TPorganics
European Technology Platform

STRATEGIC RESEARCH & INNOVATION AGENDA FOR ORGANICS AND AGROECOLOGY

SUMMARY

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This publication summarises the research priorities for organic and agroecology in Europe. To read the full publication, please visit www.tporganics.eu/publications.

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Strategic Research & Innovation Agenda for Organics and Agroecology
Leading the transition to sustainable food and farming in Europe

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INTRODUCTION

Coordinators: Maria Gernert & Yulia Barabanova

TP Organics is one of the 40 European Technology Platforms recognised by the European Commission. Since 2007, TP Organics has been shaping research and innovation agendas to advocate for more sustainable food and farming systems in Europe based on organic and agroecological principles.

The research priorities outlined in this publication are the result of intensive discussions, workshops and consultations that TP Organics held in 2018–2019. The priorities are the reflection of the knowledge and innovation needs of farmers, processors, companies, and civil society groups. They are eager to work with researchers and transform the food and farming systems of Europe.

Our food and farming systems need to be climate-neutral, circular, diverse and fair. They need to be prepared for the rapid digitalisation of our economies, which brings new opportunities but also comes with risks. To achieve this, all actors need to change the way we produce and consume our food. Policy makers have a crucial role to play in this transformation. Their role is to ensure a common, integrated and holistic approach to food policy. An approach that has a long-term vision for the future, harmonises goals, strategies and actions across sectors[1], prioritises investment for public goods and engages diverse actors in making this happen.

TP Organics is convinced that research and innovation on organics and agroecology can enable the transition of our food systems towards a more sustainable future for all. The Strategic Research and Innovation Agenda shows concrete research areas and priorities that need to receive proper support at EU level, in particular through Horizon Europe, the European Partnerships and Missions as well as EIP-AGRI, in order to leverage the potential of organics and agroecology.

1 For example, food, agriculture, trade, environment, health, technology, etc.

ORGANICS AND AGROECOLOGY AS A RESPONSE TO THE FOOD SYSTEMS CRISIS

Our current food and farming systems are unsustainable and need a profound transformation. Europe is significantly exceeding planetary boundaries with regards to climate change, nitrogen & phosphorus flows and land-system change. This is largely caused by the way we produce and consume food. The high external costs of food production are not integrated in the price of food but are paid by society at large. In addition, serious health and socio-economic impacts are linked to the current food and agricultural model.

To reduce the impact of food and farming and reach the 17 Sustainable Development Goals, a transformation of our food systems is crucial. For food production to remain within planetary boundaries, it must move away from the resource-intensive, industrial system to one that is grounded in organic and agroecological principles.

The organic and the agroecology movements are joining forces to advocate for coherent policies that can drive a transition towards more sustainable food systems. Organics and agroecology aim at redesigning food and farming systems while considering local context and needs. Data show that organic and agroecological systems can compete with industrial agriculture in terms of total outputs.

Agroecology emerged as an alternative to industrialised agricultural systems and is recognised globally. It prioritises the sustainable use of natural resources and biodiversity protection. It is a promising solution for the environmental, social and socio-economic challenges facing agriculture.

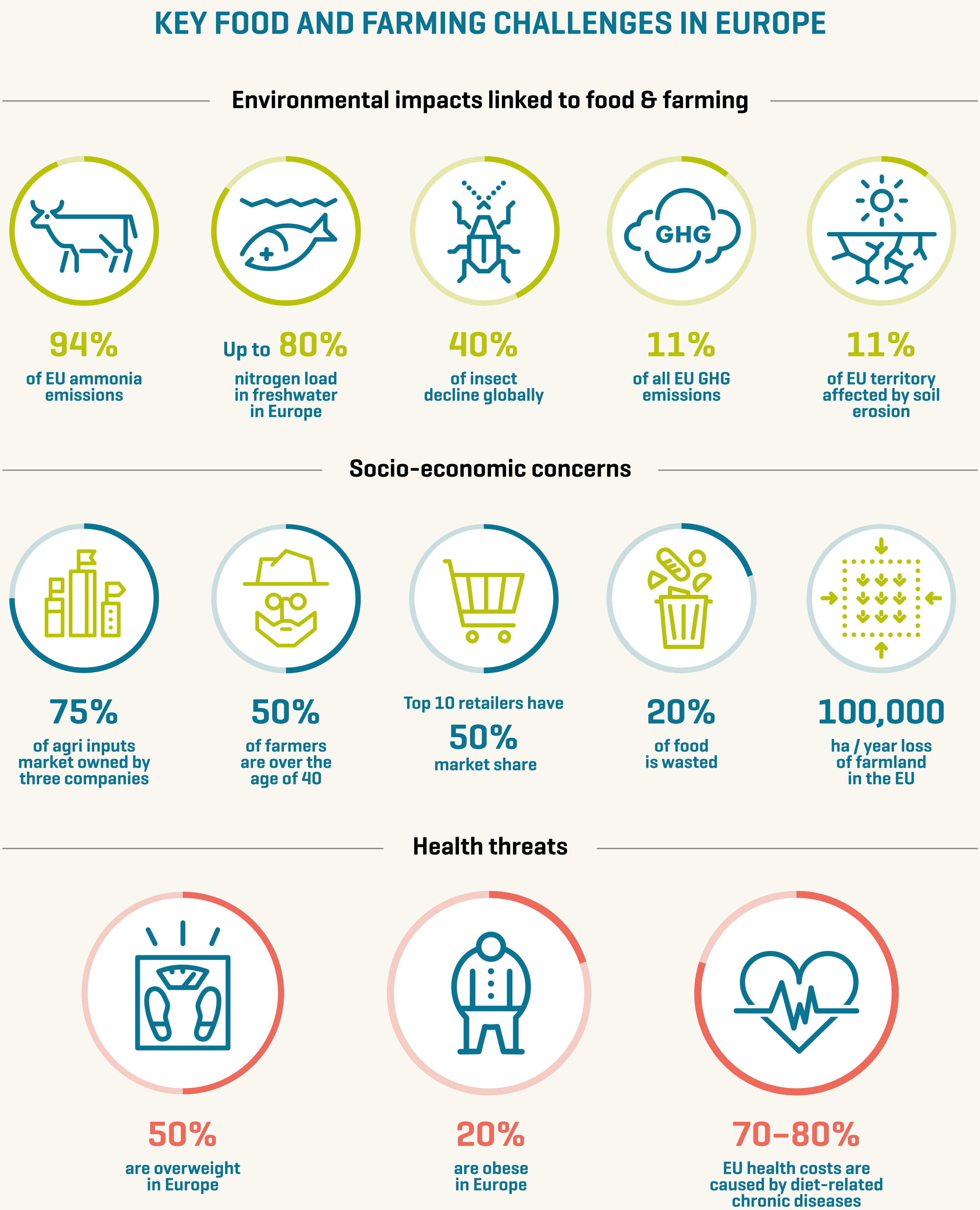
Agroecology is at once a science, a movement and a set of practices. This multidimensional definition maintains open boundaries, allowing agroecology to include many different farming systems, including organic agriculture.

Seen as promoting the transition to food sovereignty, agroecology is at times viewed as synonymous with organic farming and sometimes as a distinct movement and practice. Yet, it is important to stress the synergies between agroecological and organic approaches.

Organic food and farming is legally recognised in the regulations and standards at EU and global level, while agroecology is not. The first European regulation on organic production No 2092/91 came into force in 1993. It defines how agricultural products and foods that are designated as organic must be grown and labelled.

Together, organics and agroecology have the potential to fundamentally transform the current food system. Both organics and agroecology strive for a profound transformation of our food and farming from a systems perspective and provide a set of overlapping principles to lead the transition. Both agroecology and organic farming promote a "closed" or circular approach, emphasise the importance of soil fertility and biodiversity and aim to optimise performance by intensifying and building upon natural systems rather than by intensifying external inputs. Likewise, both propose ways to better involve producers and citizens, engage with social movements, and are open to learning and continuously improving their practices towards their principles.

