Research and development strategy 2012

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Background

In 2009 ICROFS developed a strategic research programme based on its comprehensive knowledge synthesis of the "Development, growth and integrity in the Danish organic sector"[1]. This formed the basis for the first programme under GUDP (Green Development and Demonstration Programme) with the objective of research contributing to support growth and development in the organic food sector. A new feature of the programme was the inclusion of the development and demonstration aspects needed for the sector.

The Action Plan for Organic Production towards 2020[2] published on 21 June 2012 by the Minister of Agriculture, Food and Fisheries describes research and development as pivotal for the further development of the organic sector and for the ambition to achieve a doubling of the organic area by year 2020. The government sees organic production as a cornerstone of a green transformation of Danish agriculture.

The catalogue FORSK2020[3] sets out five strategic research visions that embody the most promising areas for future public investment in research. The research that society and economic development will require in the coming years has been identified. The five visions are:

- A society built on a green economy
- A society with a high standard of health and quality of life
- A high-tech society with capacity for innovation
- An efficient and competitive society
- A competent and cohesive society.

The ICROFS research and development strategy 2012 can help achieve these visions.

The new ICROFS global research and development strategy 2012 has been prepared as a result of a lengthy consultation where stakeholders within or associated with the organic sector have had possibility to present their views on the development opportunities and barriers in the spheres where research and development can make a difference. This has led to both new ideas and a more visionary approach, which the industry believes is essential to ensure a leap in knowledge and development. The process has also identified concrete barriers and problems that need a solution to ensure economic viability and credibility of the organic sector. The administration and programme committee of ICROFS has participated in or organised 15-20 meetings, each attended by between 10 and 200 people – including primary producers, advisors, researchers, consumers and politicians from the processing, retailing and public authorities, all of whom have had the opportunity to present their views. Approx. 250 different suggestions for themes and focus areas for action have been received.

1 Alrøe, H.F. & Halberg, N. (eds.) (2008): Development, growth and integrity in the Danish organic sector. Knowledge synthesis, Oct. 2008. ICROFS, International Centre for Research in Organic Food Systems, Foulum, Denmark.

2 Økologisk Handlingsplan 2020. Ministeriet for Fødevarer, Landbrug og Fiskeri

3 FORSK 2020 – Strategiske forskningshorisonter (2012). Ministeriet for Forskning, Innovation og Videregående Uddannelser.

Research and development should contribute to the development of organic agriculture and food products for the benefit of industry and society. It is important that the competitiveness of organic production is strengthened and that the role of organic farming as a provider of societal benefits is further advanced. The research and development initiative must furthermore integrate the principles associated with organic farming, including environmental considerations and animal welfare, and thus support the integrity of organic farming. The initiatives will therefore create both a value boost in the industry and synergy in relation to the public demand for nature preservation clean drinking water and dynamic, productive and innovative rural areas.

This research and development strategy, which has been prepared by the ICROFS programme committee, describes the areas where a research effort will benefit the industry as well as its importance to society. It is the intention that the strategy should form the starting point when funds for research and development in organic food production hopefully are made available, for example under GUDP, but also through other funding sources such as the Strategic Research Council and the European ERANET, CORE Organic II etc. The strategy does therefore not constitute a call for proposals, but can serve as the basis for a call.

This new strategy is a continuation of the preceding research and development programmes (DARCOF I, II and III, CORE Organic I and II and Organic RDD) in that it both builds on top of existing results and fills in the gaps where action is still required or where further cooperation between research and industry would be advantageous.

In addition to this strategy ICROFS has prepared an analysis of the role that research and development has played in the organic sector and identified the stakeholders in business and society that have utilised the results of the projects.

Research and development prospects

To achieve the political ambition of doubling the organic area it is essential that the organic concept is financially attractive to the farmer. Despite the willingness of consumers to pay a premium price for organic products, there is still pressure on organic food prices. This applies both to local vs. imported organic products and to the price difference between organic and comparable conventional products. Research, development and demonstration that brings new insight to the sector and new tools for solving specific problems in the short term is therefore necessary. New solutions that optimise farm economy will also yield a more competitive organic sector in the longer term.

Short term ⟷ **Long term**

Short term	Long term
Improvements to existing practice	Visionary system-oriented solutions

There is a need for new solutions that are rooted in the visions formulated in dialogue with society. Research, development and demonstration with a long-term and visionary perspective will have a crucial role in the development of new cropping systems that can help solve challenges in the organic sector that at times may be both fundamental and conflicting. This effort may also help solve challenges in resource management and animal welfare in agriculture generally.

