



**Report on the Future
of the Organic Seed
Production System in
Ireland**

**Prepared for the National Organic
Training Skillnet (NOTS)**

by

**Anne Pender, Paula Pender and
Robbie Byrne**

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Anne Pender¹, Paula Pender² and Robbie Byrne³**

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1. Environmental policy consultant; policy design fellow in the School of Architecture, Planning & Environmental Policy, University College Dublin.
2. Distance Learning Co-ordinator, The Organic College, Dromcollogher, Co. Limerick.
3. Managing Director, Precision Nutrition, Ardee, Co. Louth.

Note: the views expressed in this report are those of the authors and the stakeholders interviewed. They do not necessarily represent the views of any of the organisations with which either the authors or the stakeholders are associated.

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Executive Summary

In Ireland, there are now over 5,000 farmers participating in the Organic Farming Scheme (OFS), farming approximately 225,000 hectares of land equating to 5% of the total land area. This is set to increase to 10% by 2030 (Department of Agriculture, Food and the Marine, 2024a). Key challenges for the Irish food production sector as a whole include Brexit and the war in Ukraine, which are presenting challenges for food security and access to sufficient quantities of crop seeds, as well as environmental issues such as climate change, soil degradation, water shortages, biodiversity loss and reduced plant genetic resources.

Since 1992, there has been a legal obligation on organic farmers in all EU Member States to use organic plant reproductive material under EU regulations and the Organic Food and Farming Standards in Ireland (European Parliament & European Council, 2018); IOA & Organic Farming Trust, 2023). However, due to the sector's significant recent growth and ongoing issues with organic seed supply across the EU - resulting in part from historically low levels of investment in organic seed breeding and R&D - there is currently an inadequate supply of organic seed to meet demand (Döring et al., 2012; Solfanelli et al., 2020). As a result, a system of derogations is currently in place which allows for the use of non-chemically treated (NCT) seed produced under conventional conditions (Döring et al. 2012). However, all derogations for use of non-organic untreated seed will be phased out by 2036.

Research carried out for this report has identified five key challenges for the Irish organic seed sector:

- **Organic seed demand and supply challenges**

Organic seed demand is growing but there is a high reliance on imported seed and derogations for the use of non-organic seed. There is also a lack of detailed and timely statistics on organic seed production, supply and usage, which is impacting planning.

- **Technical, economic and regulatory challenges**

There is a lack of seed and cultivars adapted to current and predicted future Irish growing conditions and insufficient expertise, capacity and investment in organic seed breeding and R&D. Organic seed production costs are also higher than for conventional seed.

- **Derogation-related challenges**

Derogations for the use of non-organic seed will be phased out from 2036 but the current high reliance on these poses a challenge for ensuring organic producers can access the quantities of organic seed required.

- **Organic seed adaptability and resilience challenges**

A lack of suitable organic seed and cultivars poses a threat to the optimisation of organic horticultural production and the improvement of supply consistency

- **Training, education and information needs**

Current provision is not sufficient to meet producer needs for both organic seed breeding and seed production. Mentorships and apprenticeships are also needed, along with guidance on regulatory requirements.

To address these challenges, there is a need for a transformation-based framework to respond to changing climatic, soil and economic conditions in a way that will support the

building of resilience in our agricultural and food systems and the transition to low-carbon, biodiverse and sustainable methods of production. This should support both formal and informal / farmer-based seed production and breeding, in order to create a secure, sustainable and diversified organic seed sector in Ireland which will support resilient local organic production systems and communities.

As part of this, a series of recommendations have been made in three areas:

Responding to organic seed supply and demand challenges:

- Establish an Organic Seed Working Group to ensure the implementation of recommendations in this report and guide national policy action so that a secure future supply of organic seed is in place to enable organic sectoral growth targets to be met.
- Expand current data collection on organic seed production, supply and usage demand.
- Review Ireland's OrganicXSeed database to identify changes needed for it to function more effectively and maximise the use of organic seed by Irish producers.
- Improve the data collection and analysis of non-organic seed use derogations granted in Ireland so as to provide a more comprehensive and useful annual report.

Addressing the technical, economic and regulatory challenges of organic seed breeding and production:

- Ensure funding is allocated for seed and plant breeding research and trials of organic crop varieties and that a work programme in this regard is developed for the relevant organisations.
- Explore the feasibility of establishing a network connecting seed producers and farmers to provide for information exchange and mutual support on technical issues.
- Expand the amount of heritage seed and non-patented seed varieties available in Ireland in order to promote agrobiodiversity and farmer seed sovereignty.
- Ensure that organic seed producers can access supports for the equipment and resources they require.
- Ensure that smaller seed producers have sufficient affordable access to plant and seed testing facilities.
- Assess the feasibility of establishing a non-derogation list of organic seed varieties.
- Improve knowledge and understanding among seed producers and farmers regarding their obligations under relevant legislation and regulations.

Providing the necessary education, training and information for current and future organic producers:

- All QQI level 5 and 6 organic farming programmes should include at least one module on organic seed production and usage.
- Identify and support providers who are best-placed to deliver specialist training on seed breeding and production.
- Identify opportunities for workshops, conferences and knowledge exchange across the organic sector and beyond to further enhance / support training and education on seed breeding and production.
- Ensure that existing and new entrant seed breeders and producers are included in the consideration of the proposed mentorship programme for the organic sector, as outlined in the new national organic strategy.
- Explore how seed breeding and production issues may best be incorporated into organic apprenticeship programmes.

Implementing these will require committed leadership over the short, medium and long term.

*“The flocks of green potato stalk
were blossom spread for sudden flight,
the Kerr’s Pinks in frivelled blue,
the Arran Banners wearing white...”*

- Patrick Kavanagh, “Spraying the Potatoes.”

1. Introduction

The Organic Seed Production System (OSPS) research project has been carried out on behalf of the National Organic Training Skillnet (NOTS) to establish the need and viability of developing the organic seed production sector in Ireland. The overall aim of the project is to support the development of a sustainable organic seed production system in Ireland in order to enable organic farmers to achieve seed security and also provide new business opportunities for seed producers in the Irish and export markets. The project consists of two parts:

- Part 1 provides an assessment of the current situation with regard to the organic seed sector in Ireland, including issues relating to supply, demand and other factors which are constraining the sector’s capacity to meet Irish organic producers’ needs.
- Part 2 draws on the Part 1 assessment to provide guidance and recommendations for policy and investment decisions on how the organic seed production system in Ireland could best be developed in order to meet the needs of Irish organic producers.

1.1 Current challenges facing Irish food production systems

The Irish agricultural sector in general and the Irish organic sector in particular currently face a number of interlinked political, economic, social and environmental challenges, arising in both national and international contexts.

Promotion of the organic sector has accelerated at EU level in recent years, with targets in place to increase the area under organic production to 25% of total agricultural land by 2030 (European Commission, 2021). Initiatives such as the EU’s Farm to Fork Strategy (European Commission, 2020a) and the EU Biodiversity Strategy (European Commission, 2020b) also highlight increased organic production as a key sustainability practice. This reflects a growing demand from the general public for more sustainable methods of food production, driven by concerns such as food safety, environmental issues, animal welfare and health (Monier-Dilhan & Bergès, 2016).

In Ireland, one of the support measures offered to farmers as part of the Common Agricultural Policy (CAP) 2023-2027 is the Organic Farming Scheme (OFS). Like all CAP measures approved under Ireland’s Common Strategic Plan, the OFS is operated by the Department of Agriculture, Food and the Marine. To bring support payments in line with other EU member states, there has been an increase in recent years of 60% in the OFS payments compared to the previous round of the CAP, which has resulted in an unprecedented rise in the number of farmers converting to organic farming at national level (CAP Network Ireland, 2024a). Other supports introduced under the 2019-2025 Organic Food Sector and Strategy include an

Organic Processors Investment Grant, the Targeted Agricultural Modernisation Scheme and the launch of an online Organic Trading Hub in 2023, as well as an increase in the number of organic advisors and the establishment of a 'Growing Organics' programme by Teagasc with twelve demonstration farms. There are now over 5,000 farmers participating in the OFS and farming approximately 225,000 hectares of land equating to 5% of the total land area. This is set to increase further, with a government target of reaching 10% by 2030 (Department of Agriculture, Food and the Marine, 2024a).

More widely, the Irish food production sector in general has been impacted by events such as Brexit and the war in Ukraine, which are presenting challenges for food security and national self-sufficiency in general and access to sufficient quantities of crop seeds in particular, for both conventional and organic producers (Quinn-Mulligan, 2022; O'Brien, 2024). In addition, environmental issues such as climate change, soil degradation, water shortages, biodiversity loss and reduced plant genetic resources are increasing the stress on agroecosystems (Sinclair et al., 2014, Tendall et al. 2015, Urruty et al., 2016) and presenting serious challenges to the health and sustainability of food production systems and the natural ecosystems which support them. Successfully addressing these challenges requires urgent interventions to build the resilience and security of these systems and has been highlighted as an urgent requirement (FAO, 2018; Foresight, 2011; Ingram et al., 2019; Schipanski et al., 2016; Seekell et al 2017).

1.2 Current situation with regard to organic seed in Ireland

Seeds are a fundamental element of all crop and food production systems and thus essential to the livelihood of farming communities (Louwaars & Manicad, 2022). In the context of organic farming, the term "organic seed" may be defined as *"as a seed of which the mother plant (if seed) or the parent plant (if vegetative propagating material) has been produced following the principles of organic agriculture, as laid out by the European Organic Farming Regulations"* (Groot et al., 2020).

Since 1992, there has been a legal obligation on organic farmers in all EU Member States to use organic plant reproductive material under EU regulations and the Organic Food and Farming Standards in Ireland (European Parliament & European Council, 2018); IOFGA & Organic Farming Trust, 2023). However, due to the sector's significant recent growth and ongoing issues with organic seed supply across the EU - resulting in part from historically low levels of investment in organic seed breeding and R&D - there is currently an inadequate supply of organic seed to meet demand (Döring et al., 2012; Solfanelli et al., 2020). As a result, a system of derogations is currently in place which allows for the use of non-chemically treated (NCT) seed produced under conventional conditions (Döring et al. 2012).

Although authorisations for the use of non-organic seed is considered as an exception to the organic production rule, data on derogation requests in the EU show that non-organic untreated seed supply still represents an important part of the total demand of seed used by the EU organic farmers (Solfanelli et al., 2020). However, EU Organic Regulation (EC/848/2018) which came into effect in January 2022 states that all derogations for use of non-organic untreated seed will be phased out by 2036. This presents serious challenges for

Irish organic producers in ensuring access to sufficient supplies of seed, especially given their reliance on derogations, as seen in the most recent report on the number of derogations granted to Irish organic farmers and growers (Soil Association, 2024).

Ensuring that producers have access to high-quality organic seed is crucial for improving yields and overall product quality, as well as to improve species genetic diversity and build resilience to diseases and changing climatic conditions (IFOAM 2011). Addressing this requires investment in seed breeding and R&D, particularly since there has historically been a lack of focus in commercial seed breeding on traits specifically needed for organic farming conditions (IFOAM 2011). It is also compounded by an over-reliance on imported seeds, which are likely to have been bred for different growing conditions to those in which they are used. The consequent lack of locally-adapted seed varieties has been highlighted as an issue of concern by organic farmers across the EU (Orsini et al., 2020). It also points to a need for investment in the conservation of heritage seed varieties, since these may possess traits that could be harnessed for improving seed quality and crop resilience (Batten et al., 2021). An associated issue relates to the ownership and control of genetic resources such as seeds, amidst a growing desire in the organic sector to support farmers in maintaining their own seed stock and develop their own breeding programmes (Lammerts van Bueren et al., 1999; 2002).

As a result of the issues and challenges mentioned above, access to sufficient sources of quality organic seed is likely to be a key limiting factor to the development of organic production systems in Ireland. However, there is no recognition in the new National Irish Organic Strategy, launched in September 2024, of the implications of this and other organic seed-related issues. Despite the targets it sets out for the growth and development of the organic sector, none of the six strategic priorities in the strategy focus on seed supply and there are only two minor references to seeds in the whole document.

As outlined in the opening paragraph, this report provides an assessment of the current situation with regard to the organic seed sector in Ireland. Section 2 provides a short summary of the methodology used in compiling the information contained in the report. This is followed in Section 3 by a detailed analysis of the key challenges impacting on the production and supply of organic seed in Ireland. Section 4 then presents a series of recommendations to address these challenges, with overall conclusions outlined in Section 5.

2. Methodology

A mixed methods approach was used for the Part 1 assessment of the current situation with regard to the organic seed sector Ireland. This comprised a combination of primary and secondary data collection and analysis tools. Firstly, secondary desk research was carried out to identify key national, EU and international sources of data and information on issues relating to organic seed production. This was done using sources such as Google Scholar and internet search engines. The literature sources identified mainly consisted of academic research articles and grey literature, such as reports and studies from government departments, state agencies, the NGO sector and other organisations involved in the organic sector. Statistics and other relevant information were extracted from these to build up a picture of organic seed production and supply issues and other related challenges in Ireland and how these compare to organic seed sectors elsewhere.

Secondly, in-depth interviews were undertaken with seven key stakeholders involved in organic seed production and supply in Ireland. These comprised a mix of smaller-scale and larger producers and suppliers in the horticultural, cereal, tillage and grass / fodder sectors. Interviewees were asked a series of semi-structured questions designed to identify what issues or factors they perceived to be enabling or constraining organic seed production in the Irish context. The interviews lasted between 45 minutes and 1 hour and were carried out via online video calls using the Zoom platform. Interviews were recorded and transcripts generated from the recordings were then used as the basis for a thematic analysis to identify key issues impacting on organic seed production in Ireland.

The stakeholder interview analysis was then combined with the secondary desk research literature which resulted in the identification of five key themes relating to the main issues impacting on the organic seed production sector in Ireland, which are presented in Section 3 below. Following this, a series of recommendations to address these issues are outlined in Section 4 and concluding points made in Section 5.