Comprehensive, public policy-driven responses and renewed leadership at EU level are required to further support organics and agroecology in order to facilitate the transition to more sustainable food systems.



Sources: EEA, 2015, 2017; Sánchez-Bayo & Wyckhuys, 2019; Panagos et al., 2015; IPES-Food, 2017; Eurostat, 2017; Stenmarck et al., 2016; IPES-Food, 2019; WHO, 2008; Seychell, 2016

Figure 1: Key food and farming challenges in Europe

VISION FOR FUTURE ORGANIC AND AGROECOLOGICAL RESEARCH

A transformation based on organic and agroecological principles is urgently needed to address the acute challenges brought about by today's input-intensive food system. Sustainable food and farming systems in Europe should be *efficient* in their use of resources to minimize the inputs and environmental impacts. However, efficiency alone will not help address all the challenges. Agri-food systems should also be based on the logic of *sufficiency* which allows for reductions in production and consumption, at the same time as sustaining thriving communities. Finally, food systems should *be consistent* with the existing ecological balance, the carrying capacity of ecosystems and the specific territorial, cultural and socio-economic contexts.

To support a transition to such food systems, research and innovation (R&I) in the EU needs to focus on:

- Moving organics forward;
- climate-resilient, diversified farming systems;
- redesign of food and agricultural policies from local to EU level;
- sustainable value chains for better food systems.

The following chapters will highlight the R&I priorities within each of these areas.

TP ORGANICS' VISION FOR RESEARCH & INNOVATION TO TRANSFORM FOOD AND FARMING IN EUROPE

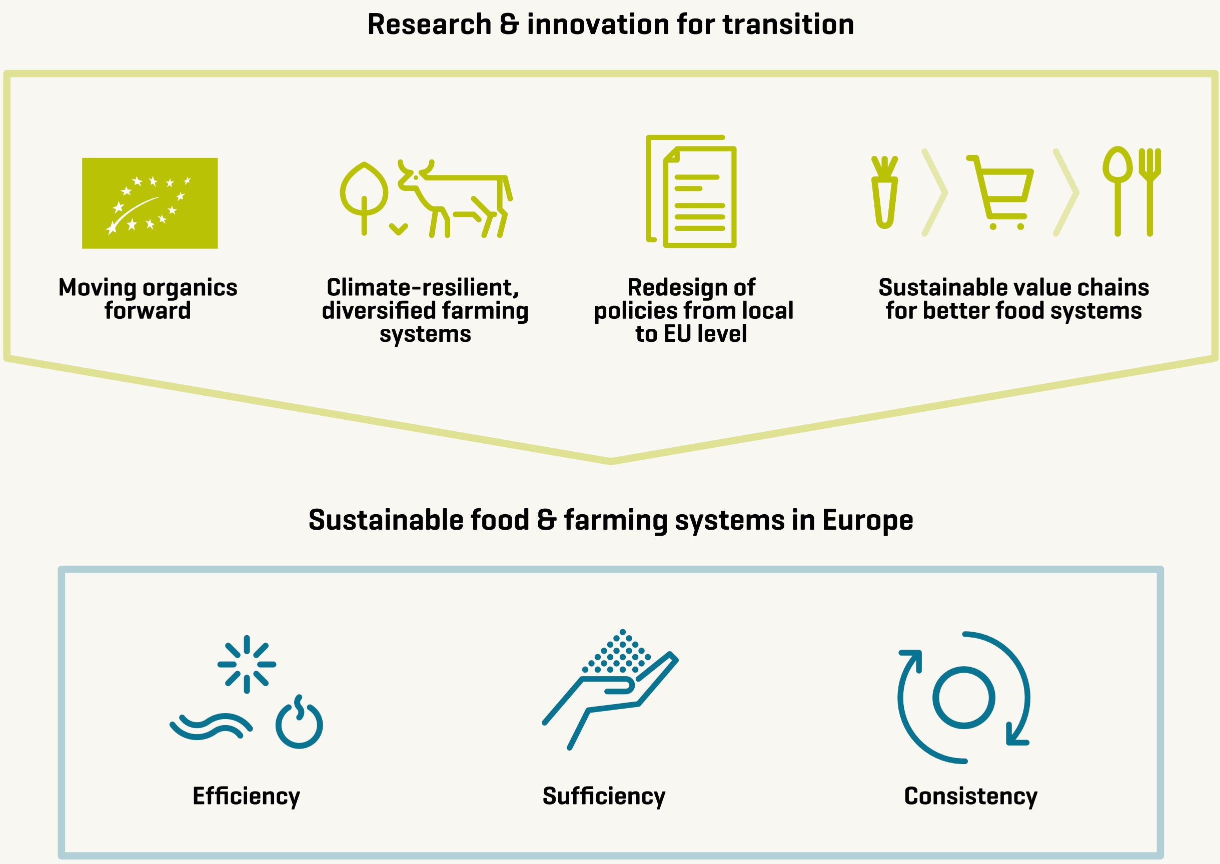


Figure 2: TP Organics' vision for Research & Innovation to transform food and farming in Europe

OUTLOOK ON HORIZON EUROPE

Horizon Europe, the new EU Research & Innovation Programme will provide an ambitious EUR 100 billion budget for the period 2021–2027. The first Work Programme of Horizon Europe is expected in autumn 2020.

TP Organics welcomes the planned Mission for Soil Health and Food in Horizon Europe which explicitly includes ecology and agroecology and the delivery of public goods. Better protection of our soils, the basis of food production, is urgently needed. Research must consider how findings can be implemented in practice.

The structure of ERA-Nets, Joint Programming Initiatives (JPIs) and all other public-public and public-private partnerships will be simplified. In terms of food & agriculture, Horizon Europe will launch two new European Partnerships: "Safe and sustainable food system for people, planet & climate" and "Accelerating farming systems transition: agro-ecology living labs and research infrastructures".

The first partnership will prove essential in the transition to sustainable food systems. 99% of Europe's food sector is made up of SMEs, yet their participation in R&I remains low. The partnership should be open to all actors in the agri-food chain, and engage citizens and civil society organisations, especially when it comes to dietary shift, including reduced consumption of animal products and the reduction of food waste.

The second partnership will support implementation and upscaling of agroecological approaches in primary production, including in organic and mixed farming or agroforestry. To be successful, the partnership must build on experiences of previous partnerships, in particular ERA-NET CORE Organic[2] that has already funded research into agroecological processes and organic farming for 15 years. Research into organic farming and agroecology – within and beyond the partnership – should be accompanied by effective advisory services. This requires building closer relationships between advisors and farmers through direct contacts, farm visits and on-farm experiments.

INNOVATION FOR THE PUBLIC GOOD

For innovation to work for the public good, it must not harm public and environmental health. Rather, it must be dedicated to upholding human values and advancing society with real investment in the pressing societal challenges including agriculture, food, nutrition and climate change. To do so, innovation must look beyond the quick fixes of a technology and consider its broader social impact.

TP Organics is therefore concerned about the "Innovation Principle" that has been introduced in Horizon Europe. The Innovation Principle might set a dangerous precedent and undermine the precautionary principle, and hence social and environmental protections and regulations. It ignores the fact that regulation in itself is a driver of innovation for the benefit of society.

To better align the R&I process and its outcomes with the needs, values and expectations of society, TP Organics calls for civil society organisations and EU citizens themselves be engaged in R&I agenda-setting. Organisational and social innovations must be promoted alongside technological ones which, on their own, often generate negative externalities. Agri-food innovation is about ecological relationships and social interactions, and should therefore be approached in a systemic, transdisciplinary way.

Local adaptions and co-creation of knowledge are integral to the innovation process. In this sense, TP Organics welcomes the fact that Horizon Europe considers the concept of Agricultural Knowledge and Innovation Systems (AKIS) and social innovation to be key drivers to speed up the uptake of research findings which will include the promotion of place-based innovations, reinforcing the multi-actor approach and establishing a network of living-labs in agroecology.