Sector perspective ⟷ **Society perspective**

Advantages for the sector — Value for society

From an sector and societal perspective, the contribution from research, development and demonstration is most valuable when considering the two perspectives, on the one hand, the need for practical solutions that ensure organic products in the shops and a sustainable organic farming system and, on the other, the need for solutions to major societal challenges such as climate change, the provision of clean drinking water and sustainable energy.

Stakeholder-driven research and innovation

Research perspective ⟷ **Practical perspective**

Researcher — Producer

There are many examples of innovation in organic food production in the areas of product development and technology and not least in the form of social/organisational innovation. The combination of restrictions formed by the regulatory framework for organic farming and ideals in the form of objectives and principles combined with systemic thinking and stakeholders who see a positive challenge in finding new ways and new methods appears to be fruitful. But innovation and new thinking is not just for pioneers. Innovation needs to be actively integrated into and supported by the knowledge-generation that is provided by research to industry.

There is a need to explore and develop new relations and interactions - both internally among producers, between producers and consumers, and between producers and researchers. This will create scope for synergy and feedback between the parties which can form the basis for further innovation, for more sustainable organic systems, and for new solutions.

For this reason, new research, development and demonstration activities also focus on stakeholder-driven research and innovation as a method. Some of the research and development activities should be based on current practice and collaboration between different actors in the field. In these types of projects the researchers are responsible for ensuring that research not only produces solid research results but also contributes to practical innovation and that the accumulated knowledge is disseminated to a wider audience.

Primary themes

Growth

Market growth is the key to the increase in primary production needed to achieve the objective of a doubling of the organic area by 2020 as set out in the Action Plan for organic production towards 2020 by the Danish government. Research and development efforts must therefore strengthen both primary production, processing, marketing and demand through filling specific knowledge gaps and by offering visionary long-term solutions. New forms of farm units, organisation and cooperation, and development of market concepts that are in harmony with current trends and societal objectives should underpin the role played by organic farming in the government's ambitions for a green transformation.

The primary objective of the strategy is to provide a base for research that can contribute to an expansion of the knowledge base to support the continued growth of the organic sector. Growth should predominantly be based on the domestic as well as the export markets and build on the success of previous years in introducing consumers to a wider range of organic products. Work should continue on creating a larger assortment of products, a larger share of high-value food products and on improving supply capacity in a number of areas where we today rely mainly on imports (e.g. apples). The catering sector is becoming an important factor, and the growing export of organic foods contributes to growth, strengthens the competitiveness of the commercial sector and strengthen the food profile for Denmark in general.

Credibility

The knowledge synthesis carried out by ICROFS in 2008 (Alrøe & Halberg, 2008) showed that the development of the organic sector based on the fundamental ecological values and principles continues to be important. The EU regulatory principles for organic agriculture include the importance of working with soil fertility, biodiversity, the environment, animal welfare and careful processing. This focus elevates the organic sector to an important contributor to society.

By focusing on these principles we can ensure that organic agri- and aquaculture become some of the strongest examples of an eco-friendly primary production that can support the initiatives required to meet the obligations under the Water Framework Directive, Natura2000 and a reduction in pesticide use as required, by the EU directive on the sustainable use of pesticides and integrated pest management[5].

Research and development must enhance the credibility of organic production by enabling the organic sector to improve its practices in harmony with its principles, important societal goals and consumer expectations, by ensuring an open dialogue and by the documentation of the importance of organic production for society.

Focus on using organic production as a means of achieving sustainability in agriculture (and not just as a static form of production) breeds innovative processes and new methods and products, also outside the organic sector. This also applies to the climate and energy area, where the contribution

4 COUNCIL REGULATIONJ (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products

5 DIRECTIVE 2009/128/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

of organic production to initiatives tackling climate change should be examined and developed both in a short-term, action-oriented perspective and in the long term. Carbon sequestration, bioenergy and optimisation of nutrient flows are all part of an overall complex web that presents both opportunities and challenges in the short and long term, which can only be solved by a research-based and coordinated effort.

