

Research data and solutions for the development of organic production in Finland

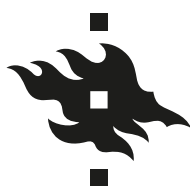
**- Finnish Organic Research Institute's
research strategy for 2021-2024**





Contents

1. Introduction	5
Organic research is needed in society	6
Strategies of background organisations as the basis of preparations	8
2. Research fields	10
2.1. Organics in the future	12
2.2. Organic primary production	14
2.3. Environmental impact of organic production	19
2.4. Organic food and nutrition	22
2.5. Organics in society and on the market	24
3. Interdisciplinary research as a goal	27
4. Co-creation	28
5. Dissemination and communication of research data	29
6. Sources	30



UNIVERSITY OF HELSINKI



Cover photo Risto Musta **Edited by** Sari Autio and Sari Iivonen
Graphic Design KMG Turku Oy **ISBN** 978-951-51-6979-2



” *Organic production differs from conventional agricultural production in that it is based on production rules laid down in the EU regulation on organic production and labelling of organic products.*

1. Introduction

According to regulation (EU) 2018/848 on organic production and labelling of organic products, organic production is an overall system of farm management and food production that combines best environmental and climate action practices, a high level of biodiversity, the preservation of natural resources and the application of high animal welfare standards and high production standards in line with the demand of a growing number of consumers for products produced using natural substances and processes.

Organic production thus plays a dual societal role, where, on the one hand, it provides for a specific market responding to consumer demand for organic products and, on the other hand, it delivers publicly available goods that contribute to the protection of the environment and animal welfare, as well as to rural development and social sustainability.

Organic production differs from conventional agricultural production in that it is based on production rules laid down in the EU regulation on organic production and labelling of organic products. In Finland, organic producers are committed to adhering to the control of organic production as coordinated by the Finnish Food Authority, and they can use the EU organic label in their products. According to the organic production conditions, the use of synthetic crop protection agents and inorganic fertilisers, for example, is not permitted. Furthermore, organic domestic animals must be able to graze, and they must be fed using organic feed. In the processing of food products, strict restrictions have been imposed on the use of additives and processing aids, as well as chemically produced synthetic raw materials.



Organic research is needed in society

Organic research is needed to support the development of organic production within the scope of the organic certification system and to raise the awareness of consumers of organic production standards and methods, so that consumers can make informed decisions. When considering organic research, it is important to develop solutions in close cooperation with all key stakeholders in the organic food value chains, especially with farmers and advisory service providers that take local conditions into consideration.

The Finnish Organic Research Institute (FORI) is a joint multidisciplinary researcher and expert network of the Natural Resources Institute Finland (Luke) and the University of Helsinki which supports the development of Finnish organic production. It started operating in 2013.

FORI prepared Finland's national organic research programme for 2014–2018 as part of the implementation of the national

organic development programme (Nuutila et al. 2014). As the programme described the previous development of organic research programmes in Finland in great detail, it is not necessary to examine it any further in this strategy. The research programme originated from the needs for research identified and prioritised in business life. However, no permanent funding was separately granted for the research programme coordinated by FORI in the organic development programme,

” *The aim is to direct research resources at key questions considering the development of organic production in Finland.*

Photo: Erkki Makkonen

and research projects were funded to a varying degree using different instruments, provided that the needs for organic research matched the goals of different funders.

There has been a growing demand for organic research in society. As an indication, the volume of funding granted for organic research conducted by FORI's researcher network has increased for several years now.

Prime Minister Antti Rinne's Government programme 2019 "Osallistava ja osaava Suomi – sosiaalisesti, taloudellisesti ja ekologisesti kestävä yhteiskunta" (Engaging and competent Finland – a socially, economically and ecologically sustainable society) states that funding for FORI needs to be strengthened and stabilised. This statement enables FORI to strengthen and stabilise its coordination and to allocate more permanent resources for the production and communication of organic research data.

The goal of this research strategy is to **prioritise the needs for organic research in Finland during the next few years**. This prioritisation is necessary due to the scarcity of research funding, challenges in the sustainability of the food system and the rapid growth of organic production.

The aim is to direct research resources at key questions considering the development of organic production in Finland in the thematic areas of FORI's research, not forgetting internationally high-quality basic research. It should be remembered that organic research is also conducted in research and educational institutes other than Luke and the University of Helsinki. This means that not all organic research conducted in Finland is coordinated by FORI. Organic research in Finland also responds to global research questions and demands.



Photo: Risto Musta

Strategies of parent organisations as the basis of preparations

FORI's coordination unit has prepared the revision and prioritisation of research needs in cooperation with the researcher and expert network. The preparation of FORI's research strategy has involved the steering group, the scientific advisory committee and stakeholders. At the end of 2019 and at the beginning of 2020, a survey was conducted for stakeholders, producing 60 responses. All this material has been used in the revision of the research strategy.

Luke's strategy for 2020–2025 (Luke 2020) focuses on four broad strategic goals and focus areas: a climate-smart carbon cycle, a bioeconomy able to adapt and recover, profitable and responsible primary production, and the circular bioeconomy.

Key elements of the research topics raised in FORI's stakeholder survey and during researcher workshops intersect these themes. Organic research significantly increases scientific understanding to resolve societal challenges in these sectors.

