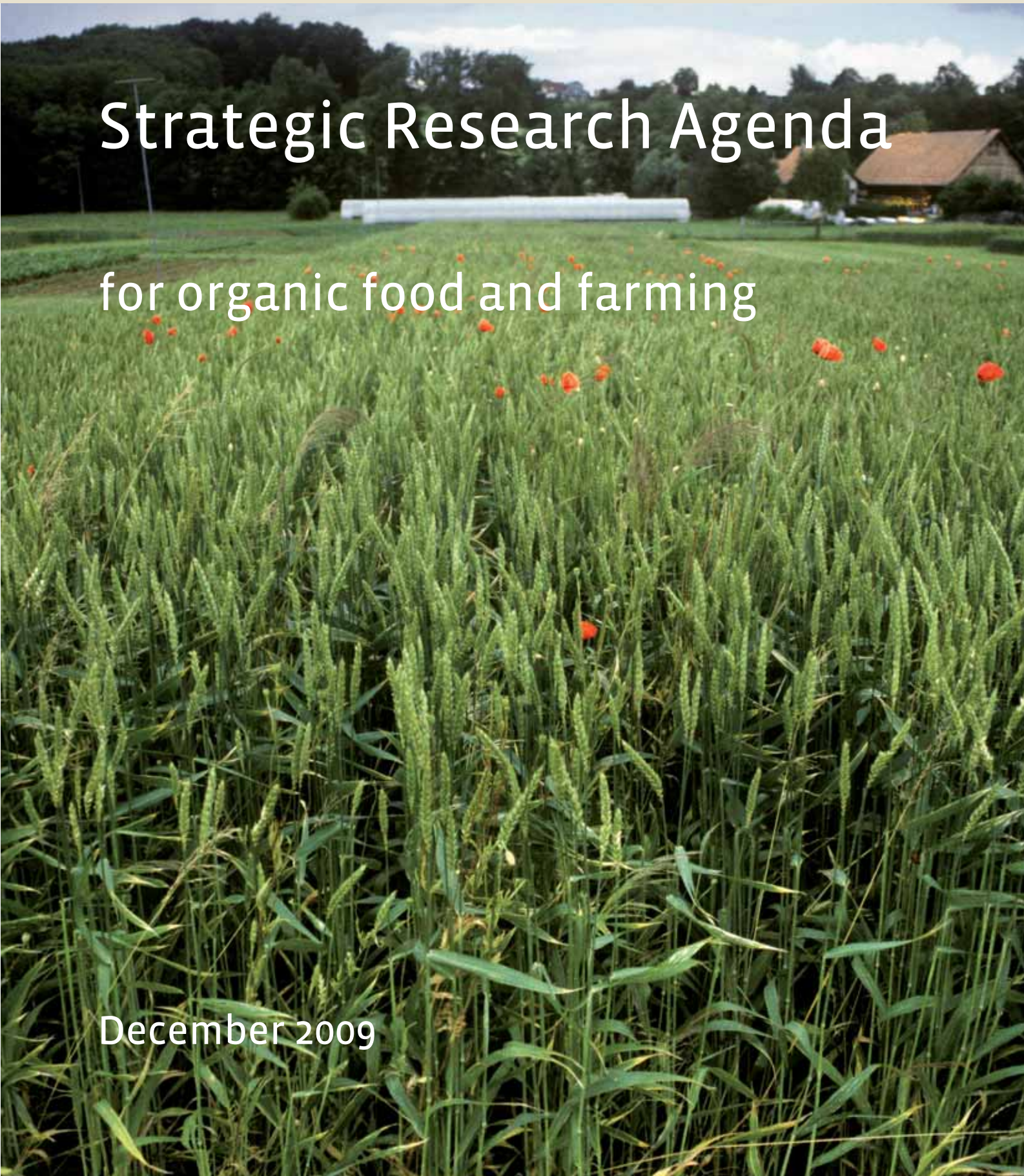
TPorganics
Technology Platform



Strategic Research Agenda

for organic food and farming

December 2009

Technology Platform «Organics»

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Strategic Research Agenda

for organic food and farming

Prepared by
Otto Schmid, Susanne Padel, Niels Halberg,
Machteld Huber, Ika Darnhofer, Cristina Micheloni,
Chris Koopmans, Susanne Bügel, Christopher Stopes,
Helga Willer, Marco Schlüter and Eduardo Cuoco.

December 2009

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Members of the European Parliament:

Paolo De Castro, Chair of the Committee on Agriculture and Rural Development of the European Parliament.

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FiBL

A special acknowledgement to FiBL (Research Institute of Organic Agriculture) for their in-kind contributions to the process of finalising this document.

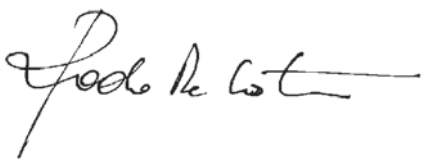
Dear Reader,

It is my great honour to introduce to you the Strategic Research Agenda for organic food and farming. Research into organic food and farming is crucial for the sector's development, and therefore I readily welcome the initiative of the organic technology platform, TP Organics. This document presents innovative research ideas and concepts which will strengthen the competitiveness of organic production in the EU and increase its sustainability benefits for the whole of society.

Today, organic production continues to grow dynamically despite the global financial crisis. On a global level, an area of about 32.2 million ha was being managed organically by more than 1.2 million producers in 2007. In Europe in 2008, organic cultivation covered an area of about 8.3 million ha. The organic market in Europe increased from 13 billion Euros in 2005 to about 18 billion Euros in 2008. This shows the tremendous market potential of organic food and farming, as well as its potential to enhance thriving rural areas. It also reminds us of the need for research, which has a crucial role in increasing the competitiveness of EU organic production.

Support for organic production starting in 1992 is one of the historical achievements of the reformed CAP. Today, with more caution towards public intervention in agriculture and rural areas, the central theme is the provision of public goods. Consequently, one of the main instruments cross-linking CAP objectives with EU citizen's expectations is organic production. To reduce the impact of agricultural production on the environment, promote biodiversity, and to encourage the quality and ethical performance of European food production are key features in the debate on the post-2013 CAP regime. With an eye to climate change and other new challenges introduced by the CAP Health Check, and keeping in mind that 2010 is the UN's International Year of Biodiversity, organic production is directly relevant to EU and global objectives. The innovative research at the heart of this Strategic Research Agenda is appreciated as an important contribution. The EU Commission should strongly support organic research projects and should recognise organic production under relevant cross cutting research themes within current and future EU Research Framework Programmes.

The organic sector can combine strong economic dynamics with sustainable food production, and thus constitutes an important reference for the strategies Europe chooses to adopt in a modern CAP which answers to the expectations of the European citizen. With this direction, we can build a future with sustainable development at its core.



Paolo De Castro
Chair of the Committee on Agriculture and Rural Development, European Parliament

Executive Summary

Technology Platforms (TPs) play a key role in highlighting where the focus of research and development funding should be placed. TP Organics is the Technology Platform for organic food and farming. It integrates views of civil society and the organic sector to represent a broad perspective on research and development priorities that can leverage organic food and farming's potential to address contemporary challenges.

TP Organics, the Technology Platform for organic food and farming, was initiated in 2007 through the cooperation between the European Group of the International Federation of Organic Agriculture Movements (IFOAM EU Group) and the International Society of Organic Agricultural Research (ISOFAR). Since 2007 more than 38 institutions, civil society organisations and companies have supported the development of TP organics.

In July 2008, a Vision for Organic Food and Farming Research to 2025 was published. In the Vision, three strategic provide a framework for the definition of Key Challenges and the associated research goals that can support ongoing development of the organic sector and other low external input systems to secure healthy food supplies, protect rural economies and and safeguard ecosystems. The three themes are:

1. Empowerment of rural areas and economies at a local, regional, national and global scale;
2. Eco-functional intensification of food production to secure food supplies and ecosystem services;
3. Food for health and human wellbeing as a basis for healthy diets to improve the quality of life.

The Vision provided the basis for the development of this Strategic Research Agenda, prepared following comprehensive stakeholder engagement and consultation during 2009. Special attention was given to the involvement of Small and Medium Enterprises (SMEs). Over 300 stakeholders and researchers contributed to the process. In addition more than 110 experts were involved in formulating and/or reviewing descriptions of research goals/topics.

Many of the research goals and topics defined in the Strategic Research Agenda are also useful for addressing questions relevant to the development of more sustainable food and farming systems in general, not only for organic agriculture. Organic systems can thus be seen as a forerunner to sustainable food and farming, efficient in producing a secure supply of high quality foods whilst delivering a range of crucial public goods, if enough support is given for research and development.

Three major cross-cutting societal challenges were identified and considered separately from the themes outlined in the Vision: climate change, biodiversity loss and water scarcity. A further horizontal cross-cutting issue is that of knowledge management and communication.

In each of the three Vision themes the Key Challenges were identified and for these up to six research goals and research topic descriptions were worked out. These descriptions include information about the goal, the rationale behind it, the

research questions, the expected impact, the priority (short, medium or long term) and possible funding schemes.

Altogether 61 detailed research goals and detailed topic descriptions have been formulated. Additional research goals and ideas are found in the annex. Following the process of consultation 11 of the 61 topics have been identified as of the highest short term priority. These are listed below:

Cross-cutting issues:

- Minimising the climate footprint through improved soil management (enhanced carbon sequestration) in organic farming systems
- European knowledge sharing and transfer platform for organic and low-external input farming

Empowerment of rural areas and economies:

- European social sustainability impact of organic and low external input farms and supply chains
- Innovative ways to implement key principles in organic standards and regulations
- Data network for better European organic market information

Eco-functional intensification:

- Improved use of ecological support functions for resilient organic and low external input crop production
- Innovative forms of mixed farming for optimized use of energy and nutrients
- Assessment of organic aquaculture for further development of regulatory framework

Food for health and human wellbeing:

- Development of quality testing methodology for organic food quality
- Processing with care – development of a Code of Practise for organic food processing Sos 31 December 2009 10:01.
- Identification of appropriate biomarkers through animal feeding studies to evaluate effects on health from consumption of food from different production systems

Table of Contents

Overview – guide to the TP Organics Strategic Research Agenda

The TP Organics Strategic Research Agenda presents a comprehensive overview of the research and development priorities for organic food and farming. It is expected that this will contribute to ensuring the sustainability and competitiveness of European organic agriculture and food systems.

- Part I provides background to Technology Platforms and the organic sector.
- Part II provides the detailed research goals under cross-cutting and thematic headings.

Part I: Background – Technology Platforms, the organic sector and a vision for R&D

1: Technology Platforms – R&D priorities for sustainability and competitiveness
Background information on Technology Platforms (TPs) and how they are established.
TPs bring together a wide range of stakeholders to identify research and development priorities, timeframes and action plans for important issues where achieving competitiveness and sustainability objectives depends on major research and technological advances in the medium to long term. Their potential is widely acknowledged by EU institutions.

2: Organic sector – production, market and policy in Europe
Key statistics for the organic sector in Europe and the policy measures that support the sector.

3: Vision for organic food and farming research and development – 2025
An overview of the vision for future research and development for organic and other low external input food and farming systems.

4: TP Organics Strategic Research Agenda
Overview of the Strategic Research Agenda and the inclusive consultative process.
61 research goals have been identified, and seven selected as top-priority. The research goals are classified into two cross-cutting issues and three themes.
Cross cutting issues:
- Meeting the big challenges (climate-change, biodiversity loss and water scarcity)
- Knowledge management and communication

Themes for research and development:
- Empowerment of rural areas – the socio-economic challenge (Theme 1)
- Eco-functional intensification – the ecological challenge (Theme 2)
- Food for health and well-being – the health challenge (Theme 3).

Part II: Strategic Research Agenda 2025

The second part provides a detailed presentation of the two cross-cutting issues (chapters 5-6) and the three themes (chapters 7-9) that form the Strategic Research Agenda of TP Organics. In each chapter a brief introduction is followed by an outline of the specific research goals appropriate to the Key Challenges. A total of 61 research goals are outlined.

Annexes

The annexes contain additional research goals and list the experts involved.

PART I: BACKGROUND – TECHNOLOGY PLATFORMS, THE ORGANIC SE

1. Technology Platforms – R&D priorities for sustainability and competitiveness

What are Technology Platforms?

European Technology Platforms have been established to give a framework for the definition of research and development priorities, timeframes and action plans for important issues where achieving Europe's future growth, competitiveness and sustainability objectives depends on major research and technological advances in the medium to long term. A total of 40 Technology Platforms (TPs) have been set up, covering an enormous range of topics including information technology, clean energy production, pharmaceuticals and biotechnology. The potential of Technology Platforms is widely recognised by EU institutions.

TP Organics is the Technology Platform for organic food and farming. It integrates views of civil society and the organic sector to represent a broad perspective on research and development priorities that can leverage organic food and farming's potential to address contemporary challenges.

Technology Platforms (TPs) thus play a key role in highlighting where the focus of research and development funding should be placed. TPs provide the 'shopping list' of those areas where there is a high degree of relevance to the sector, including all parts of the value chain. Technology Platforms can and should be used to mobilise public authorities at the European, national and regional levels to ensure that adequate resources are devoted to targeted research and development.

At the European level, the orientation and budgets of the Research Framework Programmes are critical. These Framework Programmes are the main financial mechanism for allocation of EU support to research and development. The purpose of TP Organics is to highlight key R&D priorities addressing scientific and technological challenges that could contribute solutions to key policy objectives relating to sustainable food production and consumption – essential for Europe's future competitiveness.

Public-private partnerships – mobilizing business

Adequate funding for research and development is not only a matter of public money, important though this is. Technology Platforms can also foster effective public-private partnerships. Organic food and farming is driven by consumer demand for authentic, healthy food products and higher animal welfare standards, and also by general demand for public goods including a clean environment and healthy soils.. Where there are important market drivers, TP Organics can guide private businesses, cooperatives and marketing organisations in the initiation of targeted research and development. Many businesses undertake R&D to keep them ahead and improve their performance – TP Organics defines those priority areas that could have the biggest impact.

TP Organics – a brief introduction

TP Organics, the Technology Platform for organic food and farming, was initiated in 2007 through the cooperation between the European Group of

1 *See: http://cordis.europa.eu/technology-platforms/ and ftp://ftp.cordis.europa.eu/pub/technology-platforms/docs/i652-etp09-flyers_en.pdf*

CTOR AND A VISION FOR R&D

the International Federation of Organic Agriculture Movements (IFOAM EU Group) and the International Society of Organic Agricultural Research (ISOFAR). Working with the support and encouragement of a host of NGOs, civil society organisations, members of the European Parliament and businesses, a Vision for Organic Food and Farming Research to 2025 was published in July 2008 (outlined in Chapter 3). The Vision revealed the huge potential of organic food and farming to mitigate some of the major global problems of the century – from the preservation of environmental resources to climate change, to food security, to the whole range of socio-economic challenges in rural areas. TP Organics aims to streamline organic research and development by defining agreed priorities and to help translate these priorities into funding for concrete research programmes and projects.

The Vision provided the basis for the development of this Strategic Research Agenda, prepared following comprehensive stakeholder engagement and consultation. Special attention was given to the involvement of Small and Medium Enterprises (SMEs). Over 300 stakeholders and researchers contributed to the process. In addition more than 110 experts were involved in formulating and/or reviewing descriptions of research goals/topics. The process of preparation and the structure of this Strategic Research Agenda are outlined in Chapter 4. Chapters 5-9 present the research goals that aim to meet the identified Key Challenges. These concrete research goals will enable the further development of sustainable organic food and farming and will quantify the enormous social and environmental benefit that could be achieved.

Many of the research goals and topics defined in this Strategic Research Agenda are addressing questions relating to the development of more sustainable food and farming systems in general, not only for organic agriculture. Organic systems can thus be seen as a forerunner to sustainable food and farming, efficient in producing a secure supply of high quality foods whilst delivering a range of crucial public goods , if enough support is given for research and development.

Timing is key; the publication of this Strategic Research Agenda will broadcast a clear call for R&D in organic food and farming. This is essential in the light of the outcome of the global Climate Change conference in Copenhagen in December 2009 and the ongoing negotiations within the EU defining new political priorities for the forthcoming financial period (2014-2020). Right now the challenges of climate change, biodiversity loss and water scarcity need ambitious and well thought through solutions.

2 *TP Organics (2008) Vision for an organic food and farming research agenda to 2025: Organic knowledge for the future. Niggli, U., Slabe, A., Schmid, O., Halberg, N. and Schlueter, M. IFOAM EU Group and ISOFAR. July 2008. See: www.tporganics.eu*

3 *Public goods – In economics, a public good is a good that is non-rivalrous and non-excludable. This means that consumption of the good by one individual does not reduce availability of the good for consumption by others; and that no one can be effectively excluded from using the good. http://en.wikipedia.org/wiki/Public_good*

2. Organic sector – production, market and policy in Europe

Organic food and farming satisfies rapidly increasing consumer interest in food embodying strong values: good quality, high animal welfare standards, and environmental sensitivity, for example. All of these, and more, are expected as an integral part of food by an increasing proportion of consumers.

Organic food and farming is regulated at the European level and organic certification is a European quality scheme that is seen as a benchmark for food quality certification schemes worldwide. However EU organic production shares the market with both conventional food and global organic food production. Its competitiveness therefore depends greatly on innovation, novel appropriate technologies and scientific evidence for the benefits and qualities (demonstrating this is the purpose of the project). Thriving and innovative organic food and farming research will be one of the most important tools for meeting these expectations and making the most of opportunities.

Organic agriculture continues to develop dynamically in Europe. In most countries the organic area is on the increase and the market continues to grow. This positive development is the result of a combination of consumer demand and the introduction of several policy measures, for example support under the rural development programmes; legal protection; EU and national organic action plans as well as support for research and development.

The organic sector is made up of many different people and types of organizations, governments, NGOs and civil society organizations – and ultimately millions of consumers that choose to consume organic food. Each of these plays a role in the ongoing development of organic food and farming in Europe.

European organic agriculture in a global context

About one quarter of the world's organic agricultural land (32.2 million hectares in total) is in Europe (Willer & Kilcher 2009). The European market for organic food accounts for 54 percent of the global organic market and is thus larger than the North American market (43 percent). The global organic food market was US$ 46 billion in 2007 and topped US$ 50 billion in 2008 (Sahota 2009).

Growth continues

Since the beginning of the 1990s, organic farming has rapidly developed in almost all European countries. In 2008 in Europe, more than eight million hectares were managed organically involving more than 220,000 producers (see Figure 1). This accounts for around 4.5 percent of the agricultural area. Although growth rates have slowed with the economic downturn, we continue to see higher growth rates in Spain and in the new European member states (for example Poland, the Czech Republic and the Slovak Republic).

There is a wide range in the percentage of

4 *Data from Research Institute of Organic Agriculture (FiBL) based on information of governments, EUROSTAT and the private sector. The annual survey on organic agriculture world-wide is carried out by FiBL and the International Federation of Organic Agriculture Movements (IFOAM) with support from the Swiss State Secretariat for Economic Affairs, the International Trade Centre ITC and Nürnberg Messe.*

organically managed land between countries in Europe. Four countries have more than 10 percent of their agricultural land managed organically: Liechtenstein (29.7 percent, 2007), Austria (15.9 percent, 2008), Switzerland (11 percent, 2007), and Sweden (10.8 percent, 2008). This compares with some other countries with as little as 1 percent. This difference is also reflected within countries.

The country with the largest area of organically managed land in 2008 is Spain with 1.1 million hectares, followed by Italy with 1 million hectares, and Germany with 0.9 million hectares. The country with the highest number of producers is Italy (more than 44,000 producers).

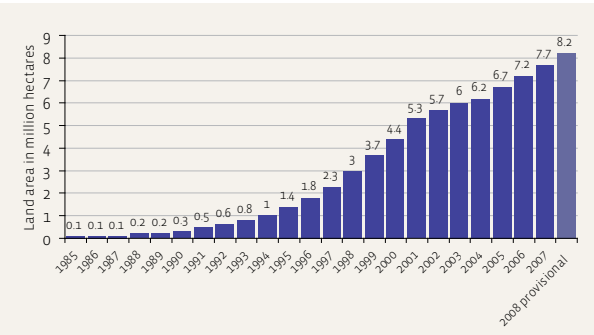


Figure 1: Organically managed land area (including forest and aquaculture, excluding wild collection) in Europe 1985-2008 (Source: Aberystwyth University, FiBL Survey (for data after 2003)

The European market for organic food and drink

In 2008 the turnover of organic food and drink through all market outlets (general retail sales, specialised shops, farm shops, farmers' markets, online) was approximately €18 billion (see Figure 2). The largest market for organic food is in Germany (€5.85 billion), followed by the UK (€2.61 billion), France (€2.6 billion) and Italy (€1.97 billion).

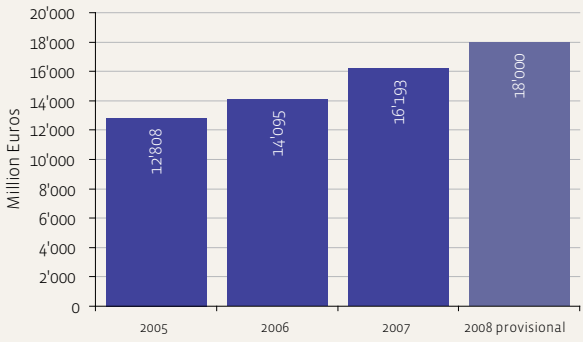


Figure 2: European organic food market 2005-2008 (Source: Surveys by FiBL, Aberystwyth University and ZMP/AMI)

Denmark, Austria, and Switzerland have the highest market share of organic food with around five percent of the total national food market. While organic land has expanded rapidly in many new EU Member States as well as in candidate and potential EU candidate countries, consumption levels have remained very low in these countries (less than 1 percent).

With the economic crisis, there have been signs of the rate of market growth slowing in some countries, however, many companies have reported further growth in the first six months of 2009.

EU regulation on organic farming

The term 'organic farming' has had legal protection in Europe since the beginning of the 1990s with

clearly defined standards and requirements for annual third party inspection and certification. A new organic regulation came into force on January 1, 2009 , repealing the previous regulation and presenting a complete set of objectives, principles and basic rules for organic production. The import of organic products is also controlled. The EU regulatory framework continues to develop as production and processing standards are developed for new products in response to new demands (e.g. for aquaculture and wine products, for example).

This high level of EU regulation provides considerable protection for both consumers and producers. It is also important since it provides the basis for the payments under national rural development programmes and organic action plans.

Rural development policy

In addition to the regulatory policy outlined above, area-based support for the conversion to and (in most cases) the continuation of organic production has been available under agri-environment schemes introduced through the 2000-2006 and 2007-2013 EU Rural Development Programmes. Now all 27 EU Member States provide some form of support for organic farming, and this is the most important policy measure in financial terms. Other countries that are not EU members provide similar support. However, payment rates, eligibility conditions and requirements vary considerably between countries.

At the same time rural development programmes have also provided broader based measures to enable the development of the organic sector, for example through investment in processing, training, marketing and promotion.

A range of policy measures have been established in different EU Members States. This has been supported and enabled through the development of Organic Action Plans at a European, national and regional level. Together these have provided an opportunity to achieve better integration of different policy measures (Schmid et al., 2007).

5 *Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91*

3. Vision for organic food & farming research to 2025

Creating a vision

As a first step towards the establishment of the Technology Platform Organics, an intensive, participatory process was initiated to prepare a coherent Vision for Organic Food and Farming Research to 2025 . Published in July 2008, the Vision revealed the huge potential of organic food and farming to mitigate some of the major global problems of the century – from the preservation of environmental resources to climate change, to food security, to the whole range of socio-economic challenges in rural areas.

The Vision showcased the enormous innovative thrust of organic food and farming research, an innovation that is clearly to the benefit of European society as a whole. The Vision was prepared following wide-ranging consultation with farmers' organisations, scientists, organic traders and retailers, EU-wide umbrella organisations representing a variety of commercial, NGO and civil society organisations. It has provided the basis for the development of the Strategic Research Agenda presented in the following chapters.

Prior to the establishment of TP Organics, short-term research projects were initiated and implemented to address immediate technology gaps in organic agriculture and food production at a European and a national level. However, these research programmes were not informed by a strategic, coherent overview of the whole organic food and farming system. Nevertheless there is no doubt that the investment in research and development to date has supported the rapid expansion of the production base and thus enabled the sector to supply consumer driven markets for organic food products that have experienced unexpectedly high rates of growth.

Informed by the Vision, TP Organics takes a long-term perspective on the research needs of organic food and farming systems; in many cases these are also relevant to a wide range of low external input farming methods – so the relevance extends beyond the organic sector.