2 http://www.coreorganiccofund.org

RESEARCH & INNOVATION PRIORITIES

MOVING ORGANICS FORWARD: PRIORITIES FOR THE ORGANIC SECTOR

Coordinator: Miguel de Porras Acuña

The new regulation (EC/848/2018) introduces many specific rules that the organic sector will have to comply with. This includes, among others, the possibility of trade with heterogeneous plant material for organic farmers, a new equivalence organic trade regime and the possibility for group certification for European operators.

These changes will have implications for organic farmers, processors, retailers, traders, and certification bodies. There are still many open questions about how the new regulation will be implemented. During this period of change it is important to maintain trust of European consumers, as their behaviour will remain an important driver for the future growth of the organic market.

1 Organic inputs and circular economy: Increasing the circularity of agricultural production

Specific challenge

The Circular Economy Action Plan adopted in 2015 sets ambitious targets to make the EU's economy more resource efficient and to develop appropriate incentives for "closing the loop".

Organic agriculture adopts a "circular" approach applying ecological and recycling/reusing principles to production. The practices of crop rotation, nutrient recycling and biological fixation of nitrogen through legumes, composting, integrating animal and crop production, concern for the health of the soil have been the circular solutions for closing the loop in agriculture.

This less input-intensive strategy of the organic sector, combining new technologies and methods with scientifically-sound, positive environmental outputs, has great potential for increasing the resource efficiency of European agriculture as a whole. This potential becomes apparent when addressing nutrient availability[3], with increasing prices on synthetic fertilizers, and reduced availability of non-renewable resources (e.g. phosphates).

Scope

Research should focus on:

- Scaling up different inputs available for organic agriculture; more effective natural plant protection products and the development of new fertilizers, their production and use in the light of both the EU organic regulation and organic principles;
- assessing the use of contentious waste products for critical and scarce resources in agriculture;
- investigating other feed inputs (e.g. concentrates, protein feed) and feed additives;
- better use of available by-products and alternative inputs (e.g. feather meal, oil cakes, okra as protein feed for fish and pigs) that could reduce the dependency on imported protein feed and increase the local feed sufficiency;
- further development of integrated animal-plant production systems to increase their adoption among EU farmers; socio-economic factors that impact on the adoption of these circular methods by farmers and consumer attitudes to these new production methods.

3 www.solace-eu.net/about

2 European Market Observatory for organic food & farming

Specific challenge

Market transparency in the organic food market remains a challenge, especially the collection, analysis and pooling of data at the European level. This includes electronic data on product volumes and values, product flows in the internal market, estimates of the retail sales markets, import/export data, price data, data on certificates, practices for fraud prevention, and data on contamination in organic farming. There is also very limited information on farm-gate and retail prices, the differences in structure of the supply chains and on added value and the farmer share in value chains.

Research also needs to address the integrity and reliability of the organic certification and control systems including organic imports, in view of rapidly increasing number of operators and how they adapt to the new rules.

Further, there is a specific need for pooling consumer survey data related to organic markets to overcome the current lack of harmonization of procedures and indicators. Data need to be pooled, exchanged and analysed for an EU-wide market perspective which also identifies changes in trends over time.

There is also a need to gather statistical information about agroecological initiatives in order to understand the scale of agroecology and to overcome the lack of any statistical data on it.

Scope

Research should:

- Build on the outcomes of the Organic Data Network[4] (ODN) and other projects (e.g., LIVESEED) to ensure better design and use of national databases for the availability of organic seed and transplants;
- include all data categories identified by the ODN, such as primary production (area and livestock, production volume and value), prices (farm level, retail), national retail sales volume and value (including the importance of specific outlets, direct sales and procurement, product categories) and data on international and intra-European trade;
- develop recommendations for standardisation and broadening of existing surveys on consumer attitudes, demand for organic products and cultural preferences across the EU and EFTA;
- collect better data about certification, control and the integrity of the organic sector for a more reliable and efficient control system and fraud prevention;
- gather data to understand the scale of agroecological initiatives at European level.

4 www.organicdatanetwork.net/home

3 Boosting organic breeding and the production of organic cultivars

Specific challenge

To preserve agrobiodiversity, the organic regulation provides new tools, such as the definition of organic heterogeneous material (OHM), and permission to market such materials. A temporary experiment for improving the release of organic varieties suited for organic production is foreseen in the regulation. To reach 100% organic seed of adapted cultivars by 2036 for all crops[5] and in all Member States is an important political goal. The new regulation will also open the door for the revival of different traditional and local crops and breeds. It will pose new problems for adequate and timely upscaling of organic breeding and seed production meeting the demand of fast-growing markets and climate change challenges.

To capitalize on the new organic regulation and the temporary experiment on organic varieties to start in 2021, implementation should be accompanied by coordinated European research which includes a broad range of crops taking into account the diversity of the European seed systems.

Scope

Research should:

- Identify and develop additional governance and financial models to support organic plant breeding;
- include the whole value chain and strengthen capacity building and collaboration with existing actors of the breeding and seed business to achieve the required breeding gains;
- implement the cultivar testing under organic conditions in collaboration with examination committees, consisting of public and private actors from on-farm and on-station networks for pedo-climatic regions;
- develop governance models and common marketing strategies for introducing improved cultivars and breeds as well as seed multiplication and treatment;
- investigate seed, root and gut microbiome to improve resilience of cultivars and breeds;
- focus on several crop categories including fodder and horticultural crops and/or animal species including aquaculture.

5 www.liveseed.eu

4 New genetic engineering technologies and their implications for organic farming

Specific challenge

The development of new genetic engineering techniques in plant breeding represents a challenge to the organic sector. In the EU, these methods are currently not permitted in organic farming. However, a possible future exemption or change in the regulatory framework poses an existential threat to the organic sector regarding transparency and traceability. The new gene technologies are controversial within the European public, intensively promoted by some scientists and actors of the agricultural industry and currently rejected by the sector. At the same time, new gene technologies in plant breeding could potentially contribute to agricultural sustainability, when embedded in a comprehensive approach to farming and food production, where plant protection relies on a variety of measures from crop genetic diversity to measures to increase local biodiversity.

However, ethical values such as freedom of choice and the precautionary principle have a relevant role on the acceptance of new technologies in general and, more specifically, in genetics, biology, agriculture and food production. Limited scientific knowledge is available about values and beliefs that are relevant in the organic sector. Therefore, it is necessary to better understand the values, boundaries and principles that shape both plant breeding based on genetic engineering and organic plant breeding.

It is also necessary to ensure that detection methods and strategies are developed to identify products obtained by new genetic engineering techniques and that both the organic sector and the conventional GMO-free sector have the technical means to identify and avoid the unintended presence of GMOs in their products.

Scope

In order to i) safeguard the integrity of organic food, ii) ensure access to crop genetic resources for organic breeders, iii) allow farmers autonomy with regard to seeds, iv) produce organically and meet the highest consumer expectations, and v) ascertain that value based approaches to plant breeding are in line with agricultural sustainability, research needs to focus on the following:

- Gaining a better understanding of the role of values, principles and aims of organic farmers and breeders on the compatibility of technologies for organic production and breeding;
- assessing and quantifying the contribution of seeds of different provenance to the sustainability and resilience of organic farms;
- comparing the efficiency of different breeding approaches for organic farming;
- developing detection methods and strategies to identify products obtained by new genetic engineering techniques;
- identifying the current market authorisation of plants and animals associated with new genetic engineering methods.

5 Dealing with contamination in organic products

Specific challenge

A great variety of synthetic substances of agricultural and other origin are present in the environment polluting natural resources as well as agricultural crops. This is particularly evident in organic farming, where synthetic pesticides may not be used, but traces can be found due to contamination. This poses multiple challenges for the organic sector: (1) Minimizing the levels of contamination in organic products is essential to maintain consumer trust in organic food; (2) the presence of unauthorized substances in organic production requires investigating by control bodies and operators. Not only does this incur labour and analytical costs to the individual operator, it can also delay delivery of the commodity, which may affect the entire downstream supply chain. The non-harmonized approach of different EU Member States poses additional difficulties when organic food is traded internationally.