The University of Helsinki's strategy also guides FORI's research activities. During the University of Helsinki's strategy period for 2021–2030, research and teaching will draw inspiration from the following themes: a meaningful life, human wellbeing and a healthy environment, a humane and fair world, a sustainable and viable future for our globe, and a universe of ideas and opportunities. These themes will spur collaboration between fields and disciplines and renew research and learning. Collaboration will require insightful discipline-specific expertise, and interdisciplinary cooperation will lead to novel research directions. The themes not only promote collaboration, but also inspire research and teaching that seek solutions to major global problems (University of Helsinki 2020). Specialists in FORI's researcher network have a lot to offer to organic university-level education and research to improve the sustainability of the food system in line with these themes.

The European Technology Platform for Organic food and farming (**TP Organics**) is one of the forty research network-based knowledge and innovation communities recognised officially by the European Commission. Its goal is to strengthen research and innovation for sustainable food production and consumption based on organics and agroecology in the EC states. TP Organics stresses that research funding from the EU's Horizon Europe instrument

should be directed at themes that have a significant impact on the implementation of the EU's policy goals, the **European Green Deal** (EC 2019) and the Farm to Fork Strategy (EC 2020b) in particular, by producing information about themes related to organic production and agroecology (TP Organics 2020). Along with a number of other European organisations, FORI participated in the preparation of the organic research strategy of TP Organics (Barabanova & Moeskops 2019), the aim of which is to have an impact on the allocation of funding under the **Farm to Fork Strategy**. European organic farming is one of the leading themes in the Farm to Fork Strategy aimed at climate change mitigation, the reduction of the environmental impact of agriculture and the protection of biodiversity (EC 2019).

Of the impact goals set in the 2030 strategy of **the Ministry of Agriculture and Forestry**, the improved competitiveness of a responsible and renewing food system, a renewing and sustainable natural resources economy as a replacement for non-renewable raw materials and energy sources, and diverse business activities in the countryside set guidelines for FORI's research strategy (Ministry of Agriculture and Forestry 2019).

The prioritisation of research also aims to respond to the **UN's Sustainable Development Goals** (UN 2020).



2. Research fields

In addition to FORI's four research fields – organic primary production, environmental impact, food and nutrition, and society and markets – the research strategy presents organics in the future as a new intersecting research field. Key research themes related to these research fields are presented in more detail in the following subsections. Research themes can also be grouped into broader research areas. These are presented in the following subsections in the light of a few examples.

The organic research themes intersect the strategic focus areas of parent organisations in a multidisciplinary way, and they can be studied broadly from the perspectives of different scientific fields. As many of the research themes are closely linked with topics in several research fields, the categorisation of the research themes under a single research field or strategic focus area simplifies the description of research problems unnecessarily. However, the presentation has been simplified to avoid repetition.

Organics in the future, the all-encompassing theme at the core of organic research, consists of ingredients from all research fields and strategies (Graph 1). The fourth theme of the University of Helsinki's strategy (a universe of ideas and opportunities) represents organic research, which seeks innovative solutions that intersect all themes and research fields (Graph 2).

Research fields in FORI's research strategy



2.1

Organics in the future



2.2

Organic primary production



2.3

Environmental impact of organic production



2.4

Organic food and nutrition



2.5

Organics in society and on the market

2.1. Organics in the future

Organics in the future is a separate leading theme that intersects and supports all research fields. During the upcoming 2021–2024 strategy period, organic enterprises will face major changes, to which they need to adapt in their activities. The application of regulation (EU) 2018/848 on organic production and labelling of organic products, which defines the principles of organic production, will begin and the Common Agricultural Policy (CAP), which guides the agricultural subsidy system, will be revised during this strategy period. As a result, there will be significant changes in the operating environment in the near future, which is why it is sensible to steer organic research and development more strongly towards the future.

Organics can be seen as an important driver for changes in sustainability (Eyhorn et al. 2019). The opportunities of organic production to provide means for climate change mitigation and adaptation to changing conditions are key questions considering the future of organic sector. The sustainability of organic production must be developed continuously so that its promises of added value towards consumers and society can be kept.

Research fields related to organics in the future are characteristically interdisciplinary, why a strict field-specific division may not be sensible (see Graph 2).

Organic production in increasing the overall sustainability of agriculture

With regard to research questions related to organics in the future, the position of organic production in the food system is examined in increasing the overall sustainability of agriculture and in increasing the social sustainability of the food system as defined in the UN's Sustainable Development Goals (UN 2020) and the EU Green Deal (EC 2019). For example, ethical, production and responsibility questions related to the development of criteria for organic certification systems and future food production technologies are part of this whole. The opportunities of organic production in reducing environmental problems associated with the global food system are examined as part of the future outlook of organics (see Section 2.3). Because the production conditions of organics are based on the EU law and trade in organic food is global, research of organics in the future is also characteristically very international (see Section 2.5).

The opportunities of organics in increasing the social sustainability of the food system combine the views of primary production

(see Section 2.2), the food chain (see Section 2.4) and societal research (see Section 2.5) in accordance with the principles of the International Federation of Organic Agricultural Movement (IFOAM) (Migliorini & Wezel 2017). Considering agricultural business activities, organic production offers opportunities for income and social wellbeing (see Section 2.5). One goal could be that organics will be among the most attractive jobs in the eyes of employees and new entrepreneurs.