Responding to the big challenges

The Vision and the Strategic Research Agenda takes into account the major challenges that human society will face over the next 20 years bringing together the economic, ecological and social elements of agriculture and food production. Three strategic themes provide a framework for the definition of Key Challenges and the associated research goals that can support ongoing development of the organic sector and other low external input systems to secure food and safeguard ecosystems. The three themes are presented in Figure 3:

1. Empowerment of rural areas and economies at a local, regional, national and global scale;
2. Eco-functional intensification of food production to secure food supplies and ecosystem services;

6 *TP Organics (2008) Vision for an organic food and farming research agenda to 2025: Organic knowledge for the future. Niggli, U; A Slabe; O Schmid; N Halberg and M Schluter. IFOAM EU Group and ISOFAR. July 2008. See: www.tporganics.eu*

7 *IFOAM (2005): The Principles of Organic Agriculture. See: http://www.ifoam.org/about_ifoam/principles/index.html*

3. Food for health and human wellbeing as a basis for healthy diets to improve the quality of life.

Organic agriculture is explicitly based on values that draw on the underlying principles of health, ecology, fairness and care as defined by IFOAM and which are to a large extent (with the exception of fairness) also reflected in the Council Regulation (EC) 834/2007 on organic production. These principles provide a unique basis for developing complex assessment and decision-making tools, as well as for modelling future sustainable food and farming systems. Stakeholders along the whole food chain are able to participate in this development and civil society must be closely involved in technology development and innovation.

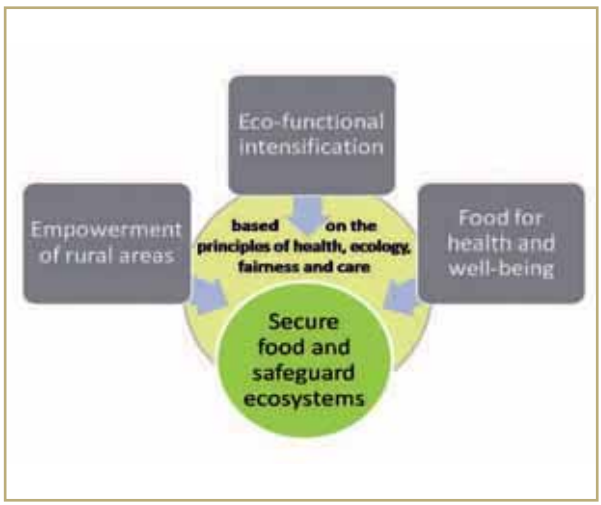


Figure 3: Schematic representation of the three themes for organic food and farming research

The world in 2025 – sustainable, healthy and fair

In each of these three themes, the Vision for an organic food and farming research agenda to 2025 provided an insightful summary of the way the organic world might look in the year 2025:

Empowerment of rural areas and economies at a local, regional, national and global scale

By 2025, new concepts, knowledge and practises will halt or even reverse migration from rural areas to urban centres. A diversified local economy will attract people and improve livelihoods. Organic agriculture, food processing and eco-tourism will become important drivers of the empowerment of rural economies. The dialogue between urban and rural populations will improve considerably and intensified forms of partnership between consumers and producers will emerge.

Eco-functional intensification of food production to secure food supplies and ecosystem services

By 2025, the availability of food and the stability of food supply will be noticeably increased through eco-functional intensification, and access to food will be considerably improved thanks to revitalized rural areas. Knowledge among farmers about how to manage ecosystem services in a sustainable way will be much greater and animal welfare and environmentally sound farming will be cutting-edge technologies in food production.

Food for health and human wellbeing as a basis for healthy diets to improve the quality of life

By 2025, people will have more healthy and balanced diets. Food and quality preferences will change: fresh and whole foods will be the ultimate trend and processing technology will produce foods with only minimal alterations to the intrinsic

qualities. The specific taste and its regional variation will be more appreciated than artificially designed.

The Key Challenges and research goals that form the TP Organics Strategic Research Agenda under these three thematic areas are presented in Chapters 7 to 9.

4. TP Organics Strategic Research Agenda

Setting research goals for the organic sector – relevant to other systems

Despite only receiving a small amount of available research funding at European and national levels, the organic food and farming system has performed remarkably well. On the one hand it provides market and development opportunities for a huge number of farmers, SMEs and rural areas. On the other hand it has improved the environmental performance of farming and offers a leading example for a sustainable food and farming system. Despite the financial crisis the organic food and farming sector continues to grow in the EU and around the world.

The Strategic Research Agenda provides a guide to the key research goals identified that, with sufficient research funding, could significantly contribute to achieving greater sustainability of food and farming. Many of the research goals proposed are relevant not only to organic agriculture but also to other low-input and sustainable food and farming systems.. Other forms of low external input farming systems are practised in Europe by many farmers, particularly in less favoured areas. Consequently the multiplication effect of organic farming research is considerable – many strategies and tools can be applied in other systems. This also applies to the agri-food industry (e.g. information technology, machinery, processors, retailers) where organic food and farming has the advantage of being a well-regulated and defined system developing innovative solutions to create added value.

Delivering relevant results – the purpose of the Strategic Research Agenda

The purpose of the Strategic Research Agenda (SRA) is to enable research, development and knowledge transfer that will deliver relevant outcomes – results that will contribute to the improvement of the organic sector and other low external input systems. More sustainable systems, vibrant and viable rural societies, healthy foods and healthy diets, better policies and more secure markets are some of the aims of the diverse range of projects proposed. These aims are relevant at the EU, national, regional and local level. They are relevant to governments, NGOs, civil society organisations, businesses, citizens and consumers. We must use this agenda to mobilise support from all, particularly taking note that it is businesses that provide the interface with consumers, and it is businesses that need to innovate to survive. The organic market is a key to the delivery of the vision for a better world; the proposed Strategic Research Agenda is the expression of the detailed steps that must be taken within a coherent framework over the coming years. These need to be considered in the light of commercial priorities that include food safety, consumer well-being, the sensory experience and convenience.

From a commercial point of view, we must look for integration of a range of quality attributes that includes organic, sustainable, climate friendly, fair trade, environmentally friendly, high animal welfare and others. The research and development ideas outlined in the TP Organics Strategic Research

Agenda could provide the basis for achieving this.

One challenge in delivering commercially relevant results is to develop a commitment and interest in a mutually beneficial agenda with food businesses. Regular network meetings, exchanging knowledge derived from research and the implementation of research that responds directly to business needs would help. Research that improves understanding of what motivates consumers based on their diverse expectations, the development of new business models and the identification of new value-added could all help bring together the currently rather separate business and R&D communities. Research inspires, educates and provides the background to business performance. Without this link, organic business could potentially drift towards 'business as usual', where organic products are simplistically perceived as having one-dimensional value-added.

How the Strategic Research Agenda was developed

The TP Organics Strategic Research Agenda (SRA) has been developed through a dynamic consultative process that ran from 2008 to 2009. It involved a wide range of stakeholders who enthusiastically joined the effort to define organic research priorities. The process of forming this coalition of partners started in June 2007, when several organisations from the organic food and farming sector got together to discuss the different scenarios of agriculture and food systems up to the year of 2025. This resulted in the Vision outlined in Chapter 3, and subsequently this Strategic Research Agenda.

The secretariat of TP Organics has been hosted by the IFOAM EU Group in Brussels, responsible for coordinating the platform. TP Organics has been managed by a steering committee and involved different working groups, who have together developed this Strategic Research Agenda. The SRA was developed in three steps:

1. Key Challenges were identified for each of the three themes outlined in the Vision;
2. Research goals were defined based on the feedback from stakeholder consultations and expert advice;
3. Research goals were formulated as project descriptions.

For each of the Key Challenges 2-4 research goals were identified and these are presented and described more in detail in Chapters 5 to 9.

Three major cross-cutting societal challenges were identified and considered separately from the themes outlined in the Vision:

- Climate change
- Biodiversity loss
- Water scarcity

The research goals and descriptions for these cross-cutting themes are presented in Chapter 5.

In addition it became clear that there was an additional cross-cutting theme of knowledge management and communication. This has also been considered separately from the themes outlined in the Vision. The research goals and topic

descriptions for knowledge management and communication are presented in Chapter 6.

The Key Challenges and research goals relevant to the three themes identified in the Vision are presented in each of the subsequent chapters (7-9):

- Empowerment of rural areas and economies at a local, regional, national and global scale (7);
- Eco-functional intensification of production to secure food supplies and ecosystem services (8);
- Food for health and human wellbeing as a basis for healthy diets to improve the quality of life (9).

The research goals are generally focussed on organic agriculture, but can be useful for the non-organic food and agricultural sector. There are also several research goals proposed that have a strong link with the implementation and further development of the EC Council Regulation 834/2007 and the implementing rules, in these cases this link is mentioned explicitly.

A full list of additional research topic ideas is provided in Annex 1, whilst the list of experts and stakeholders who have contributed to the development of the SRA is are provided in Annex 2.

Active participation in a consultative process

A call for experts was launched in November 2008 and an expert group of stakeholders and scientists was established. With the call for experts, TP Organics developed three expert groups based on the three research areas of the TP Organics vision. For each working group a senior scientist as coordinator and an assistant expert was appointed. From December 2008 to February 2009 the expert groups developed the first draft of the SRA.

The consultative process involved the active participation of many different countries (Figure 4). Consultation involved researchers, advisors, members of inspection/certification bodies, as well as different users/beneficiaries of the research such as farmers, advisors, processors, market actors and members of civil society organisations throughout Europe and further afield in order to gather the research needs of the whole organic sector. The types of organisations involved in the consultation are presented in Figure 5, with a detailed breakdown of the types of SMEs that participated in Figure 6.

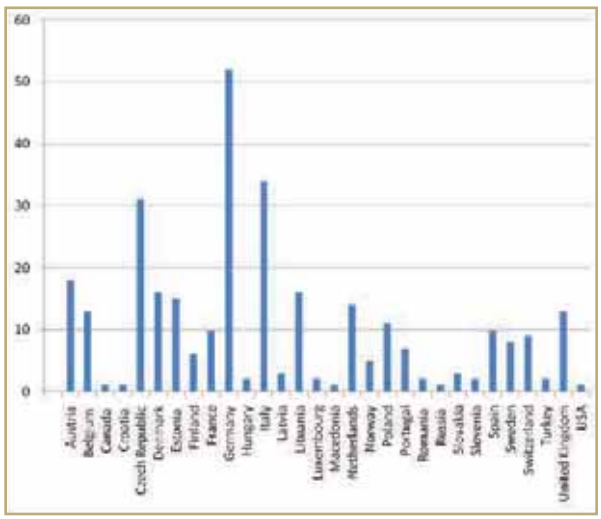


Figure 4: Country of participants in TP Organics consultation.

The major consultation events included:

- Two public online consultations in spring and autumn 2009 gave the broad public the opportunity to comment and gain ownership over the SRA;
- A targeted SME consultation was initiated to ensure in particular involvement of industry;
- A total of 18 workshops were held throughout Europe;
- Expert consultations were used to fine-tune the findings and conclusions;
- A public workshop was held at Biofach (international organic and natural trade fair in Germany) in February 2009;
- A stakeholder forum took place in July 2009 and a last presentation in December 2009 involving EU umbrella organisation and EU institutions and EU Member States.

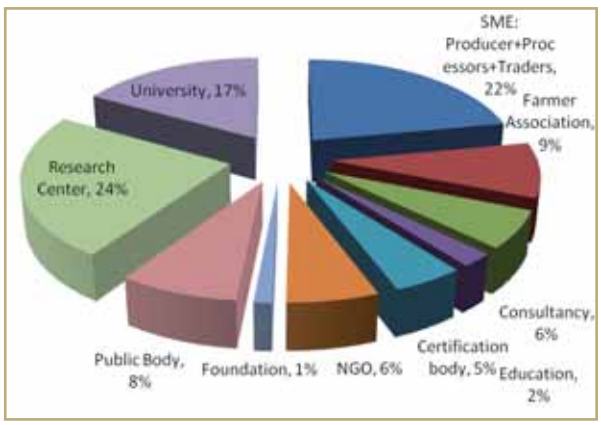


Figure 5: Organisations involved in TP Organics consultation.

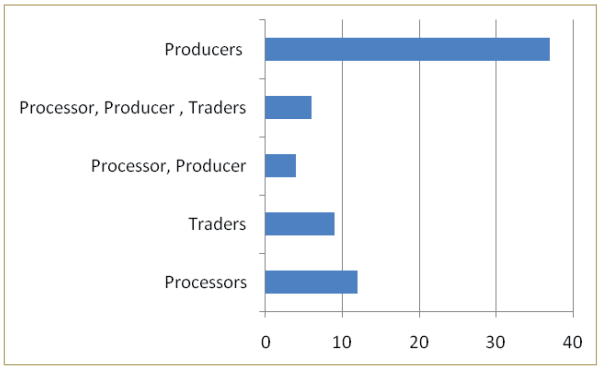


Figure 6: Types and numbers of small medium enterprises (SMEs) involved in TP Organics consultation

In total more than 110 experts (see Annex 1) have been working on the document either in formulating or reviewing the research goals/topics descriptions. Furthermore, over 300 stakeholders and researchers contributed through the consultations or in workshops.

TP Organics has seen dynamic development as an increasing diversity of stakeholders joined efforts to define organic research priorities and promote them to policy makers. It is a growing bottom-to-top initiative of EU umbrella organisations, enterprises, civil society organisations and national and EU-level public and private actors in the field of organic agriculture. Three national organic platforms were established or initiated in Italy, Hungary and Czech Republic and collaborate close with TP Organics. The currently approved ERA network CORE ORGANIC, the network of ministries for transnational research enhanced information exchange about its different activities.

PART II: STRATEGIC RESEARCH AGENDA 2025

5. Meeting the big challenges – integrating solutions to global problems

TP Organics has a strong multi-disciplinary approach, working at different levels and focusing on interactions: the organisms, plants and animals, the farm, the whole food chain, the region and society. Many of the challenging problems of our society cannot be solved by "one problem – one solution" linear approaches.

As already outlined in Chapters 3 and 4, the starting point for the Strategic Research Agenda was the three thematic areas of the Vision:

- Empowerment of rural areas – the socio-economic challenge;
- Eco-functional intensification – the ecological challenge;
- Food for health and well-being – the health challenge.

The process of developing the Strategic Research Agenda identified many specific research topics. However, the holistic or integrative system approach of organic agriculture easily gets lost. Furthermore many research topics and issues are linked and even interrelated with each other. As an example soil management is a key factor for a multi-sustainable approach. It has a strong influence both on soil carbon sequestration and on adaptation to climate change (resilience), water retention and resistance to heavy rainfall, biodiversity (soil and soil is the basis of the food web), soil erosion and nutrient emissions (for example, nitrogen can leach into groundwater or enter the atmosphere as N_2O). Therefore relevant cross-cutting issues were identified.

The most important cross-cutting issues, which came up through the broad consultation process, are considered in more than one of the three thematic areas (see Table 1).

Tab. 1 Cross-cutting issues

Cross-cutting issues	Relevant Theme	Theme 1 Empowerment	Theme 2 Eco-functional intensification	Theme 3 Food and health
Sustainability assessment	Theme 1	**	*	*
Supply chain/ systems	Theme 1	**	*	*
Ethical principles	Theme 1	**	*	*
Knowledge, Governance, Communication, Trust,	horizontal	**	**	**
Food security	Theme 1	**	*	*
Best practise	Theme 2	*	**	*
Climate change, water, biodiversity	horizontal	*	**	*
Multifunctional agriculture	Theme 1+2	**	**	

** Strongly considered

* considered

In order to emphasise the potential of research for organic food and farming for the major Key Challenges of human society, three horizontal cross-cutting issues are already outlined in this chapter 5:

- Climate change;
- Water management;
- Biodiversity.

A further horizontal cross-cutting issue is that of knowledge management and communication, which is considered separately in chapter 6.

In the research goals described in the three thematic sections (Chapters 7-9) these cross-cutting issues are also taken into consideration.

5.1 Climate change

Organic farming systems can be characterized by:

i) excellent soil fertility management,
ii) crop, livestock, habitat, farm and landscape management striving for resilience,
iii) most efficient use of nutrients by keeping their cycles short and as closed as possible.

Organic farms might therefore be expected to be less vulnerable to the consequences of climate change, be better adapted to extreme weather conditions and contribute less to global warming than industrialized conventional agriculture.

Fertile and biologically active soils with higher soil carbon levels capture and store more water and are thus less prone to extreme weather conditions, such as drought, flooding, and water logging. Highly diversified cropping systems accompanied by semi-natural habitats and landscape elements can effectively stabilize yields. And farms with increased diversity of income sources and the flexibility to cope with adverse effects of climate change and variability, such as changed rainfall patterns, have improved economic stability and thus can better manage risks. Reduced input costs make farmers, especially in poorer countries, less vulnerable since the risks of crop failure and consequent indebtedness are lower.

Moreover, higher soil carbon sequestration, minimised use of high energy external inputs and improved cycling of organic matter and plant nutrients make organic farms relevant as a means to reducing greenhouse gas emissions from agriculture.

Hence, organic farming systems represent a 'bundle of experiences and techniques' on which a highly adaptive and low carbon agriculture can be based. In order to make these approaches more powerful and applicable for many farmers and on a large-scale, interdisciplinary research programs are crucial. They could effectively help to further optimise organic farms whilst also delivering scientific evidence on efficient biotic and abiotic resource management. This research could improve many components of other sustainable farming systems as well.

Research and innovation should focus on further reducing fossil energy use and on producing agro-energy in a way that is not competitive with food production and which safeguards natural resources and the environment. The climate impact of different organic food chains and food supply systems should be assessed. Research must also include the potential for reducing the climate change impact from livestock in organic systems by choice of feedstuffs (taking account of the emissions arising from land use change for livestock feed production), and by optimal management strategies for manure and leguminous plants in the crop rotation. Improved land use efficiency has to be analysed, based on eco-functional intensification but also including livestock density, human diets and improved food supply chain management.

A special focus should be given to improved animal health through improved animal welfare as well as to the link between high health and welfare systems and greenhouse gas emissions.

Research goals

1. Minimising the climate footprint through improved soil management (enhanced carbon sequestration) in organic farming systems *
2. Organic farming for climate mitigation, sustainable mixed food and agro-/bio-energy supply
3. Reduction of greenhouse gas emissions from organic and low input livestock
4. Towards zero fossil energy organic greenhouse horticulture

* Highest short-term priority based on consultations

Minimising the climate footprint through improved soil management (enhanced carbon sequestration) in organic farming systems

Description

Organic cropping systems can reduce greenhouse gas (GHG) emissions and enhance carbon sequestration. Research is needed to support technical innovations related to design of integrated systems to strengthen the mitigation and adaptation capacities of agricultural soils, while maintaining yields. Research should look at the potential of good soil fertility management and cultivation techniques such as conservation tillage and crop rotations, including innovative green manuring systems in order to enhance carbon sequestration. Special attention will be given to the effects of improving soil quality (e.g. monitoring / models of dynamics of soil organic matter), soil biodiversity and crop rooting on the adaptive capacities of soils in organic farming systems. Increasing and improving soil organic matter is a focal concern of organic farming, needing basic research into the long term effects of location, soil type, choice of crop rotation and green manuring systems. Care should be taken to avoid sub-optimisation and counteracting effects on the carbon sequestration from possible increased emissions of nitrous oxides and methane due to improper crop rotations and manure handling.

A system-based approach including field experiments, farm level studies and modelling is thus needed. Participatory on-farm research, exchange of experience and expertise among different regions and institutes and specific extension and dissemination activities are all essential. From a technical viewpoint, innovative techniques to control weeds should be addressed as a prerequisite for sustainable yields. In addition, carbon sequestration and other climate effects are profoundly affected by the way we organise organic matter cycles, our recycling of organic matter from society, approaches to cascading, and return of organic matter to the soil versus its use for energy production. It is also vital that we better understand the effects of various forms of organic matter treatment, composting and/or storage.

Such an approach will enhance the understanding of the interactive effects of farm management practises and climate change on the long-term performance of agro-ecosystems. This will facilitate the design of practises for climate change mitigation and adaptation taking into account local conditions and different climate change scenarios. The results of this project will be of considerable importance for knowledge transfer and cooperation with developing countries, where organic farming is widely considered as a promising method of soil conservation due to enrichment of soil organic matter.

Expected impact

Organic farming systems aim to close internal energy and nutrient cycles, increase humus content and quality, and to preserve soil fertility and long-term production capacity. Thereby they inspire unique scientific insights that foster major advances in sustainability of organic agricultural production systems. During the past decades farmers within the EU have mainly capitalized on short-term approaches and external inputs for enhancing crop yields, which undermine the inherent ability of agricultural soils to sustain high yields under unfavourable conditions and/or in the absence of external inputs. Coupling advances in conservation agriculture with organic production should result in useful technical innovations, improved resource use efficiencies, reduced energy use, and appreciable reductions in overall GHG emissions per area unit and per kg of products as well as in increased carbon sequestration rates per hectare. Moreover, such approaches should also make agricultural soils more productive under adverse weather conditions associated with climate change.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)	X		

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X	X*		

* can be part of a larger project with a main focus on organic farming

Organic farming for climate mitigation and sustainable mixed food agro/bio-energy supply

Description

The principles of organic agriculture, as laid down in the EU Council Regulation (EC) 834/2007, call for the development of farming systems that are self-sufficient for energy and implementation of appropriate techniques for mitigating climate impacts. Further, the food system (processing, consumption, waste management) should be more closely linked to basic food production, and the food system should be changed to reduce greenhouse gas emissions. On the production level, the project will focus on crop rotations and land use from the farm to the landscape level for testing and

assessing methods for minimizing climate footprint. At the level of the food system, the project will focus on climate friendly and organic diets. Research includes examples of integration of food with complementary sustainable agro-/bio-energy production through intercropping, utilization of catch and cover crops, and by fermentation of manure (including green manure) as well as slurry prior to recycling. Further, the project will focus on strengthening the links between primary food production and food processing, consumption and waste management and recycling by developing and disseminating optimal menus and diets. Critical issues regarding food security and sustainability should be researched as part of the technical experiments.

Diversified land use can open up new possibilities for combining food production with biomass production and on-farm production of renewable energy from livestock manure, small biotopes, perennial crops and semi-natural non-cultivated areas. Semi-natural grasslands may be conserved and integrated in stockless farm operations by harvesting biomass for agro/bio-energy and recapturing nutrients from residual effluent for use as supplementary organic fertiliser on cultivated land. Other relevant techniques such as pyrolysis of biomass for combined bio-energy and good-quality biochar production for soil fertility improvement and carbon sequestration need to be assessed at the farm and landscape level.

When using biomass for biogas fermentation, the easily degradable organic matter (carbon fractions) becomes less available or unavailable for enhancing inherent soil fertility, which may have consequences for soil quality, carbon sequestration, emission of nitrous oxides and for control/prevention of certain soil pathogens. Research should assess the respective effects on soil quality and total farm-level greenhouse balance of using manure and other biomass in different agro/bio-energy systems; state-of the art methodologies are available to do this, including life cycle assessment, chemical analysis of N_2O and energy accounting. These analyses should be combined with social science assessments of critical food security issues in particular (for example, shortage of food and feed, as well as organic and climate-friendly diets).

Expected impact

Agricultural production and food supply in general is one of Europe's major contributors to emission of greenhouse gases. This could be reversed by developing and implementing modern technologies, designing alternative land-use systems and climate-friendly organic diets. Organic food and farming systems can be self-sufficient for energy and have improved capacity for reducing GHG emissions. Combining organic farming systems with effective livestock management, innovative land use design and sustainable forms of agro/bio-energy production may contribute to ulfilling European objectives of reducing the climate footprint associated with agricultural production and food consumption. The integration of modern sustainable technologies for agro-/bio-energy produc-

tion with innovative ecological land use (combining food production, nature preservation, biomass production and soil fertility maintenance) can thus contribute to advances in multifunctional farming that are also directly relevant to non-agricultural sectors like the energy sector). Strengthening links between food production and consumption through improved utilisation of food waste will further boost Multifunctionality and contribute to reducing the climate impact of the European food system.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)		X	
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Reduction of greenhouse gas emissions from organic and low external input livestock systems

Description

Due to lower external inputs of fossil energy, concentrates and manure than in conventional farming, organic livestock production systems show reduced GHG emissions on a per-hectare-basis. However, when considered per unit of production (per kg, litre or tonne) this positive effect is balanced by the lower productivity of these production systems. Limiting GHG-emissions from livestock through increased use of high quality feeds is a strategy of limited value in organic and low external input livestock production systems, as it contradicts the basic characteristics of these systems. Therefore, research is needed to determine relevant management options to limit GHG-emissions without a negative effect on livestock productivity. However, the importance of ruminants and wild animals able to utilise plant material that cannot be directly consumed by humans should not be forgotten. Monogastric animals are considered more climate-efficient due to their larger growth efficiency; this fact should be balanced against the fact that they consume plant products that can also be consumed directly by humans.

There are several options offering considerable scope, all of which should be researched and assessed in a farm and landscape perspective: integration of livestock with agro/bio-energy systems '(including outdoor pig and poultry production integrated with perennial crops such as willow; or production of oilseed whose oil can be used for motor fuel and whose husks for oilseed cakes fed to dairy cows); use of easily digestible forages and/or purely grazed grassland management systems; adjusting livestock production to seasonal production of feed; reduction in cow replacement rates through improved health and longevity; use in feed of legumes containing secondary compounds (e.g. tannins) with potential for reducing enteric methane production.

Research will include integrative assess-

ments of net climate impact from tested interventions and include possibly feedback and inter-linkages with changes in nitrogen cycling and nitrogen excretion from livestock resulting in changed N_2O emissions. Results from this project will provide important knowledge for the development of climate-friendly and organic diets.

