

# Boosting organic seed and breeding across Europe: recommendations for stakeholders and policy makers

A roadmap towards achieving  
100% organic seed from  
adapted cultivars in the organic sector



**LIVESEED**

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# Upscaling Organic Plant Breeding through a “Systems-Based Breeding” Approach

## TARGET GROUP

EU and national policy makers, researchers, breeders, organic value chain actors



## CURRENT REALITIES

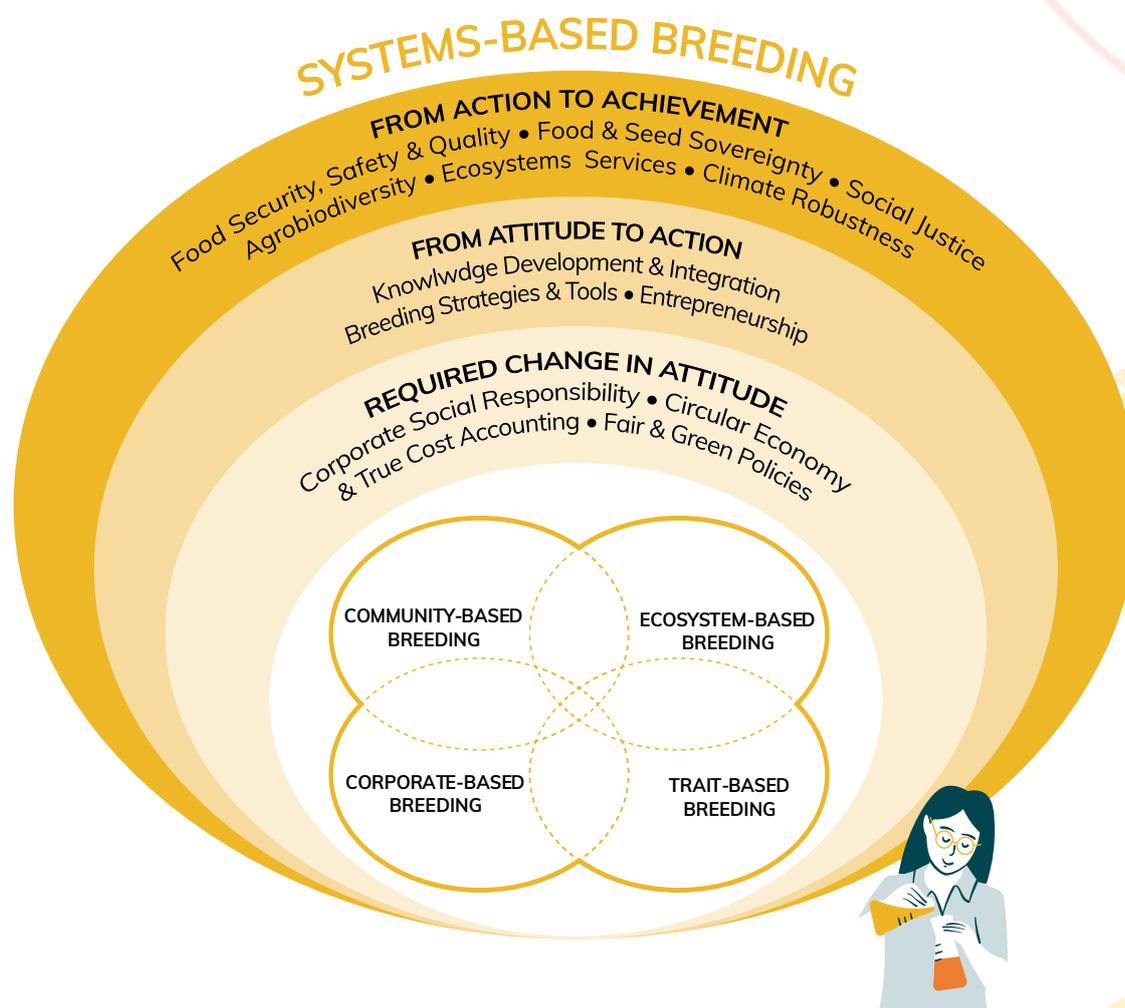
Although over 6,000 different plant species have been cultivated across humankind’s history, current food production relies on fewer than 200 crops, and over 40% of daily calories are derived from only three cereals (i.e., rice, wheat, maize). Over the course of the 20th century, farmer-selected and farm-saved seed has been largely replaced by uniform and broadly adapted varieties that are more responsive to chemical inputs, a trend which has determined significant reductions in the genetic diversity of cultivated crops. Plant breeding has become increasingly specialized, privatized, and focused almost entirely on major crops and the development of uniform varieties and/or hybrids, which are more adapted to industrialized agricultural systems and/or guarantee more rapid returns on investment. Food and seed markets are dominated by large multinational players with great market and political power, resulting in increasingly homogenized food and agricultural systems.