3. Key issues and challenges for organic seed production in Ireland

This section presents a detailed analysis of the key challenges impacting on the production and supply of organic seed in Ireland. It draws on the results of the stakeholder interviews and a review of the relevant literature to identify five key themes in relation to the production and supply of organic seed in Ireland. These are:

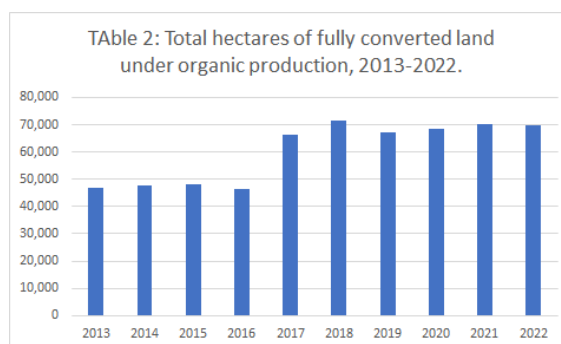
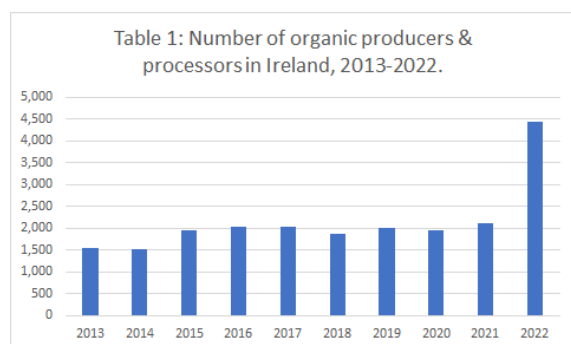
- Organic seed demand and supply challenges
- Organic seed production issues
- Issues regarding the use of non-organic seed
- Organic seed adaptability and resilience challenges
- Training, education and information needs.

3.1 Organic seed demand and supply challenges

The Organic Food and Farming Standards in Ireland (Department of Agriculture, Food and the Marine, 2023a) require organic operators to use organic seed to grow crops and where organic seed is not available, a derogation may be granted by the relevant organic certification body. Like many other member states, Ireland does not have an indigenous organic seed industry and is therefore reliant on importing most of the organic seed used in Ireland. The increased availability of organic seed over the last decade has resulted in more farmers using organic seed but combined with the unprecedented increase of producers entering the organic sector in 2023/24, there is likely to be a significant increase in demand for organic seed.

3.1.1 Demand for organic seed in Ireland

As mentioned in Section 1 above, the organic farming sector in Ireland is experiencing ongoing growth. Table 1 shows the upward trend in the number of organic producers and processors between 2013 and 2022 and Table 2 shows a similar trend for the amount of land under organic cultivation.



Source: Soil Association (2023; 2024); Eurostat (2024).

The make-up of the Irish organic sector mirrors that of the conventional sector, in that farming enterprises are dominated by livestock production and so the majority of farmers (both existing and new entrants) to the sector tend to be beef and sheep producers. This means that the main requirement is for grass and fodder seed; however, as noted by one stakeholder interviewed, this has not resulted in a major increase in demand for grass and fodder seed

overall, since many of these beef and sheep farmers are operating on marginal land and therefore do not reseed regularly but instead opt to graze and manage old pastures.

More intensive producers such as dairy farmers are increasing their on-farm fodder and feed production and, as a result, are purchasing more organic seed in order to do so. Mixed farms which finish beef will have a higher requirement for organic seed as they may grow arable crops such as CombiCrop (a spring cereal and combinable legume blend), protein crops and other fodder crops. These producers will require more access to organic seed varieties in the future in order to produce as much of their feed requirements within their holding as they can. This is both economically viable and also meets the requirements of the organic regulations. Recent information also confirms the rising demand for organic feed, most of which is currently imported (O'Brien, 2024) and current estimates indicate that over 50,000 tonnes of organic feed will be needed for the 2024/2025 winter season (Hickey, 2024).

All of these developments are already having a direct impact on organic seed demand and supply, as evidenced by the growing number of applications for derogations to use non-organic untreated seed due to insufficient quantities of organic seed supply being available (Soil Association, 2024). Furthermore, given the targets in place for the organic sector, it is likely that demand will outstrip current supply to an even greater degree in the coming years - for example, the current Programme for Government aims to increase organic production in Ireland to 10% of agricultural land by 2030 (Department of Agriculture, Food and the Marine, 2023b), up from the current level of 5% (CAP Network Ireland, 2024a). The National Irish Organic Strategy 2024-2030 also contains ambitious targets to drive growth in the sector (Department of Agriculture, Food and the Marine, 2024a).

3.1.2 Supply of organic seed in Ireland

In Ireland, organic seed is supplied by both producers and importers. The seven stakeholders interviewed for this report represent the main organic seed producers and suppliers in Ireland and so are the main source of data on volumes produced and / or supplied here. There may be some other certified organic seed producers and suppliers - mainly in the horticultural sector - but these are likely to be very small-scale in nature and no reliable data is currently available on their seed production capacity or output. The main organic seed producers and suppliers are a mix of smaller-scale organic seed producers (mainly for horticultural crop seeds) and larger producer/suppliers, both Irish-owned and multinational companies.

Seed sales channels

Currently, organic seeds are sold through a variety of channels in Ireland. Most sales tend to be online via catalogues on company websites, with other sales through merchants or smaller retail outlets, as well as directly by telephone or through a printed catalogue. The main customers for organic seed in Ireland are commercial growers and farmers in the horticultural, dairy, livestock and tillage sectors, as well as hobby gardeners. The increase in the latter during the pandemic has since dropped, as have sales to the UK following Brexit (due to onerous import / export regulatory requirements). Advertising and marketing tend to be done via websites, social media channels, advertisements in relevant organic magazines, promotion at events such as the National Ploughing Championships, annual conferences,

farm walks and word-of-mouth. One organisation runs a membership scheme which offers discounts on seed purchases. The OrganicXseeds Ireland online database of organic seed availability was also mentioned by stakeholders as a useful source of promotion. In addition, a new Organic Trading Hub was established by the Department of Agriculture, Food and the Marine in 2023 to provide an online platform for trading organic livestock, feed and seed (Organic Trading Hub, 2024).

There is a wide range of crop seeds and varieties demanded by organic producers. Popular vegetable seeds include potatoes, broccoli, tomatoes, peppers, squash, carrots, cabbage, cauliflower, kale, turnips and leeks, while cereal, fodder and grass seeds in demand include oats (e.g., Isabel and Barra varieties), wheat, multi-species sward mixes, clover and grass mixes, spelt, oil crop seeds, bird seed cover crops like linseed and some heritage grain seeds.

Data on organic seed production, supply and usage

From the research carried out for this project, there appear to be significant gaps in relation to available statistics on the volume of organic seed produced, supplied and used in Ireland. This presents a serious challenge for a) accurately describing the current and predicted future Irish market for organic seeds and b) guiding future policy direction. Some of the stakeholders interviewed were willing to supply some figures for the volumes of seed produced / supplied for 2023. This totalled approximately 250 tonnes of organic seed, comprising 130 tonnes of oat seeds and 120 tonnes of grass seed mixes. Due to commercial sensitivity, more comprehensive statistics for cereal, fodder, vegetable and fruit crop seeds were not supplied.

Several stakeholders mentioned issues in relation to the lack of timely advance data from commercial growers and farmers on the quantities and varieties of seed required each year, which is hampering seed producers' capacity to accurately plan their seed production. One stakeholder noted that market-related data in general for the organic sector seems to be 12-18 months behind.

The lack of available data on organic seed production and supply is further compounded by the fact that there does not appear to be any reliable or comprehensive data collected or made available on the volume of organic seed actually used by organic growers and farmers. This includes organic seed bought or imported directly by some larger organic growers / producers. For example, the organic certification bodies collect data from growers and farmers on the volume of conventional seed used under derogations, as well as the amount of organic output they achieve annually (e.g. crops harvested, animals reared, etc.). However, no data is collected on the volume of organic seed actually required to produce that output. It is also an issue in relation to the volume of non-organic seed authorised for use by organic farmers where sufficient supplies of organic seeds are not available, with one stakeholder pointing to the need for greater clarification on the OrganicXSeed database as to whether seed listed is actually in stock or potentially available to order. How this issue impacts on derogations for the use of non-organic seed in particular is discussed in more detail in Section 3.3 below.

The OrganicXSeed database

Ireland's OrganicXSeed database is part of an EU-wide system, whereby each member state is obliged under EU regulation 2018/848 (European Parliament & European Council, 2018) to maintain a national database which details the availability of different varieties of organic seed and other PRM available for purchase or order by organic producers and also provides the legal basis on which derogations for the use of non-organic seed may be granted. These databases play an important role in supporting higher levels of organic seed use (Orsini et al., 2019) but research has identified problems affecting their functioning, such as issues with user-friendliness and accuracy of seed availability data (Solfanelli et al., 2022a). For example, if seed databases are not updated on a daily or at least weekly basis it can remain unclear if the listed seed in a database is available or not, and as a result the database is of limited use for farmers (Raaijmakers & Schäfer, 2019).

In this regard, a new router database to connect Member States' national seed databases has been developed to offer organic producers access to a wider assortment of organic seed varieties in their national databases and create more transparency on organic seed availability across the EU, with the aim of supporting increased usage (LiveSeed, 2024). However, the success of this requires work by each Member State to ensure the efficient functioning of their national databases and, as indicated above and in Section 3.3 below, stakeholders interviewed for this project have noted issues with the Irish database that need to be addressed.

Seed supply, demand and data issues elsewhere

Issues with demand for organic seed outstripping supply and the implications of this for the sector's growth have also been noted outside of Ireland. For example, Orsini et al. (2020) highlight the lack of organic seed availability for differing agri-environmental conditions across Europe, as well as a relatively low overall usage of organic seed except where producers are part of short, specialised supply chains. Padel et al. (2021) argue that "*The organic seed market cannot be categorised as a well-functioning competitive market... [and] the market certainly cannot supply 100% organic varieties, with an organic breeding sector that is in its infancy and characterised by a shortage of funds.*" They also highlight considerable differences in organic seed availability and supply chain organisation between vegetable, arable and forage crops.

The importance of addressing the lack of reliable data on organic seed data availability has also been highlighted. For example, Solfanelli et al. (2020) note the lack of statistics on both the annual usage of organic seed by producers and the amount of production based on that seed. In subsequent research, Solfanelli et al. (2022b) note how "*The lack of sufficient information about organic seed production and use is among the key factors affecting the development of the organic seed market in the EU. Currently, only very basic organic seed market data are being reported at the country level.*"

They also identify three key reasons why reliable data on organic seed production and use is required: 1) to guide investment decisions by seed suppliers and breeders; 2) to support purchasing decisions by farmers; and 3) to inform policy-making decisions on the extent and timing of regulation and support measures; however, as they point out, such data is lacking at

both national and EU levels, apart from some limited and dated statistics on a few crops. They also suggest that data on organic seed usage (both purchased and farm-saved seed) could be collected as part of the organic inspection system but that doing so could impose additional burdens on the organisations involved.

At a more strategic level, one stakeholder was of the view that there is a need for an overall roadmap and coordinated support for the organic sector as a whole, that would bring together the individual supports currently available for different elements such as seed production. There was also a suggestion that a seed working group be set up by the Department of Agriculture, Food and the Marine. The newly-published national Irish organic strategy does aim to identify priority areas for action and guide the development of the organic sector; however, as mentioned earlier and discussed in more detail throughout this report, seed issues have not been included as a priority area to be addressed in the strategy.

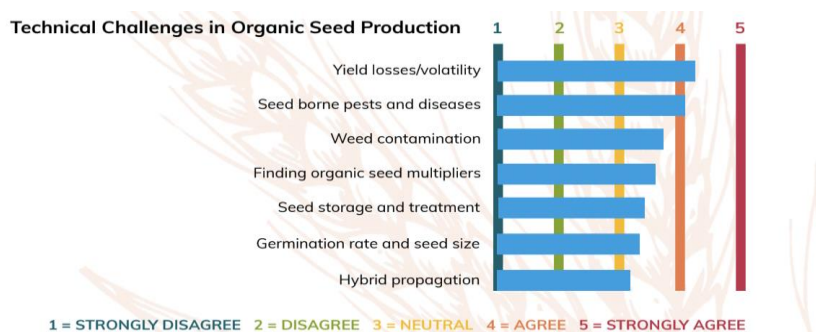
3.2 Technical, economic and regulatory challenges of organic seed production in Ireland

Organic seed producers in Ireland currently face a variety of production-related challenges. These are discussed below under the headings of technical, economic and regulatory challenges, drawing on results from the stakeholder interviews carried out for this project and information from key literature sources.

3.2.1 Technical challenges

A key foundation of organic agriculture is its reliance on ecological processes and cycles adapted to local conditions so that the use of external inputs such as agrochemicals is minimised (IFOAM, 2008). This has consequences for organic producers relating to issues such as lower yields, plant disease, weeds and higher labour requirements (Crowder & Reganold, 2015; Nyochembeng, 2021). It also means that the availability of appropriate seed varieties bred to suit organic production systems and producers' particular growing environments is crucial (Organic Seed Alliance, 2018). As part of the EU Horizon-funded LIVESEED research project which surveyed 839 organic farmers from 17 European countries, Pettiti et al. (2019) identified seven key technical challenges for organic seed production, as outlined in Figure 3.1 below.

Figure 3.1 Technical challenges in organic seed production across Europe



Source: Pettiti et al. (2019).

In the Irish context, these technical challenges were highlighted to varying degrees by the stakeholders interviewed for this project. The most frequently mentioned technical challenge was the Irish climate, in particular the prevalence of wet weather which impacts on planting and harvesting. This is likely to continue to be an issue in the context of the climate change impacts predicted for Irish agriculture, which are discussed in more detail in Section 3.4 below. Weed contamination was the next most common challenge encountered - particularly for oats -, presenting challenges for achieving the seed purity levels required by the seed certification process. Stakeholders also cited particular challenges associated with small-scale organic seed production, including the need for:

- sufficient land for seed production;
- seed-drying and cleaning facilities;

- machinery to assist with scaling-up production and with cleaning of certain crops such as carrots.

Linked to this, two stakeholders highlighted the need for improved access to plant and seed testing facilities for smaller seed producers in particular, given that the seed testing laboratory on the State Laboratory campus at Backweston in Co. Kildare only caters for large samples and can also be expensive for those only needing to test small amounts. One stakeholder also noted the potential benefits for seed producers having access to university knowledge and research on issues such as plant pathology and seed germination. In addition, two stakeholders noted the need for improved data management systems to simplify and streamline a) the reporting of data for inspections and certification and b) stock recording and management, both of which would also improve efficiency and support expansion.