Expected impact

The project will review existing research to develop a system approach to assess the impact of different organic and low external input production systems. The focus should be on contested areas, with research undertaken in cooperation with industry and environmental organisations so as to generate practical systems approaches and deployable recommendations. Increased knowledge of possible synergies between livestock and agro/bio-energy production will contribute to the organic sector's potential to reduce its climate impact while supporting soil fertility, nature preservation and water quality.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)			
Medium term (until 2020)		X	
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Towards zero fossil energy organic greenhouse horticulture

Description

The research project will develop a technically and economically feasible system of organic greenhouse production without CO_2-emissions.

In Northern Europe, most organic greenhouse horticulture requires substantial fossil energy input for heat and CO_2 for the stimulation of plant growth. Because combustion of fossil energy has significant implications for climate change, the ambition must be to create sustainable organic crop systems without CO_2 emissions.. For example, the need for heat and CO_2 can be decreased by advanced insulation and humidity control. The supply of heat can be provided by collection and storage of solar energy. Electricity and CO_2 need to be from sustainable sources.

The project will provide step by step guidance for organic greenhouse growers in Europe to achieve production that does not use fossil energy. Priorities are investments in improved insulation and climate control as well as sustainable sources of energy.

Expected impact

An organic greenhouse sector, using only energy from sustainable (renewable) sources, is particularly sustainable. This could be used in the communication to consumers.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)		X	
Medium term (until 2020)	X		
Long term (until 2025)	X		

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

5.2 Biodiversity loss

Natural scientists consider that during the next few decades there will be a continued loss in biodiversity. Among other ecological functions, the extinction of species from our planet would modify the way pests and diseases are controlled, organic wastes are broken down and recycled, food is produced by agro-ecosystems and water is purified. Agricultural development is also closely connected to other sectors and land uses, from urban to forest and natural areas. Organic food and farming is increasingly considered a realistic management option to preserve and enhance biodiversity in agro-ecosystems and protected areas. The diversity and dynamics of farming systems must be addressed to assess how their combinations can contribute to sustaining environmental resources, especially at the level of landscape mosaics and territories.

Many studies conducted world-wide over the past twenty years have concluded that organic farming can have a significant positive impact on biodiversity at different levels (genetic, species and ecosystems) and with reference to various life forms (bacteria, other microorganisms, plants, insects, as well as small and large fauna animals, birds and so on). However, there is a difference between types of organic farms and types of landscapes in terms of the significance of organic agriculture's contribution to preserving biodiversity. Thus a distinction must be made between "biodiversity induced by organic farming" and "biodiversity for organic farming".

As regards ("biodiversity induced by organic farming"), although the value of organic farming in encouraging and supporting biodiversity is undeniable, there is still the need better to understand the different agricultural factors or techniques of organic farming that mitigate the loss of biodiversity and have the potential to enhance it, both at the farm and at the landscape level. Consequently we must define and implement effective assessment methods using appropriate quantitative and qualitative indicators.

The EU Regulation on organic farming (EC) 834/2007 includes generic considerations on the maintenance of biodiversity of natural ecosystems, but so far the regulation does not include detailed standards or guidelines on measures to improve biodiversity in farm ecosystems. In particular, referring to landscape biodiversity, it is important to verify the potential for organic farming to extend the beneficial effects over long distances and periods of time. Research has demonstrated that the positive effect of organic agriculture increases significantly with increased percentage of organic cultivation at the landscape level but this potential

has so far rarely been used to target public biodiversity objectives.

As regards the second ("biodiversity for organic farming"), the extent to which functional biodiversity may be used to improve and sustain yields and quality of organic crops is not well understood, although it is practically applied to a greater or lesser extent by all organic farmers. Research should be targeted to develop basic and practical knowledge on how planned (functional) biodiversity can contribute to improving the resilience of crop and farm yields. Biodiversity cultivated for the purpose of agricultural productivity may in reality be the very same phenomenon as biodiversity that benefits from organic agriculture. So-called "planned diversity" is often not considered as 'valid' biodiversity from the point of view of conservationists. However, research may demonstrate how functional diversity and biodiversity preservation activities can work in synergy if the ecosystem services of biodiversity in non-farmed areas are better understood.

Finally, concerns regarding ground-nesting birds related to the intensity and/or timing of mechanical weeding, especially in arable crops, should be researched. Since it is observed that organic fields may be more attractive for birds, good management during the breeding period is extremely important to avoid the creation of ecological traps for these species.

Research goals

1. Management of habitats for biodiversity, ecological functions and resilience in agro-ecosystems at organic farm and landscape levels
2. Organic farming in nature conservation areas

Management of habitats for biodiversity and ecological functions in agro-ecosystems at organic farm and landscape levels

Description

The project aims to improve the management of functional biodiversity at levels of organisation beyond the field. Unproductive habitats are an integral part of farming systems. Their functions might be physical (shelter, wind breaks), ecological (natural regulation, pollination, habitats for flora and beneficial fauna) and social (landscape features, recreation), and are found at both farm and landscape levels. Together with productive land the unproductive habitats determine the structure and functions of the agricultural landscape. Organic cropping systems often, but not always, result in increased farm and landscape diversity, but the impact of this on ecological functions is uncertain. The effect of landscape matrix on biodiversity is increasingly acknowledged by scientists, beyond the local effects of agricultural practises. Such a matrix reflects the combination of various forms of agriculture (organic or not) and land uses (agricultural or not).

Across a wide range of geographical sites with varying biodiversity the quantity of habitats

is the decisive factor determining overall biodiversity, including presence of functionally important and declining groups like pollinators, highlighting the importance of farmland habitats for production. Synergies between organic fields and habitats have also been documented for some groups. Interactions between organic and not organic must be addressed. In order to reach a knowledge-based reconciliation of the possible conflict between productive and unproductive land a higher level of understanding of the interactions between land use categories is required, which enables implementation in the shape of targeted design and wise management of habitats.

Expected impact

Results will increase eco-functional intensification at the farm and landscape levels, activate more knowledge per site by the employment of context-specific designs and function-oriented habitat management, and yield other general benefits. Farm and landscape patterns likely to enhance ecological functions and system properties (such as resilience) will be identified, taking into account a diversity of production systems in heterogeneous territories.

The increased understanding of interactions between farming methods, habitat quality and landscape context will be used to develop spatially explicit policy measures and/or private sector contributions (e.g. market organisation) to get the full advantage of the marriage between organic farming and approaches to habitat design and management which optimise ecological functions locally and regionally.

The results of this project will also be of high interest for low external input farming.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)		X	
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Organic farming in nature conservation areas

Description

The project will identify the contribution of organic farming in the maintenance and improvement of nature conservation areas.

Protected areas in the EU correspond to a significant proportion of agricultural and rural areas. Usually nature conservation areas (National Parks, biotopes, Natura 2000 sites etc.) include farmland and rural structures. Within them the interest in the development of organic farming is increasing (e.g. through regional parks) as organic agriculture is based on principles that correspond to the aims of ecological stability that are commonly found in conservation areas.

Organic and also (though to a lesser extent) low external input farming may contribute to the

conservation purpose while decreasing infrastructural costs (i.e. for roads and paths maintenance or for woodland fire prevention etc.).

In order to properly implement organic farming systems within a protected area there is the need to: a) evaluate their performance and impact on the specific site sensitivity (the specific reason why the area is protected) and b) to improve performance and impact when necessary. Furthermore it might be necessary to c) combine farming activity with other local activities (i.e. tourism); d) to define and manage farming activities within the framework of conservation legislation. (i.e. long-term management plans) and consequently structure the support scheme; and e) to combine farming activities with measures to improve biodiversity and care for biotopes. Economic efficiency can also be fostered through synergistic effects among production units. Innovative collaboration between farmers and between farmers and other stakeholders (e.g. public nature conservation areas or drinking water conservation areas) should be taken into account. TThe sites to be involved should represent a good range of protected areas and farming types (including aquaculture for marine and river-side protected areas).

Expected impact

The project output will include: guidance for organic farmers in protected areas on how to combine various organic farming activities with conservation and environmental protection; guidance on the maintenance and improvement of habitats; and concrete proposals for how farming activity can decrease the maintenance costs of protected areas. These outcomes will facilitate the implementation of selected and adapted organic farming methods in protected areas and improve their efficiency. They can enhance participatory approaches in the management of protected areas and contribute to the long-term sustainability of these areas in environmental and economic terms.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

5.3 Water scarcity

The EU Water Framework Directive demands good ecological and chemical quality of ground and surface water. Sustainable agriculture plays a key role in land-use management to deliver this crucial objective whilst also preventing flooding and providing drinking water. Agriculture can have a negative impact on water catchments by abstraction for irrigation and by water contamination. Farmers must therefore obtain the right tools and assistance to ensure sustainable water use. This area of research and development in organic food and farming systems in Europe could contribute significantly to a

more sustainable future in developing countries, fostering food security and well-being.

Agriculture is a significant user of water resources in Europe, accounting for around 24 % of total water use. In southern Europe irrigation accounts for over 60 percent of water use in most countries whilst in Northern Europe it ranges from zero to over 30 percent. Given the importance of water use in agriculture, it is essential that farmers receive adequate information and training regarding efficient use of water resources. This is also important because certain agricultural activities can lead to impacts like contamination or non-sustainable abstraction of water. Since water resources are constantly decreasing, it is crucial that farmers, and in particular organic farmers, are aware of how to minimise water use and the risks from potentially contaminating materials. Research is required to identify the different approaches of water management in agriculture with a special focus on the requirements in existing legislation and voluntary systems. This would help in identifying gaps and developing tools and incentives for farmers to use precious water as a sustainable resource.

Organic farming has the stated principle of "sustainable use of natural resources" in the EU regulation (EC) 834/2007 for organic production. Consequently communication of the requirement for sustainable water management as well as the active development of appropriate tools and techniques and the objective assessment and monitoring of sustainable water use through standards and certification schemes are all necessary.

Research goals

1. Lower water need and use in organic farming systems
2. Potential to up-scale benefits of organic farming in achieving water quality preservation in Europe and developing countries
3. Assessing sustainable water management in organic farming systems
4. Improving water use efficiency and reducing emission of nutrients in organic greenhouse and horticulture production

Lower water need and use in organic farming systems

Description

The project will develop water saving cultivation systems under organic farming conditions in different European regions. Ever-increasing water use in all human activity results in competition for water between agriculture and other sectors (industry, tourism, urban use). At the same time, climate change scenarios are indicating further water scarcity and irregular availability. TThe agricultural sector, and in particular organic farming, must develop farming systems less dependent on constant and high-volume water availability and so more resilient to water stress, in an effort to minimise risk and avert conflict with other sectors over water use.

8 *EEA (2009): Water resources across Europe — confronting water scarcity and drought. EEA Report No 2/2009. The European Environment Agency, Brussels.*
9 *http://ec.europa.eu/agriculture/envir/index_en.htm*

A multidisciplinary approach is needed including expertise on a) crop breeding (including alternative breeding systems); b) soil management and agronomy; c) crop ecology (including rotations); d) cropping systems (including agro-forestry and animal husbandry); e) water management at basin and farm level; and f) socio-economic aspects.

This includes in particular innovative irrigation techniques with decreased water needs and innovative machinery for water-conserving soil and crop management that should also be useful to SMEs.

Expected impact

The project will provide examples of optimized combined organic farming systems that can be implemented in different EU environments to provide a broad benefit to society in terms of food availability with low water use. Further project impact will be derived from reducing the dependence of organic farming systems on water availability (particularly important in the near future scenarios of climate change) and consequently a higher stability of production and farm income.

The project will also contribute to decreasing costs borne by society of irrigation, water conservation and distribution structures

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)		X	
Medium term (until 2020)	X		
Long term (until 2025)	X		

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Potential to up-scale benefits of organic farming in achieving water quality preservation in Europe and developing countries

Description

Water quality is reduced by several human activities; intensive agriculture and animal husbandry are particularly important. Specific risk factors vary among areas and farming systems: nitrate and phosphorus from intensive use of mineral fertilisers, nitrate and heavy metals from inappropriate use of animal waste, point source pollution by nutrients from intensive grazing systems, herbicide use in intensive crop production, organic and microbiological contaminants from animal waste and the use of by-products from food processing in fertilization. The risk is present throughout EU member states with greater problems in fragile systems and in areas with more intensive farming. This problem is even greater in developing countries where intensification of farming practises is rapidly increasing and resources for water quality monitoring and improvement are limited.

Organic farming has proved its potential in prevention of water pollution at farm level and its contribution to mitigating other impacts of intensive systems has also been demonstrated (e.g. soil recovery capacity). What requires further research

is the efficacy of organic farming at a larger scale and its implementation in order to achieve satisfactory results in different climatic and edaphic contexts as well as different agricultural and social conditions.

The project should involve different European areas as well as representative areas in developing countries. It involves a participatory evaluation of the proposed implementation schemes in order to offer practical examples to encourage adoption.

Expected impact

The project should improve the potential of organic farming systems to: a) minimize risk of water pollution, and b) contribute to safeguarding water quality. Proof of better performance will support local-level planning for meeting water-protection goals.. The project will provide the scientific basis for the design of agri-environmental schemes targeting water quality in Rural Development Plans.

In developing countries, the outcome will assure the improvement of water quality in particular for rural populations.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)	X		

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
		X	

Assessing sustainable water management in organic farming systems

Description

Increased future competition for scarce water resources will require reliable tools to assess the sustainability of water use in organic agriculture and horticulture. Existing water accountancy methods (e.g. water footprinting), which express their results in “water volume” units, provide no appropriate parameter to judge the impact of water consumption at a local watershed level, particularly for rain-fed agro-systems Furthermore, they give no (or only weak) indication of water pollution. Since producers receive no guidance on how to respond to the outcome of these accounting methods with regard to their actual impact at local level, they have little practical impact on behaviour

Since “sustainable use of natural resources” is an official principle in organic farming (EEC reg 834/2007, Title II) and due to its established certification system, the organic sector must take a proactive role to establish, validate and implement a transparent assessment system for sustainable water management. For these reasons there is a need to develop practical tools that will assist producers in achieving minimized and efficient water use including the tools for the evaluation of envi-

ronmental and economic impacts. These management tools should enable the assessment and monitoring of sustainable water use per unit of area and per kg of product and should also be usable for clear communication to clients and consumers. Moreover, the methodology should suggest and model consequences of alternative practises and thus create positive incentives for behaviour change.

This project will provide:

- An analysis of benefit and critical points in water management of different organic farming systems;
- A system to evaluate the economic and ecologic impacts of various water management systems at local level in organic farming;
- An innovative approach for pragmatic and flexible certification schemes related to water management within the organic farming system, which can then act as positive incentive for sustainability;
- An exploration of possible threshold effects (i.e. what percentage presence of organic farming is required within a given region to achieve a significant impact on water quality?).

Expected impact

The project will develop and test the applicability of a system to define, monitor and assess the sustainability of water management at an operational level on organic farms. It will evaluate and test existing tools such as the indicators being developed by the European Water Stewardship Program, allowing for an objective assessment and supporting improved water efficiency. The water management assessment can further be developed to support future improvements in standards and regulation of organic agriculture to better align practises with the objectives and principles of the EU Regulation on organic agriculture.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Improving water use efficiency and reducing emissions of nutrients in organic greenhouse and horticulture production

Description

The EU Water Framework Directive requires that surface and ground water should be of good ecological and chemical quality. This requirement is a challenge for organic horticulture and greenhouse production, particularly in light of increasing constraints on water for irrigation. Even though organic systems have advantages in terms of minimum risk of pesticides and nitrate pollution they still need improvement in terms of efficiency in water use, improved irrigation and

leaching of nutrients to ground and surface water. Research should develop and demonstrate the use of advanced equipment and strategies for irrigation management in combination with selected organic fertilisers and strategies for fertilization and soil management to decrease the water use per ha and kg of product and the emission of nitrogen and phosphorus to surface and groundwater. Developed technologies will be tested and demonstrated in controlled experiments and in commercial practise, water use and emissions will be monitored. The socio-economic impact has to be assessed. In this multi-disciplinary approach, researchers, growers and consultants will have to cooperate to achieve a beneficial result for the organic horticultural sector whilst at the same time improving the ecological and chemical quality of ground and surface water within the EU.

A priority subject for research will be the situation in greenhouses, which involves challenges of a different order from those in outdoor horticulture. Because of the longer growing season, greater use of organic fertilisers and higher requirements for irrigation in greenhouse production, there is a much higher risk of nutrient leaching over a much longer period; on the other hand, there is also the opportunity for developing zero-emission production, which is impossible in outdoor horticulture. The other main subject of the project will be on relevant selected case studies in outdoor horticulture; where from the research point of view both the severity of the problem and the potential solutions are different.

Expected impact

The project will contribute to better water efficiency in organic horticulture and greenhouse production; and to improved implementation of the EU Water Framework Directive (2000) where it relates to proper use of surface and ground water. Research at EU level into for this issue is important, because problems in all EU countries are similar and have to be solved by 2015 as required in the Water Framework Directive.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)			X

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

6. Developing a knowledge management strategy for the organic sector

As a cross-cutting issue relevant to all themes, knowledge management must be a key part of the Strategic Research Agenda Knowledge is an important factor in competitiveness. And knowledge sharing is one of the strategic assets of any Technology Platform. Knowledge management has to cover communication among members of the platform as well as communication with the stakeholders that are likely to benefit from the research activities. The European Commission has also indicated that education and training activities should be central to all Technology Platforms.

Knowledge management is of particular importance to organic farming, a system that in many cases aims to replace external inputs by knowledge and information. The multifunctional and multidisciplinary nature of organic farming and related approaches are a great strength but can also be a weakness, presenting problems in sharing and communicating knowledge between researchers, producers and other stakeholders, as well as between producers and consumers.

The diversity of business goals and personal ambitions, the varied skills and education of organic producers, the range of enterprises and supply chains involved and their geographical diversity all contribute to the creation of knowledge in the organic sector. However this diversity can also be an obstacle to efficient knowledge and information management. Knowledge transfer should be an essential part of a research programme, but requires specific expertise. SMEs and micro-enterprises, a key part of the organic sector, often have limited resources to develop the necessary expertise to participate in innovation.

Given the multidisciplinary nature of both the production system and the supply chains, the variety of outputs and the multifaceted nature of the producers, it is inevitable that the mechanisms for dissemination will need to be diverse and target specific in order to be relevant. A broad range of actors in the organic food and farming sector need to be considered, such as consumers, producers, processors and retailers of organic food, but also control bodies, governments and other policy makers. And apart from addressing the needs of certain stakeholders, an effective knowledge management strategy for the organic sector will also aim to integrate across sectors (e.g. plant breeding, livestock breeding, aquaculture, non-food products) and along supply chains from 'farm to fork'. Consumers buy organic products for a variety of reasons, including personal health, care for the environment, the livelihood of producers, employment conditions of workers and animal welfare. Food choices are rarely straightforward (e.g. local versus organic) and consumers can be confused by a variety of claims. Terms used in relation to quality of organic food (including authenticity, naturalness, and integrity) have a different meaning to different people, and consumers are not able to personally verify claims.

Despite considerable investment in research projects at the European and national level, the uptake of R&D activities amongst farmers and growers remains poor. This is in part due to

the complexity of the production system and geographical diversity limiting the transferability of research results. New approaches of participatory research, knowledge exchange networks, development of decision-making tools (including internet based tools) as well as coaching and mentoring are frequently advocated. However, the relative importance of (and the interaction between) different factors and the role of various actors in influencing uptake of management practises are poorly understood.

At the same time, organic farmers and growers contribute actively to the development of new knowledge and techniques. Many organic farmers and growers set examples of good practise, demonstrate new ways of coping with environmental change and teach sustainability issues. Multifunctional strategies such as organic farming may deliver far more benefits overall than single-issue solutions, whilst also demonstrating the potential for change. An evaluation of existing best practise should be carried out, including analyses and further improvements of the feedback obtained from benchmarking, with the aim of developing a generic model of practise capable of adaptation at both the national and the regional level. The challenge is to create a shared knowledge grid to support the evolution and competitiveness of the organic sector in Europe.

The initiative for knowledge management for the organic sector will be developed in close collaboration with other European and national partners, such as the Enterprise Europe Network and initiatives of other European platforms addressing areas of common interest, such as animal welfare and environmental labelling. Developing a comprehensive knowledge management strategy that extends to all stakeholders of the organic sector and that covers both communication and education/ training activities is more than this Strategic Research Agenda can cover. In the following section a number of ideas for projects, arising from the consultation process of TP Organics, are presented.

Research goals

1. European knowledge sharing and transfer platform for organic and low external input farming *
2. Communication tools for ethical values of organic food in the supply chain
3. Technology-driven environmental impact knowledge for decision-making in the organic food chain

* Highest short-term priority based on consultations

European knowledge sharing and transfer platform for organic and low external input farming

Description

The main aim of the project is to build a European platform for sharing, transfer and exchange of scientific and technical knowledge in organic and low-external input agriculture between research and all other actors, especially practical farming.

The platform will utilise innovative techniques such as participatory research, where farmers, food processors and distributors participate in developing the research questions and interpreting the results. Increased contact between researchers and practitioners at all levels throughout the food chain will increase the relevance of research findings, and thereby the interest of practitioners in the adoption of scientific results.

Based on the outcomes of ongoing European and national initiatives the project will screen existing research findings and advisory as well as dissemination activities throughout Europe to identify key areas that have potential to improve practical organic farming, food processing and distribution, particularly in relation to environmental, socio-economic and animal welfare objectives. For these areas tools and materials (such as web-based tools, benchmarking, demonstration activities, discussion groups and standard setting) will be identified. Suitability for uptake will be tested with practitioners in several countries. This will form the basis for recommendations regarding appropriate structures, tools and materials and the roles of different agencies as well as for best practises guidelines for research dissemination. The project will establish a European platform for knowledge sharing in organic and low external input agriculture and prepare proposals for future funding of such activities. Recognising the important role of farmers, food processors and distributors and other involved actors in knowledge exchange, the partnership will include practitioners, advisory and research organisations engaged in knowledge exchange and dissemination activities for organic agriculture and food production.

Expected impact

The project will benefit practitioners, farmers, businesses, research funders and researchers in terms of better impact of research findings by developing recommendations and best practise guidelines for R&D dissemination.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
		X	Ev. COST project

Communication tools for ethical values of organic food in the supply chain

Description

The project will develop and test strategies for how the holistic concept of organic agriculture can be communicated in simple and easily understandable ways.

The EU Action Plan and several national action plans on organic farming aim to increase the organically managed land area within the EU and

this can lead to problems where market development lags behind production. Several studies confirm a positive attitude of consumers and traders towards buying organic food, but consumption remains lower than what could be expected from the results of these studies. Consumers are interested in different ethical values (like animal welfare, wildlife conservation, fair trade, environmental protection, preservation of biodiversity, working conditions) and state a high willingness to pay but organic products are not fully recognised for these attributes.

One of the main reasons for these deficits in communicating ethical values of organic farming is that most food has passed several different steps in a supply chain. Often processing and trading companies do not feel responsible for the communication of the broad range of benefits (in terms of ethical values) that are inherent in organic farming methods. An analysis is required of how producers, processors, distributors and retailers can be more involved in taking up ethical values in their policies (communication policy, price policy, contracts, technology used, etc.). This project will develop simple and easy communication tools that can be used either directly with consumers or via public relation campaigns targeting various members of a supply chain. It will build on activities of the EU Commission in terms of organic food (e.g. the information campaign as part of the European Action Plan for Organic Food and Farming). Furthermore it will explore the impact of intended initiatives in terms of labelling of organic, e.g. for animal welfare and origin of food extending the environmental labelling to food. Tools and strategies will be further developed for different actors in the food supply chain and tested for a variety of product groups and across different cultural EU-regions.

Expected impact

Simple messages and tools communicating the wider benefits of organic agriculture are likely to strengthen the confidence in the development potential of the organic market. They will benefit consumers through providing clear knowledge of what they are buying, companies in developing marketing concepts and policy makers in terms of better targeted campaigns.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Technology-driven environmental and socio-economic impact knowledge for decision-making in the organic food chain

Description

The main objective is to enable decision-making concerning organic food with full knowl-

edge of the environmental and socio-economic impact. A great deal of knowledge has been published about environmental and socio-economic impact of organic agriculture but it is relatively inaccessible especially for the end consumer. Given the current importance of climate change, it is essential that knowledge of the carbon footprint and other relevant sustainability indicators of organic food products are made widely available and accessible for decision-making.

The project will develop a conceptual and practical framework for knowledge capture, collation, integration, dissemination and exchange, including integrating data concerning agricultural and alimentary processes from a variety of sources, setting up systems that can handle large quantities of dynamic, constantly changing data and presenting this in easily usable form for various end-users including consumers. It will deploy a range of methods and granular techniques to collect data such as LCA, ecological footprint, virtual water and other socio-economic impacts of organic food products about production on-farm, processing, packaging and transport and that can effectively be integrated into existing work-flows. This will enable the presentation of coherent knowledge to decision-makers along the food supply chain, including final consumers.

The partnership should be highly interdisciplinary. Strong involvement of commercial companies with interest in both the data collection and the data publication technologies is envisaged. Potential for uptake across the agricultural, food processing and food labelling sectors other than for organic food and farming should be indicated.