Alternative, locally-driven plant breeding approaches, based on the maintenance of crop biodiversity and embedded in organic farming contexts and multi-stakeholder initiatives, can play a pivotal role in the construction of sustainable and resilient food systems. Organic Plant Breeding is a holistic, value-based approach focused on breeding not only with but also for diversity and conducted in living organic environments. It also takes into account nutritional and cultural aspects of crop varieties and their resulting food products. To effectively make the transition to organic breeding approaches, the participation of local stakeholders in decision making processes is of special importance, as demonstrated by the successful multi-stakeholder experiences of Organic Plant Breeding which have linked breeding actors with those from other value chain steps. However, up- and out-scaling are needed to achieve a paradigm shift toward breeding for diversity.



LIVESEED kick off project meeting, Belgium, 2017

**FIGURE 1.** A systems-based breeding approach to support diversity, which considers the long-term societal and ecological benefits that extend beyond immediate value chain interests, should be adopted. Adapted from: Lammerts van Bueren, Edith T., et al. "Towards resilience through systems-based plant breeding. A review." *Agronomy for sustainable development* 38.42 (2018): 1-21.



### RECOMMENDATIONS for stakeholders and policy makers

- Organic Plant Breeding activities should be conducted within the target farming system in order to combine genetic and agronomic innovations and positively exploit genotype by environment interactions
- Researchers and breeders need to engage with farmers to explore and incorporate their significant experiential knowledge into their research
- Organic Plant Breeding efforts should concentrate on the objective to deliver increased genetic diversity within cultivars.
- Organic Plant Breeding should place an important focus on mixed cropping systems, to support farm diversification.
- Organic Plant Breeding should take up the results from cutting-edge research on breeding for improved symbiosis with soil microorganisms.
- Public institutes and universities should engage in transdisciplinary research on Organic Plant Breeding, including in underutilized crops, and organic management of pests and diseases.
- Increased efficiency and diversity of Organic Plant Breeding efforts can be achieved by networking and decentralized participatory programs for local conditions. The impact of breeding improves when all stakeholders are involved in the process (farmer, value chain and community driven breeding).

# New Cultivar Types: from Registration to On-farm Cultivar Trials

## TARGET GROUP

National authorities, EU and national policy makers, farmers, farmers' networks, advisors



## CURRENT REALITIES

To address the shortfall of cultivars adapted to organic conditions and embrace the greater diversity derived from Organic Plant Breeding initiatives, two new categories of plant reproductive material were introduced in the new European Organic Regulation (EU 848/2018): **organic heterogeneous material** and **organic varieties**.