Scope

Research should focus on the following:

- Identifying critical contamination points of organic agricultural products in the organic value chain to increase the understanding of the main sources and extent of contamination by non-authorized substances;
- identifying and developing effective and efficient methods and practices for the reduction of the contamination of products;
- increasing the detection of fraud in cases of intentional use of synthetic substances;
- developing better guidance for the organic sector on dealing with contamination, leading to better international harmonization in the field;
- data sharing among relevant stakeholders to allow a more coordinated approach to contamination sources.

6 The implementation of the new organic trade system

Specific challenge

The changes in the organic trade system proposed in the new organic Regulation will be applicable to the international trade of organic products and to organic farmers from third countries. The new system for imports of organic products and proposal for implementation establish two imports regimes based on equivalence or compliance, depending on the third country where the organic good has been produced.

The equivalence system will maintain current equivalence agreements (currently with 13 non-EU countries) that will have to be renegotiated in the frameworks of EU bilateral trade agreements. For the countries without this equivalence recognition, only control bodies recognized by the EU can certify organic products for export to the EU. In these countries, after a 5-year transition period when the new regulation enters into force, farmers will have to comply fully with the EU regulation. This change affects organic farmers in third countries without a trade agreement with the EU.

Scope

Research should focus on:

- Assessing the impact of the compliance system on existing organic trade flows, especially on the behaviour of non-EU-equivalent third countries farmers and on the behaviour of other actors of the organic supply chain (including control bodies, importers and retailers);
- examining the impact on certification costs for farmers in these countries as well as the dynamics of the organic certification market, including competition with other relevant global organic standards and on domestic (EU) organic production;
- the EU's outermost regions where agri-environmental conditions might create new opportunities for EU farmers;
- analysing existing statistical data[6] on trade flows and the connection with domestic organic sector dynamics;
- providing recommendations for policy-makers to develop a power-balanced structure in the design of organic trade policies, regulations and agreements which support the democratization of access to markets.

7 Increasing the sustainability of organic aquaculture

Specific challenge

Producing enough sustainable seafood protein is one of the important challenges of our food systems, taking into account the stagnation of fisheries production. Increasing aquaculture production in a sustainable way requires an increase in the availability of high quality and nutritious feeds with ingredients other than fish meal and oil and which does not compete with food sources for human consumption (e.g. soybeans). Closing nutrient cycles can facilitate the sourcing of novel feed ingredients and simultaneously recycle nitrogen and phosphorous emissions into sustainable protein. European consumer demand for fish and shellfish is focused on a limited variety of often highly processed products derived from a limited range of species. Providing incentives for producers and encouraging consumers to consider more sustainably produced species from polyculture systems can reduce the ecological impact of fish and shellfish production considerably.

There is a lack of availability of organic juveniles for several key farmed species, for a variety of reasons which are mostly species-specific. This hinders the development of several species and creates the additional challenge that it completely prevents the EU-certified organic production of certain species, such as pangasius.

Scope

Research should include:

- Strategies to increase sustainable alternatives to fish meal and oil, without utilizing marine sourced feed ingredients and those competing with food for human consumption;
- the development of alternative and truly sustainable feed ingredients for organic aquaculture, including from waste nutrients which need an assessment on safety and their potential for the recycling of nutrients into high quality feed;
- a focus on organic juvenile availability, including species produced in Europe as well as imported species of high economic importance;
- analysis of the reasons why different stakeholders do not adopt environmentally friendly production systems and strategies to address them accordingly.

6 www.ec.europa.eu/environment/circular-economy/index_en.htm

PRIORITIES TO TRANSFORM EUROPE'S FOOD & FARMING SYSTEMS

1 Climate-resilient, diversified farming systems based on ecological approaches

Coordinator: Lizzie Melby Jespersen

Research on and development of more climate resilient and diversified farming systems is a prerequisite for more sustainable agriculture that can contribute to achieving the UN's SDGs, mitigate climate change and improve biodiversity in rural areas. Diversified farming systems are here defined as farming practices and landscapes that intentionally include functional biodiversity at multiple spatial and/or temporal scales in order to maintain ecosystem services that provide critical inputs to agriculture, such as soil fertility, pest and disease control, water use efficiency, and pollination. At the same time, they should contribute to public goods such as carbon sequestration, renewable energy, animal and human health and welfare, protection of the environment, biodiversity and rural development.

Diverse and healthy crops and livestock for multi-purpose production

1.1 Achieving a circular economy in livestock production

This topic was developed together with the Animal Task Force[7].

Specific challenge

Given the finite natural resources, there is a clear need to change animal production, the production of animal feed and their impact on the use of natural resources. Therefore, livestock-production systems need to be based on sustainable and efficient ecological cycles and the concept of the circular economy which is a key principle in organic agriculture. Reintegrating livestock and crop production are key elements in this. The circular economy approach to livestock production will include synergy and complementarity with sectors such as crop production and environmental protection, energy supply, food processing, human and animal health and welfare.

Scope

Research should focus on:

- Out-door systems integrating pastures, crops, agroforestry and livestock (monogastrics and ruminants);
- reintegration of livestock production systems with specialized cropping systems at farm, local or regional level;
- biorefinery of by-products and waste products to optimize the use of different plant parts for feed, food, bioenergy and other biomaterials, and the assessment of the nutritional value of other by-products;
- use of green algae and duckweed as biomass or feed to recover nutrients from water beds;
- analysis of feed interaction in relation to animal phenotypes and animal gut microbiome.

1.2 Healthy crops and stable yields – crop management based on functional diversity

Specific challenge

A major reason for the reduced yields in organic crop production is the lack of suitable and effective crop management strategies based on preventive measures such as functional biodiversity and biological control. Weed competition also causes considerable yield losses in many crops highlighting the need for effective weed control strategies. Crops with a good nutrient status are more competitive against weeds and more resistant to pest and disease attacks. Building soil fertility and optimal nutrient management are, therefore, a key part of the solution to achieve healthy crops and stable yields.

Scope

Research should:

- Investigate crop health benefits from more diverse cropping systems;
- develop and evaluate new, more selective and environmentally friendly methods and products to control diseases and pests;
- find solutions for effective biological control at field level, farm level and the wider landscape to support diversity and an abundance of natural enemies;
- develop new techniques, equipment, tillage strategies and crop rotation systems for efficient and effective non-chemical weed control, especially in stockless arable and horticultural farming systems;
- examine optimal nutrient availability as regards amounts and timing in relation to crop needs to ensure crop health and stable yields.

7 www.animaltaskforce.eu

1.3 Microbiome and sustainable food production

Specific challenge

To achieve more sustainable farming systems and reduce use of external inputs plant-associated microbiomes need to be better understood. Plants harbour a wide variety of microorganisms both above- and below-ground, which significantly contribute to stability, resilience and adaptability of farming systems via enhanced plant nutrition and resistance against biotic and abiotic stresses. However, farmers and breeders do not have access to the proper tools to make good use of beneficial plant-microbe interactions. Next-generation molecular techniques provide opportunities to make better use of beneficial interactions between the crops or livestock and their microbial communities.

Scope

Research should focus on:

- Use of plant-pathogen-microbiome interactions to predict stress resistance in legume breeding programmes;
- use of plant-plant-microbiome interactions to predict performance of legume-cereal mixed cropping systems;
- augmenting plant and seed microbiomes via management practices, organic amendments such as compost, bio-stimulants and biological control agents to increase nutrient utilisation and resilience against biotic and abiotic stresses in legumes, cereals and tubers.

