

eip-agri  
AGRICULTURE & INNOVATION

# Innovative Solutions for Organic Farmers in the EU Optimising Arable Yields



funded by



European  
Commission



Various studies have shown fluctuations in the yields of organic farms. Yields vary a lot more than in conventional farming depending on regions, systems, management practices, particular crop types and growing conditions.

How can these problems be overcome? Haven't some solutions already been developed? What innovative projects have already been set up that could be used as inspiration? Read on to find some answers...

## Table of contents .....

Improving organic yields .....	3
Fluctuating yields in today's organic sector .....	4
Practical solutions to close the yield gap .....	5
Information and decision support systems .....	5
Techniques to increase soil microbial activity and biodiversity.....	6
Machinery rings and new machinery .....	6
Nutrient release of organic fertilisers and developing new fertilisers .....	7
Fostering the use of companion planting and cover crops .....	7
Development of innovative tillage techniques .....	7
Looking for inspiration? .....	8
Carbon and nutrient management with industrial by-products .....	8
On-farm research to improve performance of local varieties .....	9
A collective approach to finding solutions to problems on the farm .....	10
Demonstration activities for organic farmers .....	10
Involving researchers on farm level.....	11
Infographic: how to minimise the yield gap in organic farming .....	12

This document has been produced within the framework of the European Innovation Partnership 'Agricultural Productivity and Sustainability' (EIP-AGRI) which was launched by the European Commission to promote innovation in the agricultural and forestry sectors and bring research and practice closer together.

The EIP-AGRI Focus Group organic farming brought together 20 experts with different backgrounds and experiences (scientists, farmers, advisers...) in 2013-2014 to make recommendations on transferable innovative solutions. This document is based on the report they made on their findings which can be found online: [www.eip-agri.eu](http://www.eip-agri.eu)





## ► Improving organic yields Suggestions and examples from across Europe

*Organic agriculture works as a complex system, often farms produce many diverse crops and farmers have fewer 'emergency tools' (i.e. chemical pesticides or fast release fertilisers) to adjust production. Organic farmers therefore need a high level of knowledge. There are several factors, however, which may hold organic farmers back from reaching their full potential.*

*This document gives ideas for transferable innovative solutions, which can help organic farming systems achieve their optimal level of production and reduce the yield gap between organic and conventional farms in arable crops.*

*"There is a need for higher and more stable yields in organic farming to improve things economically for the organic farmer and make sure that resources are used as best as possible. Organic farmers in the EU can benefit from the sharing of innovation, knowledge and experience."*

*Inger Bertelson, Focus Group expert*





## ► Fluctuating yields in today's organic sector

*Organic farming represents 5.4% of European agricultural surfaces with over 186,000 farms across Europe, and this is constantly on the rise (Eurostat, 2013). European citizens are increasing their demand for organic products, and almost a quarter of the World's organic agricultural land is situated in the European Union (EU). This makes the EU a major player in the organic sector.*

*In European organic farming, after grassland and green fodder which occupy 60% of organic land, arable crops (cereals, pulses, open field vegetables etc.) represent the biggest surface area, followed by permanent crops.*

*"It is important to increase yields in organic farming in a sustainable way, which will benefit both farmers, consumers and the environment."  
Maria Wivstad, Focus Group expert*

### ► The issue of the yield gap






On average, organic yields are 20-25% lower than yields of conventional farms working in similar conditions. However, depending on regions, systems, management practices and particular crop types, studies have shown that organic yields vary a lot more from farm to farm compared to yields in conventional farming.

The complexity of organic farming requires farmers to have a very high level of knowledge and skills. Knowledge exchange between organic farmers and technicians across Europe remains limited,

perhaps due to the distance between the farms themselves.

This means that there is room for improvement. There is potential to help organic farms to get closer to the productivity of their conventional colleagues, and with better efficiency, lower environmental impact and higher product quality.

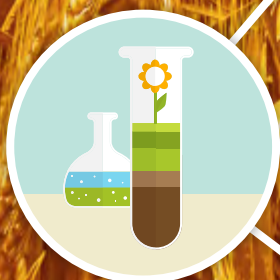
There are several **main factors** which have an impact on the yield gap. The relevance of these factors may change depending on the farming system, on the area, etc. They are:

-  **poor soil fertility management**
-  **inadequate nutrient supply**
-  **insufficient weed management**
-  **pest and disease pressure**
-  **variety choice**

### Optimising arable yields

The Focus Group experts didn't only look at yields from a quantitative point of view, they worked on optimising organic arable farm performance, where performance stands for production, quality and ecosystem services delivered. They also took account of the gap between the highest and lowest yielding organic producers and the gap between some conventional and organic crops.