The technical challenges described above are not confined to Ireland, as the research literature highlights them as presenting challenges in other jurisdictions. For example, weed contamination is widely recognised as a limiting factor for organic crop yields (Röös et al., 2018), due to the limited range of crop protection products authorised for use in organic agriculture (European Commission, 2021). Production of organic vegetable seeds can also present different challenges to grain crop seed production: crops such as wheat are largely self-pollinating, while some vegetable crops require a much longer time to produce seeds and the seeds themselves can be smaller and irregularly-shaped, which makes harvesting more difficult (Welbaum, 2024). Overall, ensuring a robust supply of organic seed requires investment in plant breeding and the development of resilient regional and local seed systems (Hubbard et al., 2022).

3.2.2 Economic challenges

Organic agriculture is now the most popular alternative to conventional agriculture, with sales approaching almost €47 billion in Europe (FIBL & IFOAM, 2023). Key factors influencing its profitability include crop yields, price premiums, labour costs and conversion costs (Zentner et al., 2011). All stakeholders interviewed cited the impact on the profitability and feasibility of Irish organic seed production due to a) the higher cost of producing organic seed and b) the relatively low level of demand / small market in Ireland. For example, one stakeholder cited the significantly lower demand for organic versus conventional malt barley (130 tonnes vs 3000 tonnes) but did note that a trial producer-buyer contract for organic malt barley is currently underway.

The same stakeholder also highlighted the higher cost and lower yield of organic pre-basic seed production compared to that for conventional pre-basic seed (i.e. the generation of seed before basic or foundation seed) and was of the view that seed producers should be allowed to buy this instead. Another stakeholder mentioned the implications for financial viability when current derogations are removed, with seed prices likely to increase. In contrast, one stakeholder expressed concern that the relatively generous compensation available for growers availing of multi-species schemes such as the Red Clover Silage Measure (which pays €300 per hectare capped at 20 hectares) (Department of Agriculture, Food and the Marine, 2024b) may have future implications for growers' willingness to pay the likely higher

price for organic seed when the current derogations allowing the use of conventional seed come to an end in 2036.

In addition, in relation to the supply of organic seed to small / hobby growers, one of the smaller vegetable seed producers also highlighted how selling seeds in small packets is currently classified as a “retail” activity and so requires rates to be paid to the local authority, whereas if it was classified as a “producer” activity, this would not be the case.

All stakeholders highlighted the need for some type of formal contract or commitment between organic seed producers and growers / processors, to reduce the economic risks of seed production and increase certainty for growing planning. Two stakeholders also mentioned financial supports, with one noting the need for recent subsidies to boost organic production to be continued so as to increase demand for organic seed and another suggesting the introduction of a cash subsidy to enable organic seed producers compete with conventional seed prices as well as some kind of sustainable production model, especially for varieties that take two years to produce seed (e.g., broccoli and cabbage). This could include a commitment to purchase a certain quantity of seed and some kind of reimbursement if this is not all sold (example from US of advance payments and initial premium price for an agreed volume of seed, with reduced seed price thereafter).

There is recognition in the research literature of the economic challenges facing organic seed producers. For example, Crowder and Reganold (2015) suggest strategies such as premium pricing and reducing external input usage to offset lower yield challenges. For smaller seed producers, Hubbard et al. (2022) highlight cost and scale issues in relation to seed cleaning and harvesting equipment in particular. However, despite such economic challenges, research indicates that the higher cost of organic seed is not regarded as a key barrier by organic farmers (Padel et al., 2021), who are generally positive about using it and which bodes well for the future of this sector. The availability of locally-adapted varieties appears to pose a more significant barrier and this is discussed in more detail in Section 3.4 below.

3.2.3 Regulatory challenges

In addition to the requirements to produce certified seed in line with organic agricultural principles as well as seed quality standards, organic seed producers face additional legislative requirements depending on how they market and sell their seeds and also in relation to seed rights and ownership issues. In Ireland, organic certification bodies certify and inspect organic seed production facilities to ensure compliance with the relevant legislation, while the Department of Agriculture, Food and the Marine has put quality control procedures in place to ensure consistency and traceability for seed buyers (Department of Agriculture, Food and the Marine, 2024b).

The marketing of seeds and other plant reproductive material (PRM) – both conventional and organic - in Ireland is governed by EU legislation which is currently being revised (European Parliament & European Council, 2018). In April 2024, the European Parliament voted to amend the Commission’s proposals in this regard and permit the informal exchange of seeds and PRM by farmers, as well as to introduce less strict rules for the sale or transfer of small

quantities of conservation varieties – for example, up to 500 grammes for vegetable seed and up to 1000 kg for seed potatoes (Sanchez Marano, 2024). This could benefit those producing seed for the organic horticultural sector in Ireland in particular, since they tend to be smaller in scale than grain seed producers. One stakeholder interviewed had expressed concern about potential implications of the revision of the regulations for smaller-scale producers since, at the time of interview, the European Parliament’s revisions had not been put forward.

There is also legislation governing the use of “open-sourced” seed and seed to which plant breeders’ rights apply. Open-sourced seed is freely available in the public domain for use, modification and redistribution and therefore no patent or register of rights apply to them or to any varieties derived from them (Open Source Seed Initiative, 2024). In contrast, certified seed carries plant breeders’ rights - also known as plant variety rights - for which royalties must be paid where this seed is used for subsequent propagation or marketing. This is to provide a return on the investment required by seed breeders to develop new crop varieties. While the long-established “farmer’s privilege” right entitles farmers to save their own seed (known as “farm-saved seed”, or “FSS”), where this is done using varieties for which plant breeders’ rights exist, then a royalty must be paid to the rights holder, usually at 50% of the standard royalty rate. Smaller-scale producers are exempt from this payment (Department of Agriculture, Food and the Marine, 2024c). The regulation of farmer-saved seed (FSS) in Ireland is governed by Statutory Instrument No. 493/2000. and 273/2007 (Government of Ireland, 2000; 2007).

In general, the main regulatory challenges mentioned by stakeholders related mainly to the paperwork and preparation time required for compliance with the requirements of the organic certification bodies and the Department of Agriculture, Food and the Marine (e.g., certification process, inspections, processing licence applications, etc.). For example, one seed producer highlighted that they are required to hold both a certified organic grower licence to produce seed as well as a processor licence for selling it on and the cost implications of this for them as a smaller seed producer. However, it should be noted that holding a processor licence does make producers eligible to apply for certain funding sources.

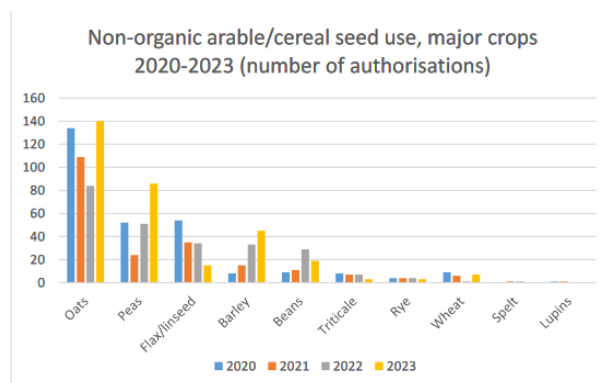
In addition, one of the larger seed producers was of the view that the requirement to use organic grass and fodder seed in the production of organic milk and meat products is an unnecessary regulatory barrier, since end consumers are a further step removed from the production process. However, this would contravene the regulatory requirement for organic operators to use organic seed and, in addition, would compromise a key principle of organic production which strongly values the use of organic inputs at all stages of the organic supply chain. Another stakeholder was of the view that the lack of a compulsory mandate for organic growers to only use organic seed - coupled with the current availability of derogations for the use of non-organic seed, which is usually cheaper - is affecting the willingness of organic farmers to pay for organic seed and thus impacting on the viability of the organic seed production sector.

3.3 Derogation-related challenges

As mentioned in Section 1.2 above, the use of NCT seed produced under conventional conditions is currently permitted in European member states where sufficient supplies of organic seed are not available but this is due to end in 2036. The decision stems from the overarching requirement that organic farmers should use organic sources wherever external inputs such as seeds are required (Council of the European Union, 2007) and the goal of achieving 100% use of organic seed for all organic crops in Europe (European Parliament & European Council, 2018). It also stems from concerns about potential distortion of the market for organic seed as a result of the availability of derogations and the implications of this for the demand and supply of organic seed (Orsini et al., 2020).

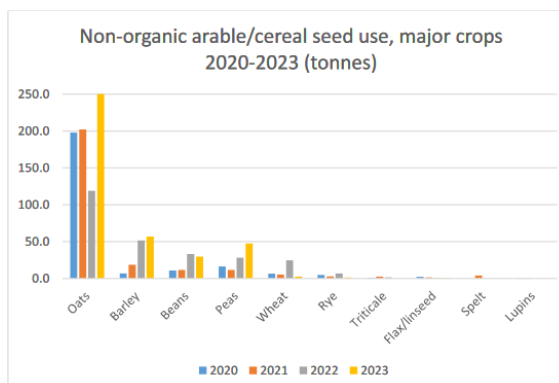
Under EU Regulation (EU) 2018/848, each EU Member State must produce an annual report on the number of derogations issued for the use of non-organic seed, non-organic seed potatoes and non-organic vegetative propagating material. The 2023 report for Ireland (Soil Association, 2024), shows a general upward trend in the overall number of applications being granted and the volume of non-organic seed being used, as seen in Figures 3.2 and 3.3 below.

Figure 3.2: Number of authorisations for non-organic seed usage, 2020-2023.



Source: Soil Association (2024).

Figure 3.3: Tonnes of non-organic seed usage, 2020-2023.



As summarised below, the crop categories differ in relation to the specific reasons for increases or decreases in the number of derogations granted and, in several cases, it is likely there will be implications for availability of organic seed post-2036.

Seed potatoes

For seed potatoes, the number of derogations have both increased and decreased in recent years, as a result of factors such as reduced supply following Brexit, the expansion of production capacity by certain organic potato producers in 2022 which exceeded available seed supply and the demand for new varieties with improved disease and drought-resistance in 2023. However, the 2023 report also notes a lack of clarity on whether there are ongoing issues with organic seed potato supply in Ireland due to limited information and supply chain complexities and that this situation needs to be addressed (Soil Association, 2024).

Arable and cereal crops

The situation is somewhat different for arable and cereal crops, where although the number of derogations granted increased by 25% between 2021 and 2022, this only comprised a 2% increase in the number of tonnes of seed involved. This is mainly due to a better supply and demand balance in the market for organic oat seed in particular, which accounts for 40% of all non-organic seed derogations.

Horticultural crops

For horticultural crops, it is difficult to get a clear picture of derogation trends, as sufficiently detailed data does not appear to be available. However, it has been noted in the 2023 report that most authorisations are for just a few species, indicating either limited availability of organic seed for these varieties or else production expansion by larger producers, as has occurred with seed potato production. Clarification of this situation is required, since both possibilities have implications for seed supply in this sector going forward, especially when derogations will be phased out.

There is a similar situation in relation to fruit crop derogations, where a combination of small market size and diverse crops and varieties makes it difficult to identify reasons for varying numbers of authorisations year on year. Of particular concern is the current limited number of suppliers of organic fruit plants and tree stock which is driving the need for derogations but which will not be possible after 2036.

Grass, fodder and forage crops

The most recent data available on derogations for grass, forage and fodder crop seed shows a relatively stable situation in relation to grass seed; however, there is no information given in the 2023 report on the potential for ensuring sufficient supply of organic grass seed post-2036. There has been a significant increase in both the number of derogations and associated seed tonnage for forage and fodder crops since 2021, which could be partly attributed to farmers seeking to become more self-sufficient in animal feed in a time of rising prices, as well as demand from new entrants. However, it is difficult to properly assess a) the implications for seed availability for these crops post-2036 and b) what measures need to be put in place in the short- and medium-term to address this.

Stakeholder views

The issue of derogations was only mentioned directly by two stakeholders interviewed. One stakeholder felt that derogations are not having a negative impact on organic seed sales in Ireland, since the market is still small. However, another stakeholder expressed concerns about the potential financial implications of increases in organic seed prices, particularly for grain and grass seed, once derogations are removed. However, as noted in Section 3.2.2 above, research by Padel et al. (2021) indicates that the cost of organic seed is not a primary concern for organic producers.

A few stakeholders made anecdotal remarks about the availability of derogations possibly acting as an incentive for some farmers to avoid using higher-priced organic seed and one stakeholder suggested that the introduction of a seed growing contract system (as mentioned

in Section 3.2.2 above) could be one way to combat this, in terms of reducing the costs and risks involved for organic seed producers.

Currently, the annual report on derogations in Ireland lacks sufficiently detailed statistics on derogations in certain areas (e.g., horticulture) and needs more analysis of the reasons why derogations are being sought i.e., whether this is the result of required cultivars or varieties not being provided by seed companies, unclear information regarding availability on the OrganicXSeed database or a combination of these and other factors. Including such analysis would provide more clarity and certainty for producers on seed availability and also identify what actions are required to reduce the amount of non-organic seed usage.

Derogation-related issues elsewhere

Concerns have also been expressed elsewhere about both the derogation system and national seed databases detailing the availability of quality organic seed, seed potatoes and vegetative propagating material, which each member state is required to provide under EU Regulation (EU) 2018/848. For example, Solfanelli et al. (2022a) highlight issues with the reliability and accuracy of data in annual derogation reports regarding the amount of non-organic seed used as a result of the derogations granted. Similarly, there have been issues with the scope of some national databases, where not all cultivars for a particular variety may be listed and so users may assume seeds for these are not available and thus apply for a derogation to use non-organic alternatives.

There have been widespread shortages in seed supply worldwide in recent years - for both conventional and organic seed - due to reduced stock levels and exports from key production areas in North America and New Zealand (Soil Association, 2024). There are concerns that the withdrawal of derogations may further exacerbate this situation if measures to boost investment in organic seed breeding and production are not put in place in time (Padel et al., 2021). Research by Raaijmakers & Schäfer (2019) as part of the LIVESEED project also found that poorly designed or maintained national organic seed databases “*can lead to unsubstantiated exemptions for the use of conventional seed*” and that the derogation process itself entails financial and administrative burdens for both farmers and the competent authorities. They were also of the view that “*if derogation to use conventional seed remains possible irrespective of the availability and suitability of the organic seed offered on the [national seed] database, this undermines the investment in organic seed production by seed companies*” (Raaijmakers & Schäfer, 2019).

Overall, it is critical that sufficient time be made available to mitigate anticipated impacts of the phasing out of derogations so as to avoid seed shortages, in particular so that seed producers can plan the expansion of their seed production and that organic farmers are encouraged to increase their use of organic seed and so boost demand and improve sector competitiveness (Padel et al., 2021).