1.4 Digitalisation for more diversified farming systems

Specific challenge

High labour costs or even lack of labour is a barrier to the productivity of farming. Robots and digital applications can help to improve production. If the new methods and techniques are evaluated and adapted to organic agriculture and agroecology, the overall effectiveness and sustainability of the systems improves.

The biggest cost factor in organic crop and vegetable farming is weed control. Whereas many possibilities exist to control weeds between the rows, in some crops, up to 200 working hours per hectare are still spent within the rows. Research & innovation is needed to develop the potential of weeding robots beyond currently existing models. Digital technologies can further be used to plan and locate management interventions with precision. In livestock management, better monitoring of animals, especially with regards to their behaviour and health can lead to improved production sustainability.

Scope

Research should focus on:

- The evaluation of tools such as GPS controlled digital cross hoes or autonomous weeding robots to distinguish weeds from cultivated plants and ways to adapt these technologies to organic and small-scale systems;
- real-time monitoring of the status of crops and livestock and in-field diagnostics including pest and disease outbreaks, e.g. using sensors, molecular technology, drones, and cameras; sensor networks to monitor/foster biodiversity;
- the reduction of soil compaction through controlled traffic farming (CTF) to limit machine loads to a minimum of permanent lanes;
- precision sowing to integrate biodiverse, green corridors into farming fields;
- more precise water management to increase water use efficiency and reduce diffuse pollution.

Autonomy in genetic resources

1.5 Plant breeding for climate resilience, production stability and income robustness in organic farming systems

Specific challenge

Crop yields per hectare are usually lower in organic farming than in conventional farming. Breeding better cultivars is part of the solution to improve production in organic farming. In addition, climate change challenges organic breeders to develop better adapted and more resilient varieties. There is a need for further development and testing of new varieties, population breeding (CCPs), line/variety mixtures for intercropping, building on the results of past and current EU research projects, such as LIVESEED and ReMIX. Little is known, moreover, concerning the influence of the plant-soil microbiota interactions on yield, quality, plant health and resilience in agriculture.

Scope

Research should focus on:

- Breeding to close the yield gap between organic and non-organic agriculture and improve yield stability, by developing varieties bred and/or tested under diverse organic growing conditions;
- breeding for nutritional quality; adaptation to intercropping systems; suppression of weeds in different crop rotation systems under different conditions; climate change adaptation; genetic plasticity to nutrient availability under low-input conditions; and for broad resistance to pests and diseases;
- adaptation of variety types towards more functional biodiversity in different rotation systems relevant for arable farming, horticulture, orchards and greenhouse cultivation;

- testing of yet underutilised crops to understand their potential benefits under different climatic conditions and potential adaptation potential;
- identifying and resolving the regulatory obstacles for the use of diverse varieties and adapting them to small scale farms.

1.6 Breeding of animals for longevity, hardiness, and multi-purpose production

Specific challenge

Until recently, most farm animals used in organic farming in the EU originated from conventional breeding companies, which use techniques and housing systems that are prohibited in organic farming. Conventional breeding goals and methods are not in line with organic principles, and the continual selective breeding for maximum yields results in animals that are not necessarily robust or suited for climate resilient, low input and diversified farming systems.

There is a need for the breeding of more climate resilient animals that are more robust, require less high-quality protein feed and which may be used for multiple purposes, e.g. milk and meat or eggs and meat. Breeds are needed that can live good quality, healthy lives on the farm.

Scope

Research should focus on:

- Mapping genotypes of relevant dairy, beef cattle breeds, laying hen and broiler breeds as regards the traits that are valuable in climate resilient organic farming systems (e.g. roughage utilisation and feed conversion efficiency, growth, health and longevity, calm temperament, meat, milk and egg quality);
- genetic mapping of traditional breeds and their use to improve hardiness and easy birth/natural breeding in cows, pigs and poultry;
- low methane exhalation as a breeding goal in ruminant breeding since different breeds of dairy cows produce different amounts of methane;
- breeding for dual purposes;
- the involvement of representatives from the slaughterhouse industry for the development of more flexible processing systems given the challenges of the requirement for uniformity of animals for slaughtering (especially poultry).

Ensuring production diversity in specialised systems

1.7 Agroecological management of protected cropping and greenhouse production

Specific challenge

Organic protected cropping or greenhouse cultivation is often carried out in monoculture which can lead to a greater incidence of disease and pest outbreaks as well as nutrient imbalances resulting in suboptimal growth and/or nutrient leaching.

A particular problem in some Nordic countries is the expected end to growing crops in demarcated beds. Demarcated beds will only be allowed for existing and certified demarcated bed operations for ten years after the organic regulation (EC 2018/848) enters into force in 2021. This is a challenge because soil temperatures may be too cold which slows down mineralisation of nutrients and reduces nutrient availability for the crops. New nutrient management strategies and/or energy efficient soil heating methods are needed to overcome this problem.

There is a need for more diversified cropping systems and agroecological management methods in organic production to increase yield stability, product quality, biodiversity, soil health and improved use of resources, e.g. better rotation systems, use of companion crops and cover crops.

Scope

Research should focus on:

- Financially feasible new and/or improved management methods and technical solutions to reduce the consumption of energy for heating and CO2 release in the atmosphere, more efficient use and recycling of inputs in heated greenhouses and foil tunnels to increase crop yields and product quality;
- evaluation of resource consumption, environment and climate impacts of greenhouse systems comparing "growing in the soil" with growing in compost beds;
- the development of diversified protected cropping systems, involving crop rotations, intercropping, cover crops, green manuring and other agroecological methods to improve the functional diversity and competitiveness of the crops against weeds and to increase their resistance against pests and diseases;
- improvement of soil health and soil fertility as well as reduction of soil borne diseases;
- new methods and management strategies to reduce/avoid leaching of nutrients to the ground or surface water.

1.8 Diversified fruit orchards and vineyards for functional intensification

Specific challenge

Organic orchards and vineyards are intensive and specialized systems. Although being managed organically means there is some positive impact on biodiversity, these systems are still simplified and often have only one variety (and one rootstock) over large areas or even a single clone (vineyards). Such simplified systems are easily attacked by pest and diseases and the organic management is often restricted to direct control, while the use of agroecological measures is limited, and when applied, often of limited effect. Increasing biodiversity by intercropping is a challenge in such simple systems but could help overcome the need for high inputs in terms of labour, plant protection and soil management and stabilise yields and product quality in the long term. Climate change demands new management strategies for diversified organic fruit orchards. Developing economically viable systems that ensure high quality fruit production requires identification of the best combinations of species and of varieties adapted to the different regions of the EU.

Scope

Research should focus on:

- Systems and designs for the inclusion of different plant species within specialized orchards and vineyards in different climatic zones and adapted to various socioeconomic farming structures and cropping systems;
- the inclusion of varieties producing high quality fruit meeting consumers' demand;
- quantifying the benefits of diversification, in terms of functional biodiversity, resilience, use of natural resources, pest and disease management;
- assessing the economic performance of the proposed diversified systems.

1.9 Sustainable concepts for organic and low input monogsastric systems

This topic was developed together with the Animal Task Force[8].

Specific challenge

Production systems with monogastric animals are mainly reliant on high quality feeds from external sources that compete with food for human consumption. Livestock production systems have become highly specialised and have become decoupled from other areas of farming. These systems prioritise high yields rather than low environmental impact, resilience and sustainability. This conflicts with consumer expectations about animal production systems.

A challenge is to design systems which overcome an apparent contradiction between animal welfare and "naturalness" on one hand and feed and resource efficiency on the other.

Scope

Research should focus on:

- Reconciling the "naturalness" of animal husbandry with resource efficiency through addressing conflicts between feeding and husbandry strategies, and market expectations by reassessing industry quality standards;
- developing and evaluating systems for keeping animals in more natural environments to achieve better animal welfare and health and avoid ecological side-effects;
- the natural behaviour of animals and ensure that part of their nutritional needs are met through natural vegetation;
- new methods of recycling nutrients into feed (e.g. via duckweed or insects) adapted to organic farming and low-input systems;
- exploring the potential of integrated systems of plant and animal production in terms of impacts on biodiversity and successful husbandry and management measures.