Interaction between organic producers, their employees and consumers may be empowering and increase mutual understanding between rural and urban areas.

Promises and challenges of digitalisation and novel technologies in organics

The information technology of the future as a tool for organics is at the core of organic research. The development and deployment of monitoring systems for plant pests, robot-based weed control, information about the fertility of fields and the current nutritional status of crops, specified using imaging methods, or remote systems for monitoring the grazing, feeding, growth and production of production animals are examples of the opportunities of digitalisation in agriculture (see Section 2.2). In the monitoring of trade, public food services and consumer behaviour, digital solutions and novel technologies can produce up-to-date information to help research and increase the transparency of the value chain and the control of organic production (see Section 2.5).

However, the development of IT for the needs of organics in Finland needs to face many challenges, and it calls for extensive research and cooperation with enterprises.

2.2. Organic primary production

The food chain starts from primary production, the high operating capacity of which is a requirement for a well-functioning and sustainable food chain, and the high quality and availability of raw materials. In organic production, goals include sustainable business activities, the diverse development of farm production and the production of healthy raw materials and also healthy processed farm products. In the research of sustainable and responsible primary production, the organic sector has identified a number of research needs, grouped into six research areas. The processing of many research results related to primary production into practical solutions requires close cooperation between researchers and producers. In organic production, the consideration of local conditions is vital.



Diversified farming systems and methods

Research and development activities to diversify organic farming systems and to promote diversified farming environments serve the development of organic production and its resilience to change. Crop diversification helps to adapt to changing climate conditions and produces information for the adoption of more sustainable diets in the future (see Section 2.1). Testing and using new crops and varieties under Finland's conditions, as well as the development of new farming methods, such as mixed cropping, the use of undersown and catch crops or applications of agroforestry, are examples of the research of organic farming systems.

Soil management and carbon sequestration potential in organic production

Strengthening the climate resilience of organic production is a central research theme. Climate change mitigation by reducing greenhouse gases in agricultural production and by improving the carbon balance is an important goal in the development of organic production (see Section 2.3). Increasing yield levels sustainably has been identified as a key measure to improve the climate resilience of organic production.

In Finland, it is necessary to study means for increasing yield levels in organic production and improving the carbon footprint through the management and development of soil fertility, the development of weed control, increases in the carbon sequestration potential of agricultural land and the deployment of regenerative farming methods. As a result, farmers will also receive more benefits in the long term. Furthermore, the impact of domestic animal production on the carbon sequestration potential, including the benefits of the use of manure and the grazing of animals, should be studied.

Organic farming offers many promising soil management methods, such as diversified crop rotation, the understanding and large-scale deployment of which may increase the sustainability of arable farming. The organic sector has a lot to give, and a lot to learn, in the research, application and implementation of these methods. Research must be conducted together with research fields that aim to develop methods for assessing environmental impact (see Section 2.3).

Nutrient economy and crop protection causing less environmental loads

One of the goals of organic production is to find ways for reducing the environmental load of agricultural production. In organic crop production, the management of a balanced nutrient economy is a challenge in that nutrient leaching must be minimised and it must be ensured that crops have access to a sufficient volume of nutrients for producing yields. Often, organic fields suffer from a shortage of nitrogen, leading to low yields. A controlled increase in yield levels also reduces nutrient loads in the environment (see Section 2.3).

Proportions of different nutrients in the soil and their usability for grown crops are significant factors. Green manures offer a key fertilisation method considering the nutrient economy of organic fields. The recycling of nutrients generated in domestic animal production should be promoted so that valuable nutrients of manure can be used in crop production instead of them causing environmental loads. What is needed is information about the opportunities of the use of digestion residues from biogas plants and their hygiene risks before and during the growth season regarding crops, the aboveground yields of which are used for human consumption or as feed. Research is needed to develop recycled organic fertilisers and to guarantee their quality and safety. Similarly, the fertilisation impact of supplementary fertilisers on different crops needs to be studied.

Organic research aims to find ways for increasing resource efficiency and the closed cycle of nutrients and energy in accordance with the principles of the circular economy. The use of biomass from production side streams, such as manure and waste materials from plants, in the production of bioenergy and the return of digestion residues from biogas plants to fields as fertilisers support this goal and also require more research from the perspective of financial profitability (see Section 2.5).

In organic farming, no chemical plant protection products can be used, which promotes the maintenance of diversified farming environments, such as the wellbeing of pollinators. Then again, weed control presents a challenge in organic production, especially when the aim is to use direct seeding and lighter soil preparation methods. Therefore, the research of weed control methods in organic production is in a key position in increasing yield levels. Fallowing reduces the volume of carbon in the soil and presents a risk to the soil structure. How can different crops be rotated effectively with as little soil tillage as possible and how can perennial weeds be controlled in different phases of crop rotation using suitable undersown crops? The research of mechanical weed control must find ways for maintaining a good soil structure and increasing carbon stocks in the soil.