Resilient systems

Sustainable growth must be based on the development of resilient systems in both a biological and an economic sense. In other words, farms that through their organisation and adaptability have strong resilience to external pressures and changes in the form of attack by pests and diseases, climate change and market fluctuations. This resilience can be strengthened by technology and knowledge which enhances the preventative capacity. The development of production systems where individual elements are mutually supportive and compensatory when unforeseen changes in the environment take place also improves resilience. Resilience can also be a question of a manager's ability to manage resources and optimise costs, to observe and continuously adjust the production and to development through innovation.

Development of more robust farms requires a better understanding of factors such as biodiversity at soil, field and landscape level and management diversity in the form of multifunctionality, interfarm cooperation and/or integration throughout the value chain to ensure the sustainable use of resources and economic profitability. For the farmers to be able to comprehend and make use of this in their daily management systems, there is a need for new tools that, as an example, combine new sensor systems, modern analytical methods and organisation and decision models.

The research and development of resilient systems should also provide fundamental knowledge on how to boost ecological support functions such as soil fertility and performance, functional biodiversity and regulation of livestock diseases while reducing the risks of long-term problems such as perennial weeds, pests and diseases. Generally, there is a need for more knowledge about how interactions between organisms above and below ground can be used innovatively to increase resilience in agriculture and aquaculture.

Focus areas

Based on the primary themes of growth, credibility and resilient systems and the span between the different perspectives of sector and society, a number of specific focus areas have been identified:

Sector perspective

1. Existing organic production systems
2. New organic production systems
3. Different types of farms, their organisation and modes of cooperation
4. Microbial interactions in soil, plants, animals, fodder and food
5. Markets and business development
6. Animal and human health
7. Climate, energy and resource management
8. Nature and environment
9. The importance of organic production for society

Society perspective

The emphasis in this research and development strategy is on interdisciplinarity. Interdisciplinary collaboration is essential to forward organic research, development and demonstration and simultaneously provide an overview and synergy between the many areas.

1. Existing organic production systems

Although significant development has been made on the organic farms in recent years, there are still a number of areas where there is a need for knowledge that can generate results in the short term.

The aim of the research, development and demonstration within the existing organic production systems is to secure an organic production that is continually improved and made more competitive without compromising credibility.

In order to increase yields and productivity there is a need for knowledge on the location of bottlenecks in the production. The solutions must both ensure a robust plant and livestock production and improve the interaction between plant production and feed supply.

There is a need for knowledge about how new technology can be developed and implemented on the farm in an intelligent manner to contribute to easing the work routines for the farmer, minimising the impact of soil cultivation, improving the housing conditions for animals and improving product quality post-harvest, for example via storage conditions.

There is also a need for solutions to a number of production-related challenges. Solutions that are the basis for growth imbue greater credibility and a greater degree of resilience to the production. Examples of obvious focus areas are set out in the box below:

Examples of research, development and demonstration topics:

- crop rotations that can be integrated into the existing organic production systems, include a higher proportion of legumes, and incorporate the health of the ecosystem and soil to suppress disease, in addition to uncovering how individual livestock farms can achieve a higher degree of self-sufficiency in protein and supply of the correct nutrient composition and quality
- selective breeding of new plant varieties for resistance to, for example, fungal infections or drought and the development of new varieties that have a lower nutrient requirement and are able to compete with weeds
- optimal grazing and management systems for larger dairy herds
- feeding and management strategies for finishing pigs
- improvement of seed health
- strategies for the control of perennial weeds
- varieties of greenhouse vegetables adapted to cultivation in soil (not hydroculture)
- biological pest control in fruit
- provision of most suitable breeding stock (fish fry) for aquaculture
- grading harvested grain to optimise the use of the finished commodity
- advanced technology to improve the utilisation of available nutrients and minimise losses
- handling of fruit and vegetables, including the development of technologies to increase shelf life and reduce waste
- local processing or biorefining of crops
- the development of large, cohesive organic units that can supply all the required nutrients, minimise costs and result in high productivity and environmental and economic sustainability
- the implications of climate change for organic production.

These are just some of the examples provided by different actors in the process. Many more can be found in the catalogue of ideas, on http://www.icrofs.dk/pdf/2012_idekatalog.pdf (In Danish)

2. New organic production systems

Present-day organic production systems have to a large extent been developed based on the traditional conventional systems. This can cause dilemmas between the consideration for the environment and animal welfare or between crop rotations and nutrient supply where new systems may be needed to create better long-term solutions.