Climate change mitigation and adaptation

1.10 Agroforestry for climate change mitigation and biodiversity

Specific challenge

Agroforestry has a positive impact on sustainability (SDG 12) and biodiversity (SDG 15) and has the potential for carbon sequestration in soils thereby lowering atmospheric CO_2 levels (SDG 13). Solid data are lacking on the contribution of different agroforestry systems, and within systems of different combinations of trees, crops and animals. There is a need for the development and testing of new systems or combinations in which more atmospheric CO_2 may be sequestered in the soil while at the same time increasing (functional) biodiversity.

Since the scale of agroforestry is still limited, the total EU-wide effect of carbon sequestration is limited as well. Farmers lack information and examples relevant to their own region and/or climatic conditions to consider taking up such systems. Finally, the lack of detailed data on the effects on carbon sequestration and biodiversity of the various elements in agroforestry systems prevents the use of these ecosystems services to be remunerated in a future CAP system based on the delivery of public goods.

8 www.animaltaskforce.eu

Scope

Research should:

- Gather accurate and reliable data to assess and compare the effectiveness of different agroforestry systems for carbon sequestration and other ecosystems services in various regional climates and soil types;
- explain locally adapted agroforestry designs to farmers and farm advisers through a network of demonstration sites distributed throughout the EU;
- monitor carbon sequestration as input for future optimization of agroforestry systems and collect data to enable future modifications of the CAP towards remuneration of public goods.

1.11 Climate-resilient grass-fed ruminants

This topic was developed together with the Animal Task Force[9].

Specific challenge

Grasslands include permanent grasslands as well as grass-legume leys that are part of crop rotations on arable land. The utilization of grasslands by ruminants is important to produce animal products without compromising arable land for food production. Ruminant production on grasslands plays an important role in carbon sequestration in soils, but there is potential for improvement through more precise and smart grassland management, fodder production systems and feeding strategies.

Grass-legume leys face the challenge of a declining proportion of clover in the grass-clover mix over time. When the legumes disappear, farmers plough the field resulting in rapid mineralisation of soil organic matter, CO_2 and N_2O emissions, followed by nitrate leaching to ground and surface water. At the same time, farmers sometimes experience that legumes become too dominant in grassland as well.

Secondary plant metabolites like tannins, contained in many herbs and shrubs, play important roles in ruminant metabolism. They represent a link between floral biodiversity and climate impacts (GHG emissions), resource efficiency and animal welfare (parasite mitigation). However, interactions between species, and potentially positive effects on the soil, animal health and feed conversion efficiency still need to be investigated in different climatic regions and soil types to optimize the benefits of grass-legume-herbs mixes. Appropriate dynamic models which link feeding behaviour and metabolic responses to fodder quality are needed in order to design smart grassland-based feeding and management systems.

9 www.animaltaskforce.eu

Scope

Research should focus on:

- The development of forage-based feeding systems for ruminants that balance dietary needs through a diversity of roughage sources rather than concentrates, also taking advantage of the effects of plant secondary metabolites;
- systematic experiments and dynamic modelling to optimize nutrient efficiency of different fodder compositions and herbal additives;
- the development of technology-based pasture management and control techniques (GPS-, sensor-, and camera-based) to optimize the link between grassland biodiversity, resource efficiency and animal health and welfare, as well as for forage conservation, storage and feeding techniques;
- investigating causes for the decline or dominance of legumes in mixed stands of grass-legumes under different geographical and climatic conditions and developing solutions for achieving the right balance;
- screening herb species and varieties for their micronutrient-uptake-efficiency, drought tolerance, contribution to water and nutrient cycling, allelopathic effects on reseeding and animal health.

1.12 Carbon sequestration and soil management for mitigation and adaptation to climate change

Specific challenge

Climate change poses great challenges to European agriculture. Farming systems need to adapt to more extreme weather events. Especially arable and horticultural systems with low proportions of perennial leys in the rotation, need measures to increase soil quality and soil organic carbon levels, for carbon storage and resilience to extreme weather conditions. Reduced tillage is proposed to be a part of the solution but poses challenges for organic arable farming as regards control of weeds. A specific challenge is the seed bed preparation in spring under reduced tillage practices and increased water scarcity.

Scope

Research should focus on:

- Arable and horticultural farming systems design and soil management techniques including conservation tillage for improved climate mitigation and adaptation;
- developing techniques and appropriate equipment for controlling and suppressing weeds in conservation tillage without using herbicides;
- designing and assessing arable and horticultural cropping systems in terms of yield performance, diversity, carbon sequestration, fuel reduction and economic viability in different climatic zones in Europe. This will also serve the future revision of the CAP in which public goods provided by farmers are directly remunerated.

2 Redesign of food and agricultural policies

Coordinators: Karin Ulmer & Miguel de Porras Acuña

To achieve the transformation of European food and farming systems new, more coherent and better targeted policy mixes and a profound revision of the Common Agricultural Policy (CAP) are needed). The new CAP post 2020 provides possibilities for the development of support measures (eco-schemes) which require addressing environmental objectives. Organic farming can play a vital role in this transformation, but this requires the continuation of a strong European framework in defining organic production (as in Regulation EC/848/2018) and common guidelines for support schemes. Research accompanying the implementation of the new policy framework should address the impact of the CAP regime post 2020 on the transition toward a more sustainable food system in Europe and specifically, on the organic sector, and policy measures that can be included in other EU policies, such as regional, national and European Organic Action Plans.

New policies mixes should consider hidden costs and externalities and better assess the synergies and trade-offs between agricultural practices, public goods and ecosystem services. Stringent monitoring systems that measure the progress towards sustainability in Europe and assess the contribution of organics and agroecology to the food security beyond Europe are required.

Finally, food procurement policies of local, regional and national public authorities and private bodies have a key role to play in encouraging more sustainable production and in supporting rural economies. They need to be designed in a way that supports young and new entrants into farming.

2.1 A more sustainable and diverse farming sector through better farming policies post 2020

Specific challenges

The gap between the demand and supply of organic products results in increasing imports potentially including products which can be supplied by the EU. There is an intrinsic imbalance between the rigidity of the organic supply and the immediacy of change of consumer preferences. Converting a farm to organic requires a substantial change in the productive structure of the farm and the marketing strategies, and thus benefits from guaranteed support measures. On the other hand, a decline in organic consumption can clearly happen almost immediately, creating the conditions for a potential weakness of the whole organic sector. Also, due to strong growth of the sector in some countries, new entrants (farmers, retailers, processors) are pushing the boundaries of an old "niche" towards a mainstream consolidated sector.

Better knowledge of the socio-economic and regulatory factors that drive the behaviour of farmers, other organic operators and consumers, both in terms of conversion and in exiting the sector is needed to design effective regulations and policies. Regulations and support measures need to allow for the transition of new entrants to the organic sector and understand their needs in order to maintain organic as an efficient production system capable of meeting the demand of EU consumers whilst upholding the founding principles.

Scope

Research should:

- Evaluate the impact of the national implementation of the CAP post-2020 on the sustainability of EU agriculture and the development of the organic sector in Member States;
- carry out projects on pilot farms and regions, combining innovative agronomic systems with novel measurement and administrative methods, including comparisons with previous programming periods;
- examine the efficacy of the common indicators to recognize public goods delivery from farm schemes like organic, and of other policy instruments that Members States may have utilized when supporting the organic sector;
- explore socio-economic aspects of conversion and reversion of both organic farmers and consumers from/to conventional agriculture and food products;
- identify the optimal enabling environment and the drivers to convert to organic farming, as well as the barriers that induce reversion with special attention to family farms and the role of supply chains.