In the protection of horticultural crops, environmentally friendly ways must be found for controlling different plant diseases and pests, while supporting a transition towards non-chemical crop protection, also in conventional production. The research and development of biological crop protection agents and organisms suitable for organic production is part of this theme. This research theme is closely linked with the research of environmental impact (see Section 2.3).

Organic breeding and propagating material in crop and animal production

Currently, no varieties developed for organic production are available in Finland. The availability of organic seeds suitable for Nordic conditions should be promoted in organic research by means of pre-breeding, for example. In pre-breeding, desired properties are sought from diverse plant material for use in the breeding of varieties through breeding back. Ecological plant breeding also takes epigenetics into consideration. It is a rapidly evolving area of breeding, in which every generation is produced in the actual farming conditions of the variety in question. This means that organic varieties are produced in organic production. The research of varieties on actual farms is needed in organic production for comparing different production methods and production inputs to identify the best practical farming measures and to balance variation in yield levels.

The breeding of domestic animals suitable for organic production would require international research cooperation, including the joint development of organic breeding criteria between researchers and organic domestic animal producers. Organic animal breeding should focus on the quality and quantity of organic animal production and aim at the multiple use, health and longevity of animals, and at survival in changing environmental conditions.

Organic domestic animal production systems

A special challenge in the development of organic production in Finland is the separation of domestic animal production and crop production. There is still plenty of room for development in the closed nutrient cycle, energy efficiency and cooperation between farms – all elements of the principles of organic production.

Organic domestic animal production is important considering the diversity of



Photo: Risto Musta

the agricultural environment (see Section 2.3). Ruminants are known to produce greenhouse gas emissions that accelerate global warming, while they play a significant part in recovering biodiversity through grazing. Grazing also improves the wellbeing of production animals.

In domestic animal feeding, research aimed to produce organic high-protein feed in Finland is important. In leys, an optimal variation in species and varieties in conjunction with mowing and grazing calls for field research. Alternative high-protein feeds and their position and use in crop rotation are research themes that require experimental research. Furthermore, the research of alternative protein sources of the future could draw lines for future organic

research in the development of protein sources that replace organic soy, and of insects and aquaculture (including organic fish farming), both in feed production and for human consumption.

Cattle plays a central part in organic production in Finland, which is why it is largely the focus of the research into domestic animal production. Milk production without any antibiotics and a high milk production capacity by investing in roughage are central research themes regarding organic dairy cattle. At present, the research of other production animals is quite rare, also on an international scale. For example, there is still plenty of room for development in the research of the organic feeding of monogastric animals, such as pigs and

poultry, and the sustainability of production systems. The development of production methods suitable for organic production as part of strictly contractual poultry and pig production is a challenge and requires additional research so that organic domestic animal production can respond to changes in the nutrition trends of the future (see Sections 2.1 and 2.4).

Wellbeing of domestic animals

The health and wellbeing of production animals are issues which increasingly raise interest among consumers and on the basis of which the organic sector can partly justify the maintenance of animal production in a more sustainable food system in the future (see Sections 2.1 and 2.3). The preventive healthcare of production animals and the maintenance of wellbeing and the species-specific behaviour of each species are key. One of the most significant minimum requirements set for organic animal production is that all organic animals must be able to graze or stay outdoors during summer. Here, challenges include safety in changing weather conditions, increased disease risks and needs for parasite control, which should be studied in sheep, pigs and poultry, in particular.

The design and construction of production buildings suitable for organic production in accordance with the requirements laid down in the EU regulation on organic production and labelling of organic products is a new topical research theme. Having foundations and structures of year-round outdoor enclosures and shelters, routes leading to pastures and outdoor feeding locations that are suitable for Finnish conditions is a very important factors when considering the production conditions and wellbeing of organic animals. Production buildings and structures must remain dry, they must not become slippery in cold weather and it must be possible to recover excrement for reasons of the nutrient cycle and environmental protection (see Section 2.3).

Revised production regulations require terrace structures between indoor and outdoor areas of poultry buildings and protective shelters in outdoor poultry farms, either plants or structures that produce shade.

Organics in forests

The strong position of the organic wild products of Finland's forests is a special characteristic of Finland's organic sector, which is why this area also requires research. The increase in and the diversification of the range of organic wild products offered by Finland's forests, as well as the production of added value, present challenges to Finnish organic research alongside with business and industrial activities (including the cosmetics and textile industries, see Section 2.4). The opportunities of organic wild collection areas and products in increasing wellbeing has not yet been fully utilised in the development of sustainable tourism. This is a new research field, which is linked with societal organic research (see Section 2.5).

Recently, general interest in different applications of agroforestry has increased in Finland considering agricultural farming systems and the diversification of forestry. Because practices in this field are fairly new and not established yet, they offer various themes for researchers in agriculture and forestry. They can diversify the production structures of organic farms, increase the carbon sequestration potential of fields and produce various environmental benefits, for example, by increasing biodiversity in agricultural environments by providing shelters for pollinators, other beneficial arthropods and game (see Section 2.3). Forest pastures could also be recovered using organic domestic animals, therefore helping to fulfil the goals defined in the Ministry of the Environment's Helmi habitats programme (Ministry of the Environment 2020).

