM means a minimum of 3 and 5 years, for annual and biennial/perennial crops respectively, of development (human and/or natural selection) under certified organic conditions (it is a minimum to have material adapted to OA and to have tools for traceability)
- Production of plant reproductive material (PRM) (seed multiplication) of OHM should also be conducted under certified organic agriculture.
- Simple notification procedure
- No intellectual property rights
- No quantity restriction

- All crops species can be OHM
- Seed quality requirement should be defined (germination...)
- Truthful labelling
- Breeding methods should comply with organic principles (at least containment within natural crossing barriers)
- Parents should also have been obtained with breeding methods in line with organic principles
- The name of the breeder should be include in the name of the OHM (ex. OHM Rouge de Bordeaux from X)

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

Open list of elements to consider in order to describe ‘CCPs’:
- Parents
- Breeding process/methods, selection methods

Tools vary for different types of OHM

Different cases being developed in cereals and vegetables

Final results available end of Dec 2019 www.LIVESEED.EU > Results > WP2
Examples of OHM in vegetables

- **Germany**
  - Lettuce (self pollinating species) started 6-7 years ago to develop populations with higher tolerance to fungal diseases.
  - Tomato (self pollinating species) started 2 years ago against main disease caused by Cladosporium.

- **Netherlands**
  - Spinach (outcrossing species) started crosses in 2018 to develop OHM to achieve longer lasting mildew tolerance and general higher level of resistance.

- **UK**
  - Sweet pepper: broad selection in sweet pepper landrace for improved adaptability in UK.

- **Other cases to start up**
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](http://www.liveseed.eu) > Results > WP2 > Deliverable 2.1
## 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>

[www.LIVESEED.EU > Results > WP2 > D2.1](www.LIVESEED.EU > Results > WP2 > D2.1)
New organic regulation 2018/848 (from 01.01.2021)

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]
New organic regulation 2018/848 (from 01.01.2021)

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
WP2.1.2 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 in February 2020 in Brussels
→ provide input for implementing acts for temporary experiments on varieties suited for organic agriculture (2021 – 2028)
Adapted methods to assess 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
## Proposal for adapted use of characteristics (example *carrots for bundling*)

<table>
<thead>
<tr>
<th>UPOV Nr.</th>
<th>Characteristics</th>
<th>Relevance of utility for farmers/ producers</th>
<th>Relevance of utility for trade/ processors</th>
<th>Relevance of utility for consumers</th>
<th>Importance for selection</th>
<th>ECO-PB proposal for adapted protocol</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>1</td>
</tr>
<tr>
<td>4 (**)</td>
<td>Leaf: division</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</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>0</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>2</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 inter-radical</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Characteristics in total:** 31

This project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727230.
Adjusted VCU Testing

- 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)
LIVESEED – ECO-PB – CPVO Workshop
attached to MEA 6th December 2018 in Angers

• 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
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