3.4 Organic seed adaptability and resilience challenges

3.4.1 Availability of resilient and productive organic seed cultivars

One of the biggest challenges facing organic agriculture across Europe is the development and availability of resilient and productive organic cultivars to provide for yield stability, disease resistance and adaptability to changing climatic conditions, as well as for nutritional value and flavour (Brusik et al., 2021; Nuijten, 2021). Maintaining seed diversity is an essential element of this, contributing to the future sustainability of agricultural and food systems. However, as Pimbert (2022, p.1), points out, *“both wild and domesticated varieties are disappearing under an onslaught of human-driven pressures.”*

At EU level, the 2021 action plan for the development of organic production (European Commission, 2021) stated the intention to earmark funding to support organic seed breeding for the development of new varieties and to improve genetic variability and biodiversity potential. However, there was no mention in the 2023 review of the Action Plan (European Commission, 2023) on what, if any progress has been made on this. Work on revising EU regulations relating to seed marketing to facilitate the registration of seed varieties, also signalled in the 2021 Action Plan, has however progressed since then, as mentioned in Section 3.2.3 above.

In Ireland, there appears to be little official recognition of organic seed-related issues in organic sector policy. For example, the 2019 organic food sector review and strategy development report (Department of Agriculture, Food and the Marine, 2019) contained no discussion of organic seed issues and only two actions related to organic seeds: one to *“Promote local seed production and registration of organic seed on Seed Database”* and a second to *“Organise a workshop on assisting growers with seed variety choice”*. Similarly, in the recently published National Irish Organic Strategy (Department of Agriculture, Food and the Marine, 2024a), there are only two minor references to seeds: a) a general aspiration to help organic farmers *“secure easier access to essential resources such as organic seeds”* (p.28) and b) a mention of departmental support for an organic seed database (p.37). However, it should be noted that the latter is a compulsory requirement for all EU member states under EU Regulation (EU) 2018/848. There is also no mention in the SWOT analysis section of the new strategy of how seed demand and supply issues are a potential constraint on future sectoral development plans (p.23).

This is despite the fact that a 2021 research project on the Irish organic horticultural sector noted a lack of organic seed and cultivars as one of the threats to the optimisation of organic horticultural production and the improvement of supply consistency (Irish Organic Association, 2021). Even in the conventional sector, there have been calls for Irish breeders to continue and boost their participation in collaborative multinational research initiatives (Griffen et al., 2022). Currently, seed breeding and R&D research is mainly confined to conventional seed varieties and is carried out by Teagasc and some private companies. Given the much smaller market demand for organic seed, the costs of conducting similar research for organic seed have made doing so infeasible to date; for example, there were indications from stakeholders interviewed that some Irish commercial seed providers will be ceasing

work on organic seed research due to the financial risk and very small sales opportunities and instead will import fully-certified organic varieties from abroad. This has implications for future seed security, given that other member states are also working to increase the amount of organic production, which may result in less seed being available for Ireland.

Most of the stakeholders interviewed for this project were of the view that there is currently insufficient expertise, capacity and investment in organic seed breeding and R&D across the board in Ireland. Specific issues mentioned included grass seed breeding, research and expertise as well as the need for research to catch up with policy measures introduced over the last few years in relation - for example, on how multi-species swards can improve organic farmers productivity and thus increase that market for organic seed. One stakeholder also highlighted the need for research on barley varieties, given the current reliance on derogations due to a lack of varieties suited to organic production systems. In this regard, it was also noted by stakeholders that for vegetable crops, all of the three certified organic seed producers in Ireland only sell seeds produced in Ireland and thus are adapted to Irish growing conditions.

3.4.2 Future adaptation challenges

Supporting the capacity for seeds to adapt to changing climatic and growing conditions through techniques such as plant breeding, seed saving and selection is key to ensuring the viability of organic agricultural production and protecting future food security (Padel et al., 2021; Hubbard et al., 2022). In addition to larger-scale and state-funded work on seed breeding, research also highlights the need to build capacity for organic producers and their associations for farm-saved seed, as well as to develop cultivars from heritage seed varieties (Nuijten et al., 2016; Solfanelli et al., 2022b).

For example, the impacts of human-induced climate change predicted for Ireland pose significant challenges for future agricultural production. These include: mean annual temperature increases of 1-1.6°C; significant decreases in overall rainfall amounts but greater heavy rainfall frequency and associated increased volumes of water run-off in winter; and extended periods of drought and associated likely water shortages in summer months (Environmental Protection Agency, 2020). Given this, there is an urgent requirement to assess the extent to which current crop varieties available for the organic sector will cope with such conditions and what new varieties will be needed. This in turn poses challenges for the amount and timing of investment needed in seed breeding and R&D, especially since some climate change impacts are likely to become apparent relatively quickly (Griffen et al., 2022). However, there is no mention of these issues in the new National Irish Organic Strategy (Department of Agriculture, Food and the Marine, 2024a).

In this regard, heritage (or heirloom) seed varieties can have an important role to play. These are open-pollinated seed varieties handed down through generations and are usually at least 50 years old. They are a source of genetic diversity and can be more resistant to local diseases and pests and better suited to local climatic conditions. As they are likely to have survived climate variations and extreme weather conditions, they are an important source of potentially useful plant traits that may be required for future growing conditions. (Nyochembeng, 2021; Aoun, 2023; Irish Seed Savers Association, 2024).

At present in Ireland, there are only a few sources of such heritage varieties. In 2019 the Office of Public Works committed to setting up a National Seed Bank and this was subsequently established at the National Botanic Gardens in Glasnevin, Dublin. Other sources include the Threatened Plant Seed bank in Trinity College Dublin and the Crop Wild Relatives Seedbank at Backweston, Kildare, which is managed by the Department of Agriculture, Food and the Marine. In line with practice internationally, the crop genetic material (in this case, seeds) available to farmers wishing to grow the varieties stored at these seed banks is very small. For example, the Crop Wild Relatives Seedbank provides 20g seed accessions to the general public from its holdings of cereal and vegetable crop seeds, via a Standard Material Transfer Agreement under the International Treaty on Plant Genetic Resources for Food and Agriculture.

The larger seed providers also supply some non-Irish heritage cereal and grain varieties such as Husky oats, einkorn and emmer. As the national agency tasked with crop research Teagasc are conducting some research on heritage grains with plot trials of Emmer, Einkorn and Spelt at their Oakpark facility in Carlow, with the aim to see how well these crops can be grown in the Irish climate and what the potential end value of the crops are in the market.

Pettiti et al. (2019) estimate that “95% of seed used in organic production is based on varieties bred for the conventional sector”, despite ongoing demand from organic farmers for seed bred specifically for organic farming conditions and for arable, vegetable and fruit crops in particular (Orsini et al., 2019). In addition, as Solfanelli et al. (2022b) note, “Official cultivar testing is carried out mainly under conventional conditions, and information from on-farm trials under organic conditions is missing”. Key barriers to the development of new cultivars better suited to organic production include a lack of investment and technical infrastructure (Pettiti et al., 2019). Given this, there is a clear need for state funding to boost seed breeding and the development of cultivars in the organic sector (Padel et al., 2021).

3.4.3 Seed sovereignty issues

The increasing privatisation of seed genetic resources worldwide has led not only to a reduction in the diversity of seed varieties commercially available but also to a gradual erosion of farmers’ rights to freely sow and save seed (Thoreau, 2011). In response to this, the concept and practice of commons-based seed systems has developed. These include both “*traditional seed systems (such as seed exchange networks or community seed banks) ... [and] recent anti-enclosure movements (such as open-source seeds and organic breeding initiatives)*” (Sievers-Glotzbach et al., 2020).

One example of such commons-based systems which links seed sovereignty and seed diversity at the local level is that of community seed banks. These are “*locally governed and managed, collective-action institutions, whose core function is to maintain seeds for local use*” (Vernooy et al., 2020, p.561). Through their support of on-farm agrobiodiversity and farmer empowerment, they also contribute to core objectives of the Convention on Biological Diversity (CBD) and the International Treaty on Plant Genetic Resources for Food and Agriculture (Vernooy et al., 2020).

In Ireland, a public living seed bank is maintained by the Irish Seed Savers Association which conserves plant genetic material of mainly vegetable seeds and propagates varieties for sale to the general public. Together with other smaller-scale organic vegetable seed producers, they currently supply heritage vegetable varieties such as Gortahawk cabbage, Winter Roscoff cauliflower, Uncle John's kale and Tipperary turnips and some heritage grain varieties.

3.5 Training, education and information needs

3.5.1 Training and education needs

Given the issues with organic seed supply discussed in Section 3.2 and 3.3 above, there is a need to increase the availability of specialised training in both organic seed breeding and seed production in Ireland, especially given the likely continued growth of the organic sector here.

Stakeholders mentioned several areas where training and education support and the necessary funding are currently lacking. Specific topics highlighted included a need for knowledge on weed control, yield potentials and seed germination, for example, as well as on the benefits of grass reseeded with newer varieties for increased productivity, especially for farmers using more marginal land. The need for improved knowledge and training amongst seed producers around plant pathology and recognition of fungal diseases was also noted. Linked to this, stakeholders also mentioned problems arising from a lack of awareness on the part of farmers and growers regarding the lead times needed to source organic seeds from other European countries and that seed sourcing should be included as part of courses on organic farming principles.

Seed breeding

In terms of seed breeding, selected aspects of seed breeding are covered in modules of some current third-level programmes such as botany courses and animal genetics; however, these generally do not focus specifically on organic seeds or the needs of Irish organic producers. While there are plans to include modules on plant breeding as part of undergraduate and postgraduate organic agriculture programmes, these are still at the initial planning stages and so it will be several years before they will have an impact on the supply of organic seed. Overall, there is a general lack of specific training courses in plant breeding in Ireland.

Seed production

In terms of organic seed production, both the Irish Seed Savers Association (ISSA) and the GAIA Foundation UK have offered seed training programmes in recent years for the horticultural sector in Ireland. The former has run specific training programmes aimed at commercial and community seed producers to increase the supply of Irish-grown horticulture seeds (Irish Seed Savers, 2024), while the latter's Seed Sovereignty Programme offers a year-long Seed Production Training course in a blended learning format comprising of online workshops, lectures, farm and field visits for those interested in commercial seed production (GAIA Foundation, 2024).

One of the six strategic priorities of the newly-published national organic strategy relates to boosting skills and support, including priority actions on knowledge transfer for farmers and education and training programmes (Department of Agriculture, Food and the Marine, 2024a). However, there is no specific action planned in relation to organic seeds, with the only reference being to the existing organic seed database as a source of organic farming information (*ibid*, p.37). There is the possibility that seed issues will be included in the various specialised courses highlighted for continued support and / or expansion, such as the QQI level 5 and 6 in Horticulture, the Organic Farming Principles course and the Organic Growers

of Ireland Work Placement Programme, as well as in the plans for other National Organic Training Skillnet (NOTS) training programmes and apprenticeship schemes, but this remains to be seen.

Mentoring and apprenticeships

In addition, one stakeholder highlighted a current lack of mentors for new organic seed producers and the need to develop seed-growing apprenticeships in addition to courses such as those run by ISSA and Gaia. There are currently no such mentoring or apprenticeship programmes in Ireland for organic seed production; however, the new national organic strategy (Department of Agriculture, Food and the Marine, 2024a) does recognise the value of farmer-to-farmer mentoring in areas such as organic farming practice and technical support (p.30), organic innovation research (p.38) and business skills (p.39) and commits to supporting this further. However, there is no indication of whether this will include seed breeders and producers as well as farmers, nor whether any similar support will be available to those already working in the organic sector. The new strategy also aims to encourage apprenticeship programmes to provide practical experience in organic farming (p.38) but it remains to be seen how this recognition plays out in practice.

4. Recommendations for the future of the Irish organic seed system

Drawing on the research presented in Section 3, a series of recommendations are now made to address the challenges identified. These are presented under three headings:

- Responding to organic seed supply and demand challenges.
- Addressing the technical, economic and regulatory challenges of organic seed breeding and production.
- Providing the necessary education, training and information for current and future organic producers.

Preceding this is an overview of the broader and deeper perspective required to deliver an efficient, resilient and sustainable organic seed production system in Ireland. This can provide a framework for the design and implementation of the recommendations in a coordinated and coherent manner and support the delivery of national targets for the organic sector.

4.1 Transforming organic seed production in Ireland

At a basic level, a functioning seed system should “*sustainably enable farmers to have access to the seeds of their choice and purpose, of the best possible qualities, the right time and at the right price from the farmers’ investment perspectives.*” (Louwaars & Manicad, 2022, p.340). Delivering on this is a complex challenge, especially in the context of the need to respond to changing climatic, soil and economic conditions in a way that will support the building of resilience in our agricultural and food systems and the transition to low-carbon and sustainable methods of production (Slater et al., 2022). There is also a need to ensure that this is done in a just and fair way that supports plant genetic diversity and continued secure access to seeds by producers (Lammerts van Bueren et al 2018).

However, research indicates that many food and agricultural policies tend to be limited to adjusting, improving or ‘reforming’ current systems in order to maintain stability, rather than reimagining or ‘transforming’ them (Slater et al., 2022; Walthall et al., 2024). Such policies are underpinned by a paradigm of increasing productivity and market development which is dependent on external inputs and monocultures but which can also increase farmer dependence and vulnerability (Ashwood et al., 2022). As Bless et al. (2023, p.1391) point out, “*Of the more than 6,000 different plant species cultivated for food, just nine contribute around 66% of total crop production.*” One could argue, for example, that such a perspective is reflective in the new national Irish organic strategy, where four of the six strategic priorities relate to driving capacity, growth and markets but there is no recognition of the need to ensure effective and resilient seed systems, even though seeds are fundamental to the achievement of these priorities.

In contrast, a transformation-based paradigm is based on principles such as “*fostering farmer independence, incorporating local knowledge and promoting food sovereignty*” and supporting the embedding of food and seed systems in local and regional “*territories and alliances among producers, consumers and other local actors*” (Walthall et al., 2024, p.7). This aligns with calls to expand the foundational principles of organic agriculture – which focus on essential elements like low-input, ecosystem-based approaches which conserve soil health - to include

issues such as food justice and rural and social wellbeing (Bless et al., 2023). As Lammerts van Bueren et al. (2018, p.42) argue, *“producing organic seeds of an existing variety assortment is one thing, but remodelling a breeding program so that it produces varieties suitable for more sustainable farming systems, such as organic agriculture, is another and more radical issue.”*

At a practical level, Louwaars and Manicad (2022, p.352) argue for a seed system that combines both formal and informal / farmer-based elements and provides both with three key forms of supports:

- *A continuous flow and capacity to use a diversity of plant genetic resources;*
- *Functioning institutions... [which can deliver] the norms, policies, regulations and social relations to ensure systems of exchange and purchase, and the reliability of products and information;*
- *Innovation for the identification and development of increasingly complex traits needed for plant breeding.”*

They go on to outline specific ways in which such a system can be achieved, arguing that *“Creating a diversified, competitive seed sector in a country as well as stimulating seed entrepreneurship through fiscal and other incentives may be necessary to increase the resilience of the formal seed system”* (ibid, p.352). Doing so will require committed leadership over the short, medium and long term and is essential to build and maintain the trust of both organic producers and consumers, without which national targets for the section are unlikely to be achieved.