The objective of research, development and demonstration in new production systems is to provide visionary models for new, cohesive production systems. The models should be based on a profound understanding of ecosystems and awareness of the biological interactions, functions and processes on an organic farm and must be instrumental in advancing credibility, resilience and profitability.

There is a need for a more thorough understanding of the cropping systems and how to design and build production systems based on ecological intensification. This includes the optimisation of soil fertility and productivity based on increased quantities of biomass in the system, new types of intercropping (for example mixed cultures and perennial crops, soil/plant management and aerobic/anaerobic manure management) that can form the basis for higher yields and resilience in the biological system and reduce nutrient losses, thus improving resource management.

Within livestock production there is a need for a radical rethink of both the housing and the management system, including manure handling, animal welfare, use of outdoor areas and feed supply – conceivably in collaboration with other production areas or other farms. There is also a need for knowledge about the integration of the different production forms – plant and animal production, for example. This could create a higher level of synergy in the total production system. Working environment and consumer expectations should be part of the equation when talking about credibility, product quality and possibly supply chains. Especially in the pig, fish and poultry industry there is a need for new, turnkey solutions that can serve as vanguards and springboards for growth and credibility in the future.

Examples of research, development and demonstration topics:

- integration of a number of livestock productions with the growing of trees, fruit and/or vegetables at one or more farms
- fish farming integrated with vegetable production
- integration of free-range production with a production of green manure and energy for glasshouse production

3. Different types of farms, organisation and cooperation

The organic sector is currently undergoing specialisation that in some areas conflicts with the organic principles such as diversity. At the same time there are opportunities in collaboration between specialised farms and in organic agriculture becoming multifunctional and integrating non-agricultural activities.

The objective of research, development and demonstration is in this context to gather knowledge about the development of diverse types of organic agriculture, whether they be individual multifunctional units or a cooperation between specialised farms or between producers and consumers.

There is a need to look at organisation, farmstructure and farming systems in connection with generational change, financing and optimal management forms, including the development of tools for decision-support in more complex production systems. Solutions should be found for the future farming challenges as they relate to the human, organisational, financial, regulatory and managerial aspects. An option could be high-yielding, biological systems that in addition to agricultural products also provide non-food products, energy, nature, recreational experiences, social integration, etc.

There is a need to provide solutions that strengthen relations between agriculture and society through local partnerships, both in the distribution chain, at local authority level or via new financing options such as pension funds or public ownership. Finally, consumer involvement and communication between urban and rural areas will continue to need development.

There is a need for research into and development of knowledge about how urban farms can contribute to food production and recreation, and knowledge about how awareness of food production among town-dwellers can be increased.

4. Microbial interactions in soil, plants, animals, fodder and food

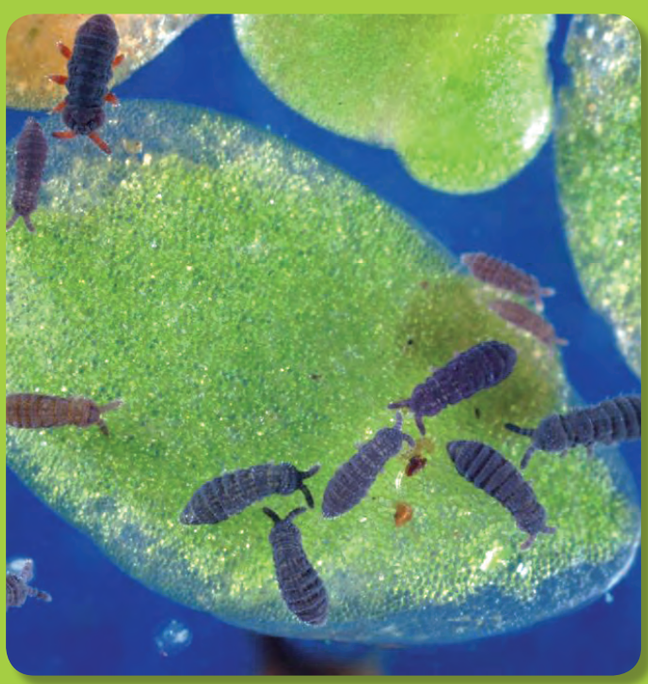
The complex microbial communities play a crucial role for the desired as well as the undesired interactions between microorganisms, animals, plants and humans. These interactions are important for soil fertility, plant growth and yield, animal robustness, food safety, and the sustainability of the system as a whole.