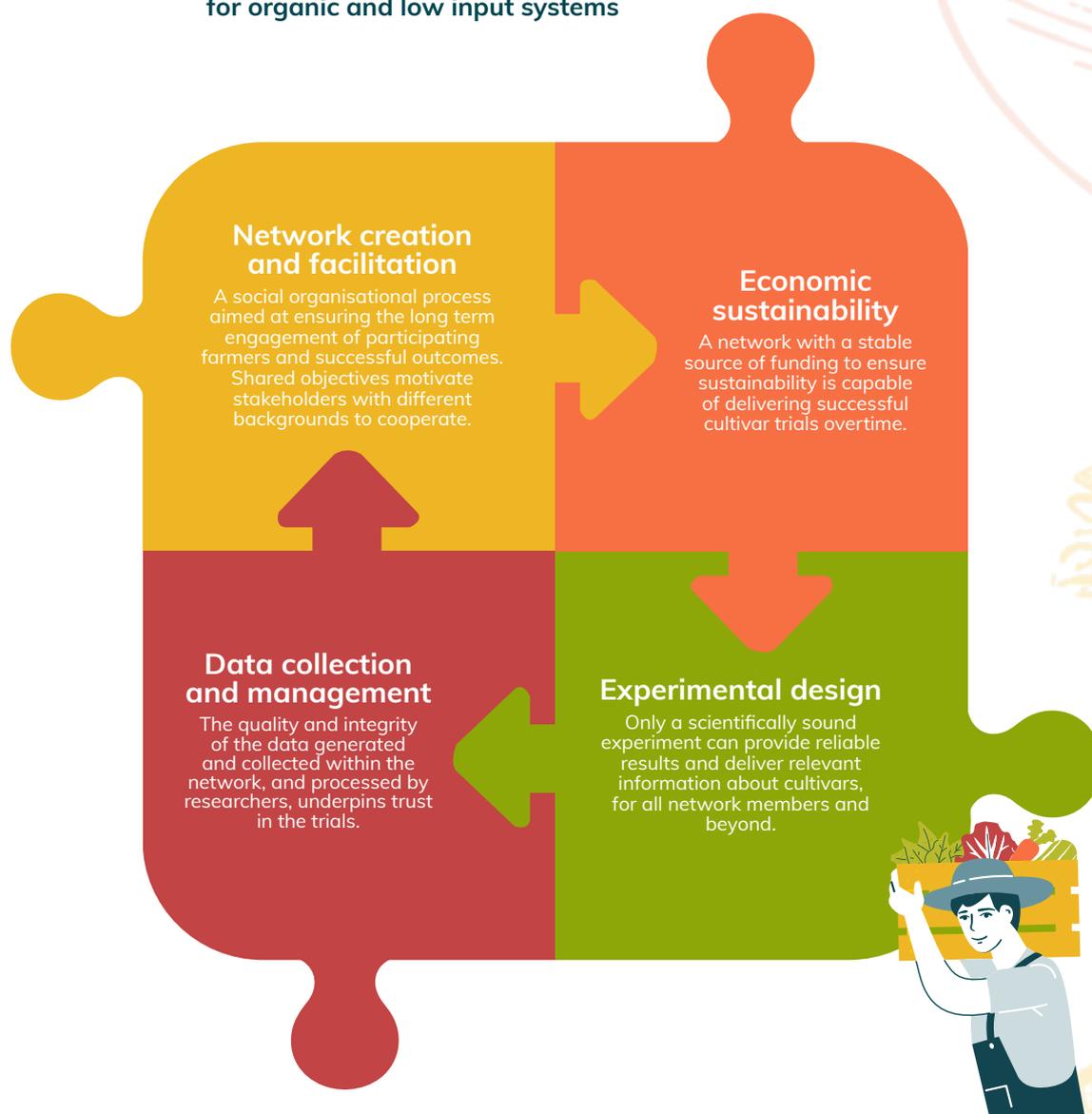
**Organic heterogeneous material** (OHM) encompasses populations, dynamic mixtures and heterogeneous farmers' varieties. It is not intended to be uniform or stable, and cannot meet the requirements of Distinctness, Uniformity and Stability (DUS) in the existing variety registration system. The identity of the material is guaranteed based on breeding methods, its history and seed lots traceability. Certified seed quality standards apply with regards to plant health, analytical purity and germination rate.

**Organic varieties** (OV) are defined as plant varieties according to EU directive 2100/94: users are thus guaranteed a variety that can be described and whose characteristics of interest are stable over time. To facilitate their registration and marketing, the European Commission has introduced a seven-year temporary experiment to develop adjusted DUS and Value for Cultivation and Use (VCU) testing criteria, taking into account the lesser degree of uniformity of OVs compared to standard varieties. Beside the limited range of adapted cultivars for the market, organic farmers also face the challenge of limited information on the actual value of the available cultivars under organic conditions. In order to make a good cultivar choice, for an organic farmer, the information from official cultivar testing on-station, mostly under conventional conditions, is not enough. What is needed is information relevant to the specific agro-environmental context and that can come from the results of on-farm trials.



ÖMKI field day, Hungary, 2019

**FIGURE 2. The four key aspects of participatory on-farm cultivar trials for organic and low input systems**



### RECOMMENDATIONS for stakeholders and policy makers

- Breeding of Organic Varieties must be conducted under certified organic conditions for a minimum of five years for annual and eight years for bi-annual and perennial crops, to ensure adaptation to organic conditions. It should follow IFOAM's guidelines on organic breeding.
- The adjusted DUS protocols for Organic Varieties should allow for more diversity in the cultivar description by identifying mandatory and voluntary DUS traits. Only mandatory traits should be considered for the acceptance of the OV.
- VCU trials (for agricultural crops) under organic conditions must be prioritized and supported in order to value organic breeding achievements in the registration process.
- Optional/voluntary VCU testing for minor/neglected crops should be considered to reduce registration costs and incentivise breeding efforts for these species.
- Decentralised organic on-farm cultivar trials represent a cost-effective solution to the limitation of on-station post-release trials and could play a pivotal role in boosting the organic sector, with targeted investments from both the public and private sectors.