Expected impact

The project will benefit producers and consumers by improving the ability to collect detailed data concerning the environmental and socio-economic impact of different agricultural and food processing practises. This will enable decision makers to take environmental concerns into account when making production, processing or purchasing decisions. The project will also provide data sets and technology stacks which will enable a variety of spin-off products to be created. The project will enhance EU leadership in environmental accounting and decision support mechanisms, with potential for global impact. The organic food and farming sector can play a pioneer role in testing such systems.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X	X		

7. Empowerment of rural areas: The socio-economic challenge (Theme 1)

Coordinators: Susanne Padel and Ika Darnhofer

Viable concepts for the empowerment of rural economies in a regional and global context

Strategic objective of Theme 1: Organic farming systems and food supply chains strengthen the sustainable development and the cohesion of rural areas

"Organic production methods play a dual societal role with on the one hand providing products for a specific market responding to a consumer demand for organic products, and on the other hand deliver public goods contributing to the protection of the environment and animal welfare, as well as to rural development" (Recital 1, EC/834/2007).

The production and distribution of organic food by farms as well as by SMEs involved in processing and retailing provides an important base for economic growth in rural areas. It builds on a solid consumer demand for high quality organic foods that are authentic and have a regional identity. Organic farmers not only provide food but are also often involved in a range of other on–farm activities, and preserve and develop ecosystem services, not least because they rely on them. Organic farming is therefore a proven model for sustainable rural development based on low external input agricultural production. Its diversity strengthens its competitiveness and its ability to cope with climate change, while safeguarding consumer health and protecting the environment.

Research can support the empowerment of rural communities by:

- Building on the concept of Multifunctionality to make transparent the trade-offs arising from the social, economic, ecological and ethical complexity of agricultural systems;
- Ensuring the involvement of a wide range of actors (e.g. consumers, farmers, processors, retailers, civil society) to clarify needs and expectations, to establish the relative weight and likely consequences of various actions, and to build a shared understanding of options and strategies;
- Focusing on strategies that strengthen resilience, i.e. that enable stakeholders to cope with change and to take advantage of new opportunities to ensure that recommendations are robust in the face of future challenges.

As organic farming is principle-based (see articles 4 to 6, EC/834/2007), the research methods need to be able to deal explicitly with ethical values alongside technical, ecological and socio-economic aspects. This requires a plurality of theoretical concepts (e.g. ecological economics, sustainability sciences and complexity sciences), as well as interdisciplinary approaches combining applied and basic sciences such as agronomy, natural sciences, farm management, economics, sociology as well as political sciences. To ensure the inclusion of various viewpoints within civil society, research approaches must furthermore include participatory research methods.

Research should be sensitive to gender is-

sues and explore the roles of women as farmers and as entrepreneurs in marketing and processing. It should highlight their specific skills; and identify training requirements and innovation potential.

Several Key Challenges and connected goals for future research are proposed, based on the Research Vision 2025 formulated by TP Organics, several rounds of consultation with stakeholders and inputs from a group of experts.

Key Challenge 1.1: Develop the concept of Multifunctionality to strengthen sustainable rural development

The systems approach underlying organic farming is aimed at simultaneously contributing to several goals, such as "(i) … sustaining and enhancing the health of soil, water, plants and animals and the balance between them; (ii) contributing to a high level of biological diversity; (iii) making responsible use of energy and the natural resources, such as water, soil, organic matter and air; (iv) respecting high animal welfare standards and in particular meeting animals' species-specific behavioural needs and (b) aim at producing products of high quality" (Art. 3, EC/834/2007).

Studies indicate that a high proportion of organic farmers contribute to regional development through activities such as on-farm processing, direct sales, tourism and recreation facilities, education, care farming, bio-energy production, composting, road-side maintenance, or flood retention. Multifunctional organic and low external input farming systems therefore appear well-placed to contribute to the management of region-specific ecosystem services and cultural landscape values. This contribution can be achieved by developing synergies between activities at the farm level, through co-operation between farms and with other rural actors, and through trade and co-operation between regions. The developments of a supportive institutional environment and of public-private partnerships at the territorial level (eco-regions, environmental cooperatives, etc.) are critical factors to realise such contributions.

Research needs to clarify under which conditions farmers using organic and low external input practises can contribute most to the various sustainable development objectives. Strong and systematic evidence, especially in relation to social sustainability, is still scarce. Previous studies have tended to neglect the challenge and opportunities of implementing organic principles, or of rural resilience in the face of uncertain future policy, economic and climatic conditions. Research therefore needs to carry out rigorous assessments, taking into account the different bio-physical, economic and cultural conditions in Europe, and acknowledging the dynamic nature of processes aiming at sustainable rural development.

Research goals

1. Social sustainability impact of organic and low external input farms and supply chains *
2. Mutual benefits of organic agriculture and urban areas

3. The socio-economic impact of care farming in Europe
4. Evaluate the sustainability of local food
5. Resilience and diversity as farming business models in a context of climate change

* Highest short-term priority based on consultations

Social sustainability impact of organic and low external input farms and supply chains

Description

This project aims to improve the contribution of organic and low external input farming systems to social sustainability, one of the three pillars of sustainability. Rural vitality is monitored as part of rural development policies. Social sustainability includes issues such as human capital, skills, entrepreneurial capabilities, social cohesion and quality of life in rural areas. There are indications that organic and low external input farms enhance job satisfaction and quality of life, but strong and systematic evidence of social sustainability is still scarce, not least due to a lack of agreed-upon indicators. Also social issues mentioned in organic principles are largely ignored in standards and certification.

The project will develop quantitative and qualitative indicators of social sustainability (level of employment, quality of work, level of qualification, etc.). These will build on an understanding of social systems as complex and dynamic, involving heterogeneous stakeholders in rural areas, and will refer to EU guidelines for rural development indicators. However social sustainability cannot be only assessed through indicators; in addition qualitative processes of evaluation have to be implemented. The most appropriate indicators and evaluation processes will be tested on a range of farm-types and supply chains. This systematic assessment of the contribution of organic and low-input farming to social sustainability will lead to recommendations for policy makers on how to create programmes effectively supporting multifunctional rural development.

Expected impact

The project will benefit producers and supply chain actors by identifying how they can improve their contribution to sustainable rural development. It will also benefit national governments and the European Commission in terms of indicators of social sustainability and an improved evidence base for a broad range of outcomes in rural development policy.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Mutual benefits of organic agriculture and urban areas

Description:

The project will apply a systems level approach and will stimulate and develop multifunctional organic farms near urban areas. It will focus on the needs of urban areas and their townspeople and the contribution organic agriculture can make to meet these needs through urban agriculture.

Urban communities are showing increased interest in the Triple P concept, where concern for People, Planet and Profit are balanced in economic activity. In the context of food and farming products, so-called People factors might be local production, social cohesion around production operations, and upkeep of beautiful landscapes; Planet factors could include reduced GHG emissions, sustainable energy production, and responsible water use; and Profit factors include, of course, generation of employment and wealth for the economy.

Organic agriculture can combine different agricultural sectors (arable farming, dairy farming, greenhouse production, etc.) with a respect for local food production (within a coordinated food strategy), to strive for sustainable cycles (e.g. by recycling of waste from the city) and to meet the needs of urban areas identified above. Furthermore, urban organic agriculture could offer several services and products like care services, recreation and education.

The project will explore the needs of urban and peri-urban areas in different EU-countries and will investigate the prospects of activities of organic agriculture for urban society.

Research is required to gather specific data in order to carry out a technical, economic and social feasibility study. The project should contain a training component with the aim to encourage and to support organic farmers in their transition towards Multifunctional farming near urban areas. In order to ensure maximum results, participation of organic farmers, economic actors outside agriculture and other stakeholders should be encouraged. An important issue to tackle are the logistical aspects for local food supply such as platforms, food hubs (for public sector supply and also for individual consumers). Involving local communities and authorities in the organisation of local food supply is necessary especially to achieve social equity goals in terms of access to healthy and tasty food and diets.

Expected impact

The project will increase knowledge about the mutual benefits of Multifunctional organic farms and urban areas and will support organic farmers in their transition towards Multifunctional farming in their specific context (country/region).

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)			X

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

The socio-economic impact of care farming in Europe

Description

The objective of the project is to provide information on the socio-economic costs and benefits of care farming for farmers, communities and the general public. A lack of data on this area is hindering the development of appropriate support systems for the sector.

The project will include a scoping study and subsequent classification of care farming system types across Europe. This will build on the work of the Social Farming Project and Cost Action 866, which has gathered existing studies and data on the costs of setting up care farms. It will further compare the social and economic performance of care farming with that of other interventions. This will include the development of a common assessment methodology.

This approach will allow the identification of systems which are more successful or economic and will enable knowledge transfer between European countries. The focus will also include care activities in farms that are not specialist care farms. Specific training and institutional aspects have to be considered.

Expected impact

The project will support policy makers by providing more information on the social and economic capital and investment required for care farming relative to other treatments. It will allow the development of a common judicial framework for care farming across the EU, by classifying care farms according to system type. The project will provide benefits to research by encouraging the use of a common methodology when assessing the social/economic impact of care farms. It will also benefit the producers, and the end users, through identifying effective systems and examples to follow in terms of best practise.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Evaluation of the sustainability of local food

Description

The project will systematically evaluate the overall contribution of local food supply chains to sustainable rural development. A wide range of local or regional supply chains exists. These are often based on a more direct contact between produc-

ers and consumers (e.g. home-sales, box schemes, farm-based web shops) and/or on collaborative arrangements between the different chain partners (e.g. co-ops of producers, consumers and/or small and medium-scale processors and sales, adoption schemes). Claims are made for the social, environmental and economic value of these business models to rural areas, but in the absence of data such claims remain unsubstantiated. Different definitions and labels are used whilst the relationship to labels of geographical origin remains unclear. In the absence of criteria these remain unproven, and above all, controversial and contested. Often the respective role of localness and mode of production (low input and organic as opposed to conventional) is also unclear. Therefore, in the evaluation of different local food supply chains, both production (organic, non-organic) and the retail modes should be considered together. The focus should also include the possibility of mixed situations where farms produce both for local and distant markets (especially relevant to medium sized farms).

By identifying best practise examples from a range of product categories and supply chains the project will identify critical control points in relation to fairness, economic efficiency and environmental sustainability and together with industry partners will develop a code of practise for the labelling of local food.

Expected impact

The project will benefit producers through a code of practise. It will benefit policy makers through recommendations to improve rural development programs in the light of CAP reform, including important (legal) obstacles that hinder the development of these supply chains. The project will also benefit consumers through greater transparency and credibility of labelling for local foods..

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Resilience and diversity as farming business models in the context of climate change

Description

The project will reconceptualise the farm business as an embedded entity whose decisions and performance both influence and are influenced by the various networks (ecological, market, social) to which its components belong.

Several foresight studies (e.g. the second SCAR foresight report) show the need for exploring the issues of resilience, vulnerability and diversity in farming business models, especially given the context of climate change. There is a growing consensus that maximization of profits through increased physical production, specialisation and

economies of scale are no longer sufficient in guiding farm development that meets all the requirements that society has in terms of food production and land based services. This is particularly relevant for family farms, which are still considered cornerstones of a vibrant food system and a dynamic rural economy.

By focussing on resilience and vulnerability questions the project will explore diversity as a new business model, including biodiversity, diversity of enterprises and diversity of success factors. Co-production of services relates both to the need to explore the potentialities of social capital (networks among peers) and of public-private partnerships (for example, with social farming or nature management) in a context of loss of population, aging and reducing level of public expenditure in rural areas. Social aspects such as social equity within farm and local communities should be included. Appropriate and adapted models and indicators of resilience are needed both for policy evaluation and for new research approaches (in general, they are based on physical productivity, incomes and levels of pollution/emissions etc). Models and indicators should give much more attention to cognitive aspects (individual and social learning) and relational aspects (ability and willingness to cooperate). These will be tested and assessed in different farming contexts and in different farming systems (organic, low external input, integrated, conventional) in Europe to develop sound recommendations both for the farming community and policy makers.

Expected impact

The project will result in scientific basis for the development of new governance patterns and new support instruments for the European Commission and for national or regional governments and administrations. Furthermore tools for farmers will be developed, indicating how to assess resilience and diversity in farming businesses and activities. The outcome will contribute to robust farm strategies, where diversity and social networking are not cost factors but added benefits facilitating the response to climate challenges.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)			
Medium term (until 2020)		X	
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Key Challenge 1.2: Build and maintain competitive, trustworthy and fair supply chains of high quality organic food

Organic food supply chains need to be credible and trustworthy and maintain consumer confidence by working in support of the objectives of organic production: “products of high quality; and aim at producing a wide variety of foods and other agricultural products and provide goods produced by

the use of processes that do not harm the environment, human health, plant health or animal health and welfare" (Art 3b, EC/834/2007). The supply chains need to implement the overall principles of organic production, as well as the relevant specific principles for farming and processing such as the restriction of external inputs and food additives as well as the exclusion of substances and processing methods that might be misleading regarding the true nature of the product. The organic integrity and vital qualities of the product have to be maintained throughout the supply chain and the risks and rewards should be shared fairly between all partners.

To achieve these goals, the linkages in the supply chains need to be identified and the different stakeholders' interests and priorities need to be reconciled. The precautionary principle must be exercised and new models and procedures to ensure fairness along the supply chain need to be developed and implemented.

Research goals

1. Innovative ways to implement key principles in organic standards and regulations *
2. Data network for better European organic market information *

   * Highest short-term priority based on consultations

Innovative ways to implement key principles in organic standards and regulations

Description

The project aims to develop innovative ways to include key principles in organic standards and certification procedures. Consumers are attracted to organic products as customers and as citizens because organic stands for a range of values. Principles, aims, and objectives of organic agriculture are stated in Regulation (EC) 834/2007 on organic production. However, core values of organic production may be neglected or inconsistent in implementation.. The translation of principles into certifiable practises remains challenging, particularly for more specialised production systems and for international trade. Also, operators are sceptical about more detailed rules and weary of the growing bureaucracy of certification.

This project will review different ways in which principles can act in standards and certification. Focussing on contested areas (e.g. reliance on renewable resources, localised agro-ecological systems, high animal welfare, quality aspects like organic integrity and vital qualities), it will explore how rules influence practises in a range of farming systems across Europe. This will lead to clear recommendations on how key principles can be better translated into organic standards/rules, as well as into innovative certification practises, which give more emphasis to system development. Lessons may be learned from other quality labels (e.g. origin-labels, fair trade). The project partnership

should be multi-disciplinary. Participation of industry (including SMEs), regulatory bodies, and stakeholders of the organic movement is encouraged to ensure feasibility and acceptance of the recommendations.

Expected impact

The project will benefit producers and consumers by increasing the credibility of organic products. It will thus strengthen the competitiveness of all actors in the food chain (especially farmers and SMEs) throughout the EU. It will also benefit the European Commission and other regulatory bodies by improving transparency with regard to how the principles can be implemented in organic standards. Furthermore it will give guidance to competent authorities and control bodies in how to assess the equivalence of standards based on principles (as foreseen in Regulation (EC) 834/2007), in particular for international trade.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Data network for better European organic market information

Description

This project aims to increase the transparency of the European market for organic food through better availability of market intelligence. Currently, no official market statistics (such as volume and value of production and retail sales) of the European market for organic food exist. Data are collected and published by various bodies, including governments, private companies and academic research institutions. However, they often show contradictory trends, and this can lead to very different interpretations of the market situation and lack of willingness of operators to respond to likely growth areas. The project will improve the collection, quality and publication of such market data. Building on established national examples and recommendations of EISfOM-Project (QLRT-2001-02400), the project partners will include a variety of bodies that collect and publish such data including the European Commission, EUROSTAT and statistical departments of Member States, as well as market research companies, research institutes, universities and certification bodies. It will develop and test common methodologies and quality criteria, including how to account for the range of products (including non-bar coded) in a variety of outlets and how to assess the feasibility of national data in relation to trade flows. The partnership will act as co-ordinating centre between public and private bodies and stakeholders, and will develop recom-

mendations on how similar goals can be achieved in the long term.

Expected impact

Improved market transparency of the European organic food market will lead to fairer competition and investment in growth areas within organic agriculture and food production. It will reduce the information asymmetry between large processors or retail chains on the one hand, and farmers and SMEs on the other. Small actors will then be better able to respond to new market opportunities. Better data will improve projections of future trends, assist control bodies and authorities in fraud prevention, and aid policy makers in designing more effectively targeted support mechanisms to complement market activities.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Key Challenge 1.3: Improve organic farming's contribution to food security and international development

The recent food crisis and the economic recession have dramatically put the issue of food security at the top of the policy agenda. However, there is a disagreement on the priorities to follow. On one side a strategy is proposed that calls for a large increase in world food production through a 'second green revolution', based on massive introduction of new technologies and on opening up of markets. On the other side a strategy is proposed that is based on an approach that advocates strengthening the capacity of local communities to build resilient local food systems based on principles of agro-ecology, the use of renewable resources and on enhanced local interaction.

Organic farming can make some contribution to the first strategy through application of agro-ecological methods for productivity increase (see also Theme 2, Eco-functional Intensification). In crude terms of productivity per unit of land, organic farming cannot compete with models of agriculture heavily dependent on oil and other external inputs.

However, if we consider the continuing trend of resource depletion, organic farming may reveal itself as an important alternative approach. In Europe organic farming is more viable than conventional farming for many farm types, provided that it is able to:

› Create value for consumers, by offering prod-

ucts with higher quality standards for which they are willing to pay more;

- Create value-added (income) on the farm e.g. by a diversification of farm activities in smaller holdings and spreading the risk over a larger number of activities;
- Link up to consumers to enable direct channels of communication and supply.

The food crisis and the recession have contributed to a change in the public discourse over organic farming. In the new context, research should be directed towards identifying how organic farming can substantially contribute to 'feeding the world' and is not only targeted at a small group of wealthy consumers and that organic food for all can be considered as a realistic goal. Research focussing on European farming systems (as set out in other Key Challenges and topics of the Strategic Research Agenda) should help to remove the barriers to this goal and contribute to strengthening a new paradigm of food production and consumption, in response to a growing consumer demand for healthy and authentic products.

Demand for various products of certified organic quality also opens up opportunities for producers from southern countries to access European markets. But exporting certified commodity products does not necessarily translate into lasting benefits for sustainable rural or agricultural development and does not secure human capacity building and fair economic returns for producers.

Smallholder agriculture represents a great opportunity to increase agricultural production, particularly in tropical and sub-tropical countries. Global food security will depend essentially on the improvement of this subsector of agricultural production. So far, ecological methods have proven quite effective in increasing soil productivity and improving crop yields. Development of farming systems towards higher (eco-functional) intensity has to continue. Secondly and complementary to international trade, regional and national organic markets have to be built up in order to make organic agriculture a strong driver for rural development.

Research is needed to analyse potential opportunities, conflicts and trade-offs involved in trade with organic products (food and feed, fresh and processed) nationally and internationally and in supporting development of organic agriculture for livelihood improvement in poor regions of the world. It needs to address the impact of different food chain development models (including trade and certification models) on food security and sovereignty, as well as on socio-economic and agro-ecological aspects in the countries of origin, both at the local and the national level. This research is needed although it must be acknowledged that research alone can neither substitute for solving difficult political and ethical choices nor can it overcome the lack of advisory services nor open access to markets. Research results will benefit producers and consumers in developing countries but will also be relevant to European consumers, allowing them to consider a range of ethical attributes (e.g.

Fair trade, food security, environmental sustainability and carbon footprint) when purchasing organic food from developing countries.

Growing international trade also has implications for European markets, especially as regards maintaining the integrity of organic principles embedded in the local areas (e.g. fair trade, development of social and natural capital, soil fertility improvement as well as food security at farm and village level).

Another important focus of research is to link organic farming with sustainable consumption. Sustainable consumption implies a different hierarchy of values in consumers' choice, based on a preference for eco-efficient products and a reduction of overall consumption whilst not reducing quality of life. Sustainable consumption and sustainable production can be the outcomes of co-production initiatives. Public institutions can help these processes through regulation, financial support, and facilitation of citizens' participation in choices over food.

Research goals

1. Urban food production and gardening for food security and sustainable development
2. Sharing best practises to promote sustainable, large-scale transition to organic agriculture

Urban food production and gardening for food security and sustainable development

Description

The role and potential benefits of public engagement in home food production are not properly recognised within the food production system. Research is required so that small-scale food production in domestic gardens, allotments, community gardens, etc. can fulfil its potential in terms of contributing towards food security and providing benefits for the environment, for human health and wellbeing and for building stronger communities.

Firstly, the project should include a scoping study of urban food production and gardening across the EU; defining and mapping home food growing, rates of participation, levels of food production, methods used, barriers/opportunities for participation as well as learning and knowledge exchange systems in place. Secondly, existing knowledge on socio-economic, environmental and health impacts of public engagement in gardening and food production should be reviewed. The study should focus on engagement in organic and sustainable growing methods, considering their potential in terms of delivering on environmental and health objectives. Issues related to standards/guidelines for organic food growing on this scale should also be considered together with barriers/opportunities for sharing (marketing) the produce. Thirdly, case study models should be constructed for different typical regions to demonstrate how

public engagement in food production can be supported and implemented at strategic and practical levels in different areas and situations.

Expected impact

The project will benefit policy makers by providing baseline data on urban food production and gardening in Europe and information on the impact of public engagement in organic and sustainable food growing in terms of delivering towards sustainable development outcomes. This will enable the role of home food production to be included, as appropriate, in policies and strategies for food and land management in the future. The case study models and the opportunities for countries to learn from each other will support regional implementation of urban food production and gardening initiatives. The project will benefit the public (consumers) by providing internet and practical training courses, videos, leaflets and other materials encouraging people to get involved in home food production as a practical action to adopt sustainable lifestyles.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
		X	

Sharing best practises to promote sustainable, large-scale transition to organic agriculture in the Mediterranean and Western Balkan regions

Description

The project will promote large-scale transition to organic agriculture in specific regions.

A sustainable organic sector will be achieved with requisite support from all actors in the establishment: state, market and civil society. These actors must engage in constructive interaction with each other to achieve a balanced equilibrium and to mainstream sector developments. Unbalanced development with dominance of one actor over the others (on a more than transitional basis) can hamper large-scale diffusion of organic agriculture systems; the realisation of social, environmental or economic benefits; and the accomplishment of change to the system from within Under such circumstances organic agriculture's potential for revitalization of rural economies and stabilization of rural populations remains substantially unexpressed and unexplored.

The project will focus on policy and governance aspects to foster the sustainable growth of organic agriculture in the Euro-Mediterranean area. In European Mediterranean countries and Western Balkans the project will pay specific attention to the strengthening of the territorial and rural development dimensions of conversion to organic agriculture. The project scope will also include organic agriculture's potential contribution to food security and poverty alleviation. In territories still

experiencing unbalanced and isolated development trajectories of organic agriculture the project should provide opportunities for a coordinated and structured identification, assessment and exchange of good practises on mechanisms of support to organic agriculture that prove to be able to:

- generate collective learning and innovative stakeholder alliances;
- deepen the integration of principles and practises of organic agriculture into mainstream policy–making processes and relations along the supply chains.

Public/private partnerships will be fostered and participatory approaches will be adopted in the achievement of the project goals.

The project should produce recommendations for agriculture and rural development policies which fully integrate organic agriculture's potential for sustainable change in rural areas.

Expected impact

The project will provide relevant operational knowledge to inform decision-makers and supply chain actors' choices for better targeted support action for organic agriculture. In this light, the project results are expected to be important to:

- improve governance mechanisms inside the organic sector itself and between organic agriculture and other actors and activities which are relevant for the development and empowerment of rural areas;
- enhance the capacity of stakeholders dealing with organic agriculture;
- produce valuable insights on the role that organic agriculture should play in near future reforms of agriculture and rural development policies.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
		X	

Key Challenge 1.4: Develop an integrative policy framework for organic farming and sustainable rural development

The Common Agricultural Policy has provided a framework for the organic sector and has contributed to its growth for more than 20 years. European policy for organic food and farming started with the European regulation on organic food in 1991 (Regulation EEC 2092/91), followed by the introduction of organic farming as a measure in the agri-environment programme (Regulation EEC 2078/92). Organic food and farming systems can simultaneously contribute to many European policy objectives relating to sustainable management of natural resources and rural development. The European Council accepted the proposal for a European Action Plan for organic food and farming in 2004, for

which an evaluation methodology was developed (www.orgap.org).

There is a need to continue the development of an overarching policy framework facilitating the simultaneous contribution of organic farming to a range of policy goals, such as sustainable rural development and the delivery of public goods and services. The balance between different policy programme goals, market requirements, demands for public goods and services and the diversity of the regions must be considered and integrated. Also, policy makers require evidence – quantitative and qualitative, ex-post and ex-ante – on the comparative socio-economic impact of farming systems in terms of social sustainability, income, employment, skills, and quality of life in various types of supply chains and systems.

Research should refer to a variety of approaches to economics, including heterodox approaches which are better able to tackle environmental and social issues. Specific policy issues will also be considered as part of the other themes and Key Challenges.