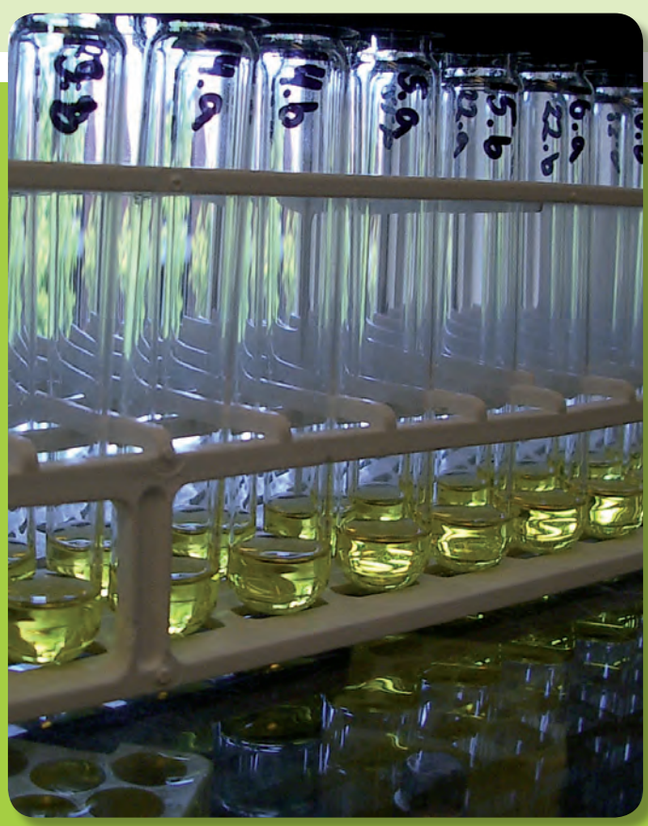
The objective of research into and development and demonstration of microbial interactions is to examine possible contributions from this area for solving specific issues in organic agriculture. The reason is that new concepts for analysing complex microbial communities enable a better understanding of microbial interactions and the use of this knowledge to better manage these interactions for the benefit of plant and animal production.

There is a need for more knowledge of the interactions between the beneficial and harmful microorganisms in soil and between microorganisms and plants. This is particularly the case for analyses of how different growth-promoting microorganisms function under more practical conditions. The central areas are the biological control of pests and the importance of beneficial microorganisms for plant nutrient uptake, root growth and health. Finally there is a need for improving our knowledge of the microbial interactions in food and feed that affect the shelf life and quality of a product post-harvest. More knowledge on whether host-microbe interactions can be used to improve soil fertility, plant resistance to pests and disease, nutrient uptake and product quality post-harvest are desirable. The vision is to develop sustainable organic production systems that nurture the beneficial microorganisms in the agroecosystem and to develop probiotic microorganisms for plants.

There is a need for a better understanding of the mechanisms of infections (zoonoses and organisms resistant to antibiotics) and susceptibility to these as affected by management, including initiatives that help establish a protective gut flora. More knowledge about the importance of microbial communities in soil/plants/rhizosphere with a view to strengthening animal resistance to infections and robustness in free-range animals is also desirable.

In terms of fodder there is a need to analyse the fermentation and refining methods of particular relevance in organic agriculture, so that health and nutrient uptake can be improved. Fermentation methods impacting food flavour and health effects also need closer scrutiny.





5. Markets and business development

The market share of organic products has grown, also during the economic crisis. This indicates that the purchase of organic products has become a regular part of many consumers' shopping habit and that the number of customers is rising. If more farms are to convert to organic production, it is necessary for consumption to continue to grow. This means that there is a need to appeal to new consumer segments and marketing of a wider range of organic products. At the same time, the export of organic products has an important role to play, partly by boosting sales and partly because for many companies there is potential synergy between a strong domestic market and increased exports.

The objective of research, development and demonstration within market and business development is to support market-driven growth via a better understanding of consumer behaviour, targeted product development and innovation, a reduction of energy and resource consumption and a minimisation of air and water pollution in the processing chain and in packaging. The objective is also to devise business concepts that integrate primary production with the leisure economy and/or social responsibility as part of the concept, to identify the barriers and requirements of the catering sector, and finally to produce knowledge that bolsters the export market.

There is a need for a greater insight into how value-based organic consumption can be maintained and expanded, both as it relates to the different life phases of individual consumers and to the long-term changes in consumer patterns, including how to engage consumers and create loyalty.