4.2 Responding to organic seed supply and demand challenges

4.2.1 Summary of key issues

Overall, the trend of growth in the numbers of organic producers and processors in Ireland, as well as the amount of land under organic conversion is likely to result in continued demand for organic seed. Demand is particularly high for grass and fodder seed, given the dominance of livestock production in the organic sector and the increased pressure for farmers to generate their own animal feed supplies. Vegetable crop seeds are mostly produced in Ireland by small-scale organic producers, while cereal, tillage, grass and fodder seeds are supplied by larger Irish companies and branches of multinational companies headquartered outside Ireland.

The current small scale of the organic seed production industry in Ireland overall means there is still a high reliance on imported organic seed, a situation made even more risky as a result of Brexit and the war in Ukraine which have caused disruptions to seed supply. There is also a reliance on derogations for the use of non-organic seed to make up for the insufficient supply. The level of reliance on derogations varies between crops, being influenced by factors such as the increasing on-farm production of stock feed crops. This poses challenges both currently and in the post-2036 period, when derogations will be phased out.

In parallel, there is an ongoing lack of sufficiently detailed and timely published statistics on the volumes of organic seed produced, supplied and used in Ireland, as well as on derogation applications. The data is especially poor for the horticultural sector. This is hampering efforts to accurately plan for both the phasing-out of derogations and the future investment and

development required for the organic seed production sector as a whole. There are similar data-related issues affecting the accuracy of information on organic seed supply on the national OrganicXSeed database.

Recommendations to address these issues are made below under two headings:

- Guiding the development of a well-functioning and resilient organic seed production and supply system in Ireland.
- Ensuring the availability of regular and up-to-date data on organic seed supply and usage.

4.2.2 Guiding the development of a well-functioning and resilient organic seed production and supply system in Ireland

Ensuring a secure supply of organic seed is essential if the planned growth of the organic sector is to be achieved and sustained. This is particularly urgent given the phasing-out of derogations for the use of non-organic seed from 2036 onwards. Several stakeholders interviewed for this report noted the need for action at a national level to ensure that seed producers will be in a position to meet future demand and that organic farmers will have security of supply in relation to their organic seed needs. As mentioned in Section 1.2 and Section 3.4.1, the new national organic strategy contains only two minor references to seed issues. This is a critically serious omission, since, without a secure supply of seeds and plant reproductive material (seeds, tubers, cuttings and roots used for the reproduction of plants) for vegetable, fruit, forage and fodder crop producers, it will be difficult, if not impossible, for the strategic priorities and sectoral growth targets to be achieved. In the absence of any clear indication that organic seed issues are a policy priority, the following recommendation is made to help address this situation.

Recommendation 4.2.2(a): *Establish an Organic Seed Working Group to ensure the implementation of recommendations in this report and guide national policy action so that a secure future supply of organic seed is in place to enable organic sectoral growth targets to be met*

- A key function of this group will be to advise on [and steer] the infrastructure and funding required for the development of a robust and fit-for-purpose organic seed system in Ireland. This could include the development of an organic seed production strategy.
- A key element of such a strategy would be to guide the development of a roadmap for each of the main organic crops e.g. cereals, vegetables, grasses and multi-species, clover and legumes. Each roadmap would set out intermediate goals such as growth targets for each crop, associated seed demand, timelines for phasing out derogations, etc. This is essential information for seed producers, as they need to know how much they will need to invest and when.
- Potential members of the working include key stakeholders such as organic seed companies and suppliers based in Ireland, the organic certification bodies (OCBs), the Department of Agriculture, Food and the Marine, Teagasc, OGI, organic advisors, NGOs working in the organic seed area and interested organic farmers/growers.

- The working group could potentially be established as a sub-group of the Organic Strategy Forum. A similar sub-group was set up in 2022 to develop a digital organic hub, which was successfully delivered in September 2023 (Organic Trading Hub, 2024).
- The work of the group could also feed into the planned six-monthly reviews and any future revision of the new national organic strategy.

Box 1: UK Soil Association seed working groups

The Soil Association is a UK-based charity and is the UK's largest organic certification body. As part of its work, it has set up a range of seed working groups for arable, cereal, grass and forage crops, as well as seed potato and vegetable seeds. These groups include stakeholders such as the Department for Environment, Food and Rural Affairs, organic seed breeders and seed suppliers, organic certification bodies, business and farming sector representatives and buyers from large supermarkets.

These working groups aim to support producers by ensuring the availability of appropriate seed varieties. For example, its grass and forage working group meets annually to review non-organic seed authorisation data and discuss changes in organic regulations and market conditions. This group also facilitates the sharing of confidential information by seed companies on upcoming seed availability to complement the UK's own national OrganicXSeeds database. Its seed potato working group has also facilitated discussions between organic growers and supermarket chains on how best to ensure a market for the robust and high-yielding potato varieties preferred by growers but which may be less familiar to customers (Soil Association, 2016; LiveSeeding, 2024).



Box 2: OCA'S Global Seed Strategy

The Organic Cotton Accelerator (OCA) is a multi-stakeholder organisation working to support farmer prosperity through the creation of a transparent, resilient, and responsible organic cotton supply chain. Some of its founding partners include major textile organisations such as H&M, Kering and Inditex.

Its Global Seed Strategy contains four strategic pillars focused on boosting the development, commercial release and production of organic and non-GM cotton cultivars in countries such as India. These are:

Capacity building: supporting farmers and farm organisations to set up their own cultivar trials and identify which cultivar works best for them at a local level.

Joint market initiatives: coordinating the seed demand of organic cotton producers so that seed producers have a clear signal of seed demand and are incentivised to invest in seed production.

Advocacy: developing an environment where organic seed activities can thrive, by working with public institutions to support the coexistence between organic / non-GM and GM seed systems and highlight the need for organic seed and genetic diversity.

Seed knowledge management: ensuring clear means for the gathering and sharing of knowledge and best practice on organic cotton seed production and for collaboration between seed producers.

The OCA has also developed a guide on Participatory On-Farm Breeding of Organic Cotton and supports the Seeding the Green Future investment programme to develop a portfolio of diverse indigenous organic cotton cultivars tailored for local organic farming conditions in India (OCA, 2021).



4.2.3 Ensuring the availability of regular and up-to-date data on organic seed supply and usage

As outlined above and in Sections 3.1 and 3.3, the lack of accurate and timely data on volumes of organic seed demand, supply and usage is presenting challenges in terms of a lack of market certainty for seed producers and poor security of seed supply for organic farmers and growers. The following recommendations are suggested in order to address specific aspects of these issues.

Recommendation 4.2.3(a): *Expand current data collection on organic seed production, supply and usage demand*

- Data on volumes of organic seed actually used by growers and farmers is a key need in this regard but this is sensitive data and so it would not be appropriate for it to be collected via a public platform such as the OrganicXSeed database.
- In this regard, there is a need to identify the most practical and efficient means of collecting this data, which may require some kind of partnership between the Department of Agriculture, Food and the Marine and the organic certification and inspection bodies.
- Implementing this recommendation would support priority actions in the new national organic strategy regarding the need for more in-depth data collection as part of measures to improve market certainty to farmers (Department of Agriculture, Food and the Marine, 2024a, p.32). The availability of more and better-quality data also has the potential to deliver better value for money in terms of the quality of the Irish OrganicXSeed database and derogation reporting.

Recommendation 4.2.3(b): *Review Ireland's OrganicXSeed database to identify changes needed for it to function more effectively and maximise the use of organic seed by Irish producers.*

- As the competent authority for Ireland, the Dept. of Agriculture, Food and the Marine is likely to be best placed to initiate this work.
- Areas for improvement are likely to include ensuring that all relevant PRM and specific cultivars for varieties are included and that it aligns with all levels of the new EU-wide router database.
- Part of this work should also include ensuring that Ireland's organic seed sector is represented at all relevant discussions and events dealing with further development of the OrganicXSeed databases across Europe. This would include keeping up-to-date with the ongoing work of the LiveSeeding initiative and ensuring its research outputs and guidance on seed-related issues are made available in Ireland.
- This work will also support the production of more accurate and useful annual derogation reports.
- A useful example in this regard is the establishment by the UK Soil Association of a task force to ensure accurate information on seed availability on the UK's national organic seed database (LiveSeeding, 2024). Establishing a similar task force in Ireland could be one of the functions assigned to the Organic Seed Working Group proposed above.

Box 3: UK Soil Association seed task force

A useful example in this regard is the establishment by the UK Soil Association of a task force to ensure accurate information on seed availability on the UK's national organic seed database. The task force also aims to enable growers to alert the database authorities when the organic seed they require is not available so this can be addressed as quickly as possible (LiveSeeding, 2024).

**Recommendation 4.2.3(c): Improve the data collection and analysis of non-organic seed use derogations granted in Ireland so as to provide a more comprehensive and useful annual report**

- As outlined in Section 3.3, there is a need for more detailed statistics and analysis in the annual reports to identify why derogations are being sought and how reliance on non-organic seed can be reduced, especially when the derogation system ends in 2036.
- Ireland's derogation reporting also needs to be more closely aligned with EU Commission template and information requirements (LiveSeeding, 2024).
- The recommended upgrading of Ireland's OrganicXSeed database under 4.2.3(b) above could potentially support the collection of the additional derogation-related data required.
- Strong consideration should also be given to allocating the data collection and production of the annual report on derogations to an Ireland-based organisation with specific knowledge and experience of the Irish organic seed sector in order to address current data gaps.
- It will be necessary to ensure the allocation of sufficient financial resources to allow this expanded work to be carried out on an on-going basis.

4.3 Addressing the technical, economic and regulatory challenges of organic seed production

4.3.1 Summary of key issues

The requirements imposed by organic production standards can result in certain technical challenges, including lower yields, seed-borne pests and diseases, weed contamination, seed propagation and germination issues and higher labour requirements. In Ireland, weather conditions and weed contamination are particular challenges at all scales of organic production. However, a lack of organic seed and cultivars is currently impacting negatively on organic horticultural production and the improvement of supply consistency in Ireland (Irish Organic Association, 2021). There is little official recognition and insufficient expertise, capacity and investment in organic seed breeding and R&D across the board to provide the required new varieties, improve genetic variability and increase biodiversity potential.

There is also an urgent requirement to assess the extent to which current crop varieties available for the organic sector will cope with changing climatic and growing conditions and what new varieties will be needed. This in turn poses challenges for the amount and timing of investment needed in seed breeding and R&D. It also has implications for sources of heritage seed varieties, which are an important source of potentially useful plant traits that may be required for future growing conditions. However, there are currently only a few sources of such varieties available, as noted in Section 3.2.1.

The organic seed production sector in Ireland faces several economic and finance-related challenges, including higher production costs (especially of organic pre-basic seed) and relatively low levels of demand. Concerns have been expressed about the financial implications of the phasing out of derogations from 2036. The current system of subsidies for organic production is providing some support for organic seed producers and there is a desire for these – or some other form of financial support, such as buying contracts – to be continued. Smaller-scale seed producers are also having additional issues in relation to accessing suitable machinery and facilities. There are also regulatory challenges, in terms of ensuring compliance with the requirements of the organic certification bodies and with legislation governing royalties payable on the use of seed or other plant reproductive material to which plant breeders' rights apply.

4.3.2 Addressing technical challenges of organic seed production

As far as can be established, there are currently no research projects or breeding trials being conducted in Ireland specifically for organic varieties of seeds, and existing seed breeding funding appears to be solely for non-organic system requirements. This is a serious lack, as discussed in Section 3.4 above, especially in relation to specific challenges experienced by organic producers such as lower yields, higher labour requirements, seed-borne pests and diseases, weed contamination and seed propagation and germination issues.

As part of its strategic priority to boost skills and supports, the new national organic strategy states that resources will be allocated for research – especially farmer-led “living laboratories” - to improve organic farming practices and for the dissemination of research findings on

organic crop varieties (Department of Agriculture, Forestry and the Marine, 2024a, p.38) but there is no specific reference to organic seeds as part of this. In this regard, the following recommendations are made.

Recommendation 4.3.2(a): *Ensure funding is allocated for seed and plant breeding research and trials of organic crop varieties and that a work programme in this regard is developed for the relevant organisations.*

- The work could be incorporated into the current seed breeding work for mainstream crops carried out by organisations such as Teagasc.
- It is also important that commercial seed companies are encouraged to continue their investment in organic seed research and development, as discussed in 3.4.1 above.
- The proposed 'living laboratories' initiative in the new national organic strategy (Department of Agriculture, Forestry and the Marine, 2024a, p.11; p.39) could also include one specifically dedicated to organic seed production research.
- Specific elements which the research and trials need to address include the development of higher-yield varieties as well as breeding for improved pest and disease resistance.
- It is also essential that research and trials be carried out on trait selection for adaptability and resilience to changing climatic and growing conditions, as noted in Section 3.4.2.

Box 4: ÖMKi On-Farm Living Lab, Hungary

The ÖMKi initiative was set up in 2012 and is an on-farm research network which carries out a system of innovative experiments in partnership with Hungarian organic farmers on how new products, practices and technological innovations in organic agriculture perform under the diversity of everyday farming. It is operated by the Hungarian Research Institute of Organic Agriculture and participating farmers gain feedback directly from their own involvement. This creates a space for open innovation, product development and dynamic knowledge co-creation between farmers, research and other stakeholders of the value chains.

ÖMKi is also a member of the Horizon Europe-funded *Organic Yield Up* research project which runs from 2024 to 2028 involving 17 partners from 12 European countries, aimed at improving yields in organic cropping systems. As part of the project, ÖMKi will host one of 10 On-Farm Living Labs to provide testing, experimentation and demonstration sites for improving organic crop yields and productivity.