Research goals

1. Organic farming policies and climate change
2. Determination of reasons for re-conversion of organic farms to conventional agriculture and development of measures to prevent it

Organic farming policies and climate change

Description

Policies for organic farming in Europe since the late 1980s have been developed in the context of production surpluses, environmental concern due to agricultural intensification and a heavy reliance on commodity support for mainstream agriculture. However, climate change now tops biodiversity and pollution as the key environmental concern. With the focus on climate change, there are now strongly competing claims as to which farming systems deliver most in terms of reducing greenhouse gas emissions. Organic farming's reduced productivity and reliance on livestock as an integral part of the system is seen by some as a weakness, but by others as a way of significantly reducing fossil energy inputs, reducing nitrous oxide emissions associated with manufacture and use of nitrogen fertilisers and providing opportunities for soil organic carbon sequestration. At the same time, other environmental concerns still need to be part of the equation.

The project will therefore be based on an integrated impact assessment of organic farming's contribution to reduce greenhouse gases in the EU. To analyse different pathways of organic farming policy development in the context of the Common Agricultural Policy, the environmental impact assessment will be linked to Policy Impact Assessment Models covering the European dimension of the EU. Furthermore, the project will analyse how organic agriculture and climate change could add

important economic, cultural, ecological and ethical benefits to the trend of European agriculture's role in regional economies.

Expected impact

The project addresses the new challenges of organic farming policy development in the context of climate change identifing organic agriculture's contribution to reducing greenhouse gases and how this could be addressed within the CAP.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Determination of reasons for re-conversion of organic farms to conventional agriculture and development of measures to prevent it

Description

The aim is to determine reasons for the re-conversion of organic farms to conventional agriculture and to develop measures for reducing the number of re-conversions. Although the absolute number of organic farms has been increasing steadily in the EU, there have been several organic farms that re-converted to conventional agriculture since the mid-1990s. In many European countries, there were periods, in which the absolute number of organic farms decreased. The re-conversion to conventional agriculture can be regarded as a policy failure and a failure of agricultural advisory services. It can be seen as a waste of know-how and financial resources invested for conversion. So far, there have only been very few national studies analysing the reasons for re-conversion of organic farms despite the framework for support being set by the CAP. To explore causes of this development, a survey will be conducted among farmers in several EU countries who withdrew from organic certification. Based on the outcome, an analysis will reveal farmers' motives in-depth in the different socio-economic and regional contexts. Finally, measures to prevent re-conversion will be identified.

Expected impact

By avoiding re-conversions the project will strengthen the credibility of the organic sector, giving clear policy recommendations on adapting existing or on new measures to avoid re-conversion.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)	X		

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

8. Eco-functional intensification: The ecological challenge (Theme 2)

Coordinator: Niels Halberg, Cristina Micheloni and Chris Koopmans

Securing food and ecosystems by eco-functional intensification

While organic farmers strive to achieve high overall productivity based primarily on natural resources in combination with high environmental standards, the productivity, yield-stability and quality have in some cases been inadequate. This is particularly true in systems which do not include livestock (or only include livestock to a limited extent) and that consequently do not benefit from the incorporation of forage legumes and the recycling of nutrients through animal manure. In the light of future global demands for food it is important that yields in organic agriculture continue to increase. However, the narrow assessment of yield per hectare of conventional mono-crops is not appropriate to evaluating the yield of organic systems, characterised by mixed cropping and livestock systems where a 'basket' of products is produced on an area of land.

Higher productivity and yield stability may be achieved by means of appropriate "eco-functional intensification", i.e. more efficient use of natural resources and processes, improved nutrient recycling techniques, and innovative agro-ecological methods for enhancing the diversity and the health of soils, crops and livestock. Such eco-functional intensification builds on the knowledge of all stakeholders involved, and relies on powerful information and decision-making tools in combination with new research knowledge and tools in the biological and ecological sciences. Eco-functional intensification is characterized by cooperation and synergy between different components of eco-systems and food systems, with the aim of enhancing the productivity and stability of agro-ecosystems, and the health of all components. Such knowledge will be crucial not only for developing more sustainable organic farming systems in Europe, but also in developing countries.

Key Challenge 2.1: Improved ecological support functions for resilient crop production

Organic cropping systems need to be more productive and stable (yield stability and quality values) while at the same time be robust, resilient and environmentally friendly. The principles of organic agriculture express the core assumptions that agriculture and farming should emulate and sustain living ecological systems and cycles and "enhance the health of soil, water, plants and animals and the balance between them" (Art. 3, EC/834/2007). This should be achieved mainly by "the appropriate design and management of biological processes based on ecological systems using natural resources which are internal to the system" (Art. 4, EC/834/2007). Thus utilising natural regulation and resilience by high biodiversity, would in turn contribute to securing Europe's "Ecosystems service delivery". Research will lead to improved recycling of macro- and micro-nutrients and enhanced

self-reliance in nitrogen supply through innovative systems involving new crop combinations and sequences coupled with the recycling of high-quality organic matter sources from agriculture, industry and society. Improved techniques and products for management of weeds, diseases and pests (e.g. bio-control, phyto-pesticides, and physical barriers) should be developed.

An integrated combination of research methods, ranging from the applied systems level and modelling to experimental crop science and molecular methods, will unlock new potential for using and sustaining ecological support functions to the benefit of food production, product health and quality as well as environmental protection and enhancement. Topics will include improved management of soil quality and fertility, improvement of nutrient supply/recirculation, soil moisture retention and water management; pest, weed and disease prevention for crops and livestock by use of functional biodiversity and habitat management, pollination and resilience of agro-ecosystems. These aspects should be linked with theoretical work on definitions of functional biodiversity, suitable bio-indicators and modelling.

Research goals

1. Improved use of ecological support functions for resilient organic and low external input crop production *
2. Designing resilient cropping systems for pest and disease control
3. Soil disease suppression in organic farming as alternative to off-farm inputs
4. Enhanced sustainability by use of innovative nutrient sources
5. Designing resilient cropping systems for organic fruit production
6. Develop alternatives to the use of critical inputs in organic farming systems

* Highest short-term priority based on consultations

Improved use of ecological support functions for resilient and organic low external input crop production

Description

Organic and low external input based cropping systems improve ecological and qualitative factors, but still need to improve and stabilize yields as well as quality values while maintaining/improving their robustness, resilience and environmental sustainability.

Higher and more stabilized yields may be achieved by means of appropriate "eco-functional intensification", i.e. more efficient use of natural resources and processes, which enhance the self-regulating capacity of the system.

An integrated combination of research methods, ranging from the applied systems level and modelling to experimental crop science will unlock new potentials for using and sustaining ecological support functions to the benefit of food production, product health and quality as well as

environmental preservation. Research should improve the use of functional biodiversity and environmental diversification through novel cropping systems (intercropping, crop rotations and companion crops) and proper management practises (soil, nutrient supply, nutrient losses as well as weed, pest and disease management). Research should improve the farming design to combine productive and non-productive areas and then to improve crop performance by the use of natural resources. Research should focus on a major annual cropping system (e.g. cereals, and/or vegetables) and a perennial one (e.g. fruit production) under different European conditions in order to obtain workable results to be extended afterwards to other systems. Botanical composition, soil biodiversity and health should be addressed, as well as disease suppression and ecosystem services at farm and landscape level. The economic valorisation of the products from these novel organic or low external input cropping systems should be taken into account, as this is an important condition for their successful introduction.

Expected impact

Results will allow EU farmers to improve their yields and their environmental performance through the formulation of strategies for improved control and elimination of pests, weeds and diseases in combination with efficient nutrient cycling in the two analyzed cropping systems.

Research results will also support European and national policies for reducing pesticides use, improving biodiversity at the soil and farm level and fulfilment of water quality standards.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)		X	
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Designing resilient cropping systems for pest and disease control

Description

The project will design resilient cropping systems to suppress pests and diseases.

Above ground pests and diseases, such as aphids, whiteflies, botrytis and downy mildew are an enormous threat to organically produced fruits and vegetables. Augmentative biological control of pest species has been a common practise for many years in greenhouses, but it does not guarantee successful control. The low biodiversity in horticulture, greenhouse crops and perennials limits the establishment and performance of natural enemy releases due to the lack of food sources. Furthermore direct and indirect food web interactions within created pest-enemy communities can limit the efficacy of biological control. Control of diseases is mainly dependent on effective climate

control. However, with the fast changing climate conditions and the slow drying capacity of the soil in the root and stem zone this is not enough to prevent wet conditions and infection with fungi can occur easily.

There is a strong need to design resilient cropping systems that maximise the use of ecological support functions to suppress horticulture pests and diseases and enhance biological control. These functions can be based on:

- Introducing biodiversity in cropping systems (alternative to monoculture systems);
- Releases of compatible natural enemies with synergistic effects on pest suppression (= functional diversity);
- Enhancing the performance of natural enemies by supplying alternative food/prey e.g. with banker plants, habitat management;
- Inducing plant resistance and defences against pests and diseases linked with soil suppression and belowground - aboveground interactions).

Expected impact

Designing resilient cropping systems, that enhance pest and disease suppression, will increase the productivity and reduce crop losses of vegetables crops and perennials. Furthermore it can increase the shelf life of the products in the retail channel. The bio-control industry producing natural enemies will finally also benefit from the better performance of released natural enemies.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Soil disease suppression in organic farming as alternative to off-farm inputs

Description

The aim of the research is to direct soil towards natural suppression of soil borne diseases. Organic production systems rely to a large extent on internal mechanisms for sustaining soil health and productivity. Several studies have documented the effects of soil management practises on inherent soil fertility, disease suppression, and crop production. Soil borne pathogens are major yield-limiting factors and difficult to control. To date there has been a lack of integrated research and management tools to effectively monitor and manage organic and low external input production systems based on disease suppression.

Practical examples of natural suppression of pathogens within organic horticulture exist and have resulted in increased interest among growers. Although knowledge of the diverse mechanisms that confer suppression is substantial, applied knowledge - i.e., how to use soil suppression - is

limited. Research should thus improve knowledge on biological mechanisms and develop monitoring tools, indicators and accompanying measures to reduce yield loss by promoting natural suppression of plant pathogens in soil..

Diagnostic tools and indicators (such as bio-assays, soil visual assessment, biodiversity counts) will be employed to provide a direct link between field observations and key system parameters including inherent soil fertility, crop yield and product quality. This research will lead to the development and use of models linking soil biodiversity with plant rooting and plant growth aimed at improving crop health and productivity and a sustained soil fertility.

Expected impact

The project will deliver a soil management system which allows growers to direct their soil towards suppression of pathogens. The research techniques and management tools developed can in turn be used to design strategies for building resilient soils in sectors like horticulture, greenhouses and perennial cropping systems. Emphasis should be put on dissemination, to inspire stakeholders for a more caring soil management strategy. It will reduce yield losses and costs for controlling pathogens and provide a sustainable agricultural strategy. By doing so, it will support the EU policy on organic and low external input farming and contribute to strengthening the competitiveness of the European organic farming sector. In addition, it will facilitate good agricultural practises in order to protect soil and water (EU Soil and Water Thematic Strategies).

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)		X	

Short term: Development of indicators and soil management measures
Medium and long-term: Development of indicators, lay open mechanisms and development of soil management measures

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Enhanced sustainability by use of innovative nutrient sources and recycling

Description

Organic and low external input agriculture are focussed on efficient use of nutrients, decreasing losses and closing nutrient cycles at appropriate scales. However, the potential use of organic matter and available nutrients from sources outside agriculture has received little research and development. This will become increasingly important for many agricultural systems due to degradation of soils and with phosphorus and potassium sources for fertiliser becoming limited and expensive resources.

Research will focus on the quality and possibilities for short and long term use of a wide vari-

ety of industrial and societal waste products (e.g. composts and green materials from various origins, food industry waste, sewage sludge, products from bio-energy production, and algae products). Research will also focus on regional solutions, with a local management of waste resources and recycling of organic matter from society. For example in areas within or bordering on nature conservation areas, solutions will differ from peri-urban areas. Special emphasis will be put on the question of clean and contaminant-free recycled products and losses that occur during various treatments of organic matter (composting, fermentation, storage). Social and economic aspects of such options will be taken into account.

Expected impact

Inputs of nutrients from various sources will help to close local and regional nutrient cycles. Regional nutrient recycling will be increased, resulting in higher sustainability of agriculture on the long term, higher regional self-sufficiency and a further decrease of the global footprint of organic and low input agriculture.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Designing resilient cropping systems for organic fruit production

Description

Perennial crops such as fruits and vines are frequently attacked by pests and diseases, and they require intensive fertilization, often with commercial organic fertilisers. An important example is organic apple production, which is challenged every year by scab, mildew and different fruit rot diseases and is also affected by various pests.

Organic apple production is very reliant on a few essential plant protection agents allowed in organic farming. The loss of one of these products by registration problems can create enormous problems as seen in the case of the use of copper compounds. It is possible that resistance problems may be the long-term consequence of this dependency. The reduction of this dependency on those pesticides permitted in organic farming is a very important step for the long-term sustainability of organic fruit growing systems.

Thus, there is urgent need for cultivars of low susceptibility, for cropping systems of high resilience, and for optimised ecological support functions that enhance biological control in limiting pests and disease..

› New varieties: first steps for crossing and se-

lecting varieties adapted for organic fruit growing together with private and public breeders could be done in this project;

- Testing existing new robust varieties under organic cultivation conditions and on organic farms considering the regional conditions;
- Optimizing the fertilization to improve quality and shelf life of the fruits and to evaluate regional resources to improve flows of energy and nutrients;
- Enhancing the performance of natural enemies and creating less favourable conditions for pests and diseases;
- Release of natural enemies;
- Reduction of the input of organic plant protection products in the optimized system.

Different research partners will work on the different strategy approaches in research stations. In the same time, on different organic farms together with farmers the strategies will be united in a system approach adapted to the regional and individual conditions of the farms. Thus, the real reduction of inputs and the enhancement of sustainability can be observed and assessed. Furthermore, the strategies will be tested and improved on production sites.

Expected impact

Designing resilient cropping systems that enhance pest and disease suppression will increase the productivity and reduce crop losses of organic fruits. Furthermore it can increase the shelf life of the products in the retail channel.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Develop alternatives to the use of critical inputs in organic farming systems

Description

The project shall study management and preventive methods as well as direct alternatives to critical inputs for organic farming. This research is needed as current organic practise often requires use of inputs such as copper and sulphur to prevent fungal diseases, and use of manure from non-organic farms. This may reduce consumer confidence in organic farming. Research might look at developing alternative methods and inputs for reducing the severity of pest and disease attacks, and for improving and reinforcing the self-defence capacities of crops. Another main focus should be on better nutrient management to reduce the need for conventional manure and slurry. This research will build on methods for improved management of nitrogen (including nitrogen fixation by legumes) and on development of alternative sources for phosphorus and potassium. A coordination and support action is recommended to reveal which in-

puts should be most urgently phased out, identify the most promising alternatives, and assess the related costs and challenges for different organic farming systems.

The project will be closely related to the effects of regulation, which has prohibited use of manure or manure-based fertilisers from industrial production, and use of straw from conventional production that has involved shortener chemicals (e.g. CCC growth regulators). Propositions are expected for region-specific adaptations to the Organic Regulation.

Expected impact

The project will make organic farming systems more independent and self-sufficient, and lead to more sustainable organic farming practises, which contribute to consumer confidence in organic products.

The project will also contribute the development of specifically organic farming methods, and counter developments towards "input substitution" focused on finding alternative inputs to those used in conventional farming.

Evolution of regulation is an important result of the approach.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)		X	
Medium term (until 2020)	X		
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Key Challenge 2.2: Modern mixed farming systems

In order to be economically and ecologically resilient, self-reliant for energy and nutrients, to optimise resource use and adapt effectively to climate change and other environmental pressures, organic farming systems need to be diverse. There are, however, factors such as economic pressure, efficiency and specialised market demands which push organic farmers away from diversity. Therefore, research should develop and document innovative collaboration between specialised farmers to achieve new mixed farming systems that can achieve multiple objectives.

Crop and livestock systems should be redesigned to increase integration, enhance nutrient and organic matter cycles, and diversify the production systems using strategies such as mixed-cropping, agro-forestry, integration of grassland and rangelands into cash crop systems. Research will also look at how to capture nutrients from regional-scale cycles, investigating possibilities in high quality household waste, human urine, bioenergy by-products, ashes and so forth. Transition patterns should also be considered in order to define possible paths for farming systems evolution towards more diversification. Research could also

take the perspective of whole food systems, using more qualitative assessment methodologies in addition to value chain and life cycle assessments. Food quality issues in particular could be addressed.

Research goals

1. Innovative forms of mixed farming for optimized use of energy and nutrients.*
2. New mixed organic farming systems, based on new combinations of greenhouse, open field and livestock production, in the vicinity of metropolitan areas with closed energy and nutrient cycles.
3. Implementation of organic principles at landscape level: organizational and regulatory constraints and needs.

* Highest short-term priority based on consultations

Innovative forms of mixed farming for optimized use of energy and nutrients and improved yields

Description

A basic principle of agricultural sustainability is to establish optimized flows of energy and nutrients with a high degree of recycling by transforming waste into resources such as fertilisers. Modern specialised crop production systems rely on external inputs for feed and fertilisation, whilst specialised livestock systems face dramatic costs and problems in waste disposal. The profitability and importance of traditional mixed farming systems is drastically reduced because of pressure for specialisation, economies of scale and work load reduction.. This is also observed in the organic sector.

The project will evaluate new innovative ideas and develop new strategies to connect livestock and crop production at farm, district and landscape level in order to optimize energy and nutrient flows preserving natural resources and maximising production. Profitability, socio-economic aspects of collaboration models and implementation potential in different systems (organic, low external input, integrated, etc.) across Europe will be assessed.

Research activity shall also involve innovative forms of collaboration between farmers to identify and test new combinations of agronomic practises (crop rotations, soil management, agroforestry) and livestock practises (species selection, feeding, management) that will ultimately allow re-orientation of energy and nutrient flows by rural communities. A participatory approach in the identification and evaluation of the systems will allow immediate transfer possibilities and assessment of legal and organisational challenges. Models will be applied at the various levels to predict productivity gains and economic viability of the mixed farming systems developed.

Expected impact

Prototypes of new farming systems may be adapted to local conditions, where their appropriate implementation can alleviate environmental

problems in crop and livestock production, minimising reliance on external inputs (feed, energy, manure and mineral fertilisers) that must be procured on unpredictable global markets.

If these new systems show a positive effect on rural vitality, they might constitute a valuable guide for EU, national and regional agro-environment support schemes, and boost the role of mixed farming in landscape protection.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

New peri-urban mixed organic farming systems, based on combinations of greenhouse, open field and livestock production, with improved energy and nutrient cycles

Description

The aim of this topic is the development of new mixed organic and low external input food and farming systems in peri-urban areas benefitting from proximity to consumers, with improved recycling of energy and nutrients. The mixed farming systems can consist of several combinations of greenhouse, horticulture, animal husbandry and arable farming. The individual systems may use each others' stored energy surplus and by-products flows. Modern greenhouses already collect plenty of solar energy during summer and store it in an aquifer for the winter period. In future mixed organic production systems they may use biogas directly or heat from biogas, electricity from dung and CO_2 from animal respiration. The profits of this valorisation of the residual flows can be invested in improved animal welfare which will be of special interest in these systems because the space for outdoor exercise may be limited in urban areas. New ways of creating links in systems will be investigated, including, for example, re-cycling organic waste from large kitchens. The topic will lead to new mixed production systems that produce organic food in the vicinity of metropolitan areas based on small-scale innovative technologies.

Using solar energy from greenhouses, biogas, CO_2, and minerals and nutrients from livestock production should eliminate the need for fossil energy in crop and livestock production. Import of nutrients can be reduced; where imports are needed, they might come, for example, from household or kitchen waste. Energy requirements in livestock production and food processing could be met with stored solar energy, energy from dung, and energy from biomass produced as part of open field agriculture. Important development steps required to make this symbiosis possible include new livestock housing systems (where appropriate with separation of urine and faeces), reduced energy consumption and suitable choice of animal breeds

to assure good welfare standards despite limited outdoor access. The mixed systems could be combined with small-scale food processing and innovative distribution networks which will facilitate recycling of waste and water to the primary production. A code of practise will be developed taking into account different regional contexts in Europe and tested on some pilot farms.

Expected impact

The European value-added lies in the development of sustainable production systems of safe and healthy food in peri-urban areas and the potential to improve recycling of nutrients and organic matter. This will and partly compensate for agricultural land losses due to urban sprawl. Food production in the vicinity of urban areas will also reduce the future logistic challenges for European food sourcing and improve consumer's experience of "nearness" in food production and consumption. The close localisation of production and processing will offer chances for SMEs to participate in a new and intelligent food system. This topic will create integrated new knowledge on the development of sustainable food systems and will give Europe a leading role in food production.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)		X	
Medium term (until 2020)	X		
Long term (until 2025)	X		

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Implementation of organic principles at landscape level: organizational and regulatory constraints and needs

Description

The implementation of organic farming principles at farm level can secure good production performance for the farmer whilst reducing environmental impact. If the same principles are applied at the landscape level (river basin, valley, district and so on), there can be even greater benefits to the community in terms of ecology and rural vitality, in addition to facilitation of farm-level actions such as crop rotations or recycling of animal waste which are often associated with lower production costs.

Demands for landscape development and care for biotopes in different regions can be combined with a regional conversion to organic farming. Special measures to improve biodiversity can be linked to the organic farming concept.

Nevertheless, analysis must be undertaken of organisational constraints and regulatory and fiscal limitations (such as those on manure transportation or product sales). Innovative forms of cooperation between different actors should be developed along with proposals for appropriate legal and regulatory frameworks. Furthermore socio-

economic barriers will be identified and solutions to overcome these developed.

Expected impact

The project will provide guidance on how to overcome organisational, regulatory, legal and fiscal obstacles to implementing organic farming principles at landscape level. The possibility of larger-scale implementation will lead to enhanced environmental benefits for water, biodiversity, soil quality and other factors, benefits which will accrue to whole communities and which should improve rural vitality. Ways in which different landscapes could fulfil nature conservation goals through regional conversion to organic farming will be developed.

This will be of utmost importance for a wide range of different farming environments and, in particular, for marginal or environmentally sensitive areas such are mountains or river-basins where it can also prevent current agricultural activity abandonment. This can provide options for farms to generate a higherr income by additional work in order to conserve biotopes and species within the rural landscape.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)		X	
Medium term (until 2020)	X		
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Key Challenge 2.3: Appropriate and robust livestock production

Organic agriculture contributes significantly to development of livestock systems which balance productivity with other societal goals such as animal welfare, environmental preservation and landscape values. Research will enhance this potential of organic agriculture by developing appropriate livestock technologies and practises that foster welfare throughout the animal's life and take account of the ethological needs of farm animals whilst also minimizing environmental impact.

Based on principles for good animal welfare, organic livestock production devotes attention to "animals' species specific behavioural needs and the maintenance of animal health by encouraging the natural immunological defence of the animal, as well as the selection of appropriate breeds and husbandry practises" (Art. 5, EC/834/2007). Health management for organic livestock is holistic, based on outdoor systems, prevention, alternative medicine use and longevity. Research will improve the scientific basis for and understanding of these concepts. Improvement is also expected in biosecurity, and in handling of risks from infectious and vector-borne diseases and parasites. A specific focus should be on minimising the use of antibiot-

ics where organic livestock production may serve as a pilot system demonstrating the potential for reducing antibiotic medication through improved management at herd and animal level without compromising animal welfare.

Research will also encompass the relation between the working environment for farmers and the health and well being of livestock, thus taking into account the multiple roles of livestock.

Research goals

1. Disease management strategies for phasing out of antibiotics from organic dairy herds
2. Innovative outdoor pig systems – Sustainable strategies to increase pig welfare and longevity
3. Development of organic poultry systems which combine high animal welfare and ethological needs with environmental sustainability
4. Mixed livestock systems for improved farming and food system resilience

Disease management strategies for phasing out of antibiotics from organic dairy herds

Description

Livestock farming is an important part of organic farming systems, and it is an explicit goal of organic farming to ensure high levels of animal health and welfare (AHW) through proactive and appropriate management of breeding, feeding, housing and species specific husbandry. Nevertheless, many herds face animal welfare issues and disease problems, and a number of production diseases present big challenges for organic dairy herds in particular. Strategies for handling diseases are still needed, both in terms of animal health and welfare promotion. Organic livestock farming deploys strategies to support general health and welfare, based on competent overall management, a good housing system, fresh air, disease prevention measures (such as those for mastitis and claw disease) and disease treatment measures.

There is still a considerable need to reduce the input of chemical synthetic drugs in European organic livestock production systems. The new EU Regulation for organic production (EC) 834/2007 (which entered into force in 2009) emphasises the use of phyto-therapeutic and homeopathic products instead of the use of chemically synthesised products to treat animal diseases. More research is necessary to deepen the knowledge about the efficiency and optimal use of these products to reduce all risks associated with chemical drugs such as residues in the food chain and environment, and resistant micro-organisms.

The level at which bioactive herbs are present in different European domestic ruminant nutrition systems is not well understood; nor is the impact of such herbs on ruminant physiology. Nonetheless, our increasing knowledge in the composition of secondary plant components suggests strong potential for herbs to be used in regulating digestion and stabilising metabolism. The likelihood is that herbs will be useful both for general animal wellbeing and for specific disease prevention strategies.

Production systems for different dairy ruminants have developed quite independently of each other into a diverse array of farming systems which have received varying levels of attention. Organic dairy goat and sheep production has not been nearly as well explored as cow production, although it represents great potential gains as well as embodying challenges (especially from mastitis and other diseases, pasture management, feed production and breed choice).