There is also a need for research into and development of diversity in the range of goods marketed, in new types of high-value products and differentiation of quality, and in documentation and traceability, including the possibility in organic agriculture of linking product with production- and site-specific qualities. This has a huge potential, also for the export market.

There is a need to develop new business concepts that explore new potential sales outlets and methods and new concepts for collaboration between producer cooperatives, wholesalers and/or the processing sector and consumer involvement in the sales market, including new methods of financing.

In the catering area there is a need to support the growth in the purchase of organic products over the next few years by identifying the structural barriers for the use and supply of organic products to commercial kitchens. The development of concepts and tools that help remove such barriers and that can increase supply and consumption of organic products in commercial kitchens and the international catering industry and create cost-effective links between all parts of the food chain is desirable. There is finally a need to develop local/regional concepts such as local supply cooperatives with a local authority and/or concepts that in addition to supplying commodities also contribute knowledge on ecology in agriculture or aquaculture and create dialogue between producer and consumer (for example, school fruit, school meals and school vegetable gardens).

The notion "careful processing" is not legally defined and there is a need to develop methods that ensure that quality is preserved during processing without adverse effects on the environment. There is a need for better knowledge and for innovation in the area of packaging, including the need for it to be highly biodegradable. The use of new technologies that affect product credibility should be assessed for both processing and packaging.

Examples of research, development and demonstration topics:

- consumer response to organic products, including knowledge of the Danish state-controlled organic label ('Ø'), the organic labels for large scale kitchens and restaurants, the EU organic label, etc., and their meaning
- risk-benefit aspects of eating conventional versus organic produce to help consumers in their food selection
- economic mechanisms in the pricing of organic products, including factors affecting the price differential between conventional and organic production and the potential for reducing this
- opportunities and barriers in the current regulation of public procurement
- systems that can ease documentation on using organic produce in commercial kitchens and promote the organic cuisine label
- importance of local marketing and agritourism

6. Animal and human health

According to the organic principles, health is an integral part of the biological system including soil, plants, animals, humans and environment, and healthy systems are resilient systems.

The aim of the research, development and demonstration of health and welfare of animals and humans is to address both specific health problems and to generate knowledge about health in a holistic perspective. Animal health and welfare is affected by the housing systems, breeding, feeding regimes, outdoor facilities and management, including advisory services, and disease management.

There is a need for strategies for the prevention of specific diseases and for further knowledge on how the farmers are best supported in their work with aspects of health, immunity/tolerance and resilience in animal husbandry. This applies both to the daily disease prevention and use of new therapies and the more long-term management of health involving production aspects, feeding, breeding, etc., but also the risk of undertreatment with antibiotics and its impact on animal welfare should be investigated. There is also a need to better understand the relationship between food production methods and human health.

The modest use of antibiotics in organic animal husbandry and subsequent lower resistance to antibiotics is interesting from a societal perspective. There is a need for a better understanding of how the use of organic methods in the prevention of disease and the low consumption of medicine in organic herds can help reduce the use of medicines also in conventional productions.

There is finally a need for a better understanding of the impact of organic products and lifestyle on human health, also in relation to new international definitions of health. The importance of varieties, breeds and production systems and conditions on the health benefits of organic products which could lead to the development of even healthier products in the future warrant a closer study. There is also a need for a general comparison of the health benefits of organic products with possible negative effects, for example the balance between bioactive ingredients, the absence of pesticide residues and the possible content of mycotoxins.

7. Climate, energy and resource management

It is crucial to the credibility of organic production that it continues to improve on all climate indicators. This means a reduction in energy consumption on farms and in the carbon footprint of livestock husbandry, an increase in crop yield with less use of fertiliser and in the sequestration of carbon in soil, and a general optimisation of the biological performance. The nutrient balance on the farm is a limiting factor, and the supply of nutrients other than nitrogen requires new initiatives on the recycling of nutrients. This is a problem that conventional agriculture will also be facing in the long term.
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The aim of the research, development and demonstration within climate change, energy consumption and resource management is to steer the development of organic farms towards a robust, high-yielding and sustainable system in symbiosis with society and the environment. The biological processes and interactions need further research, and the institutional barriers to, for example, the recycling of nutrients from urban to rural areas will need to be identified. Minimisation of the carbon footprint and the inclusion of renewable energy production form part of this work. The long-term aim is to create an energy surplus in the production system in addition to food production. The aim is also to generate knowledge to provide a sound basis for EU legislation for organic production concerning energy utilisation, low climate impact, etc.