2.3. Environmental impact of organic production

Agricultural production always causes environmental impact to some extent. A sustainable food system must aim to minimise the environmental impact of production and consumption. The EU regulation on organic production and labelling of organic products sets stricter requirements for organic production than for conventional agriculture so that it can produce ecosystem services that are vital for society by combining best practices for the environment and climate action, supporting biodiversity, saving natural resources and applying strict requirements to the wellbeing of animals (EU 2018). The environmental impact of organics is studied in close cooperation with the research of primary production (see Section 2.2). Often, it is difficult to define the research field, to which individual projects belong.





Assessment of the environmental impact of organics

Currently available methods for assessing the lifecycle environmental impact of agricultural production are not sufficiently advanced to reliably assess the environmental impact of organics based on agroecological cultivation methods and compare it with conventional production. In particular, the inclusion of environmental benefits offered by organic production, such as its ecosystem services, in lifecycle assessments is still insufficient. The development of comprehensive assessment methods is an important theme in the research of the environmental impact of organics, and it is closely linked with the research theme organics in the future (see Section 2.1).

Organic production in reducing environmental loads

Alongside the research of primary production, the research of the environmental impact of organic production focuses on the opportunities of organic production in reducing environmental loads (see Section 2.2). The circular economy promotes the resource-efficient use of

materials. A nutrient management and crop protection causing lower environmental loads, the recycling of nutrients and lower emissions of harmful substances, such as crop protection agents, into the environment by means of organic farming are on the agenda of environmental research related to organic production. For example, crop protection agents approved for organic production and separated from nature, as well as washing and cleaning agents used at organic production plants, must be harmless to the environment. Similarly, it should be ensured that biomass used in soil improvement and fertilisation and industrial side streams do not cause additional harmful substance loads, and research data should be produced to define any threshold values. Furthermore, reducing the adverse environmental impact of organic animal production in relation to the use of manure and the degradation of pastures is a research theme linked to this field.

Organic production in climate change mitigation and adaptation to climate change

General interest in the climate impact of organics has increased alongside with



Photo: Risto Musta

production growth and climate change mitigation goals. Currently available research data about the climate impact of organic production is not unambiguous, and not much data about Nordic production conditions is available. Policy steering has a need for reliable research data (see Section 2.5).

The carbon sequestration potential of organic fields and the climate efficiency of cattle farming are key research questions that environmental researchers aim to respond alongside with the research of primary production (see Section 2.2). Identifying the carbon footprint of organic production is even regarded as a crucial question considering the future of the organic sector (see Section 2.1). Research also supports the adaptation of the organic sector to climate change, for example, through the development of new varieties and farming systems suitable for extreme climate conditions.

Impact of organic production on biodiversity

The diverse positive impact of organic production on maintaining biodiversity

in agricultural environments is regarded as one of its key environmental benefits. For example, avoiding chemical plant protection products maintains pollinator and field bird populations, while the grazing of organic animals helps to preserve many threatened species in traditional biotopes far into the future. The European Commission's biodiversity strategy highlights organic production as a means to prevent biodiversity from decreasing, protect species in agricultural environments and increase resilience to change (EC 2020a). Organic production also helps to fulfil the goals set in the Ministry of the Environment's Helmi habitats programme (Ministry of the Environment 2020).

We are only starting to understand the significance of microorganisms for the fertility of soil (see Section 2.2) and the quality of nutrition. Biodiversity is also linked to human health through microbes in the environment and the body (see Section 2.4). Links between environmental and social research include the pricing and markets of ecosystem services provided by organic production as a possible incentive scheme to increase organic production (see Section 2.5).

2.4. Organic food and nutrition

One of the goals of organic production is to produce healthy, safe and tasty organic-certified food for consumers in line with the principles presented in the EU regulation on organic production and labelling of organic products and the Finnish Food Authority's confirmed production conditions. The following research themes have been identified in relation to the sustainability of the organic food chain and the further processing of organic food.



More domestic organic products on the market

One of the challenges of the organic sector is to produce more domestic organic products on the market to respond to the growing demand for consumption and to promote the sustainability change in the food system (see Sections 2.1 and 2.3). Research supports the expertise of food enterprises so that they can address the requirements of organic production and changes in consumption demand in their R&D and business activities. Research is conducted in cooperation with the research field of organics in society and on the market, focusing on the business expertise and models of enterprises that produce a competitive edge on the market (see Section 2.5). Projects under this research theme are typically carried out as joint development activities with enterprises.

Processing and quality of organic food

The careful, minimal and mild processing and preservation methods of organic food must be studied so as to maintain the good properties of organic raw materials, including the potential bioactivity of organics, to secure the growing consumption demand for organic products. It is important to identify how organically produced raw materials behave during processing and whether their characteristics can be maintained in different processes, with novel processing technologies and in large-scale industrial production. Production conditions affect the quality of organic food. Here, key questions for example are how cattle feeding with roughage affects the fatty acid composition of organic meat and how high residues remain in food due to the cultivation system. Preventing and analysing contamination remains a central part of the research of organic food. Research is also needed to identify how the overall quality of organic food meets the expectations of demanding consumers regarding health and processing attributes. Examples include new plant-based products (see Section 2.5).