The proposed research topic will specifically explore the disease patterns and health situation in organic dairy sheep and goat systems, and address the following three areas for a long term improvement of the animal health and welfare situation in organic dairy herds in general:

- Animal health and welfare promotion, e.g. through robust management systems with appropriate and relevant use of technology (e.g. milking robots in outdoor systems).
- Disease prevention, e.g. the use of bio-active herbs; and disease-specific measures (particularly against mastitis, claw diseases and metabolic diseases). Strategies for identifying diseases at an early (subclinical) stage can be offered to farmers as a standalone tool, or integrated into their health planning programmes. Disease prevention measures will be developed specifically for organic dairy systems.
- Holistic approaches to disease management with focus on phasing out antibiotic use from organic herds through animal health promoting efforts and alternative disease treatment methods. Holistic disease management, including bioactive herbs, as well as various active health promoting efforts and professional medical school traditions in veterinary practise, such as the use of homoeopathy and similar methods.

Review and rigorous analysis of knowledge gathered should be undertaken as a basis for further development of the project.

Expected impact

With work towards reducing the need for medical treatment and use of synthetic drugs, disease management will improve, disease occurrence will reduce, and products will become safer.

Time perspective and priority:

1) Strategies for health, welfare and disease management in European dairy farming systems:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)		X	
Medium term (until 2020)		X	
Long term (until 2025)			X

2) Exploring disease-management challenges and opportunities specific to organic dairy sheep and goat systems:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)			X
Medium term (until 2020)			X
Long term (until 2025)	X		

3) Prevention measures and alternative treatments in holistic disease management:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)		X	
Medium term (until 2020)		X	
Long term (until 2025)			X

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Innovative outdoor pig systems – Sustainable strategies to increase pig welfare and longevity

Description

In organic outdoor pig husbandry, major challenges include: how to ensure adequate rotation; how to ensure that natural behaviours can be expressed; how to increase longevity; and how to improve biosecurity in disease management. New systems need to be developed where certain life stages are outdoors, farrowing can take place at least once a year, and/or male and female finishing pigs are separated. Consumers expect organic pigs to have outdoor access, the ability to express natural behaviours, and a clean environment to live in. In some countries organic pig production occurs indoors with concrete outside-runs. In other countries, organic pigs are mainly outdoors; this poses a number of challenges such as rotation, nitrate leaching and expression of natural behaviour.

The research will identify and describe existing innovative forms of outdoor pig production across Europe using a multidisciplinary approach. Assessment will be undertaken of feeding, health, welfare, production, economic and environmental issues. The work will combine experimentally based development of new pig rearing practises and systems with farm level studies and assessments. On-farm implementation of new strategies under various conditions will permit direct testing of results in the context of commercial organic pig husbandry. Evaluation criteria will include production, resource use and economy, working conditions, animal health and welfare and environmental aspects and research will suggest improved practises leading to sustainable balances between different criteria.

Expected impact

This project will generate completely new practises for organic pig farming, providing farmers in different countries with valuable support in increasing their sustainability without compromising productivity. Its target is to fulfil the principles of organic farming, meet high consumer expectations, and answer the behavioural needs of pigs. Keeping pigs outdoors in well-managed systems can enhance health, immunity and longevity. This reflects European animal health strategies designed to encourage disease prevention rather than treatment; consequently, it is expected that research results will be highly relevant for conventional pig farms too.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Development of organic poultry systems which combine high animal welfare and ethological needs with environmental sustainability

Description

Poultry welfare in organic agriculture is expected to be good thanks to requirements for outdoor runs, more space per animal, and smaller group sizes. However, farms that keep organic poultry are becoming bigger and this is expected to increase mineral contents in the soil and possibly affect soil organisms in the outdoor runs. Although in theory it is possible to feed animals 100 percent organic, it has proved not always to be so in practise, in addition to which the quality of organic feed is sometimes sub-standard. Moreover, poultry feed mainly consists of concentrates, but chickens also need roughage for gut health and ethology reasons. The aim of the proposed research is to find solutions for the dilemmas related to feeding and other factors, between animal health and welfare on the one hand and negative effects on the environment on the other hand.

The project will:

- Develop methods for minimising the mineral impact of manure on outdoor runs;
- Conduct an international survey with a focus on the relation between quality of organic poultry feed, animal health and behaviour and product quality.

Issues concerning feed composition (e.g. roughage, alternative protein sources) should be addressed by several approaches. Systems will be developed in which eating roughage is a part of the nutrient supply for animals and which possibly can be implemented in large-scale systems (number of flocks as well as big flock sizes) thus supporting ethological needs and animal health.

Expected impact

Results will lead to reduced environmental impact of organic animal production and better animal health and welfare. In addition, producers will be supported in keeping poultry in a way that meets the ethological needs of their animals as well as promoting health and preventing disease.

Concerning the environmental impact of letting poultry outside, possible problem areas will be identified. At the same time practical solutions for reducing this impact can be developed.
There is strong interest in such work from policy makers and industry (e.g. organic feed production); demand is also strong for research to clarify poultry requirements for protein and roughage.

Time perspective and priority:

1) Impact of poultry (manure) on the outdoor run

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)		X	
Medium term (until 2020)		X	
Long term (until 2025)		X	

2) Poultry feed and animal health

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)	X		

Funding scheme:

1) Impact of poultry (manure) on the outdoor run

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

2) Poultry feed and animal health

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Mixed livestock systems for improved farming and food system resilience

Description

The organic livestock sector faces a number of challenges. Especially in Europe, many organic livestock systems have become increasingly specialised and even partly industrialised. Reliance on mono-culture farming decreases resilience in farming systems, so ecological and environmental problems have arisen as well as economic vulnerability, in addition to the fact that such systems face animal welfare issues and disease problems.

More resilient systems may be developed through mixed livestock (dairy ruminants integrated with poultry and/or pigs, for instance); localised feed and food systems with access to grazing to promote health and welfare; and proportionate relationships between land area, crop and vegetable production, animal number and production levels. A truly sustainable food system will include more ruminants than mono-gastric animals. This is because ruminants are able to digest roughage and other fodder resources that cannot be readily consumed by humans, whereas mono-gastric animals are in direct competition with human beings for food resources. The potential for feed self-sufficiency through the inclusion of legumes and systems where ruminants are feed only on roughage will be considered.

Research should identify, explore and assess different pathways to more robust and resilient livestock systems which include more species

within the same farming system and in this way utilize and exploit the potential synergy and all aspects of the farm and its different enterprises. Many challenges are also present in such systems, and they need to be addressed. A major challenge is creating and maintaining a management system that allows efficient collaboration and distribution of responsibilities between all the actors involved in farm activities. Mixed grazing systems, feed production, disease management and integration of animals into agro-forestry systems all present particular agricultural and veterinary challenges. Management systems must be well-conceived, exploiting the technology available, building social capital amongst actors, and taking a system approach to animal health care.

Research efforts for resilient organic and low external input mixed livestock systems should undertake:

- Studies and assessments of existing mixed livestock systems in selected regions across the EU, dealing with production, environmental impact, feeding, management, disease management and animal welfare using documented assessment methods such as WelfareQuality and Life Cycle Assessment. Also the socio-economic impacts need to be considered. This can create a basis for interdisciplinary approaches to local-level development of different mixed livestock systems, for example through a combination of controlled experiments and modelling.
- Community development and collaboration on local feed and food systems researching social capital aspects.

Research must also draw on existing examples, extracting and disseminating useful lessons concerning the structure and functioning of mixed livestock farms. It is important to enhance learning between systems, with appropriate integration into each context, and partly through innovative farm developments in collaboration with communities and demonstration farms under different conditions.

Expected impact

The main outcome will be development of integrated systems that break new ground for the organic sector as well as being relevant for other livestock producers. The project will contribute to more economically stable and environmentally friendly farming systems, an increased diversity of enterprises in the market, and the appearance of more local food products. Development of local-level collaboration and learning networks will also be facilitated.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)			X
Medium term (until 2020)		X	
Long term (until 2025)	X		

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Key Challenge 2.4: Green improvement of genetic resources

According to the EU regulation, organic agriculture should use suitable crop varieties "resistant to pests and diseases, appropriate crop rotations, mechanical and physical methods and the protection of natural enemies of pests" (Art. 5, EC/834/2007). In livestock, the choice of breed will affect the capacity of the animal to adapt to "local conditions, their vitality and their resistance to disease or health problems." Organic and other low input farming systems afford limited opportunity to adjust the environment of crop plants and livestock for their health and productivity (by adding fertiliser, for example). Genotype-environment-management interactions are more significant in organic and low input agriculture, and life processes differ in rate, timing and duration from those observed in conventional systems. Breeding has hitherto tended to overlook the question of how to adapt plants and animals to environmental conditions. Recent studies such as those conducted by the Quality Low Input Food project indicate that yield differentials between organic/low input and conventional/high input production systems were partly due to the lack of suitable crop varieties. Organic production systems require plants to have traits such as ability to compete with weeds; resistance to biotic and abiotic stress; ability to efficiently utilise nutrients from organic matter inputs; suitability for mixed cropping and so on.

Organic and low input agricultural systems are more exposed than conventional ones to heterogeneous environments, low soluble nutrient availability and biotic as well as abiotic pressures. Chances are that global climate change will increase these phenomena. This could, however, be seen as an opportunity for the organic sector to develop original and innovative strategies for high resilience, partly through plant breeding programmes. Such an achievement might in time also benefit other agricultural sectors.

To optimise function and crop performance in organic farming systems, there is a need for crop varieties and animal breeds well adapted to organic conditions: robustness and flexibility are essential. This is particularly important with respect to low levels of external inputs where breeding is a very efficient tool to develop varieties optimally adapted to organic farming, provided selection is performed under these conditions. Research should include an assessment of the value of traditional and modern genetic resources within plants and animals, with special emphasis on robust and multifunctional traits. Besides high yield and stability of crop varieties and livestock breeds, a broad range of quality traits such as product quality, plant and animal health, growth patterns, nutrient use efficiency, robustness and tolerance to various stresses will be assessed. Furthermore potential for mitigation or reduction of greenhouse gas emissions as well as for better adaptation to climatic changes must also be taken into account.

On-farm breeding approaches for livestock and crops should be further developed and encour-

aged, studying and utilising genotype-environment-management interactions including and benefiting from the use of modern molecular breeding techniques such as markers and genome-wide selection.

Research goals

1. Developing on-farm livestock and plant breeding integrating modern technology and appropriate regulatory frame work
2. Breeding for within-crop diversity
3. Improvement of production efficiency in organic and low external input farming systems by multidisciplinary breeding approaches
4. Genetic improvement of minor crops to improve food security and agricultural biodiversity
5. Breeding of varieties with improved rhizosphere for organic and low external input food production

Development of on-farm livestock and plant breeding integrating modern technology; development of the appropriate regulatory framework'

Description

According to the EU regulation, organic agriculture should use suitable crop varieties resistant to pests and diseases, appropriate crop rotations, mechanical and physical methods and the protection of natural enemies of pests (Art. 5, EC/834/2007). In livestock, where genetic variability is a structural source of genetic progress, the choice of breed will affect the capacity of animals to adapt to local conditions, their vitality and their resistance to disease or health problems. There is a need to improve crop varieties and animal breeds adapted to the organic farming growth conditions, especially with respect to low levels of external inputs. Research will include assessment of the value of traditional and modern genetic resources within plants and animals, with special emphasis on robust and Multifunctional traits. Besides high yield and stability, a broad range of quality traits such as product quality, plant health, growth pattern, nutrient uptake capacity, robustness and tolerance to various biotic and abiotic stresses will be assessed. On-farm breeding concepts for livestock and crops should be further developed and encouraged, studying and utilising genotype-environment-management interactions and combining them with modern molecular breeding techniques such as markers and genome-wide selection. This should be accompanied by the definition of innovative regulatory scenarios that allow their implementation and development.

Expected impact

There is a clear limitation to the possibilities of improving organic and low external input production systems by management alone without including improvement of genetic resources as part of an overall strategy. Often described as less productive, local animal and plant varieties should be considered invaluable resources with regard to variable production and market expectations. As

organic and low external input farming systems have to deal with a larger influence and diversity of environments, decentralised, on-farm breeding strategies can enhance locally adapted breeds and crops. Results will lead to improved use of genetic resources for modern breeding purposes including yield and growth patterns as well as resistance and quality traits. There exists a unique opportunity to undertake on-farm animal and plant breeding in parallel under one (integrated) program as there is much to learn from both approaches about common constraints!

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)		X	
Medium term (until 2020)	X		
Long term (until 2025)	X		

* An EU funded project on plant breeding for organic and low-input farming is financed and starts in 2010

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Breeding for within-crop diversity

Description

It is a central aim of organic farming to improve diversity within the cropping system in order to stabilize yield and quality. However, market demands and legal requirements for variety approval and seed certification makes it difficult to market diverse seed and products thereof. Organic production has in some cases other priorities than conventional agriculture, and there is a need to develop crops with traits specifically suited to organic productionorganic production. This could include resistance to seed borne diseases or adaptation to reduced soil tillage in a herbicide free cropping system. There must be field-level, regional and global analysis of the impact of lack of diversity in terms of economics and the spread of plant disease. Analysis may include potential advantages of landraces or developments of new populations or lines with improved diversity, and quantification of the effect of these compared with homogeneous certifiable varieties. Also, there is a need to evaluate obstacles to increasing diversity and to develop legal logistical systems to manage diverse crops at each stage of the production cycle from breeding through multiplication, cultivation and sale to consumption. To exploit the full potential of such a new variety concept, stakeholders all along the chain should be included in the development.

Expected impact

Improving within-crop diversity is expected to yield innovative strategies for heightened resilience and genetic material for use in erratic climatic conditions and low external input ecosystems.. It will also improve nutrient uptake in low input conditions, and limit the spread of epidemic plant diseases and thereby stabilize yield at field and regional level. Development of alternative systems for breeding and certification of organic diverse varieties and seed will improve the organic integrity

by reducing dependence on conventional breeding systems and seed with intellectual property rights. Development of new varieties with specific traits suitable for organic and low external input agriculture (with higher drought resistance and pest resistance, for example) will potentially be an additional source of variation to explore for future breeds better adapted to climate change. Within crop diversity will provide more yield stability and market opportunities.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)		X*	X
Medium term (until 2020)	X		
Long term (until 2025)	X		

* An EU funded project on plant breeding for organic and low-input farming is financed and starts in 2010

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
		X	

Improvement of production efficiency in organic and low external input farming systems by multidisciplinary breeding approaches

Description

The overall goal is to improve the production efficiency and yield stability of organic and low external input crop production systems while safeguarding human health, soil fertility and biodiversity in consideration of limited land, nutrient, energy and water resources. Recent studies such as those conducted by the Quality Low Input Food project indicate that yield differentials between organic/low external input and conventional high-input production were partly due to the lack crop varieties suited to organic or low input systems, i.e. with traits such as ability to compete with weeds; resistance to biotic and abiotic stress; ability to efficiently utilise nutrients from organic matter inputs; suitability for mixed cropping and so on. Breeding is a very efficient tool to develop varieties with an optimal adaptation to organic farming if selection is performed under these conditions. The project aims at (a) the development of efficient breeding schemes and optimized selection methods for relevant European crops including, pulses, vegetables and fruits, (b) the characterisation, use and recombination of available germplasm including breeding material, land races and wild relatives and (c) the development of pre-breeding material and varieties specifically adapted to organic and low input farming. Research and breeding programs for improved productivity need to be focused on sustainable use of resources, and are embedded in innovative cultivation systems (like mixed cropping; novel rotational, disease, pest and weed management; and specific fertilisation and tillage regimes) to improve soil fertility. This is particularly important in view of the expected impact of climate change on agricultural production. To better deal with closer genotype-environment-management interactions and with larger intrinsic variation in process rate, timing and duration of life processes under lower

external input conditions as well as modern breeding approaches (e.g. identification of Quantiative Trait Loci, QTLs) can benefit from interdisciplinary approaches, e.g. by combining agronomy, genetics and crop physiology.

Expected impact

The outcome of the project shall make organic and low external input production more economically viable and attractive to farmers. It will improve the competitiveness of European crop production and reduce imports to cover the demand of consumers for organic products. The new varieties will be suitable for mixed cropping, conservation tillage, and limited water and nutrient resources, and should contribute to mitigation of CO_2 emissions as well as to better adaptation to climatic changes and a high level of resilience.. The integrated optimization of germplasm and farming systems through decentralised breeding schemes will enhance productivity and product quality (nutritional, organoleptic and end use) in the organic sector. Varieties designed for the organic/low-input sector will strongly contribute to the improvement of productivity and yield stability, and thus contribute to food security and ecosystem preservation.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)	X		

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X	X	X	

Genetic improvement of minor (less frequently grown) crops to improve food security and agricultural biodiversity

Description

The consequences of climate change and reduced agricultural diversity accompanied by loss of fertile soils are the major obstacles to ensuring food security for a growing population. The global food supply relies on few species (maize, rice, and wheat account for 60% of global supply) mainly produced in large-scale often mono-cultural cropping systems. Breeding and cultivation technique improvements are therefore concentrated on a small number of crops. What we then observe is rapid yield increases for these dominant crops, so that less frequently grown types become less and less attractive, resulting in reduced acreage and loss of the skills required for cultivation and processing. Grain legumes in Europe provide a typical example of this phenomenon.. It is a central aim of organic farming to improve diversity within the cropping system in order to stabilize yield and quality. Concerted action and research are needed for a revival of less frequently grown crops (e.g. many vegetables, legumes, oil crops, specific grains and pulses) and locally important crops (e.g., lentils, okra, brown cabbage; root crops) and fruits

(e.g. mirabelle, elderberry) and crops for specialist purposes (e.g. flax, safflower). The overall goal is to improve the agricultural biodiversity and utilize eco-functional services but also to improve human diet and food security. The project aims at:

- the collection and characterization of available germplasm of underutilized crops in different geographic regions;
- the development of efficient breeding schemes and optimized selection methods with special emphasis on yield stability and quality (organoleptic, nutritional, health benefit aspects).

Besides genetics and breeding issues, attention must be given to farming techniques, marketability and profitability of less frequently grown crops.

As agricultural biodiversity minimizes the risk of yield losses, this program should be extended to small-scale farming systems in Europe as well as in Sub-Saharan Africa to maintain and improve local crops and vegetables suitable for local food supply.

Expected impact

The outcome of the project will be a thorough survey of advantages and constraints in the cultivation and marketing of less frequently grown crops and therefore facilitate their introduction in farming systems where they can improve the agricultural biodiversity. It will improve the competitiveness of European organic farming with a large range of premium products. Biodiversity of different crops at farm and regional levels will counteract rapid adaptation of pathogens and diseases and will reduce the risk of severe yield losses. The project will prevent the disappearance of underutilized or local crops, will contribute to food and income security, preservation of ecosystems and preparation for the consequences of climate change.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)	X		

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X	X		Collaboration with developing countries

Breeding of varieties with improved rhizosphere development and activity for organic and low external input food production

Description

Plants have evolved several strategies to acquire nutrients and avoid diseases in natural ecosystems.

Plant – soil microbial interactions are responsible for (a) biological N_2 fixation (legume – rhizobia symbiosis), (b) improved water and nutrient acquisition (e.g. crop symbiosis with mycorrhiza), (c) outbreak of plant diseases (soil borne

pathogens), but also for (d) disease suppression (association with plant growth promoting rhizobacteria). On poor soils and under low nutrient availability conditions the successful establishment of beneficial plant - soil microbial associations (rhizosphere competence) could prove essential for enhanced crop yield through improved resistance and/or nutrient uptake. Root exudates of crop plants influence the soil microbial community. However, genetic factors responsible for the specific associations with beneficial rhizosphere microorganisms and the complex interaction among different groups of microorganisms and soil characteristics are poorly understood, and might be masked under favourable growing conditions. Targeted efforts are needed to elucidate the potential of beneficial plant - soil microbial interactions in order to exploit them in breeding programs for organic farming.

The project aims at the (a) identification of the genotypic effects of the crop plants for sustaining beneficial microorganisms, (b) the quantification of the impact of such plant-soil microbial interactions on plant nutrition, plant health and yield under organic farming conditions, (c) the validation under different pedo-climatic conditions and agricultural management regimes and finally (d) the development of efficient selection methods (e.g. qPCR analysis of soil microbia and other state-of-the-art tools) to identify and breed for varieties with improved rhizosphere competence.

Expected impact

The outcome of the projects will provide a better understanding of the impact of plant-microbial interaction for nutrient acquisition, disease suppression and yield under organic farming conditions. The project will reduce the gap between basic sciences and applied breeding research to address the exploitation of these complex plant – soil interactions. It will result in selection tools for improved rhizosphere competence of crop plants. Thus the project will enhance breeding for organic and low external input farming systems and result in crop production better supported by the eco-functional diversity of soil microbia.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)	X		

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X		X	

Key Challenge 2.5: Development and adaptation of novel technology

Organic agriculture is knowledge intensive and requires skilled observation and careful management in order to benefit from ecological service functions in the prevention of disease, resistance to weeds and pests and so forth. Modern technolo-

gies can be helpful to achieve this, and research should develop appropriate tools for automation and sensing along with precision technologies for efficient crop production and maintenance of soil quality.. Moreover, there is a need for development of lightweight machinery benefiting from Information and Communication Technology (ICT) and automation of frequently repeating operations in order to reduce soil compaction and labour use. Low-cost technologies have to be developed in order to allow small-scale farmers to benefit from mechanization. Livestock production will also benefit from the development of tools for sensing and automation for better health management and reduced workload for the farmer. Monitoring tools for soil, crops and animals should better support farmers' observation.

According to the principle of "care", organic agriculture should be managed in a precautionary manner including the choice of new technologies. A crucial part of research and innovation will therefore be to assess novel technologies in the context of sustainable production and processing systems, working conditions and socio-economics as well as in relation to the health and welfare of humans and livestock and the impact on ecosystems.

Research goals

1. Innovation in tools and strategies for efficient weed management
2. Physical control of pests
3. Combining field crop diversity with novel technologies
4. Innovation in sensors and automation for organic livestock production
5. Assessment and sustainability of novel technologies for organic agriculture

Innovation in tools and strategies for efficient weed management

Description

Insufficient management of weeds due to improper methods, high costs and labour intensity is one the most significant factors in yield reduction in organic crop production.. Improved weed management techniques will most likely consist of a combination of improved strategies starting with crop rotations, timing of soil preparation and sowing, choice of crop cultivars and targeted mechanical operations with specialised tools. New technologies have developed in recent years for differentiating crop plants from weed plants, making possible automated, selective mechanical weeding. However, the few European prototypes of these technologies need further improvements, followed by validation of their selectivity and weed control effectiveness achieved through international research and knowledge exchange among weed scientists, agronomists, technicians, and industry partners. Knowledge and experience of farmers and advisors should be tapped through participatory research methods and SMEs are expected to be involved. Parallel to technological improvements, cropping systems need to be redesigned to support optimal use of techniques such

as transplanting and precision seeding, and to integrate preventive, cultural and direct physical measures. Collaborative research will develop and test weed management strategies based on agronomic and technical interventions suitable for different crop production enterprises and under varying agro-ecological and market conditions.

Also, small-scale farmers should benefit from the research into advanced weed control technologies and their strategic uses. Spin-off of new short-term affordable solutions for improving less advanced tools will be created. The technology research and its agronomic implementation have relevance for small farms and may result in new cropping options (e.g. double cropping). Small mechanised tools can be used in a more intelligent way and robotised for economic use on larger scales. The strategies and tools for improved weed management shall be evaluated according to multiple criteria: agronomic (short and long term weed control efficacy); economic; social (nature and amount of labour input); energy consumption; greenhouse gas emissions; and impact on soil structure and fertility. Furthermore concerns regarding ground nesting birds related to the intensity of mechanical weeding especially in arable crops should be researched. Organic fields are often more attractive to birds, and therefore sound management during the breeding period is extremely important to avoid the creation of ecological traps.

Expected impact

Research and innovation in both tools and weeding strategies will promote more efficient and feasible weed control measures for organic cropping. Automation and efficient weed control methods will reduce farm production costs by reducing manual weeding, and will potentially increase the managed area of high value crops. The technologies and information provided will also have relevance to other low external input as well as integrated farming systems. It is also an aim that the solutions can be implemented in third world countries, reducing manual weeding by means of simple machines powered by simple traction measures.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Physical control of pests

Description:

The aim of the project is to test and develop different possibilities for physical pest control.

Increasing demand for residue free foods from organic or low input production adds to the need for alternative methods of pest control. Also, such cropping systems rely on preventive measures, meaning that populations of persistent, re-

sidual pests must be kept strictly under damage thresholds. Physical control methods such as vacuum application, hot or compressed air or protecting nets have proved helpful in certain specific cases. Research should make an inventory of the possible techniques for physical pest control and pests against which these techniques could be effective. The technical development will build on in-depth understanding of the ecology of the most important pests in different European regions in order to adapt the technology, e.g. to sensitive development stages of the pests. Promising techniques need to be tested for a set of identified pests under a range of climatic circumstances.