# Holistic Seed Health Strategy & Quality Organic Seed



## TARGET GROUP

Seed producers, researchers, farmers, national authorities

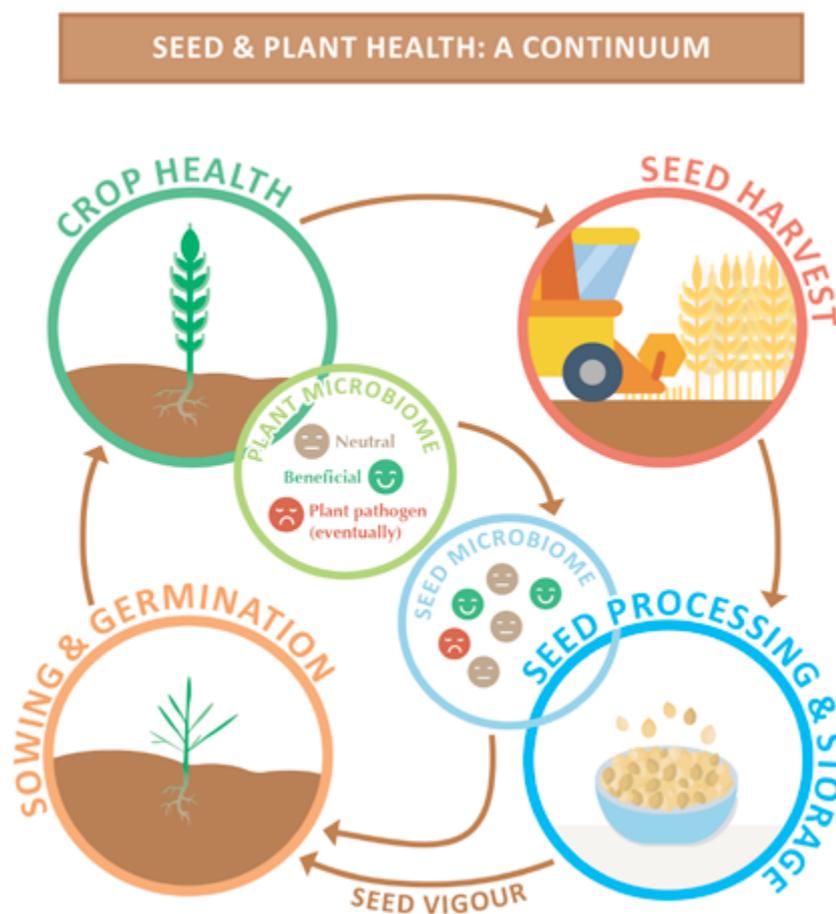
## CURRENT REALITIES

Seed health and quality affect how well a crop will establish and perform, influencing crop yield, farmers' incomes and, ultimately, food security. For these reasons, official seed quality certification is a requirement for the seed market. Routine seed testing by seed producers and certification bodies evaluates seed germination rates and detects potential seedborne pathogens. If a problematic level of a seedborne pathogen is detected, seed treatments can be used for disease control. In organic farming, these range from natural compounds (e.g., vinegar) and physical treatments (e.g., hot water or brushing) to the application of biological agents (e.g., antagonistic microorganisms). However, both practical experience and recent scientific findings suggest that additional aspects may be relevant for increasing the quality of organic seed: for instance, the potential of the seed microbiome could be explored further and critical control points in the application of microorganisms (biologicals) could be considered as alternatives to chemical seed treatments which are subject to increasing restrictions (e.g. Copper, Thiram). Within the LIVESEED project, two case studies on carrot and wheat seed-borne diseases (*Alternaria* ssp. and *Tilletia* ssp. respectively) provided baseline information and suggestions for the development of novel organic seed health strategies<sup>2</sup>.



<sup>2</sup> [https://www.liveseed.eu/wp-content/uploads/2021/02/LIVESEED\\_D2.5-Inventory-of-scientific-legal-and-technical-measures-to-improve-seed-quality-in-organic.pdf](https://www.liveseed.eu/wp-content/uploads/2021/02/LIVESEED_D2.5-Inventory-of-scientific-legal-and-technical-measures-to-improve-seed-quality-in-organic.pdf)

**FIGURE 3.** Elements of a holistic seed health strategy covering the entire cycle. Image by Dr. Stephanie Klaedtke (ITAB, France) and Dr. Steven Groot (Wageningen Research, Netherlands)