There is a need for more knowledge about how to measure and improve the impact on climate of organic food production. How can individual farms optimise their production to meet climate targets through both concerted efforts in specific areas such as feeding, the improvement of crop rotations through e.g. more intelligent use of cover crops, and with cohesion throughout the value chain in an effort to reduce the impact on climate from production, processing and consumption?

There is a need for more knowledge about how biomass and energy production can be integrated into the organic farming system without compromising food production or soil fertility. This can be seen in the context of opportunities for improved resource management and added value through biorefining.

There is a need for research, development and demonstration of organic, recycled fertiliser products, including processes for their biological treatment (aerobic/anaerobic) and processing (e.g. separation, extraction, extrusion) in order to optimise their nutrient content and their contribution to soil fertility and reduction of pollutants and utilisation of residues for energy production. At the same time the adverse effects of pollutants and their fate in the soil in the long term should be examined.

Research and development should look not only at the currently available resources, but also look into how we can improve the recycling of nutrients in the future. What are the opportunities and barriers? How can we continue to improve the collection and handling of sewage sludge, of sludge from aquaculture facilities, ash, food scraps, seaweed, etc., for recycling, so that they are of a quality that can be used for organic production?

8. Nature and environment

Organic principles already play a role in achieving the societal targets for protection of nature and the environment and it is imperative to further develop the role of organic agriculture in these areas.

The aim of the research, development and demonstration within the area of nature and environment is to develop and demonstrate the contribution and ability of the organic management form to meet the national targets for nature and environment.

There is a need to review the analysis of the importance of organic agriculture for biodiversity on cultivated land and surroundings - also in relation to conventional farming. Likewise there is a need to examine the interaction and synergy between the establishment of functional diversity and the social requests for the preservation of endangered habitats and biodiversity.

There is a need to support the promotion of organic agriculture as a tool for maintaining biodiversity in the landscape. This involves the development of cultivation and grazing strategies that function in harmony with the local flora and fauna. This may help preserve and restore specific, desirable habitats and form part of the concerted nature preservation programmes in, for example, Natura 2000 areas. The inclusion of precision farming to provide better conditions for floral and faunal diversity in the fields and minimise field operations such as ploughing should be investigated.

There is a need for models on how organic farming practices designed to protect nature and biodiversity can be linked to the development of specific products and an event economy, which, in addition to heralding new economic opportunities for farms, also leads to a closer involvement of citizens/consumers.

There is a need for further knowledge about the importance of organic management forms for nutrient flows and losses from a landscape and water catchment perspective. Development of models for regulatory and management initiatives and the design of systems that to a greater extent use different organic management forms as instruments for protecting the aquatic environment is desirable. This also applies to compliance with site-specific requirements in the Water Framework Directive for eco-friendly land use. We also lack up-to-date knowledge of, among other things, nutrient losses as influenced by farm type and land use, which can form the basis for further development of, particularly, eco-friendly management systems that respect public preferences and regulations. There is a need to develop better management systems for organic livestock productions, particularly in order to minimise ammonia emissions and phosphorus and nitrate losses. There is finally a need to develop tools for calculating the pros and cons of organic livestock production to give a more holistic assessment of these farms – this to include not only the standard nutrient values but also positive factors not currently part of the system.

9. The importance of organic production for society

As described in the previous focus areas, organic production is closely interwoven with a large number of other areas of society. In some areas there are already positive synergy effects, in others there is potential for organic production to increase its contribution.

The aim of research, development and demonstration on the societal importance of organic farming is to develop and define its societal value and to provide feedback to the organic producers about how its contribution to society can be increased.

There is a need to routinely detail and verify the total contribution of organic food production to society and to quantify synergies. This can be done by using new tailored approaches to calculate costs and other effects, and by multi-criteria assessment that include other perspectives such as employment, public health, rural development, climate contribution, sustainability, etc.

Against this background, there is a need to examine how organic agriculture can increase its contribution to society in terms of income and employment and the provision of a sustainable production in terms of health and environment.

There is finally a need to use the experiences obtained from practising organic farming for research into agro-economic development within the framework of sustainable development, rural development and employment. This can involve new economic theories, institutional economics and the study of formal and informal regulations and structures that may be used as tools in the drive towards a sustainable society.