The use of the side streams of food production is part of the circular economy, and research should be shifted towards the effective use of valuable organic raw materials. This improves the resource efficiency of production and reduces any environmental loads caused by waste fractions (see Section 2.3).

Assessment of the health impact of organic food

So far, the health effects of organic food have been studied to a fairly small extent. Instead of comparing the healthiness of individual ingredients or food products, development is strongly focusing on the assessment of the effects of specific diets on health and wellbeing and of overall sustainability. Here, insight about research on organics in the future is also needed (see Section 2.1). Microbiome research is a rising theme, ranging from organic fields and cattle farms to marketed organic products and the human body and living environments. This is linked to the research of biodiversity (see Section 2.3).

Sustainability of the food chain

Organic food research related to the sustainability of the food chain is part of the research theme of organics in the future (see Section 2.1). For example, research aimed to increase the recycling of packaging material and reduce food wastage is linked with the sustainability of the food chain. Professional kitchens play a significant part in increasing the consumption of organic food, and research should find ways for professional kitchens to easily increase the use of organic raw materials. This is closely linked to the research field of organics in society and on the market (see Section 2.5). Research on the sustainability of organic food chain relates to both environmental and social sustainability.

2.5. Organics in society and on the market

There is high demand for questions related to the organic sector's markets and finances, as well as for broader social research, from the perspective of policy steering, for example, to better understand the functioning of organic food chains and markets and the behaviour of Finnish consumers.



Operating conditions of the organic sector in society

The legislation that regulates organic production sets ground rules for enterprises, and they also have an impact on the profitability and competitiveness of the organic sector. Research related to the development of criteria for organic certification systems, the control of production conditions (Finnish Food Authority 2020) and the general principles of organic production (Migliorini & Wezel 2017) is key considering the organics in the future (see Section 2.1). The position of organics in the legislation and governance, as well as legal interpretations related to the monitoring of organic production and the subsidy policy, are key research themes that have an impact on the functioning of Finland's organic chain and the operating environment of the organic sector as a whole. For example, research related to the development of regulations on organic production is needed so that organic production can be better differentiated from conventional production in the future within the scope of the certification system. Traceability and authenticity assessment is important to distinguish commercial organic products from conventionally produced products on the market.

Organic business models

Key research themes include business models in the organic food chain and the finances of enterprises, through which the chain's hidden potential for change and growth can be uncovered. The profitability of organic enterprises is linked to improved technical and operational effectiveness and to demonstrating environmental and social sustainability to consumers and society as a whole. For example, it should be identified what special features maintain the profitability of small-sized organic horticultural enterprises. Organic business models are reflected not only in the food system, but also in other business sectors, such as sustainable tourism.

In organic business, the verification of responsibility questions and their communication to consumers are becoming more and more important. The research of the pricing principles of organic products helps to identify the distribution of responsibilities, risks and results in the organic food chain and to assess the socioeconomic positions of different parties, which affects the development and future of organic markets (see Section 2.1). This research on pricing principles of organic products in Finland has to account for the overall market structure in retailing and processing, since responsibilities of producers are inter-linked with responsibilities of other organic value chain stakeholders.

It would also be interesting to study how key principles of health, ecology, fairness and care are connected to business profitability in the organic sector and how they increase social, ecological and economic sustainability in society (e.g. Meredith, Lampkin & Schmid 2018). For example, means to increase wellbeing at work in the organic sector and the understanding of occupational healthcare services regarding special questions of organic production and to support organic farms as attractive and interesting workplaces can be developed in cooperation with researchers and enterprises.