### RECOMMENDATIONS for stakeholders and policy makers

- Adopt a holistic strategy for the entire seed production cycle taking into account the seed and plant microbiomes, seed vigour and plant establishment, crop management, seed maturity, drying, processing and storage.
- Raise awareness on the importance of using organically produced seed instead of non-chemically treated conventional seed in organic agriculture.
- Place more emphasis on producing and maintaining high seed vigour to further improve the stress resilience of seedlings.
- Integrate the role of the seed microbiome in seed quality aspects (both for organic and conventional markets).
- Harness the potential of optimised seed microbiomes to aid in the protection of the seedling against biotic (pathogens) and abiotic (e.g., climatic) stresses, and contributing to more resilient cropping systems.
- Evaluate the balance between the risks of pathogen presence on seed and the benefit of maintaining the seed's microbiome, when deciding about sanitation treatments.
- Investigate the application of useful microorganisms as biocontrol agents to be used for seed or seedling treatments.
- Harmonise seed testing for pathogens (e.g. wheat bunt) across Europe and boost testing facilities for seed producers and farmers who produce their own organic seed.

# From Seed to Plate: Organic Breeding and Seed in the Value Chain

## TARGET GROUP

EU and national policymakers, organic food processors & traders, farmers, researchers, seed producers, organic certifiers, labelling organisations, breeders and consumers



## CURRENT REALITIES

In the European organic seed market, the potential demand vastly outstrips supply for most crops in most countries. Improving the availability of organic seed for a wider range of species and suitable varieties appears to be critical for farmers. Consumers also prefer “natural” and “not manipulated” food products and demand transparency in breeding methods and seed used. However, seed companies are discouraged from investing in organic seed because of the general derogations granted to the use of conventional seed for some crops species in several Member States. In addition, technical difficulties in the multiplication under organic conditions result in higher costs or yield losses.

The need to develop new varieties can be met by organic breeding tools and approaches, that aim to emphasise quality as much as yield and resilience. However, funding for organic breeding is scarce and limited to short-term resources. Although royalties and seed sales can also be re-invested in organic breeding, these would likely not be sufficient to cover a wider range of varieties both for major and niche crops.





Artisan sour-dough bread made with einkorn and emmer landraces

### RECOMMENDATIONS for stakeholders and policy makers

- A well structured **roadmap to reach 100% organic seed** of a wide range of adapted cultivars is needed to prevent seed shortages caused by phasing out derogations **without introducing further measures**.
- The provision of **subsidies and/or the introduction of price premiums for using organic seed** is recommended as a first step to mitigate the risk of **seed price increases and profit losses** at farm level.
- **Resources from the CAP Rural Development Programmes (RDP)<sup>3</sup>** should promote supply chain initiatives supporting organic seed production and use from organically bred varieties, and should be grouped into a unique RDP measure clearly dedicated to organic breeding.
- **Promotion of organic farm-saved seed**, which will ease a transition to 100% organic seed. Where appropriate, farmers should be trained and supported to produce high quality seed.
- **Investments are required to research** ways for reducing the costs of organic seed production and for overcoming technical difficulties in organic seed multiplication.
- **Increased efforts in Organic Plant Breeding** through public funding and public-private partnerships, including contribution of supply chain actors.
- **Private labelling to differentiate food produced from organically bred varieties**, and setting a premium price so that the additional costs are shared along the whole chain.
- **Transparent and precautionary acts by operators of the organic sector**, from breeders to farmers and policy makers, **to meet consumer demands concerning the origin and quality of the seed used**.

<sup>3</sup> Second pillar: <https://www.europarl.europa.eu/factsheets/en/sheet/110/second-pillar-of-the-cap-rural-development-policy>

# Organic Seed Databases for Harmonised and Transparent Data on Organic Seed Use

## TARGET GROUP

EU and national policy makers,  
national authorities, certification bodies



## CURRENT REALITIES

Each EU Member State is required to have a national organic seed database (EC 834/2007; EU 2018/848) which serves as a legal reference point to check the availability of organic seed in the country. Farmers can apply for derogations allowing them to use non-organic seed if the database contains no suitable offer. However, not all national databases function properly and there is insufficient data on organic seed supply and demand, key elements for market transparency. Only some countries maintain fully computerized and interactive databases: in most other cases, the national seed database is not user-friendly, unfrequently updated, unknown to farmers and difficult to access for local and foreign seed suppliers due to administrative and/or language barriers. As a result, several national databases do not meet the main goal of providing an up-to-date overview of the organic seed available on the market in that country<sup>4</sup>.