2.2 Measuring agricultural sustainability and public goods in EU agriculture

Specific challenge

The new CAP delivery model and the shift towards a more results and performance-based approach offer opportunities to achieve good environmental practices. Although a framework of indicators for monitoring the new CAP is under discussion, there is still no widely accepted definition of environmental outcomes, sustainability and public goods and how to measure them. Such a framework needs to reflect the real impact of measures, covering a wide range of objectives, including contribution to landscapes and to biodiversity, resource use efficiency, animal welfare and rural development and potential synergies and trade-offs.

There is an indication that environmental externalities of organic food production are consistently lower than those for conventional, but the contribution of organic food systems to public goods is not necessarily reflected in the prices paid by consumers as it is often challenging to evaluate such effects.

Through methodologies that look at true value and cost accounting, public subsidies and direct payments for farmers could be coupled to public goods and ecosystem services. Food systems that reflect hidden costs and externalities are a key instrument for steering consumption patterns towards environmental and societal needs.

Scope

Research should:

- Improve and broaden sustainability assessment and management tools, such as the new CAP tool for nutrients (FaST);
- include other dimensions of sustainability in such tools, such as biodiversity, greenhouse gas emissions, energy consumption, environment and animal welfare. This should build on existing frameworks such as SAFA Guidelines from the FAO and recent scientific evidence on how to measure impacts;
- improve and refine the tools to allow for fair and reasonable comparisons, as well as extend their use to other actors in agri-food value chain (retailers, processors, etc), considering consumer expectations for more transparency in the sustainability of food;
- further develop and adapt reliable and rigorous methodologies to evaluate the internalisation of externalities in the cost of agricultural production, such as True Cost Accounting (TCA) and calculations of Quality-Adjusted Life Year (QALYs) and Disability-Adjusted Life Year (DALYs);
- use such methodologies to compare the performance of organic vs. conventional food systems, either in monetary or non-monetary terms.

2.3 Opportunities for young entrants in local sustainable food systems through green public procurement

Specific challenge

Strengthening the socio-economic fabric of rural economies is mentioned as one of the nine CAP objectives, but the lack of generational renewal in the EU is a problem. In 2013, the average age of European farmers was 51.4 years. Organic farming attracts younger farmers, with evidence showing that 61% of farmers are younger than 55 in the organic sector, whereas they represent only 45% in the conventional sector. One reasons for this lack of interest of young people in entering the farming sector might be the fact that value chains have not delivered on providing fair farm gate prices and fair distribution of added value between farmers and other actors in the value chain.

Local economies, short food chains and the use of European quality labels can be alternative models, serving as a motivation to young entrants, but there is lack of evidence in support of such claims. Food procurement policies of local, regional and national public authorities and private bodies have a key role to play in encouraging more sustainable production and in supporting rural economies. Organic food specifically is recognised under European Commission guidelines for green public procurement. However, many authorities do not specify organic food in their procurement policies, in some cases due to concerns about higher costs.

Scope

Research should focus on:

- Identifying examples of green public procurement policies, models and measures (including public, private and public-public partnerships);
- evaluating initiatives such as local food hubs, community kitchens, organic districts, and short supply chains. Also, identifying factors that may influence whether organic food is specified in in green public procurement;
- further evaluating the impact of green public procurement policies on local regions and their potential for creating opportunities for new entrants in farming and enhancing local food networks;
- developing new business models for local sustainable food supply, in particular for young entrants and women farmers, considering issues of land access, advisory and mentoring support, as well as the distribution of risks and rewards and the potential of capital grant schemes;
- developing ambitious policy recommendations for supporting new entrants and for green public procurement at all levels, from local authorities to European level policy making.

2.4 Contribution of organics and agroecology to food security and sustainable management of natural resources on a global level

Specific challenge

Studies have shown that organic and agroecological approaches can be effective at addressing food security and sustainable resource management challenges in various global contexts. There is a need to assess the transformative potential of agroecological and organic farming using a broad and comprehensive framework that allows for the evaluation of impacts, considering trade-offs and synergies and potential positive and negative externalities in the process of upscaling organic farming and agroecology at a global scale in general and in Sub-Saharan Africa.

Scope

Research should:

- Assess the contribution of organic agriculture to the SDGs and the Paris Agreement based on the lessons from existing initiatives and building on established frameworks for impact evaluation of the sustainability of food systems, nutrition and healthy diets considering planetary boundaries;
- consider food security, food safety, nutrition, agricultural technologies as well as synergies and potentially negative implications, such as loss of indigenous varieties or landrace, making use of existing frameworks such as the FAO's SAFA guidelines;
- cover gender issues, positive and negative impacts on socio-cultural integration and cultural identity, empowerment of small farmers and political dynamics considering the principles and practice of both organic agriculture regulations and agroecology;
- include multi-disciplinary international consortia and link to the EU-Africa Partnership on Food and Nutrition Security and Sustainable Agriculture.

2.5 Strengthening knowledge and innovation systems for organics through digital tools

Specific challenge

Agricultural Knowledge and Information Systems (AKIS) is key for the implementation of organic and ecological agricultural practices. However, AKIS for organic farming is neither well embedded in national innovation systems nor is it well connected between the Member States. The organic sector has a strong tradition of self-help groups, and of producers, advisors and researchers working together to develop solutions. Yet little is known about how to foster effective and efficient innovation systems for the specific circumstances of organic food and farming. The sector needs targeted advisory services that cover a large range of technical solutions, networking, training and demonstration approaches.

New digital technologies offer possibilities for an increased exchange of knowledge between different actors in the agri-food sector. Developers, users, researchers, practitioners, advisors, entrepreneurs and legislators need to discuss the compatibility of technologies with agroecological and organic principles and develop joint approaches.

Scope

Research should focus on:

- Establishing a permanent network of organic advisory services and demonstration farms embedded in the national and European innovation systems;
- mapping existing provisions and initiatives in advisory services for organic farming and agroecology (from public and private providers including control bodies) focussing on particular target groups and topics;
- exploring the role and importance of local knowledge and practice, on-farm research and farmer-led trials, and various methods of knowledge exchange and extension;
- examining best practice, including digital knowledge exchange tools and digitally supported farmer field schools;
- the role of group facilitation in sharing of knowledge between farmers with different levels of experience and on the integration of traditional knowledge into digital tools while protecting farmers' rights and preventing data misuse.

3 Sustainable value chains for better food systems

Coordinator: Raffaele Zanoli

To feed the world sustainably, not only must agricultural efficiency and productivity increase (especially in organic agriculture) but also resource efficiency and sufficiency in consumption must become a common social practice.

It is acknowledged that food processing, distribution and consumption must be better integrated in organics. One of the major questions is how to operate on each step of the food chain in accordance with organic values and principles, including processing and packaging. While organic agriculture is now established as a more sustainable method of production, further research and innovation is required to increase the sustainability and efficiency of the whole organic agri-food chain, contributing to consumer trust and enhancing consumer acceptance of organic food products. The link between organic food systems and sustainable/healthy diets and other public goods that benefit society at large needs further investigation to form the basis for promoting, implementing, and further developing sustainable organic value chains.

The topics included in this chapter aim at strengthening the European food sector through a more efficient and sustainable processing, innovation in packaging and waste reduction, food safety, traceability and delivery of sustainable and healthy diets.

3.1 Consumer demand for minimal processing

Specific challenge

Consumers care more about sustainability, animal welfare and health and want to know more about their food. They continuously demand pure products, wish to avoid additives and GMOs, and prefer gently processed foods. At the same time consumers' knowledge of contemporary food production is low and nutrition skills are in decline. Together, these factors serve to create a strong demand for organic foods with fewer additives and minimal processing.

Processors are provided with a framework for organic food production by the EU regulations. The use of food additives is regulated by a positive list while processing is not further differentiated. Formulations reducing or phasing out additives typically correspond with increased processing hence these issues need to be addressed in parallel. Natural food additives provide an alternative to synthetic additives and both processors and consumers will contribute to a growth in their demand. Natural food additives, specific for organic foods across application categories are therefore needed that are in line with the principles and objectives of organic food and farming.