Website: <https://biokutatas.hu/en/research/improving-yields-in-organic-cropping-systems-organic-yields-up/>



4.3.2(b): Explore the feasibility of establishing a network connecting seed producers and farmers to provide for information exchange and mutual support on technical issues

- This recommendation would support the intention in the new national strategy to facilitate the growth of farmer-to-farmer and farmer-led initiatives (Department of Agriculture, Forestry and the Marine, 2024a, p.30; p.39).
- It would also support producers and farmers in building resilience ahead of time for dealing with emerging issues such as climatic challenges.
- As part of this, it would be useful to investigate whether there are any similar pan-European networks that Irish seed breeders and producers could join.
- The network could also be represented on the proposed new seed working group.

Box 5: Organic seed networks in the USA

In the United States, there are several initiatives to link organic seed producers and related businesses to provide for knowledge exchanges and mutual support. In the state of Oregon, the non-profit organisation Oregon Tilth works to increase collaboration and support between actors in the regional organic sector (Oregon Tilth, 2024). Also in Oregon is the partnership between Gathering Together Farm and other local organic farmers, artisan producers and restaurants (Small Farm News, 2012). At a local level, such networks can also facilitate the sharing of machinery between members.

Similarly, the Culinary Breeding Network works to build collaboration between organic plant breeders, vegetable and grain farmers, chefs and consumers. It organises various events across the US and beyond, to provide opportunities for stakeholders to share insights and actively engage with the development of resilient and flavourful vegetable and grain cultivars and varieties suited to organic systems (Culinary Breeding Network 2024).



Recommendation 4.3.2(c): Expand the amount of heritage seed and non-patented seed varieties available in Ireland in order to promote agrobiodiversity and farmer seed sovereignty.

Relevant actions to implement this recommendation are likely to include the following:

- Extend the new Teagasc trials on heritage seeds such as Emmer, Einkorn and Spelt for conventional production to include organic heritage varieties, with a particular focus on producing more crops for human consumption, improving food security and mitigating environmental stress.
- Provide the necessary financial and other resources required to increase the amount of genetic material available to producers and farmers in existing heritage seed banks.
- Promote on-farm agrobiodiversity, conservation of agricultural heritage and access to non-patented seeds by supporting the further development of commons-based seed systems such as public and community seed banks.

Box 6: Arche Noah heirloom seed saving association

Arche Noah is an Austria- and Brussels-based non-profit seed saving association founded in 1990. It has around 14,000 members, comprising gardeners and farmers from across Europe and currently conserves and disseminates about 5,500 endangered cultivated plants in its private seed bank. It runs a variety of seed-based seminars, workshops and events, ranging from basic seed-saving techniques to marketing of heirloom crop varieties.

Through its Farmers For Diversity initiative, it cooperates with organic farmers and producers to support the crop diversity market and also runs the Seed Guardians network, whereby hundreds of its members cultivate endangered varieties in their private gardens and on farms and provide seed to other seed savers, ensuring that plant diversity is managed through usage. It also engages in its own plant breeding research, using its collection of heritage varieties to develop new ones that are adapted to the needs of today's growers and farmers.



4.3.3 Addressing economic challenges

The new national organic strategy contains a key priority of supporting participation in organic farming, outlining several actions relating to economic challenges facing organic producers. These include grants to support investment in processing facilities, purchase of equipment, as well as the continuation of existing supports such as the TAMS 3 Organic Capital Investment Scheme and the Organic Farming Scheme payment for primary producers (e.g., organic farmers and growers). However, it is important to ensure that the particular needs of organic seed producers are recognised as part of these supports and so the following recommendations are made.

Recommendation 4.3.3(a): *Ensure that organic seed producers can access supports for the equipment and resources they require*

Organic seed producers can currently avail of the Organic Farming Scheme payments to grow crops for seed but require other support, which may require actions such as the following:

- Ensure the continuation of existing support schemes accessed by seed producers, such as the TAMS 3 Organic Capital Investment Scheme (OCIS) for equipment and the Organic Processors Investment Grant. An extension of equipment required for seed production should be made eligible under the OCIS.
- The provision of subsidies and/or the introduction of price premiums for the use of organic seed should be explored to encourage organic producers to opt for organic seed as their first choice. This would help to bridge the price gap that currently exists between conventional and organic seed in Ireland. The success of the Red Clover and Multispecies scheme in the last two years demonstrates how farmers can be incentivised to use organic seed (Department of Agriculture, Food and the Marine, 2024a).

- Provide short training courses for organic seed producers and seed-related organisations on what funding and other supports are available and how to apply for these. Similar examples include the Organic Farming Scheme Information Day for Horticultural Growers held in 2024 and funded by the National Organic Training Skillnet (CAP Network Ireland, 2024b).

Recommendation 4.3.3(b): *Ensure that smaller seed producers have sufficient affordable access to plant and seed testing facilities*

- While the new national organic strategy does note the need to ensure organic producers can access the necessary facilities (Department of Agriculture, Food and the Marine, 2024a, p.29), there is no mention of the particular challenges that organic seed producers may face.
- In this regard, it is important that the seed disease and pest testing facilities provided through the State Laboratory at Backweston can meet the needs of organic seed producers and farmers producing their own seed, where they may only have small amounts of plant material for testing.

4.3.4 Addressing regulatory challenges

As discussed in Section 3.3 above, the impending regulatory requirement to remove derogations by 2036 has implications for the ongoing availability of organic seed for organic farmers. This is something which many EU member states are focusing on; however, in Ireland most focus has been on expanding the sector to increase the land area under organic farming, as outlined in Section 1.1. In this context, the following recommendations are made:

Recommendation 4.3.4(a): *Assess the feasibility of establishing a non-derogation list of organic seed varieties.*

- The non-derogation list would include those varieties for which sufficient supply is deemed to be available and thus derogations for the use of non-organic versions of these should not be required.
- The OrganicXSeeds database currently provides the option to include such a non-derogation list.
- This approach has worked well in other member states and should be explored in the Irish context to see if it could increase the volume of organic seed produced here.
- Varieties can be temporarily removed from the non-derogation list if and when supplies become restricted and guidance on this could be provided by the proposed new producer network and seed working group.

Recommendation 4.3.4(b): *Improve knowledge and understanding among seed producers and farmers regarding their obligations under relevant legislation and regulations*

- This would include the payment of royalties for using seed varieties to which plant-breeders' rights apply (as outlined in Section 3.2.3) and could be done as part of the recommendations on seed-related training and education outlined in 4.4.2(c) below.

- It is also important to ensure ongoing information is available for organic producers about changes to legislative and regulatory requirements affecting organic seed production. One of the tasks of the proposed new seed working group could be to identify which organisation/s may be best placed to do this.

4.4 Addressing training, education and information needs

4.4.1 Summary of key issues

Given current and planned targets for the growth of the Irish organic sector, there is a need to address the current insufficient availability of training and education in both organic seed breeding and seed production. There is a particular lack of training in areas such as weed control, yield potentials and seed germination. Linked to this is the lack of mentors for new organic seed producers and a need to develop apprenticeships in seed-growing. In addition, there is a need for clear guidance and information for organic producers in relation to compliance with organic certification and inspection processes, as well as other legislative requirements.

4.4.2 Address seed-related training and education needs

While the new national organic strategy does support expanding the provision of training and education for the organic sector (Department of Agriculture, Food and the Marine, 2024a), it does not specifically mention organic seed-related issues. Given this, the following recommendations are made in order to ensure that seed-related training and education needs are met.

Recommendation 4.4.2(a): *All QQI level 5 and 6 organic farming programmes should include at least one module on organic seed production and usage.*

- To achieve this, new component modules at QQI Level 5 and 6 should be developed and offered that cover all stages of organic seed production and usage.
- Topics are likely to include seed germination, weed control, pest and disease identification, seed saving and post-harvest seed cleaning and storage techniques, seed legislation and regulation, etc.
- These new modules can subsequently be added to the QQI database and thus become part of certificate /and or diploma courses in horticulture offered by existing or new training providers.
- Implementing this recommendation will support the priority action on education and training programmes under Strategic Priority 6 of the new national organic strategy and also the identified need for ongoing training on organic farming techniques and regulations under priority action 2 of the new national organic strategy.

Recommendation 4.4.2(b): *Identify and support providers who are best-placed to deliver specialist training on seed breeding and production*

- As outlined at the start of section 4 above, there is a need for both formal and informal / farmer-led initiatives on organic seed breeding and production.
- In this regard, it will be important to support those small non-profit organisations working on organic seed issues in Ireland, especially in relation to organic vegetable and fruit seed production.

BOX 7: LiveSeeding training courses in organic seed breeding and production

The Liveseeding initiative has been developed from the EU Horizon-funded LIVESEED project and aims to foster the growth of the organic sector and transition towards more sustainable local food systems. One of its key goals is to improve the quality and availability of organic propagating material and it offers various training in organic seeds and breeding in this regard. Its training task force coordinates the provision of training in areas such as organic plant breeding, organic cultivar testing, high-quality organic seed production, organic seed regulation and policy and organic seed entrepreneurship.

These training events are targeted at various groups, including researchers, plant breeders, seed networks, organic farmers and growers, organic seed producers, third level students, national authorities and EU policy makers. For example, in 2023, there was a “Trainers’ training on Organic seed Quality” event to support knowledge transfer between practitioners. It also organises conferences and training days, as well as producing handbooks and other tools for practitioners.

A similar initiative is the Organic Seed Alliance in the USA which offers various training programmes for organic producers. These include teaching farmers how to conduct organic plant breeding trials on their own farms so they can adapt crops to changing climates, environmental conditions and market needs. It also allows farmers to maintain control over their seed while also helping to fill gaps in the organic seed supply. One example is their free online organic seed production course for students working or interning on farms which grow seed.



Recommendation 4.4.2(c): *Identify opportunities for workshops, conferences and knowledge exchange across the organic sector and beyond to further enhance / support training and education on seed breeding and production.*

- This would support the priority action on Industry Collaboration and Networking in the new national organic strategy (p.39).
- It also links with Recommendation 4.3.3(a) above, regarding training for producers on accessing financial and other supports.
- Such activities could also include actors such as supermarket chain buyers, where there can be insufficient understanding of why organic growers need to produce certain varieties that are more robust and higher-yielding but which may not be those most familiar to customers (as discussed in Section 4.1.2 above).
- There is also a need for general awareness-raising among organic producers of the importance of using organically-produced seed instead of non-chemically treated conventional seed, especially given consumer expectations in this regard and the need to maintain and build consumer trust in organic products, which is mentioned in the new national organic strategy (Department of Agriculture, Food and the Marine, 2024a, p.19; p.22)
- In a wider context, there is a need to carry out research on Irish organic producer attitudes to the use of organic seed and measure this against other EU countries in

order to identify what factors are constraining or enabling organic seed usage and how these could best be addressed.

Recommendation 4.4.2(d): *Ensure that existing and new entrant seed breeders and producers are included in the consideration of the proposed mentorship programme for the organic sector, as outlined in the new national organic strategy*

- The potential to link with organic mentorship programmes in countries such as the USA and Canada (see below) should also be explored, so that Irish seed producers can benefit from the long-standing expertise there.
- These actions could form part of the work programme for the proposed organic seed working group.

Box 8: Organic seed mentorship programmes in the USA and Canada

In Canada, the Ecological Farmers Association of Ontario (EFAO) runs a seed mentorship programme which links new seed growers with experienced seed grower mentors. The aim is to provide hands-on, personalised and timely training to farmers and growers seeking to enhance the quality, quantity and diversity of seeds grown on their farms and garden. It also offers a Farm Resilience Mentorship as part of its Farmers for Climate Solutions programme, providing access to experienced farmer mentors and a network of farmers to help producers adopt practices that reduce emissions and build resilience (Ecological Farmers Association of Ontario, 2024).

Similarly, the Organic Seed Alliance (OSA) in the USA runs a mentorship programme to connect organic seed farmers with students and interns participating in its organic seed production courses. These mentor seed growers provide support, feedback and advice on their seed growing experience and in planning for achieving personal and professional goals as a seed grower (Organic Seed Alliance, 2024).



Recommendation 4.4.2(e): *Explore how seed breeding and production issues may best be incorporated into organic apprenticeship programmes*

- The new national organic strategy encourages such programmes as a valuable source of hands-on learning for organic education and training (p.38).
- There is a need to review whether existing apprenticeship programmes such as the OGI's existing internship programme (which involves work placements on organic farms) could be expanded to include seed-related training or whether a new separate programme may be required to focus more specifically on seed production.
- Seed-related apprenticeships could also include farm visits to other European countries to avail of the expertise there.

5. Conclusion

It is evident from the above that the organic seed sector in Ireland currently faces a number of challenges and these are likely to intensify in the coming years unless sufficient measures to address them are put in place in a timely fashion. Overall, there is insufficient supply of organic seed to meet both current needs and likely future demand, given the continued growth of entrants to the organic sector. This is resulting in a high volume of seed imports and a reliance on derogations for the use of non-organic seed, with further pressure likely in the post-2036 period when such derogations will be phased out.

On a practical level, seed producers face technical challenges such as climatic conditions, and weed contamination, coupled with insufficient availability of cultivars bred specifically for organic production in general and Irish conditions in particular. Smaller-scale producers, who are responsible for most of the Irish-produced horticultural crop seed, face additional challenges in this regard. The relatively small size of the Irish organic seed market also poses an economic challenge for seed producers and suppliers at all scales.

One positive development has been the recent amendments voted on by the European Parliament to relax seed marketing rules to support smaller scale seed producers and this will potentially be of benefit to Irish organic seed producers. However, there are significant issues across the board with the lack of sufficiently detailed timely data on organic seed supply and usage, which is hampering the identification of a clear picture of the sector's needs. The lack of recognition of organic seed issues in the new National Irish Organic Strategy is a serious omission in this regard.

Recommendations have been outlined to address the challenges identified and these have been framed in the context of the wider need to transform seed systems and not just reform them, if we are to generate the levels of security, sustainability and resilience needed for the future. Relevant examples of best practice from other countries have been included to guide work on designing and implementing the recommendations made.

Overall, there is a need to shift from reform-focused thinking to more transformational approaches if a secure and sustainable organic seed system is to be developed in Ireland, recognising that the country, like others, is unlikely to become fully self-reliant on the seeds and other plant genetic resources required (Louwaars & Manicad, 2022). If fully implemented, the recommendations in this report can provide a solid foundation for developing such an approach in Ireland to support the organic sector as it continues to develop. However, this will require committed support and leadership over the longer term by all political parties. It will also require a recognition of the fundamental importance of seeds for our agricultural and food production sectors and the particular challenges that organic seed production involves.