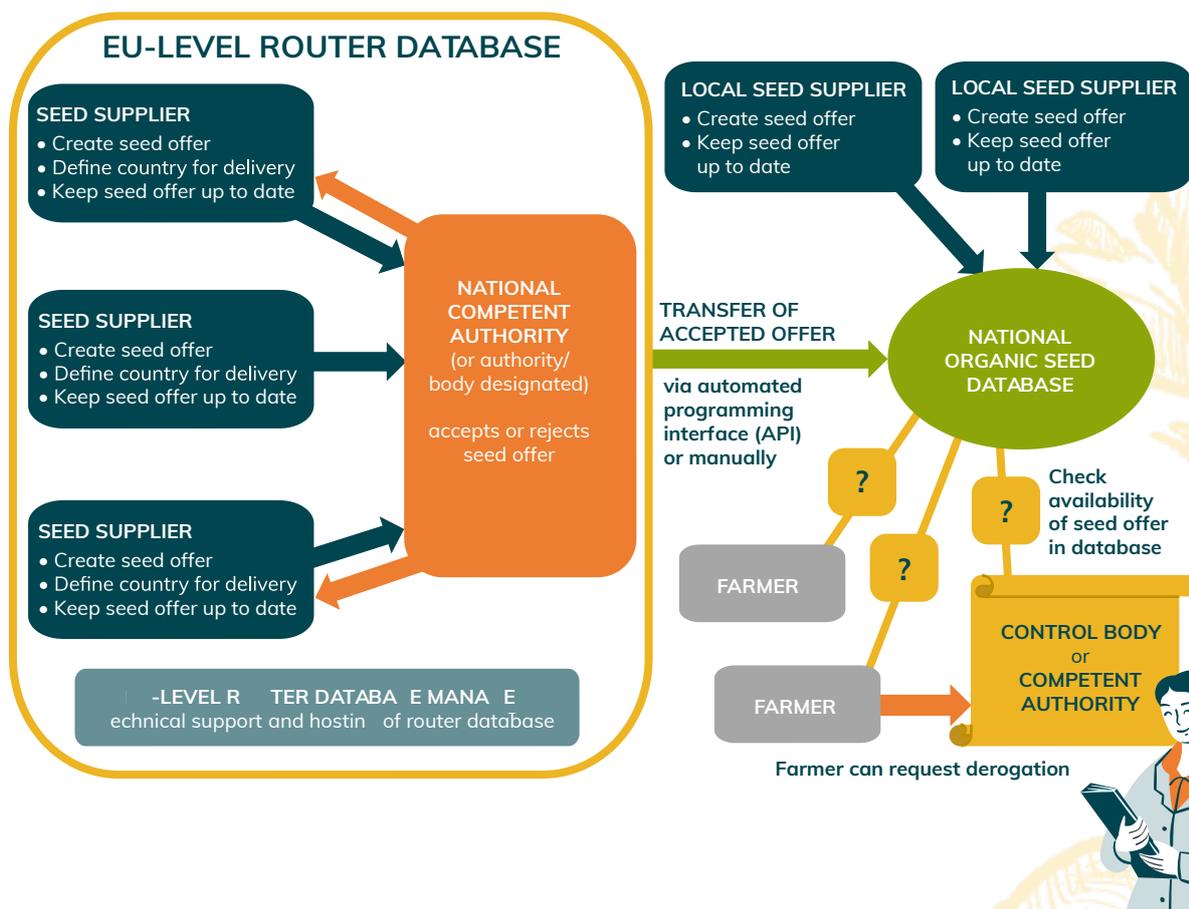
There are currently no official statistics reporting data on supply and demand of organic seed, either at the national or EU level. In most EU member states, only very basic organic market data such as land area and number of organic holdings are reported; data referring to production (organic area and sowing density by crop species) and use of organic seed (including farm saved seed) are missing. The accessibility and quality of national derogation reports are inconsistent among countries, and often incomplete (e.g., no data for “general derogation” species).



National workshop with stakeholders involved in organic seed, Hungary, 2019

<sup>4</sup> See LIVESEED booklet #2: “The State of Organic Seed in Europe”  
[www.liveseed.eu/tools-for-practitioners/booklets/](http://www.liveseed.eu/tools-for-practitioners/booklets/)

**FIGURE 4.** Flowchart of the router database and data output to national organic seed databases. Blue arrows indicate seed offer uploads performed by seed supplier; red arrows indicate offers rejected by the competent authority; green arrows indicate offers accepted by the competent authority with a data output into the respective national organic seed databases (via Application Programming Interface API or manually). Farmers and control bodies can check the availability of organic seed in national databases. If no appropriate organic seed is available, farmers can request a derogation for the use of non-organic untreated seed.