Scope

Research should:

- Investigate the potential for and application of natural additives across application categories and processing technologies and scales;
- investigate behaviour and properties during processing and in end products, as well as determining changes in quality attributes;
- address sourcing issues such as quality, guarantees and volumes as well as evaluate ingredients across all sustainability dimensions;
- study attitudes, beliefs and intentions regarding buying and eating behaviour concerning foods with and without additives through motivational research and behavioural research;
- assess consumer knowledge levels, information and misinformation, food literacy with respect to synthetic and natural additives, their functions and links with processing.

3.2 Innovation for reducing food and packaging waste

Specific challenge

While there has been much research into innovative food packaging technologies and solutions aimed at reducing the environmental footprint of packaging materials, little has been done to tackle the issue of food and related packaging waste by innovations along the food supply chain.

Using digital technologies, the use of energy can be managed efficiently allowing greater use of renewable energy to produce food. Similarly, water efficiency can be improved by using sensors and control systems to target water use more precisely. In the organic sector there is a need for innovations that reduce waste by minimal and reusable packaging, facilitate public procurement, and for social innovations such as last-minute/food recovery marketing platforms. A proper regulatory environment favouring the reuse of food packaging is also needed. A new holistic, systemic approach to the design of production, processing and handling processes is required to help reduce waste at every stages of the organic agri-food supply chain.

Scope

Research should:

- Identify the main challenges to reducing food and packaging waste in organic supply chains;
- provide an in-depth understanding of organic actors' perception and behaviour with respect to these issues resulting in the design of new processes and leading to new business models and better performing value chains;
- identify incentives and barriers to the uptake of existing strategies, solutions and tools and validate the benefits of these strategies for users/buyers while measuring the technical and economic performance at a system level;
- examine ways to ensure consumer and societal acceptance, optimise access to and the dissemination of results;
- explore policies and regulatory requirements aimed at the reduction of food and packaging waste along organic food chains.

3.3 Sustainable and healthy organic diets

Specific challenge

While organic agriculture improves the sustainability performance on the production side, there is also a need to address the consumption of organic food. The consumption patterns of regular organic consumers seem to be close to the sustainable diet concept of the FAO and an organic diet may help achieve the SDGs. However, the growth in demand for organic food has brought many processed and ultra-processed food products onto the market that do not correspond fully to organic principles and to sustainable and healthy diets. There is a need to educate and inform processors, retailers and consumers of the risks associated with the "conventionalisation" of organic diets.

Scope

Research should:

- Explore consumer food habits and current diets to identify patterns that distinguish organic consumers' approaches to food and diets;
- analyse the role of organic foods in different European food cultures and diets, as well the relationship between the consumption of organic food the food literacy of consumers;
- find ways to optimise organic food systems and supply chains to favour the adoption of greener and healthier food consumption behaviours and to enable more responsible, sustainable and healthier organic diets that could benefit the whole society and contribute to the SDGs.

3.4 Food safety in the organic supply chain

Specific challenge

Food safety continues to be a priority for EU and global food policies. Although the food supply in the EU has never been so safe as today, the World Health Organisation estimates that food-borne bacteria, parasites, toxins and allergens still cause about 23 million cases of illnesses and 5,000 deaths in Europe every year. Furthermore, the European citizen does not have complete confidence in food supply systems. There is also a need to anticipate emerging risks linked to environmental, economic and societal changes. European organic food chains face stricter protocols to avoid external accidental contamination while controlling microbiological safety and preventing food-borne diseases. Given that organic regulations ban most synthetic additives and preservatives in organic food production and processing, there is a need to ensure food safety by alternative processing methods, and to develop risk assessment methods specially tailored to organic food systems.

Scope

Research should:

- Explore solutions to support improved risk assessment and risk management to ensure organic food safety at every stage of the supply chain and beyond;
- explore the use of digital technologies (sensors, blockchain, IoT etc) and develop techniques and protocols to minimize accidental contamination by pesticides, other non-admissible substances, and by food-borne bacteria;
- identify solutions to avoid problems with imported organic raw materials or food and to fully account for the specific risks of each organic food supply chain;
- review current agronomic methods and post-harvest strategies to reduce contamination of food and produce and provide state-of-the art quality assurance strategies for specific organic food sectors.

3.5 Digital solutions for transparency across the value chains

Specific challenge

Across Europe, consumers' interest in the impact of food on the environment and health has been increasing. Consumers expect more transparency in the food chain regarding sustainability of production and origin of food. The faster pace of life and changing family structures require new and more efficient ways of buying and recovering food. Yet, most food in Europe is still supplied using traditional models in which consumers travel to buy food from central points (markets or shops) with limited information about the provenance and quality of the food available. Therefore, new business models that fulfil both consumers' expectations and the need for more flexibility and better traceability need to be developed. There is also a need to optimize the logistics, storage and distribution of food to reduce environmental impacts and shorten the value chains.

Scope

Research should:

- Assess the impacts of blockchain and other relevant digital technologies on the value chain, transparency levels and consumer trust;
- develop and provide end-to-end trustworthy traceability, through blockchain, or other digital technologies, combined with artificial intelligence and IoT, on every input and transaction occurring to a food product from field to consumer;
- carry out social and consumer research to understand the neuroscience behind consumer decisions within digital food chains.

RECOMMENDATIONS FOR POLICY-MAKERS

Our food and farming systems in Europe are facing multiple interrelated challenges. Citizens are increasingly concerned about the impacts of food production and consumption on the ecosystems, health and livelihoods. They want to know where the food comes, how it is made and how sustainable it is. For decades, the organic movement has been committed to providing food with a minimal environmental footprint, of the highest quality and produced fairly. The booming organic food market in Europe reflects citizens' trust in organics and its principles.

To build on this, organics and agroecology need to develop further, inspiring and leading wider food systems. Research and innovation are crucial to this. They lay the foundations of our future food systems. Thanks to the efforts of TP Organics and like-minded organizations, research investment in organic food and farming has grown from EUR 42.5 million in FP7 to EUR 430 million in Horizon 2020[10]. However, while impressive in absolute terms, the amount of funding devoted to organics represents only 0.48% of the total expenditure. To enable the organic sector to support the transformation of food and farming, research and innovation investment needs to step up significantly in Horizon Europe.

In the cluster "Food, Bioeconomy, Natural Resources, Agriculture and Environment", priority should be given to organic and agroecological approaches that use natural resources efficiently and sustainably, create circular systems, and reduce soil erosion and pollution of the environment.

Furthermore, the partnerships "Safe and Sustainable Food System for People, Planet & Climate" and "Accelerating farming systems transition" will prove essential in the transition to sustainable food systems and upscaling of organic farming and agroecology. The partnerships must build on experiences of previous instruments, in particular ERA-NET CORE Organic that has funded research into agroecological processes and organic farming for 15 years. They should also be open to all actors in the agri-food chain, and engage with citizens and civil society organisations.

TP Organics welcomes the planned Mission for Soil Health and Food in Horizon Europe that explicitly includes ecology and agroecology and the delivery of public goods. Better protection of our soils, the basis of food production, is urgently needed. Research must consider how findings can be implemented in practice.

The multi-actor cooperation championed by the EIP – AGRI in Horizon 2020 should be strengthened in Horizon Europe by better engaging advisers and organic actors who have a track record in participatory and collaborative approaches to innovation. The definition of innovation in Horizon Europe should go beyond a technology bias to include social innovation, remaining broad, context-specific and serving the public good.

To conclude, the Strategic Research and Innovation Agenda for Organics and Agroecology identified four priority research areas (moving organics further, redesign of food and agricultural policies, climate-resilient and diversified farming systems, and sustainable value chains) and 29 potential topics to be addressed. TP Organics is convinced that dedicating appropriate funding and support to these priority areas will help steer Europe's food and farming systems towards full sustainability and thriving societies.

10 Excluding the amount dedicated in the 2020 Work Programme of Horizon 2020

TP Organics' Financial Supporters

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