"Seed is not just the source of life. It is the very foundation of our being."

- Vanadana Shiva

References

- Agriland (2023). Insight: Momentum building in the Irish organic sector. Available at: <https://www.agriland.ie/farming-news/insight-momentum-building-in-the-irish-organic-sector/> (accessed 7 May 2024).
- Aoun, M. (2023) Unlocking heirloom diversity: a pathway to bridging global challenges in modern apple cultivation. *Frontiers in Horticulture*, 2. <https://doi.org/10.3389/fhort.2023.1268970>
- Arche Noah (2017). *Our Hearts Beat for Diversity*. Available at: https://www.arche-noah.at/media/an_folder_politik_2017_en_final_web.pdf (accessed 1 September, 2024).
- Ashwood, L., A. Pilny, J. Canfield, M. Jamila, and R. Thomson. 2022. From Big Ag to Big Finance: a market network approach to power in agriculture. *Agriculture and Human Values* 39(4): 1421–1434. <https://link.springer.com/article/10.1007/s10460-022-10332-3>
- Batten, L., Plana Casado, M.J. and van Zeven, J. (2021). Decoding Seed Quality: A Comparative Analysis of Seed Marketing Law in the EU and The United States. *Agronomy*, 11(10), 2038. <https://doi.org/10.3390/agronomy11102038>.
- Bless, A., Davila, F. & Plant, R. (2023). A genealogy of sustainable agriculture narratives: implications for the transformative potential of regenerative agriculture. *Agriculture and Human Values*, 40, 1379–1397. <https://doi.org/10.1007/s10460-023-10444-4>
- Bruszik, A., Ozturk, E., Lazzaro, M. and Petitti, M. (2021). Boosting organic seed and breeding across Europe: recommendations for stakeholders and policymakers. LIVESEED Project report. Available at: https://www.liveseed.eu/wp-content/uploads/2021/08/BOOKLET_6_EN_V4.pdf (accessed 16 May, 2024).
- CAP Network Ireland (2024a). Irish Organic Sector Continues to Grow. Available at: <https://capnetworkireland.eu/irish-organic-sector-continues-to-grow/> (accessed 7 May, 2024).
- CAP Network Ireland (2024b). Horticultural Growers Information Day: A Knowledge-packed Event. <https://capnetworkireland.eu/horticultural-growers-information-day/> (accessed 1 October, 2024)
- Connor, D. (2008). Organic agriculture cannot feed the world. *Field Crops Research*, 106(2), 187–190. <https://doi.org/10.1016/j.fcr.2007.11.010>.
- Council of the European Union. (2007). Council Regulation (EC) No 834/2007: On organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91, European Union. Official Journal of the European Union, 2007 L 189/1.
- Crowder, D. W., & Reganold, J. P. (2015). Financial competitiveness of organic agriculture on a global scale. *Proceedings of the National Academy of Sciences*, 112(24), 7611–7616. <https://doi.org/10.1073/pnas.1423674112>
- Culinary Breeding Network (n.d.) Flavor Begins with Seed. Available at: <https://www.culinarybreedingnetwork.com/about-1> (accessed 4 October, 2024).

Department of Agriculture, Food and the Marine (2019). Review of Organic Food Sector and Strategy for its Development. Available at: <https://assets.gov.ie/101045/c4a42921-2530-470b-bda3-ac87229c53aa.pdf> (accessed 6 May, 2024).

Department of Agriculture, Food and the Marine (2023a) Organic Food and Farming Standards in Ireland Edition 2. Available at: <https://www.gov.ie/pdf/?file=https://assets.gov.ie/245377/60a2ff34-3194-4529-96bc-6c280bb66e4c.pdf#page=null> (accessed 20 May, 2024).

Department of Agriculture, Food and the Marine (2023b). Minister Hackett announces 12 local and national projects to support organics. Available at: <https://www.gov.ie/en/press-release/352f8-minister-hackett-announces-12-local-and-national-projects-to-support-organics/> (accessed 7 May, 2024).

Department of Agriculture, Food and the Marine (2023c) Public Consultation on the Draft National Organic Strategy up to 2030. Available at: <https://www.gov.ie/ga/comhairliuchan/a7e66-public-consultation-on-the-draft-national-organic-strategy-up-to-2030/> (accessed 6 May, 2024).

Department of Agriculture, Food and the Marine (2024A). *National Irish Organic Strategy: 2024 to 2030*. Available at: <https://www.gov.ie/pdf/?file=https://assets.gov.ie/305309/efc858ad-0c69-47ee-9c4a-73045c380168.pdf#page=null> (accessed 20 September, 2024).

Department of Agriculture, Food and the Marine (2024b). 2024 Multi Species Sward Measure. Available at: <https://www.gov.ie/en/service/4ccda-multi-species-sward-measure/> (accessed 21 May, 2024).

Department of Agriculture, Food and the Marine (2024c). Seed Certification Scheme and Plant Breeders' Rights. Available at: <https://www.gov.ie/en/collection/68b24-crops/> (accessed 13 May, 2024).

Döring, T.F., Bocci, R.M, Hitchings, R., Howlett, S., Edith, T., van Bueren, L., Pautasso, M., Raaijmakers, M. et al. (2012). The organic seed regulations framework in Europe. *Organic Agriculture*, 2(3), 173-183. <https://doi.org/10.1007/s13165-012-0034-7>.

Ecological Farmers Association of Ontario (2024). EFAO Seed Mentorship Program. <https://efao.ca/seed-mentorship/> (accessed 3 October, 2024).

Environmental Protection Agency (2020). *Ireland's Environment: An Integrated Assessment 2020*. Environmental Protection Agency, Wexford. Available at: https://www.epa.ie/publications/monitoring-assessment/assessment/state-of-the-environment/EPA_Irelands_Environment_2020.pdf (accessed 16 May 2024).

European Commission (2020a). *Farm to Fork Strategy: For a fair, healthy and environmentally-friendly food system*. EU Publications Office, Brussels. Available at: https://food.ec.europa.eu/document/download/472acca8-7f7b-4171-98b0-ed76720d68d3_en?filename=f2f_action-plan_2020_strategy-info_en.pdf (accessed 29 April, 2024).

European Commission (2020b). *EU Biodiversity Strategy for 2030: Bringing nature back into our lives*. EU Publications Office, Brussels. Available at: https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en (accessed 29 April, 2024).

European Commission (2021). Communication from the Commission to the European Parliament, the Council, The European Economic and Social Committee and the Committee of the Regions on an action plan for the development of organic production. COM/2021/141 final/2. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0141R%2801%29> (accessed 24 April, 2024).

European Commission (2023) *Action Plan for the Development of Organic Production. What has been achieved so far?* DG Agriculture and Rural Development. Available at: https://agriculture.ec.europa.eu/document/download/a400dd14-572a-41ed-86e5-46e84f8a4e0f_en?filename=organic-action-plan-report-sept23_en.pdf (accessed 8 May, 2024).

European Parliament & European Council (2018). Regulation (EU) 2018/848 of 30 May 2018 concerning organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007. Official Journal of the European Union, L150, 1–92. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.150.01.0001.01.ENG

European Commission (2021). Commission Implementing Regulation (EU) 2021/1165 of 15 July 2021 authorising certain products and substances for use in organic production and establishing their lists. C/2021/5149, OJ L 253, 16/07/2021, p. 13–48. Available at: <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32021R1165> (accessed 13 May, 2024).

Eurostat (2024). Organic Farming Database. Available at: <https://ec.europa.eu/eurostat/data/database> (accessed 20 May, 2024).

FAO (ed.). (2018). *Building climate resilience for food security and nutrition. The State of Food Security and Nutrition in the World 2018*. Food & Agriculture Organisation, Rome.

FIBL and IFOAM (2023) *The World of Organic Agriculture: Statistics and Emerging Trends 2023*. Organic World. Available at: <https://www.organic-world.net/yearbook/yearbook-2023/contents/download.html> (accessed 13 May, 2024).

Foresight (2011). *The future of food and farming: Challenges and choices for global sustainability – final project report*. Government Office for Science. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/288329/11-546-future-of-food-and-farming-report.pdf (accessed 20 May, 2024).

GAIA Foundation UK (2024). www.gaiafoundation.org/about-us/ (accessed 24 May, 2024).

Gathering Together Farm (2012). Building community through food and partnerships: Gathering Together Farm Part 1. Available at: <https://smallfarms.oregonstate.edu/smallfarms/building-community-through-food-and-partnerships-gathering-together-farm-part-1> (accessed 17 September, 2024).

Government of Ireland (2000). Statutory Instrument No. 493/2000 - Plant Varieties (Farm Saved Seed) Regulations, 2000. Government Publications Office, Dublin. Available at: <https://www.irishstatutebook.ie/eli/2000/si/493/made/en/print> (accessed 14 May, 2024).

Government of Ireland (2007). Statutory Instrument No 273/2007 - European Communities (Protection of Plant Variety Rights) Regulations, 2007. Government Publications Office, Dublin.

Available at: <https://www.irishstatutebook.ie/eli/2007/si/273/made/en/print> (accessed 14 May, 2024).

Griffin, D., Bourke, L., Mullins, E., Hennessy, M., Phelan, S., Kildea, S. and Milbourne, D. (2022). Potatoes in Ireland: Sixty years of potato research and development, market evolution and perspectives on future challenges. *Irish Journal of Agricultural and Food Research*, 61(1), 184-200. <https://doi.org/10.15212/ijafr-2020-0144>.

Groot, S.P.C., van der Wolf, J.M., Jalink, H., Langerak, C.J., & van den Bulk, R.W. (2004). Challenges for the production of high-quality organic seeds. In *Seed Testing International. ISTA News Bulletin*, 127, 12-15. Available at: <https://research.wur.nl/en/publications/challenges-for-the-production-of-high-quality-organic-seeds> (accessed 28 August, 2024).

Hickey, L. (2024). DAFM: Over 50,000t of organic feed needed next winter. Agriland website. Available at: <https://www.agriland.ie/farming-news/dafm-over-50000-tonnes-of-organic-feed-needed-next-winter/> (accessed 7 May, 2024).

Hubbard, K., Zystro, J. and Wood, L. (2022). *State of Organic Seed 2022*. Organic Seed Alliance, Washington State. Available at: <https://stateoforganicseed.org/state-of-organic-seed-2022/#understanding-the-needs-of-organic-seed-growers-and-companies> (accessed 13 May, 2024).

IFOAM Organics International (2008). Definition of Organic Agriculture. IFOAM-Organics International. Available at: <https://www.ifoam.bio/why-organic/organic-landmarks/definition-organic> (accessed 21 May, 2024).

IFOAM Organics International 2011 The use of Organic Seed and Plant Propagation Material in Organic Agriculture. IFOAM-Organics International. https://www.ifoam.bio/sites/default/files/2020-03/position_seeds.pdf

IOA and Organic Farming Trust (2023). *Organic Food and Farming Standards in Ireland. Edition 2.03* <https://www.irishorganicassociation.ie/wp-content/uploads/Organic-Food-And-Farming-Standards-Ireland.pdf> (accessed 1 October, 2024)

Ingram, J., Zurek, M., Sykes, R., and O’Kane, E. (2019). Exploring the resilience of the UK food system in a global context. Global Food Security, UK. Available at: <https://www.foodsecurity.ac.uk/publications/exploring-the-resilience-of-the-uk-food-system-in-a-global-context.pdf> (accessed 7 may, 2024).

Irish Organic Association (2021). Maximising Organic Production Systems European Innovation Partnership (MOPS EIP) Project 2018-2021 Final Report. Available at: <https://www.irishorganicassociation.ie/wp-content/uploads/MOPS-Report-December-2021.pdf> (accessed 7 May, 2024).

Irish Organic Association (2023). Ireland’s Strategy for Organics and the New Organic Trading Hub. *Organic Matters Podcast*, Season 2. Available at: <https://www.youtube.com/watch?v=hZP8XrmwKQk> (accessed 2 September, 2024).

Irish Seed Savers Association. (n.d.) *About Us*. Available at: <https://irishseedsavers.ie/about/> (accessed: 29 August 2024.)

- Irish Seed Savers Association (2024). Seed To Seed course. <https://irishseedsavers.ie/2022/09/22/seed-to-seed-two-year-intermediate-seed-saving-course/>
- Irish Seed Savers Association. (n.d.) *About Us*. Available at: <https://irishseedsavers.ie/about/> (accessed: 29 August 2024).
- Jones, S. K., Estrada-Carmona, N., Juventia, S. D., Dooloo, M. E., Laporte, M.-A., Villani, C. & Reman, R. (2021). Agrobiodiversity Index scores show agrobiodiversity is underutilized in national food systems. *Nature Food* 2(9), 712–723. <https://doi.org/10.1038/s43016-021-00344-3>.
- Kliem, L. and Sievers-Glotzbach, S. (2021). Seeds of resilience: the contribution of commons-based plant breeding and seed production to the social-ecological resilience of the agricultural sector. *International Journal of Agricultural Sustainability*, 20(4), 595-614. <https://doi.org/10.1080/14735903.2021.1963598>
- Kniss, A. R., Savage, S. D., & Jabbour, R. (2016). Commercial crop yields reveal strengths and weaknesses for organic agriculture in the United States. *PLoS One*, 11, e0161673. <https://doi.org/10.1371/journal.pone.0161673>.
- Lammerts van Bueren, E.T., Hulscher, M., Haring, M., Jongerden, J. Van Mansvelt, J.D., Den Nijs, A.P.M. and Ruivenkamp, G.T.P. (1999). Sustainable Organic Plant Breeding – A Vision, Choices, Consequences and Steps, Louis Bolk Institute, Driebergen, NL.
- Lammerts van Bueren, E.T., Struik, P.C. and Jacobsen, E. (2002). Ecological concepts in organic farming and their consequences for an organic crop ideotype. *NJAS – Wageningen Journal of Life Sciences*, 50(1), 1-26. [https://doi.org/10.1016/S1573-5214\(02\)80001-X](https://doi.org/10.1016/S1573-5214(02)80001-X).
- LiveSeed (2021). New router database connects Member States' organic seed databases. Available at: https://www.liveseed.eu/wp-content/uploads/2021/03/liveseed_comm_router-database_PRESS-RELEASE.pdf (accessed 30 September, 2024)
- LiveSeeding (2023) Trainers' training on organic seed quality. <https://liveseeding.eu/trainings-summer-school/> (accessed 23 September, 2024).
- LiveSeeding (2024). Engaging Insights Shared at LiveSeeding Webinar on Organic Seed and Planting Material Databases. Available at: <https://liveseeding.eu/engaging-insights-shared-at-liveseeding-webinar-on-organic-seed-and-planting-material-databases/> (accessed 19 September, 2024).
- Louwaars, N.P. and Manicad, G. (2022). Seed systems Resilience - An Overview. *Seeds*, 1(4), 340-356. <https://doi.org/10.3390/seeds1040028>.
- Lundkvist, A. and Verwijst, T. (2011). Weed biology and weed management in organic farming. In R. Nokkoul (Ed.) *Research in Organic Farming*, Intech Open Publishing, Croatia. <https://doi.org.10.5722/31757>.
- Merfield, C. N. (2012). Problems and progress for organic seed production. *Agronomy New Zealand* 42, 89-102. Available at: <https://www.agronomysociety.org.nz/page/321804> (accessed 7 May, 2024).