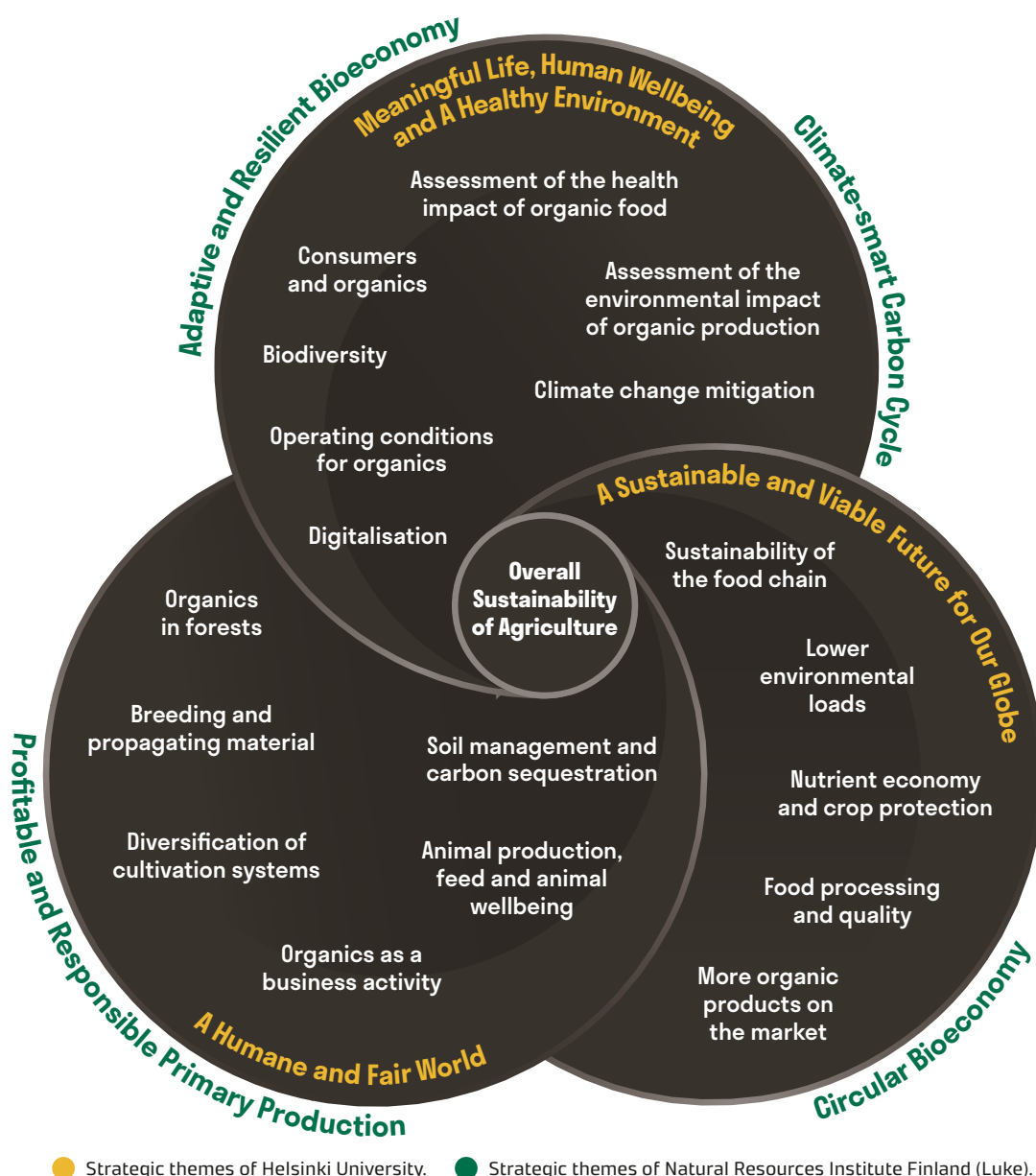
Consumers and organics

This research theme studies the type of discourse on organics in society. Different perspectives and topics can be raised from organic discourse, such as social inequality in the food system, the differentiation of organic consumers as a result of increased veganism and other special diets, increasing concerns over climate change as well as novel IT and processing technologies (see Sections 2.1 and 2.3).

Organic research of the organic awareness, valuation and purchasing behaviour of

consumers needs to be continued in the changing society. Identifying and developing the success factors of different sales channels for organic products, also from a consumer-driven perspective, will potentially increase the position of organic production in Finland and internationally. To increase the procurement of organic products of professional kitchens calls for cooperation between the research fields of primary production (see Section 2.2) and organic food and nutrition (see Section 2.4).

In Graph 2, the aforementioned research themes, raised on the basis of the stakeholder survey and researcher workshops, are grouped according to themes that mirror the strategies of FORI's parent organisations, i.e. Luke and the University of Helsinki. Because most of these research themes are interdisciplinary and can be studied from the perspectives of several different scientific fields, many themes also intersect other strategic themes.



Graph 2. Key research themes relative to the strategic themes of FORI's parent organisations (Luke and the University of Helsinki). A universe of ideas and opportunities, the fourth theme of the University of Helsinki, comprehensively represents the way of working in all of FORI's research themes.



Photo: Pihla Teder

3. Interdisciplinary research as a goal

Responding to the sustainability challenge is a major question in society, and research calls for an interdisciplinary approach, also regarding organic research themes. FORI's multidisciplinary researcher network has good opportunities to respond to stakeholders' expectations regarding the significantly applied and interdisciplinary approach of organic research. In the stakeholder survey, cooperation between different parties across the boundaries of disciplines was regarded as one of the strengths of organic research.

Expertise in many different fields must be brought together in research projects. Networks between different parties, farms, enterprises and educational institutes is both a challenge and an opportunity for organic research and researchers. Research should start from solving practical problems, while maintaining high scientific standards by publishing research results produced by the researcher network in international series. Finland's organic research should highlight the special features and unique nature of our Nordic farming and environmental conditions – no-one else will do this for us.



4. Co-creation

FORI encourages and supports the engagement of farmers and enterprises in organic research projects on the basis of co-creation to fully help Finland's organic production to strengthen its role in the food system and to put research results into practice in the activities of organic enterprises. Organic production intrinsically involves the need to customise the most ideal solutions for each local operating environment, which would be difficult if not for a close dialogue and shared goals between researchers and local organic enterprises. Cooperation with organic advisory services is important so that research data about organic production can be used as broadly as possible.

Key financiers, such as Horizon Europe, the Academy of Finland's Strategic Research Council and Business Finland, emphasise co-creation so that research helps to find solutions to develop business activities and to help enterprises to make use of innovation. The participation of organic enterprises in research and development projects has been selected as an indicator to assess the fulfilment of this strategic goal.