## RECOMMENDATIONS for stakeholders and policy makers

- **Real-time fully computerised national databases** with standardized derogation systems and reports should be put in place by each Member State. National databases should be made accessible to seed suppliers, and provide traceability of seed offers as well as information on varieties and cultivar trials.
- The **European Router Database**<sup>5</sup> developed in the LIVESEED project gives seed suppliers access to all connected national organic seed databases. The European Commission should support **long-term funding of the European Router Database** and **promote its use by national authorities** to reduce trading barriers. National authorities should connect the national database to the EU Router Database.
- **Data collection on organic seed supply and demand should be improved** in coordination with organic certifying bodies, including harmonized derogation reports, data on the certified organic seed marketed by European suppliers, land areas devoted to organic seed multiplication per crop and country, statistics on seed use which distinguish certified organic, farm-saved and certified non-organic seed.

<sup>5</sup> [www.seeds4organic.eu/rdb](http://www.seeds4organic.eu/rdb)

# Organic Seed Expert Groups and National Derogation Rules

## TARGET GROUP

National policymakers, national authorities, farmers, researchers, seed producers, breeders, certification bodies, certification bodies



## CURRENT REALITIES

While the EU Organic Regulation (EC 834/2007) requests Member States to use organic seed, derogations can be granted if no sufficient seed is available in the national organic seed databases. In the EU, large differences in the implementation of the derogation rules and reporting<sup>6</sup> were observed at national level. In most countries, **single derogations** are easily granted, for varieties that are not offered in the database. In some countries, applying for a derogation involves high administrative costs and the sanctions for not complying with the rules can be high. In others, farmers are granted **general derogations** for crop species where organic seed is unavailable. Some countries (Germany, Benelux states, France, Italy, Sweden and Switzerland) have implemented a national non-derogation list (“National Annex”) for crops/sub-crops where the offer of organic seed is enough to cover the national demand and no derogations are granted. In these countries, **expert groups** with relevant stakeholders advise the competent authorities on which crops should be placed on this list.

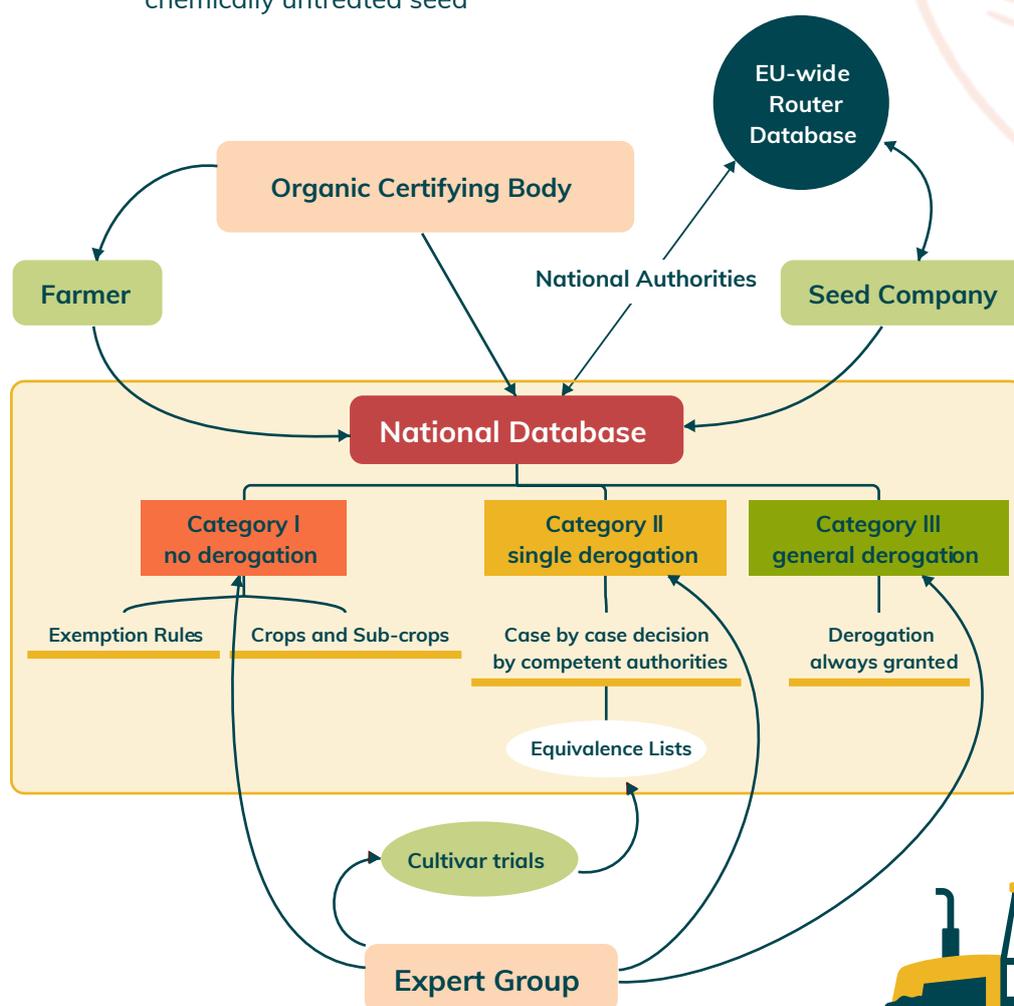
The new Organic Regulation (EU 2018/848) plans to phase out derogations by 2036, while the EU Farm to Fork Strategy aims at growing the land under organic production to 25% of the total farmed area by 2030, which translates in the need to **increase organic seed production by about 500-600%** to cover demand.