In order to fit in practically with routine farming practise, the machinery and techniques for these methods require further development. The efficacy of available methods should be tested and compared under different climatic conditions and at different kinds of farms. The collaboration with the machine industry is strongly recommended.

Expected impact

The aim of the project is to give farmers tools and background information to choose appropriate methods to control pests without pesticides. Solutions for obstacles to adoption will be found and the effect on non-target organisms will be monitored. Economical analysis of the methods will be carried out. High priority will be placed on knowledge transfer to farmers through, for example, demonstrations, technical leaflets, articles in growers' journals and workshops. The outcome should be organic vegetable production that better fulfils consumer expectations.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)		X	
Medium term (until 2020)	X		
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Combining field crop diversity with novel technologies

Description

The use of monocultures or simplified rotations in agriculture has often been followed by a tremendous decrease in biodiversity, including crop diversity. Therefore, the introduction of crop diversity through intercropping systems, agroforestry, [efficient exploitation of space by growing crop plants, (LRW: unsure of meaning, suggest deleting)] and selective harvesting and sorting will generate benefits for biodiversity, soil fertility and crop performance. The potential of novel technologies such as GIS, GPS, crop and landscape modelling, computer vision and automation to support organic farming systems, where crop diversity is acknowledged as a crucial instrument to achieve stable yields, quality and other values, has so far been very little explored The use of novel technolo-

gies should be cheap, transparent and applicable for the complex and highly dynamic outdoor environment and complying with the notion of sustainability (e.g. run by solar energy, agro/bio-fuel). Research will promote and encourage communication between interdisciplinary research institutions, end-users like farmers, and manufacturers of various technologies.

Expected impact

The interdisciplinary project consisting of agronomists, biologists, engineers and economists will lead to a redesign of organic farming systems by introducing diversity at field, farm and regional scales. Selective harvesting and sorting has significant positive impact on quality, especially of high value crops. Novel technologies for biodiversity and crop quality will be beneficial for the value-oriented organic food market and will improve the synergy between organic farming and society. The research efforts will facilitate the adoption of organic farming methods through raising proficiency in technology management at a European level.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)		X	
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X		X	

Innovation in sensors and automation for organic livestock production

Description

Organic husbandry farmers have specific needs for assistance in free-range farming, animal health monitoring for disease prevention, and documentation of production and waste. In this context, focussed development and use of sensory and automation technology could optimize production (feed, allocation, logistics), detect possible causes of animal discomfort, pain or distress, and detect contaminants and emissions (which can cause problems for animals, humans and the environment). Sensor technology development and implementation, data processing and communication facilitate automation and management support. Automated mechanical tools using input from real-time behaviour information and stored production data can assist decision-making and undertake routine procedures. Examples are devices for robotic milking or feeding, surveillance and nursing. Automation can prevent environmental overload and facilitate targeted and directed action. Online storage control of feed and produce could enable the organic farmer to optimize production and product quality. Novel technology needs continuous assessment of its implications for ecological, economical and social sustainability. Collaboration with manufacturers is strongly recommended.

Expected impact

Sensor technology and automation will en-

hance animal welfare and increase profitability for farmers through greater animal longevity, lower veterinary costs, and increased input/output levels of feed, energy, and labour. They will also facilitate management of larger herds and improve product quality. Greater manageability in free range farming will enable pigs, poultry and cattle in large or small herds to graze outside, with positive side effects such as weed suppression, soil tillage and manure spreading. Farmers can reduce hard physical labour, accidents and repetitive chores, and will have increased time for managing the animals and other activities. Novel technology implementation and assessment will provide organic livestock farming with the means to minimise fossil energy usage and climate impact, controlling emissions of GHGs such as nitrous oxides and methane. Consumers will benefit from documented organic quality, possibly also from regional origin. Society will benefit from free-range livestock farming combining landscape advantages with, high quality livestock products and animal welfare.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)		X	
Long term (until 2025)			X

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Assessment and sustainability of novel technologies for organic agriculture

Description

Present crop production technologies are not always adapted to organic crop production principles. Research into such issues as maintaining rational production methods, enhancing yield and product quality, or minimizing resource inputs in organic farming will assess the potential of advanced technologies applied in conjunction with optimized management practises

Viable innovations in electronics, information technology and automation combined with light, small, and renewable energy powered machinery have been underutilised. Interdisciplinary research should compile relevant production criteria and establish the farming tasks necessary to optimize organic production forms in different European regions. Current technical innovations supporting the farming tasks will be assessed and terms of reference for developing future technical solutions will be identified. Research will evaluate novel scalable technologies. Particular promise is foreseen in modular technologies, which encompass a broad range of machines, small to large or low-tech to high-tech, which can interact flexibly to fit the diversity of organic production systems.

Expected impact

The design and development of dedicated organic farming technologies and the formulation of methods and strategies for planning and apply-

ing these technologies will enhance sustainability of the work processes in organic farming by, among other things, reducing energy input and soil compaction, increasing biodiversity, and improving plant and soil health. In general, the research will lead to increased quantification of the benefits and drawbacks of novel technologies, identify barriers to implementation as well as provide the requirements and guidelines for developing and adapting the proposed technologies. New ideas for research and development in agricultural engineering will foster the competitiveness of the European agricultural machinery manufacturers.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)		X	
Medium term (until 2020)	X		
Long term (until 2025)		X	

Funding scheme: .

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
		X	

Key Challenge 2.6: Aquaculture and seaweed

Aquaculture is the fastest-growing animal food-producing sector. According to recent statistics from the FAO, current annual production amounts to about 50 million tons whilst production of fish from open waters has levelled off at around 100 million tons and is not likely to increase beyond current levels.

Organic aquaculture is a relatively new field of production, supplying high quality fish products with specific attention to fish health and welfare as well as to protection of the environment and the consumer. Annual global organic aquaculture production amounts to about 50,000 tonnes of which approximately 20,000 tonnes including salmon (16,000 tonnes) and rainbow trout (2,500 tonnes) are produced within Europe. An EU regulation on organic aquaculture, amending EC Regulation 889/2008, will be in force from 1st of July 2010.

Buyers of organic fish and seafood trust the quality and the production process of these products and expect sustainability, differentiating organic from conventional products and accepting an organic price premium. This area is linked to the aim of the European Aquaculture Technical and Innovation Platform (EATIP) that looks for strategies to strengthen European aquaculture. Also in organic aquaculture - which is still a niche-market but growing faster than the conventional sector – filling important research gaps will lead to more competitiveness especially of SMEs.

The research vision is to stimulate innovative fish production systems based on a holistic concept of fulfilling physiological needs to secure health and welfare of the fish while also paying attention to environmental protection and the working conditions of farmers..

The EU regulations (EC) 834/2007 and (EC) 710/2009 introduced requirements for the cultivation and harvesting of organic seaweed. Since this was not in the scope of the former EU organic

regulation (EEC) 2092/91, there is little experience particularly regarding harvesting methods and resource management. Therefore, the organic sector in Europe needs to have consolidated scientific results on this topic in order to further develop organic production rules and systems for seaweed.

Research goals

1. Assessment of organic aquaculture for further development of regulatory framework *
2. Sustainable feeding of organic fish: nutritional, environmental and welfare aspects
3. Alternative raw-material sources for aquaculture feeds from integrated by-products management
4. Organic seaweed: sustainable harvesting methods and management systems

* Highest short-term priority based on consultations

Assessment of organic aquaculture for further development of regulatory framework

Description

Organic aquaculture is a relatively young market segment, which as of 2009 is regulated at the EU level (EC Reg 710/2009). Research is needed to support a possible revision of this regulation planned for 2013. Impact assessments of different organic aquaculture production systems and management strategies, nutritional resource utilization, fish welfare as well as the environmental impact for different fish species and production sites are needed. Different applied strategies for health maintenance and alternative veterinary treatments have to be assessed and optimal slaughtering procedures should be evaluated. Production -environment interactions need to be analysed to find thresholds for an eco-functional intensification of organic production in line with organic farming principles. Socio-economic investigations of the relationship between organic certification and competitiveness as well as studies on consumer perceptions and sentiments are needed to guide farmers, regulators, policy makers as well as market actors towards acceptance of this innovative new sector and to promote its further development.

Expected impact

The results of the research will create a scientific basis for the future revision of the EU rules for organic aquaculture taking into account different fish species and climatic conditions.

The results in the field of organic aquaculture research will also be of benefit to the conventional sector. Substantial scientific knowledge and policy recommendations regarding stocking densities, feed issues and welfare will be gained for a code of conduct of organic aquaculture production for different European contexts (Mediterranean, Atlantic, Middle European, Nordic, etc.) and as a basis for community-wide development and promotion. Consumer confidence will improve based on broad dissemination of the scientific knowledge gained and good communication from stakeholders.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)		X	
Long term (until 2025)			X

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Sustainable feeding of organic fish: nutritional, environmental and welfare aspects

Description

The limited world supply of fish meal (i.e. protein) and fish oil for aquaculture feeds cannot cover the increasing demand from the aquaculture industry, necessitating the exploration of alternative strategies for fish feeds in accordance with the EU Regulation on organic aquaculture (EC Reg 710/2009). Consistent with this, the principles of organic aquaculture encourage using less marine resources in fish feed to protect global fish stocks and secure sustainable fishery according to the FAO Code of Conduct.

However, substitution of fishmeal and fish oil by organic plant ingredients is partly hampered by the presence of anti-nutritional substances (including polysaccharides, phenols and glycosides); low content and availability of phosphorus; shortage of certain essential amino acids; and lack of essential omega-3 fatty acids with negative effects on fish health and welfare. This also implies effects on fish metabolism and stress responsiveness as well as reduced utilization of macro- and micronutrients, which causes increased environmental impact.

Appealing to customers concerned about ethical issues, specific attention should be paid to aspects of fish welfare in organic aquaculture taking into consideration differences among species in stress susceptibility. In higher vertebrates, fatty acid composition affects the physiological stress response and learning. These two factors are essential in stress resistance, suggesting that replacement of fish oils with vegetable oils has a profound effect on fish welfare.

Research will deal with topics such as improved utilization of plant nutrient sources in organic fish feed, evaluating productivity, physiological health and welfare as well as environmental protection. Reduction and optimization of marine resources in organic aquaculture feed with respect to metabolic programming, optimum fish development, physiological performance and product quality is envisaged as well as improved management of organic fish farming systems taking into consideration nutritional and physiological welfare. Further issues to be considered are:

- Selection and growth of organic crops designed for aquaculture feed;
- Optimization of organic plant phosphorus availability for fish feed;
- Development of new harvesting and processing technologies for optimizing organic plant ingredients for fish feed.

Expected impact

The results of the project will be a significant contribution to the development of the European organic aquaculture sector. The research will involve key elements of innovative production methods and technologies including nutritional and physiological performance potentials, ethics and welfare, sustainability and product quality.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)		X	
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Alternative raw-material sources for aquaculture feeds from integrated by-products management

Description

It is a key concern of the EU policy for sustainable aquaculture strategies and of the technical platform EATIP to develop new sustainable feed resources. The platform also raises the need for and opportunities of innovative recycling strategies.

The project will focus on alternative raw-material sources for aquaculture feeds. Modern feed precursors for aquaculture feeds need to fulfil the demands of cultured fish and crustaceans in terms of amino and fatty acid profiles while not using resources that can serve as food for humans. biodegrading, saprophagous organisms can transform agricultural and other waste into animal feed of invertebrate, microbial or fungous origin, rich in protein and essential fatty acids. Systems need to be developed for exploiting integrated by-products, converting the recyclable fraction of agricultural and food processing operations into valuable feedstuffs. Combined action of engineering and biotechnological sciences will lead to effective and economically feasible processes and competitive products.

Expected impact

The results of the project will support the development of new technologies based on recycling strategies and to give insights into new (synergistic) metabolic pathways of bio-degrading organisms. It will help to remove a reliance of marine eco-systems on the use of terrestrial biomasses. This will contribute to consumer confidence in the sustainability of the sector. Projects are expected to develop strategies and techniques that will lead to feed precursors free of dioxin and antibiotic residues. Also, these technologies will generate economically valuable precursors for the chemical and pharmaceutical industries, such as chitin, oil, functional peptides and others. Facing the growing demand for non-vegetarian feed proteins and the expected decline in fishmeal production, associated (new) industries will gain competitiveness by being able to fill a supply gap.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)		X	

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Organic seaweed: sustainable harvesting methods and management systems

Description

The EU regulations (EC) 834/2007 and (EC) 710/2009 introduced requirements for the cultivation and harvesting of organic seaweed. Since this production area has never been in the scope of former EU organic regulation (EEC) 2092/91, there is little experience in particular regarding harvesting methods and resource management. Therefore, the organic sector in Europe needs to have consolidated scientific results on this topic in order to develop the organic production rules. This research proposal aims to undertake annual monitoring of approaches applied in different European regions with regard to a) sustainable harvesting of wild seaweed and b) the management tools set up by the different stakeholders. The main questions of the applied scientific research program will be:

- How are harvesting methods impacting on biodiversity and non-target species;
- What are the methods corresponding best with organic production rules?

The following issues will be analysed for the main seaweed species relevant for the organic sector: global and seasonal life cycles of a range of defined wild organic seaweeds; management strategies, tools, methods and fallows applied by harvesters'.

Research will identify and evaluate the impacts of once-off biomass on target and nontarget species as well as on biodiversity. A code of practise will define sustainable annual yields, harvesting seasons, harvesting methods and site management systems closest to organic production principles.

Expected impact

The beneficiaries of the project will mainly be the economic operators in the sector (who will receive information on resources, management, techniques and stocks) as well as the competent authorities (who will receive recommendations of management tools) and the control bodies (who will receive tools to verify whether practises are in line with regulatory requirements). The final consumers as well as the whole production chain will also benefit from the results (by providing consistent and correct explanations available for what is an "organic seaweed").

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)		X	
Long term (until 2025)			X

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

9. Food for health and well-being: The food quality and health challenge (Theme 3)

Coordinators: Machteld Huber and Susanne Bügel

High quality foods – a basis for healthy diets and a key for improving the quality of life and health

For most consumers expectations of high quality and a positive effect on health are important motives for buying organic food. Farmers and SMEs are urgently demanding solid arguments to communicate the expected value-added and possible positive health effects of organic products. However, scientific evidence concerning expected health effects of consuming organic products is still scarce.

The EU organic Regulation (EC/834/2007) states that "organic production is defined by an overall system of farm management and food production that combines best environmental practises, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes" (Recital 1). Furthermore the regulation includes objectives like "the aim for high quality" (Article 3), as well as overall principles, restrictions and the operation of the control system. Although some definitions are provided, several concepts relating to quality from an organic food and farming perspective (here described as 'organic quality') like natural substances, organic integrity, true nature of the product and vital qualities, are not defined. No standards for this 'organic quality' has been worked out. Thus, a tension arises between the widely referred principle of a systems approach of organic production and the lack of validated tools which connect to this systems approach, when evaluating the quality of organic products. The organic movement questions whether characterisation by nutrient content covers all quality aspects of an organic product. From the organic point of view a product is not merely a collection of nutrients but is seen as a living, integrated entity, which is 'more than the sum of its parts'. This needs to be reflected in a broader quality approach and further development of quality testing methods (often called 'holistic methods') is necessary. Consequently, more explicit definitions as well as methods to assess and assure 'organic quality' are urgently needed. Organic processors who are obliged to "process with care" (Article 6d, EC/834/2007), are, in a growing market of processed food, in need of more 'gentle' techniques and natural substances, which "guarantee that the organic integrity and vital qualities of the product are maintained through all stages of the production chain" (Recital 19, EC/834/2007).

"Maintaining consumer confidence in all aspects of organic production is very important" (Recital 22, EC/834/2007). The organic sector is more than ever challenged by society to deliver and prove the expectation of higher quality and positive health effects. An increasing number of studies are being published, with contradictory conclusions, dealing with differences in nutrient content and presence of harmful substances in organic and conventional products. However, re-

sults from such studies can only speculatively be connected to health effects. Consumption studies need to come up with convincing causal relationships with health outcomes. Until now, only limited research has been carried out to study the effect of organic food on health following consumption. Well-designed human studies are urgently needed. Research results on the topic of quality, as well as health and well-being, would generate a high level of public interest.

Key Challenge 3.1: Development of quality testing methodology to assess food quality from an organic point of view, of standards and of connected references

The system approach of organic production should be reflected upon when the quality of the products is being evaluated throughout the supply chain. Definitions of 'organic quality' and related terms, which mirror the organic systems approach and that are not limited to the nutrient content, are urgently needed. Once these quality characteristics have been defined, tools need to be developed and made available to assess the levels of these quality characteristics. Here, the adequacy of existing conventional techniques like analytical chemistry, as well modern techniques (like metabolomics, proteomics and so on) must be evaluated. In addition to these, complimentary holistic methods (image forming methods), used to measure systemic quality parameters are required. Potentially valuable methods need to be further developed, standardized, evaluated and validated according to generally recognised scientific standards. Measurement tools cannot function without references for good, medium and poor quality, so references need to be produced in controlled trials. Once references are available, quality standards can be established.

Research goals

1. Development of quality testing methodology for organic food quality *
2. Establishment and validation of standards for holistic (e.g. image creating) methods for assessing organic food quality
3. Development of tools/methods to differentiate between organic and conventional products

* Highest short-term priority based on consultations

Development of a quality testing methodology for organic food quality

Description

Regulation EC No 834/2007 for organic production describes aspects of organic food quality, such as organic integrity, true nature of the product, use of natural substances and vital qualities. These are all aspects of a dynamic quality concept. There is a need from consumer and market chain perspectives to first define these terms and then to select and/or develop verifiable criteria to measure them.

Once the terms and concepts of these relatively new criteria are defined, existing laboratory

methods for quality testing need to be evaluated for their adequacy with respect to measuring them. Shortcomings in methodology need to be identified. An adequate testing methodology should be described. The first focus should be on plant products.

Organic products are defined by process criteria and in reality vary widely in quality. A stronger focus on organic product quality will stimulate producers to improve quality.

Stakeholders like producers, processors, traders, consumers and scientists from the organic sector will be brought together in order to develop adequate definitions. Once existing assessment techniques have been evaluated for their ability to assess the defined quality criteria, a manual for testing organic food quality for producers, processors and traders will be developed.

Expected impact

The resulting manual for testing organic food quality will have a positive influence on the end product quality within the organic sector. It will stimulate producers to improve quality and will thus maintain and/or increase consumer confidence in organic produce.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
		X	

Establishment and validation of standards for holistic (e.g. image creating) methods for assessing organic food quality

Description

For many years researchers and private laboratories have investigated the potential of alternative quality testing methods, which not only deal with the chemical composition, but which reflect more the systems approach of organic food production. Such complimentary methods (e.g. image forming methods), in the organic food and farming sector often described as holistic methods, are increasingly applied for quality differentiation in several EU member states. There is a need for further development and validation of laboratory standards for these methods. Such a European-wide harmonised laboratory network does not exist yet.

Standards have to be developed for various food product types e.g. vegetables, grains and milk. They must be related to EC 834/2007 food quality definitions (Article 19, §6c, d), such as of levels of vital quality and levels of the organic integrity. Furthermore the way of production of such standards must be documented according to the European rules for organic production. Links between crop management and quality products should be studied through these approaches. It should contribute

to the establishment of standards. These will be characterized through routine chemical analysis for the specific sample before testing using holistic methods in different laboratories. For the definition of the standards as well as the development, experts from farming and processing industry (stakeholders) as well as from laboratories (scientists) will be involved.

Expected impact

The resulting standards for holistic/complimentary methods will contribute to the harmonization and standardization of organic food quality analysis. Furthermore a positive influence on quality improvement by organic producers and thus an increase in consumer confidence in the analysed products is to be expected.

Time perspective and priority

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Development of tools/methods to differentiate between organic and conventional food products

Description

Often consumers expect a difference between organic and conventional products. Whereas the way of production is regulated in EC Regulation 834/2007 and EC Regulation 889/2008 for organic production, a possible difference in food products needs to be evaluated. There is a need from a consumer and market chain perspective to develop methods for authentication in this area. Samples from vegetables and grain products should be selected from existing field trials within the EU. The samples should be characterized by a wide range of existing analytical (e.g. metabolomic techniques) and complimentary methods, often also described in the organic sector as holistic methods. Sampling and data collection and analysis should follow standardised procedures (e.g. enough repetitions to take account of the natural variation). The evaluation includes the comparison of the abilities of the different methods applied (method approach) and multivariate statistical analysis (data approach) for quality differentiation. To increase the validity, data from earlier projects will be used and compared with the new results from this project (more years, seasonal influence). In a second step (larger project) those methods and tools should be applied on others products (milk, processed food).

Expected impact

The results will clarify which quality testing methods/tools can be applied and are most suitable to differentiate between organic and conventional products but also between different cultivation techniques and fertilisation intensities.

The outcomes are of high societal interest and if successful will result in more consumer trust in organic produce.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X Vegetables, grains		
Medium term (until 2020)	X Other products		
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X	Medium term X		

Key Challenge 3.2: Processing with care - development of gentle processing technologies to maintain and improve 'organic food quality'

Consumers expect organic food to be minimally processed and organic processors aim to maintain the fresh 'natural' quality of organic products during processing. The EU Council Regulation (EC) 834/2007 refers to "processing with care", however processing and packaging are less defined than farming systems are. It is known that processing technologies have a very high impact on different quality aspects. However, processing techniques used today are not developed specifically for organic foods. And many industries are using the same processing techniques for conventional and organic food. Organic processors, confronted with a growing market of processed food, express their need for new gentle techniques that maintain or improve the 'organic quality' of the product. The conventional trend to use additives is not in line with the organic principles; consequently the availability of well-defined natural functional ingredients that improve organic food quality is of great interest amongst organic processors.

A standardised method for the evaluation of careful processing methods should be established. Existing technologies as well as new technologies (e.g. nanotechnology) should be evaluated from the point of view of their potential impact on optimal 'organic quality'. New or adapted technologies need to be developed and analysed on the critical control points to maintain the organic quality during processing. Low energy expenditure needs to be included in the development of minimal processing techniques.

Research goals

1. Processing with care – development of a Code of Practise for organic food processing*
2. Establishment of quality analysis of critical (control) points in processing and develop technologies for safeguarding quality along critical parts in processing
3. Development of more natural functional ingredients or new technologies to improve organic food quality and replace additives

** Highest short-term priority based on consultations*

Processing with care – development of a Code of Practise for organic food processing

Description

Organic food processors, confronted with a growing processed food market, have to follow several objectives and principles outlined in EC Regulation 834/2007 (Articles 3 and 6). In particular organic food has to be processed with care, which should result in maintaining organic integrity and vital qualities, and should protect the true nature of the product (Recital 19, Article 7c, EC/834/2007). Organic food processors have expressed their need for a Code of Practise in which the principles are translated into practise and which provides processors with decision criteria concerning different processing steps.

The Code should be developed for the most relevant product groups in a participatory process with the organic industry, taking into account perceptions of consumers and market actors.

Processing techniques used today are not developed especially for organic foods and many industries are using the same processing techniques for conventional and organic food. The conventional mainstream trend to add many additives is not in line with the organic principles, while the availability of defined natural functional ingredients to improve organic food quality is of great interest to both organic and conventional processors. A standardised approach for the evaluation of processing methods according to the principle of care is lacking.

The project will develop criteria to evaluate the principles of organic integrity, vital qualities and the true nature of the product. Existing processing techniques will be evaluated along critical control points for the most relevant product groups. A Code of Practise for processing with care for the most relevant plant product groups will be developed to serve as a support document for the certification process.

Expected impact

The availability of a Code of Practise for defined and tested processing with care will improve the quality of products and will lead to more competitiveness for SMEs. Consumer confidence in the organic sector will be improved, based on ample communication with stakeholders.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X – 3 plant product groups		
Medium term (until 2020)	X – more relevant product groups		
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Further establishment of a quality analysis of critical (control) points in processing and development of technologies for safeguarding quality along critical parts in processing

Description

Consumer demand for natural, sustainable and carefully processed food with a high quality is rising. Most of the consumed food is nowadays processed food. The impact of this intensive processing might threat the product quality unnecessary.

Next to food safety and health aspects also the demand of an excellent sensory quality is rising in the organic food sector. The organic sector with the principles of limited use of additives as well minimal processing activated the discussion of quality. In the trans-national project Core Organic, the QACCP (Quality Analysis of Critical Control Points), a method for the systematic evaluation of the quality influencing production steps, was elaborated and basically tested with baby food. In a next step there is a big need to establish this concept in the industry broadly. A further development of the concept for the special needs of the different product groups (e.g. milk, meat, fruit and vegetables, bakery products) is the basis for a successful implementation.

The research will further develop the QACCP-instrument for the typical needs of more different product groups. More insight in crucial quality influencing production steps will be established. The instrument will be developed in collaboration with the industry, aiming at a dissemination of the methodology and concrete recommendations.

Expected impact

The research will contribute to establishing a better balance between the different requirements for high product quality: food safety, sensory quality and health aspects as to optimize the overall product quality of organic food. This will increase the quality of organic products and meet better the consumer's expectations of processed organic food of high quality.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X			

Development of more natural functional ingredients or new technologies to improve organic food quality and replace additives

Description

The organic sector has the principle of limited use of additives. In organic food only 47 food additives are allowed in the EC Regulation 889/2008 compared to more than 400 in conventional food (in 2009). Yet the availability of more defined natu-

ral functional ingredients to improve organic food quality and to influence technical properties is of great interest among organic food processors. Also the conventional food industry is increasingly looking for replacement of additives in order to achieve "clean labels". However, the principle of not using additives produced by GMO modification, causes extra challenges for the organic food sector.