Monier-Dilhan S. and Bergès F. (2016). Consumers' motivation driving organic demand: between self-interest and sustainability. *Agricultural and Resource Economics Review*, 45(3): 522–538.

<https://doi.org/10.1017/age.2016.6>

Nuijten, E., Messmer, M.M. and van Bueren, E.T.L. (2016). Concepts and strategies of organic plant breeding in light of novel breeding techniques. *Sustainability*, 9:18.

<https://doi.org/doi:10.3390/su9010018>.

Nuijten, E. (2021). Breeding for quality: Lessons learned on three vegetable crops. In: International Conference on BREEDING AND SEED SECTOR INNOVATIONS FOR ORGANIC FOOD SYSTEMS By EUCARPIA Section Organic and Low Input Agriculture jointly with LIVESEED, BRESOV, ECOBREED, FLPP projects and ECO-PB, 8 – 10 March 2021, Institute of Agricultural Resources and Economics, Latvia, pp.67-68. Available at: https://orgprints.org/id/eprint/39763/1/EUCARPIA_2021_Abstract_e-Book_LF.pdf (accessed 15 May, 2024).

Nyochembeng, L.M. (2021). Enhancing Seed Health for Organic Vegetable Production Systems: Challenges and Opportunities. *Journal of Agricultural Science* 13(12). 35-42.

<https://doi.org/10.5539/jas.v13n12p35>

O'Brien, A. (2024). Organics Series: 1,000 farmers expected to join scheme this year. Agriland website. Available at: <https://nginx.agriland.ie/farming-news/1000-farmers-expected-to-join-organic-scheme-this-year/> (accessed 7 May, 2024).

O'Brien, D. (2024) Seed shortages compound potato growers' woes. *Irish Farmers Journal*, 10 April, 2024. Available at: <https://www.farmersjournal.ie/news/news/seed-shortages-compound-potato-growers-woes-813106> (accessed 23 April, 2024).

O'Donovan, T. (2020). Across Muir Éireann. SeedWorld website:

<https://www.seedworld.com/europe/2020/02/21/across-muir-eireann/> (accessed 8 May, 2024).

ÖMKi (2024). Improving yields in organic cropping systems: Organic Yields Up.

<https://biokutatas.hu/en/research/improving-yields-in-organic-cropping-systems-organic-yields-up/>

Open Source Seed Initiative (2024). The Open Source Seed Initiative. Available at:

<https://osseeds.org/> (accessed 17 May, 2024).

Oregon Tilth (2024). Increasing collaboration, support and investment in organics. Available at:

<https://tilth.org/about/> (accessed 4 October, 2024).

Organic Seed Alliance (2018). The Growers Guide to Conducting On-farm Variety Trials. Available at:

https://seedalliance.org/wp-content/uploads/2018/02/Growers-guide-on-farm-variety-trials_FINAL_Digital.pdf (accessed 23 September, 2024)

Organic Seed Alliance (2022) Organic Seed Production Online Course. <https://seedalliance.org/2022-organic-seed-production-online-course/> (accessed 25 September, 2024).

Organic Seed Alliance (2024). Seed Mentor Requirements and Expectations.

<https://seedalliance.org/seed-mentor-requirements-and-expectations/> (accessed 3 October, 2024).

Organic Trading Hub (2024). Website: <https://organictradinghub.ie/about-us/#> (accessed 7 May, 2024).

Orsini, S. (2021). Organic seed use in the EU: A survey of organic farmers from across Europe. ORC Factsheet no. 4. Available at: <https://www.organicresearchcentre.com/wp-content/uploads/2021/01/4.-Organic-seed-use-in-the-EU.pdf> (accessed 17 May, 2024).

Orsini, S., Padel, S., Solfanelli, F., Costanzo, A. and Zanolli, R. (2019). Report on relative importance of factors encouraging or discouraging farmers to use organic seed in organic supply chains. LIVESEED Project report. Available at: https://www.liveseed.eu/wp-content/uploads/2019/09/LIVESEED-D4.1-Report-on-relative-importance-of-factors-encouraging-or-discouraging-farmers-to-use-organic-seed-in-organic-supply-chains.Cpdf_.pdf (accessed 16 May, 2024).

Orsini, S., Costanzo, A., Solfanelli, F., Zanolli, R., Padel, S., Messmer, M.M., Winter, E. & Schaefer, F. (2020). Factors Affecting the Use of Organic Seed by Organic Farmers in Europe. *Sustainability*, 12, 8540. <https://doi.org/10.3390/su12208540>.

Padel, S.; Orsini, S.; Solfanelli, F. & Zanolli, R. (2021) Can the Market Deliver 100% Organic Seed and Varieties in Europe? *Sustainability* 13:10305. <https://doi.org/10.3390/su131810305>

Petitti, M., Ortolani, L., Schäfer, F. & Messmer, M. (Eds.) (2019). The state of organic seed in Europe. LIVESEED project report. Available at: https://www.liveseed.eu/wp-content/uploads/2019/12/FNL-FNL-Web-Interactive-NOV19-Booklet2-LIVESEED_web.pdf (accessed 8 May, 2024).

Pimbert, M. (2022) Introduction: Thinking About Seeds. In Y. Nishikawa & M. Pimbert (eds.), *Seeds for Diversity and Inclusion: Agroecology and Endogenous Development*, Palgrave Macmillan, Switzerland, pp.1-20. https://doi.org/10.1007/978-3-030-89405-4_1

Ponisio, L. C., M'Gonigle, L. K., Mace, K. C., Palomino, J., De Valpine, P. & Kremen, C. (2015). Diversification practices reduce organic to conventional yield gap. *Proceedings of the Royal Society B: Biological Sciences*, 282(1799): 20141396. <https://doi.org/10.1098/rspb.2014.1396> .

Quinn-Mulligan, H. (2022). Every core element of the food supply chain is affected by the war in Ukraine. *The Irish Times*, 4th March, 2022. <https://www.irishtimes.com/news/ireland/irish-news/every-core-element-of-the-food-supply-chain-is-affected-by-the-war-in-ukraine-1.4818483> (accessed 29 April, 2024).

Raaijmakers, M. & Schäfer, F. (2019). Report on Political Obstacles and Bottlenecks on the Implementation of the Rules for Organic Seed in the Organic Regulation. LIVESEED Project Report. Available at: https://www.liveseed.eu/wp-content/uploads/2019/10/LIVESEED_D1.9_M1.9_Political_Obstacle_Report_FINAB.pdf (accessed 8 May, 2024).

Röös E., Mie A., Wivstad M., Salomon E., Johansson B., Gunnarsson S., et al. (2018). Risks and opportunities of increasing yields in organic farming: A review. *Agronomy for Sustainable Development*, 38, 14. <https://doi.org/10.1007/s13593-018-0489-3>.

Sanchez Marano, S. (2024). Parliament wants to ease seed marketing rules for conservation efforts. *Euractiv agrifood news*, 24 April, 2024. Available at: <https://www.euractiv.com/section/agriculture->

[food/news/parliament-wants-to-ease-seed-marketing-rules-for-conservation-efforts/](#) (accessed 8 May, 2024).

Schipanski, M. E., MacDonald, G. K., Rosenzweig, S., Chappell, M. J., Bennett, E. M., Kerr, R. B., Blesh, J., Crews, T., Drinkwater, L., Lundgren, J. G., & Schnarr, C. (2016). Realizing resilient food systems. *BioScience*, 66(7), 600–610. <https://doi.org/10.1093/biosci/biw052>

Seed Sovereignty (2024). Seeding Tomorrow. <https://www.seedsovereignty.info/seeding-tomorrow/> (accessed 21 May, 2024).

Seekell, D., Carr, J., Dell'Angelo, J., D'Odorico, P., Fader, M., Gephart, J., Kummu, M., Magliocca, et al. (2017). Resilience in the global food system. *Environmental Research Letters*, 12(2), 1–10. <https://doi.org/10.1088/1748-9326/aa5730>

Sievers-Glotzbach, S., Tschersich, J., Gmeiner, N., Kliem, L. & Ficiciyan, A. (2020). Diverse Seeds – Shared Practices: Conceptualizing Seed Commons. *International Journal of the Commons* 14(1), 418–438. <https://doi.org/10.5334/ijc.1043>

Sinclair, K., Curtis, A., Mendham, E., & Mitchell, M. (2014). Can resilience thinking provide useful insights for those examining efforts to transform contemporary agriculture? *Agriculture and Human Values*, 31(3), 371–384. <https://doi.org/10.1007/s10460-014-9488-4>

Slater, S., Baker, P. and Lawrence, M. (2022). An analysis of the transformative potential of major food system report recommendations. *Global Food Security*, 32: 100610. <https://doi.org/10.1016/j.gfs.2022.100610>

Small Farm News (2012) Building Community Through Food and Partnerships: Gathering Together Farm, Part 2. Available at: <https://smallfarms.oregonstate.edu/smallfarms/building-community-through-food-and-partnerships-gathering-together-farm-part-1> (accessed 1 October, 2024).

Soil Association (2016) Supporting farmers and the grass seed sector. <https://www.soilassociation.org/news/2016/june/30/organic-seed-working-group/>

Soil Association (2023). *Republic of Ireland: Annual Non-Organic Seed Authorisation Report for 2023*. Report prepared for the Department of Agriculture, Food and the Marine. Available at: https://ie.organicxseeds.com/_Resources/Persistent/5/9/a/3/59a3076606ba200e0de3296cb87ca2f9dd220ebd/2022%20Ireland%20Non-organic%20Seed%20Authorisations%20-%20REPORT%20FINAL.pdf (accessed 11 May, 2024).

Soil Association (2024). *Republic of Ireland: Annual Non-Organic Seed Authorisation Report for 2023*. Report prepared for the Department of Agriculture, Food and the Marine. Available at: https://ie.organicxseeds.com/_Resources/Persistent/4/f/f/b/4ffb5f284229b3f9a79e99bd57e2f3bec43875ad/2023%20Ireland%20Non-organic%20Seed%20Authorisations%20-%20REPORT.pdf (accessed 29 April, 2024).

Solfanelli, F., Ozturk, E., Orsini, S., Schäfer, F., Messmer, M. and Zanolli, R. (2020). The EU organic seed sector – statistics on organic seed supply and demand. LIVESEED, Università Politecnica delle Marche, Italy. Available at: https://www.liveseed.eu/wp-content/uploads/2020/11/Solfanelli-et-al.-2020-the-EU-organic-seed-sector_17_11_20.pdf (accessed 25 April, 2024).

Solfanelli, F., Emel Ozturk, E., Orsini, S., Freya Schafer, F. & Zanolli, R. (2022a). Improving the quality of national organic seed databases to increase the use of organic seed and propagation materials in Europe. *Computers and Electronics in Agriculture*, 198:107006.

<https://doi.org/10.1016/j.compag.2022.107006>

Solfanelli, F., Ozturk, E., Dudinskaya, E. C., Mandolesi, S., Orsini, S., Messmer, M., Naspetti, S., Schäfer, F., Winter, E., and Zanolli, R. (2022b). Estimating supply and demand of organic seeds in Europe using survey data and MI techniques. *Sustainability*, 14, 10761. <https://doi.org/10.3390/su141710761>.

Tendall, D. M., Joerin, J., Kopainsky, B., Edwards, P. J., Shreck, A., Le, Q. B., Kruetli, P., Grant, M., & Six, J. (2015). Food system resilience: Defining the concept. *Global Food Security*, 6, 17–23.

<https://doi.org/10.1016/j.gfs.2015.08.001>

Thoreau, C. (2011). Opportunities and constraints to seed sovereignty for organic vegetable farmers in British Columbia. M.A. thesis, University of British Columbia, Vancouver. Available at:

<https://open.library.ubc.ca/soa/cIRcle/collections/ubctheses/24/items/1.0406191> (accessed February 2024).

Urruty, N., Tailliez-Lefebvre, D., & Huyghe, C. (2016). Stability, robustness, vulnerability and resilience of agricultural systems. A review. *Agronomy for Sustainable Development*, 36(1), 15.

<https://doi.org/10.1007/s13593-015-0347-5>

Vernooy, R., Mulesa, T.H., Gupta, A., Jony, J.A., Koffi, K.E., Mbozi, H., Singh, P.B. et al. (2020) *Development in Practice*, 30(5), 561–574 <https://doi.org/10.1080/09614524.2020.1727415>

Walthall, B., Vicente-Vicente, J.L., Friedrich, J., Piorr, A. & Lopez-García, D. (2024). Complementing or co-opting? Applying an integrative framework to assess the transformative capacity of approaches that make use of the term agroecology. *Environmental Science and Policy* 156: 103748.

<https://doi.org/10.1016/j.envsci.2024.103748>

Welbaum, G.E. (2024). *Vegetable Seeds: Production and Technology*. Cabi Digital Library.

<https://doi.org/10.1079/9781789243260.0000>.

Wilbois, K.-P., & Schmidt, J. E. (2019). Reframing the debate surrounding the yield gap between organic and conventional farming. *Agronomy*, 9(2), 82. <https://doi.org/10.3390/agronomy9020082>.

Winge, T. (2015). Seed Legislation in Europe and Crop Genetic Diversity. In E. Lichtfouse (Ed.) *Sustainable Agriculture Reviews*, Volume 15, Springer International Publishing Switzerland, pp.1-64.

https://doi.org/10.1007/978-3-319-09132-7_1.

Zentner, R.P., Basynat, P., Brandt, S.A., Thomas, A.G., Ulrich, D., Campbell, C.A., Nagy, et. al. (2011). Effects of input management and crop diversity on economic returns and riskiness of cropping systems in the semi-arid Canadian Prairie. *Renewable Agriculture and Food Systems* 26, 208–223.

<https://doi.org/10.1017/S1742170510000591>.