5. Dissemination and communication of research data

Data about organic production based on scientific research has its uses in society, for example, in guiding policy steering, supporting university-level education in organic production, developing the expertise of producers and other parties engaged in organic production and increasing the awareness of consumers of organic production. Opportunities to use Luke's statistics of organic production are communicated to the researcher network and in society at large.

FORI's communication plan is a central tool in the execution of the research strategy. The communication plan defines key communication channels, target groups, indicators and development needs and activities at an annual level. The communication plan is revised regularly as guided by FORI's steering group.

FORI has a dual role in communicating organic research. On one hand, FORI presents research data produced by its researcher network about Finland's organic sector, both in Finland and internationally. On the other hand, it is equally important to produce understandable data about the results of international researchers and research projects in other parts of the world for the needs of the Finnish public. Regarding these, FORI increasingly invests in increasing the visibility of Finland's organic research internationally. The goal is to help specialists in the researcher network to save all their publications in the international Organic ePrints database (orgprints.org), where they are available to the international scientific community. Collecting organic research reports in a single database also enables the use of publications as an indicator of the fulfilment of the strategy in the future.

Communicating the opportunities to receive funding for organic research to the scientific community is an important task for FORI. FORI has an impact on research themes of financial instruments through its membership with TP Organics and the research programmes of its parent organisations and by actively influencing the themes of EU funding instruments.

Producing research-based literature reviews, meta studies, synthesis reports and statements is a natural way for FORI to produce information. The need for extensive expertise is emphasised when hearing stakeholders, and the broad expertise of the researcher network is useful in this type of data production. FORI's stakeholders consider it important that it is impartially assessed how international research data can be used in Finland.

6. Sources

Barabanova, Y. & Moeskops, B. (eds.) 2019. Strategic Research & Innovation Agenda for Organics and Agroecology Leading the transition to sustainable food and farming in Europe. TP Organics, Brussels. 56 p. tporganics.eu/wp-content/uploads/2020/01/ifoam-sria-full-version-final.pdf

EC 2019. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. The European Green Deal. European Commission, COM (2019) 640 final, Brussels, 11 December 2019. 24 p. ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

EC 2020a. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. EU Biodiversity Strategy for 2030: Bringing nature back into our lives. COM (2020) 380 final, Brussels, 20 May 2020. 27 p. ec.europa.eu/info/sites/info/files/communication-annex-eu-biodiversity-strategy-2030_en.pdf

EC 2020b. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A Farm to Fork Strategy for a fair, healthy and environmentally friendly food system. COM (2020) 381 final, Brussels, 20 May 2020. 23 p. ec.europa.eu/info/sites/info/files/communication-annex-farm-fork-green-deal_en.pdf

EU 2018. Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007.

Eyhorn, F., Muller, A., Reganold, J.P, Frison, E, Herren, H.R, Luttikholt, L., Mueller, A., Sanders, J., El-Hage Scialabba, N., Seufert, V. & Smith, P. 2019. Sustainability in global agriculture driven by organic farming. *Nature Sustainability* 2: 253–255.

Finnish Food Authority 2020. Forms and instructions for organic production. www.ruokavirasto.fi/en/about-us/services/guides--instructions--and-forms/companies/forms-and-instructions-for-organic-production/

Luke 2020. Strategy 2020–2025. www.luke.fi/en/luke-3/strategy/

Meredith, S., Lampkin, N. & Schmid, O. 2018. Organic Action Plans: Development, implementation and evaluation, Second edition, IFOAM EU, Brussels. 120 p.

Migliorini, P. & Wezel, A. 2017. Converging and diverging principles and practices of organic agriculture regulations and agroecology. A review. *Agron. Sustain. Dev.* 37: 63

Ministry of Agriculture and Forestry 2019. Strategy 2030 of the Ministry of Agriculture and Forestry. [mmm.fi/documents/1410837/1708297/Maa-+ja+mets%C3%A4talousministeri%C3%B6n+strategia+2030/843e2b79-b4d8-c228-3ce1-a461fc482944/Maa-+ja+mets%C3%A4talousministeri%C3%B6n+strategia+2030.pdf](https://www.mmm.fi/documents/1410837/1708297/Maa-+ja+mets%C3%A4talousministeri%C3%B6n+strategia+2030/843e2b79-b4d8-c228-3ce1-a461fc482944/Maa-+ja+mets%C3%A4talousministeri%C3%B6n+strategia+2030.pdf)

Ministry of the Environment 2020. Helmi habitats programme. ym.fi/en/helmi-habitats-programme

Nuutila, J., Siiskonen, P., Kahiluoto, H., Mikkola, M., Schäfer, W. & Tikkanen-Kaukanen, C. 2014. Research Programme for Organic Food and Farming 2014–2018. 39 p. www.luomuinstituutti.fi/en

TP Organics 2020. Priority challenges for Horizon Europe – First Work Programme. Position paper, 14 p.

UN 2020. Sustainable Development Goals. www.un.org/sustainabledevelopment/sustainable-development-goals/

University of Helsinki 2020. UNIVERSITY OF HELSINKI'S STRATEGIC PLAN 2021–2030. Approved by the Board of Directors of the University of Helsinki on 26 February 2020, HY/408/00.04.00/2020. 10 p. www.helsinki.fi/en/university/strategic-plan-2021-2030