Possibilities to replace additives with functional ingredients or new technologies should be evaluated. Food products and raw materials with promising properties or new technologies will be tested in collaboration between the organic processors and the industry for food additives. Functional ingredients should be developed and tested for specific uses and needed adaptation of connected processing techniques should be evaluated.

Expected impact

New functional ingredients will be developed and tested for selected use in the products in collaboration with the industry. The food industry (organic and non-organic) will get impulses for innovative processing technologies and innovative new "clean" products will occur. Agricultural products will have better market access if more natural ingredients are used. Consumers will get organic food with higher authenticity, which fulfil their expectations.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
X –Short term for specific product groups and technical properties	X – Medium term for a broad range of products and properties		

Key Challenge 3.3: Effect studies on health and well-being in humans consuming organic food in comparison to foods of different qualities

Consumers predominantly buy organic food because they believe it to be healthier. It is however not known if this expectation is correct. Various types of studies have different evidence value, from a scientific point of view. In observational studies a given life style habit (food intake) of a large group of people is studied and correlated to health. Such observational studies can bring valuable information about correlations but cannot establish causal relationships. Further the quality of the consumed food is not assessed.

More convincing are experimental human intervention studies that control as many health-related factors as possible and are performed with food products of well-assessed quality. However, such intervention studies can only be performed

in humans once relevant end-points, so called biomarkers, have been defined that identify convincing outcomes. At present, studies need to be performed to define relevant biomarkers for health, taking into consideration health aspects like resilience, robustness and long-term survival on organic food. These biomarkers need to be established in animal feeding studies, before they can be used in humans. In human studies other factors potentially influenced by organic food intake (for example mental well-being and daily functioning and social behaviour) need to be studied.

Once health effects from organic products are identified in larger animals, in vitro laboratory test models may contribute to unravelling the physiological mechanisms that underlie the observed effects. Promising developments are available with small organisms (e.g. bacteria, small worms) or cell-lines that show basic vitality reactions to different food extracts. The availability of standardized and validated fast and cheap in vitro models, that can be used with food extracts by revealing basic vitality reactions (e.g. length of life span or number of offspring of an organism), will be valuable for the sector.

Research goals

1. Identification of appropriate biomarkers through animal feeding studies to evaluate effects on health from consumption of food from different production systems *
2. Effect of organic food and foods of different quality on risk and severity of allergies, health and well-being in children
3. Effect of organic food and foods of different quality on nutrient availability, health and well-being of adults
4. Observational studies comparing different levels of consumption of organic food in relation to health problems, considering the impact of other lifestyle factors

* Highest short-term priority based on consultations

Identification of appropriate biomarkers through animal feeding studies to evaluate effects on health from consumption of food from different production systems

Description

The aim of this topic is to identify biomarkers (measure points) for health in animal feeding studies which are relevant in future human studies, comparing diets sourced from different farming systems and different fertilisation regimes/intensities.

Biomarkers so far used in food studies have been classic disease biomarkers, whereas here the focus will be on subtle markers for differences in health. Health factors like resilience, robustness and long-term survival will be taken into account. Ethically acceptable health and stress tests should be included. Biomarkers defined will be appropriate for scientifically convincing controlled studies in humans.

Products and foods tested should be from controlled production and from different fertilisation regimes within production systems. Products and feeds should be of well-assessed quality.

Expected impact

Once appropriate biomarkers are available, comparative analysis of health effects of foods and diets from different production systems and different intensities within the systems will become possible in humans as well as in animals. The outcomes are certain to be of high societal interest, and if positive will result in a strong incentive for consumers to buy best quality products.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)			
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Effect of organic food and foods of different quality on risk and severity of allergies and on general health and well-being of children

Description

Allergies affect many people and the numbers are rising (counts of 1/5 to 1/3 of the population are described). Today it is still unknown why people get allergies, but something in the environment and/or imbalances in food and environment during the first years of life, are supposed to be involved. Especially western countries are affected by allergies.

Conventional foods might contain traces of pesticides used in primary production and although the amounts of pesticide residues are below detection limits or are at permitted levels for single pesticides, the total sum of pesticide residues might have harmful effects on health. Limited but promising recent studies are available on the effect of organic food diets on health and development of allergies. Whether these results are caused by the absence of synthetic pesticides or by specific nutrients in the organic food is not known.

In a long term intervention study with children the effect of organic food diets and foods of different quality on risk and severity of allergies and on general health and well-being should be measured. Defined biomarkers and techniques from the social sciences should be used.

Expected impact

The increasing amount of allergies is costly both for the consumers affected and for society. If intake of organic food or foods from low external input systems could decrease the risk and severity of allergies this would have enormous impact on at-risk consumers, as well as for producers and industry.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)			
Medium term (until 2020)	X		
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Effect of organic food and foods of different quality on nutrient availability, health and well-being on adults

Description

Many consumers expect organic food to be healthier and more nutritious than conventional food. The scientific basis of this expectation is weak.

Most studies have measured amounts of nutrients in single food products and even these studies are conflicting. Well-designed long-term intervention studies testing the different health effects of diets based on either organic or conventional foods are lacking. A few short-term human intervention studies have been performed, but most of these have tested effect of addition of either conventional or organic single products like carrots, tomatoes to an otherwise uncontrolled habitual diet. In the only published study looking at effect of a fully controlled diet with organic products on antioxidant status, results indicate that differences might exist, but more studies are needed to clarify whether the differences are beneficial for health and well-being.

Therefore, controlled intervention studies with adults, with fully controlled diets made from organic and high- as well low external input production systems are needed, to study nutrient availability and effects on the development of markers of health problems. These studies should include measurements of biomarkers, as well as traditional disease risk biomarkers, new explorative analysis (e.g. metabolomics techniques or holistic methods), and techniques from the social sciences should be used for testing well-being.

Expected impact

Years ago it was postulated that diet plays a crucial role in 1/3 of all diseases. This number might for some diseases be higher, for others lower. However, there is no doubt that diet plays a crucial role in obesity, type-2-diabetes, cardiovascular disease and in some cancers. Therefore any dietary change that might decrease the risk of these life-style related diseases will have a tremendous impact on society.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)			
Medium term (until 2020)	X		
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

Observational studies comparing different levels of consumption of organic food in relation to health problems, considering the impact of other lifestyle factors

Description

The potential health impact of organic food is an important issue, touching consumer's expectations and as well organic food producers. Often posed by patients, but not addressed in research until now, is the question whether an organic diet can help people with major health problems (e.g. cancers) to improve their life expectancy or their quality of life.

Although intervention studies are most convincing, observational studies can produce relevant information about correlations between food intake and health impact. For these, new identified biomarkers are not essential. Yet, several important life style factors, known to be related to health, like income level, educational level and physical activity are also correlated to the choice for organic foods. In research on the topic, these life style factors should be counted with.

Observational studies will investigate in two focus groups with specific health problems the impact of organic food consumption, taking into account other relevant life style factors. The two focus groups are: (1) Children in the primary school age will be studied on the development of allergies and obesity; (2) Identified cancer risk groups and people with diagnosed cancer will be studied on the impact on the disease process and the quality of life. The studies will select subjects with different levels of organic food intake, ranging from non-organic-consumers to consumers exclusively consuming organic or bio-dynamic food. The groups will be followed up for at least 3 years.

Expected impact

This study will contribute to the knowledge base of the association between organic food consumption and health. This information is valuable for stakeholders like producers, traders and consumers. For producers and traders the results could strengthen their marketing strategies. For consumers, sometimes being patients, the outcomes will bring information to health questions.

Time perspective and priority:

Time perspective	High priority	Medium priority	Lower priority
Short term (until 2015)	X		
Medium term (until 2020)	X		
Long term (until 2025)			

Funding scheme:

Small collaborative project	Large collaborative project	Coordination and support activities	Other type:
	X		

ANNEX I : EXTRA RESEARCH GOALS

Theme: Empowerment of rural areas

Key Challenge	Key issue Topic title
1.1: Develop the concept of Multifunctionality to strengthen sustainable rural development	Enable organic farmers (especially young farmers) from diverse regions, farm size, farm types and supply chains to increase their contribution to Multifunctional rural development and to the sustainability of rural areas through adapting their farm system and through co-operation.
1.1: Develop the concept of Multifunctionality to strengthen sustainable rural development	Develop an integrated understanding of how organic farming can contribute to transitions at the regional level (e.g. for regions with high nature value, lagging regions, mountain regions). The goal is to identify resilient territorial strategies to achieve sustainable food, feed, fibre and energy production.
1.1: Develop the concept of Multifunctionality to strengthen sustainable rural development	Evaluate the economic factors related to the use of draught animals in organic and sustainable production.
1.1: Develop the concept of Multifunctionality to strengthen sustainable rural development	Strengthen the competiveness of the organic sector and the opportunities for product differentiation by clearly defining the food quality attributes related to the organic production process (including fairness, origin, and animal welfare).
1.2: Build and maintain competitive, trustworthy and fair supply chains of high quality organic food	Advance the understanding of consumer attitude to food assurance schemes (including geographical indications and place of origin labelling for organic food).
1.2: Build and maintain competitive, trustworthy and fair supply chains of high quality organic food	Increase efficiency and fairness along different types of supply chains (producer-consumer co-ops, box schemes, urban agriculture, public procurement) through developing models to improve transparency and collaboration.
1.2: Build and maintain competitive, trustworthy and fair supply chains of high quality organic food	Develop new concepts of organic certification of operators considering assessment of progress and the impact of growing competition between control bodies and the considering the needs of very small producers.
1.3: Improve knowledge and communication systems for Multifunctional organic and low-input food production	Develop ways to use various forms of organic land management (including urban agriculture and gardening) as tools for teaching sustainable living and production in the education of school children, for a higher education and for future farmers.
1.3: Improve knowledge and communication systems for Multifunctional organic and low-input food production	Ensure the effective exchange of knowledge for specific methods for working draught horses (e.g. description, performance, machinery, labour requirements).
1.3: Improve knowledge and communication systems for Multifunctional organic and low-input food production	Develop a conceptual framework for successful learning networks using novel methods (e.g. coaching, web-based tools) to develop skills for organic and low external input land and livestock management, entrepreneurship, public good delivery, innovation and co-operation.
1.4: Improve organic farming's contribution to food security and international development	Assess the contribution of different schemes for organic production in developing countries (for domestic markets and international trade) to rural development, food security, environmental sustainability and to economic development and develop guidelines and practises for securing sustainable food chains.

1.4: Improve organic farming's contribution to food security and international development	Identify the regional pathways through which organic agriculture and low-input systems can contribute to sustainable development in a range of political, economic and ecological environments in developing countries.
1.4: Improve organic farming's contribution to food security and international development	Assess the impact of financial systems and policies on the development of innovative projects with clear public good benefits and benefit to smallholder farmers (e.g., eco-plant breeding)
1.5: Develop an integrative policy framework for organic farming and sustainable rural development	Review specific policy measures supporting organic farming to suggest improvements, such as the consideration of organic farming in Rural Development Plans, LEADER-type projects, and the integration between vertical and horizontal policy measures.
1.5: Develop an integrative policy framework for organic farming and sustainable rural development	Evaluate the likely impact of new policy measures (such as pesticide taxes or emission trading) on organic and low external input farming systems.
1.5: Develop an integrative policy framework for organic farming and sustainable rural development	Ensure that policy evaluation methods provide comprehensive information regarding the extent to which rural development aims are achieved while simultaneously contributing to other policy goals.
1.5: Develop an integrative policy framework for organic farming and sustainable rural development	Clarify the expectations regarding public goods and services of various stakeholders and develop procedures for balancing public goods and services with market needs and production restraints.
1.5: Develop an integrative policy framework for organic farming and sustainable rural development	Assess the contribution of participatory and action research methods on development of organic food and farming systems and policy development and evaluation.

Theme: Eco-functional intensification

Key Challenge	Key issue Topic title
2.1: Improved ecological support functions for resilient crop production	Active use of functional diversity among plant species (main crops, catch crops, cover crops) for development of novel cropping methods and improved prevention and control of pests and diseases to achieve high yields of quality products.
2.1: Improved ecological support functions for resilient crop production	Management of soil quality and functional diversity enhancing disease suppression, water use and soil nutrient cycling for high combined yields of quality products.
2.1: Improved ecological support functions for resilient crop production	The appropriate treatment of manure (including modern composting methods) in order to improve its use in support of soil quality, while reducing nutrient losses.
2.1: Improved ecological support functions for resilient crop production	Assessment of use of animal traction on soil and biodiversity
2.1: Improved ecological support functions for resilient crop production	Development of organic farming systems targeted at the fulfilment of the Water Framework Directive and other objectives for environmental protection at farm and catchment level.
2.1: Improved ecological support functions for resilient crop production	Optimized use of cover of soil and impacts on weed management and fertility in arable crops for sustainable organic farming.
2.2: Modern mixed farming systems	Development of organic farming systems resilient to water stress.
2.2: Modern mixed farming systems	Development of organic farming systems targeted at the fulfilment of the Water Framework Directive and other objectives for environmental protection at farm and catchment level.
2.2: Modern mixed farming systems	Transition patterns and subsequent requirements in terms of technical or farmers support, possible collaborations with other farmers and stakeholders (consumers, gardeners, etc.).
2.3: Appropriate and robust livestock production	Improved management of livestock health, and welfare in a farming and food systems context and taking into consideration the life-long production versus yearly production of animals.
2.3: Appropriate and robust livestock production	Practical implementation of animal health and welfare promotion practises under different European contexts (climatic, geographical, cultural, traditional etc).
2.3: Appropriate and robust livestock production	Improvement of self-reliance of protein animal feed production at poultry and pig farms with consideration for productivity and product quality.
2.3: Appropriate and robust livestock production	Determination of synergies or barriers for the integration of different animal species in same farming systems.
2.4: Green improvement of genetic resources	Breeding under eco-conditions including mixed/dual purpose breeding using new selection principles and mass selection in polygenic populations.
2.4: Green improvement of genetic resources	Efficient genetic material for use in erratic climatic conditions for organic and low external input agro-ecosystems.
2.4: Green improvement of genetic resources	Further development of on-farm breeding techniques, using as well non-GMO molecular methods (marker-assisted, genome-wide selection) and definition of innovative regulatory scenarios, which allow their implementation and development.

2.5: Development and adaptation of novel technology	Benefits of automation, censoring, and precision technologies for efficient crop production, nutrient cycling and maintaining soil quality.
2.5: Development and adaptation of novel technology	Identification of effective tillage and planting techniques and operative machines including both automation and choice of implements.
2.5: Development and adaptation of novel technology	Assessment and evaluation of future "green technologies" that fit organic farming goals.
2.5: Development and adaptation of novel technology	Assessing novel technologies: tradeoffs and hazards taking into account the full performances and economical sustainability of automation technologies in organic farming.

Theme: Food for health and well being

Key Challenge	Key issue Topic title
3.1: Development of quality testing methodology to assess food quality from an organic point of view, of standards and of connected references	Develop strategies for communication of the organic value-added and quality parameters for the communication strategies.
3.1: Development of quality testing methodology to assess food quality from an organic point of view, of standards and of connected references	Develop biological test methods for soil, raw material and food.
3.2: Processing with care - development of gentle processing technologies to maintain and improve 'organic food quality'	Understanding better the transformation processes from basic raw materials and their specific quality, through technologies to new products with specific high quality performance.
3.2: Processing with care - development of gentle processing technologies to maintain and improve 'organic food quality'	Evaluation of shelf life stability.
3.2: Processing with care - development of gentle processing technologies to maintain and improve 'organic food quality'	Evaluation of food safety aspects (microbial and chemical hazards).
3.3: Effect studies on health and well-being in humans consuming organic food in comparison to foods of different qualities	Causal relations between quality parameters and health value of the organic and comparative diets consumed and physical, mental and social well-being of the consumers.
3.3: Effect studies on health and well-being in humans consuming organic food in comparison to foods of different qualities	Investigate correlations between specific quality measurements of food products and experiences of consumers.
3.3: Effect studies on health and well-being in humans consuming organic food in comparison to foods of different qualities	Develop in vitro test models of small organisms (e.g. bacteria, nematodes) or cell-lines, to elaborate the mechanisms from different qualities of food on specific physiological functions.
3.3: Effect studies on health and well-being in humans consuming organic food in comparison to foods of different qualities	Validate in vitro test models on food extracts for use as routine tests for basic vitality reactions, like length of life span or number of offspring.

Theme: Cross-cutting issues

Key Challenge	Key issue Topic title
Knowledge management Developing a knowledge management strategy for the organic sector	Establish guidelines for successful school and community gardens.
Loss of Biodiversity	Crop wild relatives and their role in maintaining a high crop genetic diversity in order to fulfil the needs of organic farming
Water Management	Innovative desalinisation system for organic and low input agriculture

Experts and contributors

Name	First name	Institution	Country
Baars	Ton	University of Kassel	Germany
Basile	Salvatore	Ecologica / AIAB, Italian Association for Organic Agriculture	Italy
Beck	Alexander	BLQ, Büro Lebensmittelkunde & Qualität	Germany
Bellon	Stéphane	INRA, National Institute for Agricultural Research	France
Bestman	Monique	Louis Bolk Institute	Netherlands
Billman	Bettina	FiBL, Research Institute of Organic Agriculture	Switzerland
Bocci	Riccardo	Rete Sementi Rurali	Italy
Bochicchio	Davide	CRA-SUI	Italy
Borgen	Anders	Agrologica	Denmark
Bos	Merijn	Louis Bolk Institute	Netherlands
Brandt	Kirsten	Newcastle University	United Kingdom
Brewster	Christopher	Aston University	United Kingdom
Brunori	Gianluca	Pisa University	Italy
Bügel	Susanne-Gjedsted	Department of Human Nutrition, Faculty of Life Sciences, University of Copenhagen	Denmark
Cadavez	Vasco	CIMO-Centro de Investigação de Montanha; IPB - Escola Superior Agrária	Portugal
Conseil	Mathieu	Inter Bio Bretagne	France
Corral	Eva	COPA-COGECA	Belgium
Cozzo	Riccardo	BIOAGRICOOP	Italy
David	Christophe	ISARA - LYON	France
De Wit	Jan	Louis Bolk Institute	Netherlands
Desclaux	Dominique	INRA, National Institute for Agricultural Research	France
Dienel	Wolfram	ÖkoStrategieBeratung	Germany
Erik Steen	Jensen	Swedish University of Agricultural Sciences, Dept. of Agriculture - Farming Systems, Technology and Product Quality	Sweden
Ferrante	Andrea	AIAB, Italian Association for Organic Agriculture	Italy
Finckh	Maria	University of Kassel	Germany
Fog	Erik	Danish Agricultural Advisory Service, National Centre, Organic Farming	Denmark
Fountas	Spyros	University of Thessaly, Volos	Greece
Giovannucci	Daniele	Co-Founder Committee on Sustainability Assessment (COSA)	USA
Goldringer	Isabelle	INRA, National Institute for Agricultural Research	France
Grausgruber	Hermann	University of Natural Resources and Applied Life Sciences	Austria
Greco	Marco	AIAB, Italian Association for Organic Agriculture	Italy
Grøn Sørensen	Claus	Århus University, Faculty of Agricultural Sciences,	Denmark
Hamm	Ulrich	University of Kassel	Germany
Hansen	Sissel	Bioforsk Organic Food and Farming	Norway
Hansson	Per-Anders	SLU, Uppsala	Sweden
Häring	Anna Maria	University of Applied Sciences Eberswalde	Germany
Hospers-Brands	Monique	Louis Bolk Institute, FQH	Netherlands
Kahl	Johannes	University of Kassel, Dep. for Organic Food Quality and Food Culture	Germany

Name	First name	Institution	Country
Kledal	Paul Rye	Institute of Food and Resource Economics, Copenhagen University, Denmark	Denmark
Klocke	Peter	FiBL, Research Institute of Organic Agriculture	Switzerland
Knierim	Ute	University of Kassel	Germany
Koller	Martin	FiBL, Research Institute of Organic Agriculture	Switzerland
Koopmans	Chris	Louis Bolk Institute	Netherlands
Lamine	Claire	INRA, National Institute for Agricultural Research, Centre de recherche de Versailles-Grignon	France
Lammerts van Bueren	Edith	Louis Bolk Institute	Netherlands
Langer	Vibeke	University of Copenhagen	Denmark
Lauridsen	Charlotte	Aarhus University, Faculty of Agricultural Sciences	Denmark
Le Lagadec	François	Bio Bretagne	France
Leeb	Christine	CertWEL	Austria
Lennartson	Margie	HDRA, Garden Organic	United Kingdom
Løes	Anne-Kristin	Bioforsk Organic Food and Farming	Norway
Mäder	Paul	FiBL, Research Institute of Organic Agriculture	Switzerland
Maurer	Veronika	FiBL, Research Institute of Organic Agriculture	Switzerland
Measures	Mark	Institute of Organic Training and Advice	United Kingdom
Messelink	Gerben	Wageningen University - GreenHouse Horticulture	Netherlands
Messmer	Monika	FiBL, Research Institute of Organic Agriculture	Switzerland
Micheloni	Cristina	AIAB, Italian Association for Organic Agriculture	Italy
Michelsen	Johannes	University of Southern Denmark	Denmark
Niggli	Urs	FiBL, Research Institute of Organic Agriculture	Switzerland
Nørremark	Michael	Aarhus University	Denmark
Paoletti	Flavio	National Institute for Research on Food and Nutrition	Italy
Peruzzi	Andrea	Department of Agronomy and Management of Agroecosystem (DAGA) – University of Pisa	Italy
Pires	Jaime	Mountain Research– Instituto Politécnico de Bragança	Portugal
Ploeger	Angelika	University of Kassel, Dep. for Organic Food Quality and Food Culture	Germany
Pugliese	Patrizia	CIHEAM-IAMB	Italy
Raaphorst	Marcel	Wageningen University - GreenHouse Horticulture	Netherlands
Radics	László	Corvinus University of Budapest	Hungary
Rahmann	Gerold	Referat Marktpolitik, Ökologischer Landbau	Germany
Löser	Rainer	Die Ökoberater	Germany
Rämert	Brigitta	Swedish University of Agricultural Sciences	Sweden
Reents	Hans Jürgen	TUM, Technical University of Munich	Germany
Rembiałkowska	Ewa	Warsaw University of Life Sciences	Poland
Renting	Henk	Rural Sociology Group, Wageningen University	Netherlands
Ruijs	Marc	Wageningen University - GreenHouse Horticulture	Netherlands
Salomon	Eva	Swedish Institute of Agricultural and Environmental Engineering	Sweden
Schäfer	Winfried	MTT, Agrifood Research Finland	Finland
Scholberg	Johannes	Louis Bolk Institute	Netherlands
Seidel	Kathrin	FiBL, Research Institute of Organic Agriculture	Switzerland

Name	First name	Institution	Country
Slabe	Anamarija	Institute for Sustainable Development; and representing EEB – European Environmental Bureau	Slovenia
Soave	Ivano	Brio Spa and Coop La Primavera	Italy
Stamer	Andreas	FiBL, Research Institute of Organic Agriculture	Switzerland
Stolze	Matthias	FiBL, Research Institute of Organic Agriculture	Switzerland
Stopes	Christopher	EcoStopes	United Kingdom
Straesser	Cornelius	Software AG Stiftung	Germany
Sukkel	Wijnand	Wageningen University and Research Centre, Sustainable Farming and Food Systems	Netherlands
Sundrum	Albert	University of Kassel	Germany
Thorup-Kristensen	Kristian	Aarhus University	Denmark
Vaarst	Mette	Aarhus University	Denmark
Van de Vijver	Lucy	Louis Bolk Institute	Netherlands
van der Wurff	André	Wageningen University, Horticulture	Netherlands
Van Elsen	Thomas	FIBL, University of Kassel	Germany
van Os	Erik	Wageningen University - Greenhouse Horticulture	Netherlands
Velimirov	Alberta	FiBL, Research Institute of Organic Agriculture	Austria
Vilas-Boas	Miguel	Mountain research centre – Polytechnic Institute of Bragança	Portugal
von Bassewitz	Heinrich Graf	Gut Dalwitz / COPA-COGECA	Germany
von Wirén-Lehr	Sabine	EOCC, European Organic Certifiers Council	Belgium
Walkenhorst	Michael	FiBL, Research Institute of Organic Agriculture	Switzerland
Watson	Christine	SAC, Scottish Agricultural College	United Kingdom
Wetterich	Frank	Deutscher Bauernverband e.V.	Germany
Wezel	Alexander	ISARA	France
Wolfe	Martin	Elm Farm Research Centre	United Kingdom
Wyss	Eric	FiBL, Research Institute of Organic Agriculture	Switzerland
Zollitsch	Werner	Univ. of Natural Resources and Applied Life Sciences, Vienna	Austria

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Editor: TP Organics c/o IFOAM EU Group
Rue du Commerce 124, 1000 Brussels, Belgium
Ph.: +32 2 2806844, Fax : +32 2 7357381
www.tporganics.eu, info@tporganics.eu

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