LIVESEED workshop on heterogeneous material, France, 2018

<sup>6</sup> LIVESEED booklet#2: <https://www.liveseed.eu/tools-for-practitioners/booklets/>; and Solfanelli et al. 2021: <https://orgprints.org/id/eprint/38616/> (Fuss et al. 2020, Solfanelli et al. 2019, 2021).

**FIGURE 6.** Model for the implementation of derogations for the use of non-organic, chemically untreated seed



## RECOMMENDATIONS for stakeholders and policy makers

- **National organic action plans should include targeted steps to achieve 100% organic seed use** and the allocation of funds from the CAP Rural Development ('second pillar') measures to improve knowledge and access to infrastructure for the production of high quality seed.
- Developing a **roadmap for each crop with intermediate goals** is essential, as seed companies need targets and deadlines for derogations to know how much they should invest.
- The establishment of **National Annexes** and **multi-stakeholder national organic seed expert groups** with a clear mandate in each EU Member States would facilitate the discussion on goals and steps needed to meet seed demands per crop. Such expert groups should include organic farmers, seed producers, researchers, certification bodies, database managers and competent authorities.
- For **vegetative planting material**, pre-ordering deadlines should be introduced to enable producers to adequately assess market demand and respond accordingly.
- A template for harmonized derogation reports was developed in LIVESEED for national authorities and the European Commission to improve **data collection**.
- Member States should take part in **structural knowledge exchanges between countries** with similar challenges and circumstances.

<sup>7</sup> LIVESEED booklets #1 <https://www.liveseed.eu/tools-for-practitioners/booklets>

<sup>8</sup> Annex I of Policy and Stakeholder Recommendations of the LIVESEED project (D6.3)

## BOOSTING ORGANIC SEED AND BREEDING ACROSS EUROPE: RECOMMENDATIONS FOR STAKEHOLDERS AND POLICY MAKERS

### A roadmap towards achieving 100% organic seed of adapted cultivars in the organic sector

The use of a broad portfolio of crops and cultivars adapted to specific climatic, soil and farming conditions are key for more sustainable agriculture. The goal of the Horizon 2020 LIVESEED project is to improve the performance of the organic sector by boosting organic seed and plant breeding activities across Europe. In a concerted action, 50 project partners covering different disciplines and actors along the seed value chain, addressed all relevant aspects from organic seed market transparency and policy, organic cultivar testing and registration, organic seed health, novel breeding concepts aiming for higher diversity as well as socio-economic modelling of organic seed production.

Here we summarize key results and innovations that can boost the organic seed and plant breeding sectors. LIVESEED identified for the first time the use and market potential of organic seed for major crops and highlighted the importance of more harmonized and stricter implementation of derogation rules for non-organic seed, supported by improved interactive national databases and an EU-wide router database.

**Our evidence-based recommendations** cover six key areas of Organic Plant Breeding, Seed Production and Use:

- Upscaling organic plant breeding through a “systems-based breeding” approach
- New cultivar types: from registration to on-farm cultivar trials
- A holistic seed health strategy for quality organic seed
- From seed to plate: organic breeding and seed in the value chain
- Organic seed databases for harmonised and transparent data on organic seed use
- Organic seed expert groups and national derogation rules



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