## ► Practical solutions to close the yield gap

*So what can organic farmers do when faced with these problems? What solutions are already available (or need to be developed) to improve yields in organic arable farming?*

*The following ideas for activities and projects offer a few solutions to close the organic yield gap and could be the basis of Operational Groups. Some related suggestions for research topics (often requiring a multi-actor approach) are also included.*

## ► Information and decision support systems

**Factors tackled:**   

**Description:** Help can be found in the digital world. Existing software tools can, for example, analyse the risk of attack from pests and diseases and guide the decision-making process regarding the most efficient control interventions. For example watering to decrease the risk of red spider on soybean.

**Operational Group idea:** Find out why these tools are not often implemented in organic arable farming (a need for demonstrations? Lack of user-friendliness?) and promote their usefulness to farmers and advisors in Europe.

**Related research topic idea:** Development of more precise and easy-to-use forecasting tools for the management of pests and diseases and for more efficient fertilisation.



## Using these examples to help form Operational Groups

The EU Rural Development policy can provide funding for 'Operational Groups'. Operational Groups are projects involving several partners who come together to work on concrete, practical solutions to a common problem or innovative opportunity. The people involved should be from a similar area but diverse backgrounds (for example: farmers, a scientist, an agri-business and others). This support is managed through the regional or national Rural Development Programmes. Contact details are in the **EIP-AGRI fact sheet on Operational Groups** which can be found on the [EIP-AGRI website](#).

## ► Techniques to increase soil microbial activity and biodiversity

**Factors tackled:** 

**Description:** Increasing soil fertility and nutrient availability plays a major role in reducing the yield gap. Several research results have already demonstrated: the beneficial effects of the use of organic matter, how some species produce chemicals which can affect the growth of other organisms (allelopathic effect), implementing soil management tools which do not negatively affect soil life.

**Operational Group idea:** Test these techniques in specific farming systems and others further so that new, site-specific knowledge can be produced and shared with others.

## ► Machinery rings and new machinery



**Factors tackled:**

**Description:** Many organic farms produce a wider range of crops compared to conventional farms and so they need a number of different tools, and often these tools can be expensive and require very specific skills. "Machinery rings" are a cooperative way for farmers to share resources. They purchase machinery together, exchange it (if necessary, someone with the skills and experience to operate it can also be made available), thus saving time and money and guaranteeing quality. Also, several new machines have recently been developed (for example harrows and highly specific tools for row crop weeding, or seeders able to work into the cover crops without the need to plough), but very few people know how to use them, and the advantages (and limits) of the tools according to local conditions are not sufficiently known.

**Operational Group idea:** Although machinery rings may already be common in some countries, they are used rarely or even not at all in many other areas, so more could be established. Also, testing the new machines and training people to use them is a priority.

**Related research topic idea:** Development of machines tuned to the needs of organic farming, especially for soil management but also for weed control, this could include adapting conservation agriculture techniques.





## ► Nutrient release of organic fertilisers and developing new fertilisers

**Factors tackled:**  

**Description:** Farmyard manure, organic and green manure, crop residues, waste products, these are just a few of the organic fertilisers used in organic farming. But their availability varies as well as quality and cost.

**Operational Group idea:** Share knowledge and experience on the performance of existing organic fertilisers. Find ways to develop new fertilisers through cooperation between local authorities, local food industries, scientists, farmers and advisers to evaluate possible ways to make waste products suitable for organic farming. It is important to make sure the products used for the fertiliser do not contain any substances which are unsuitable for organic farming.

**Related research topic idea:** Identification of new sources of organic fertilisers and analysis of their potentials and optimal use.



## ► Fostering the use of companion planting and cover crops

**Factors tackled:**    

**Description:** Companion planting and cover crops can contribute greatly to soil fertility, nutrient availability, management of weeds, pests and diseases and help to build resilient systems also able to cope with climate change.

**Operational Group idea:** Despite the scientific and practical experience on the benefits of these techniques, they are not yet common practice among organic farmers. Operational Groups could identify the relevant information and experience which fits best with the local environment and test these on the farm.

## ► Development of innovative tillage techniques

**Factors tackled:** 

**Description:** Organic farmers must build more resilient farming systems which are able to adapt to climate change and at the same time maintain good production levels and protect soil fertility. This can be achieved by reduced tillage techniques. These techniques also add to keeping carbon in the soil and preventing weed growth, while limiting disturbance to the soil and maintaining soil fertility and structure.

**Operational Group idea:** Implement, test and promote reduced tillage techniques.

**Related research topic idea:** To develop farming systems that include reduced tillage techniques combined with the use of cover crops and with optimised rotation schemes.

## ► Looking for inspiration?

Farmers across Europe have experimented on their farms for centuries, testing out new, innovative ideas and methods. Inspiration can be drawn from these experiences. Sharing what has been found will help the organic sector to continue to flourish. Combining systems and setting up joint initiatives which involve farmers, advisors, researchers, local companies and authorities have proven to be an essential way to compensate for the lack of knowledge and experience sharing between organic farmers. When they are given the opportunity to look for solutions outside of the box, innovation often comes about as a result. Here are some more potential solutions illustrated by real stories ...



### Fine-tuning of composting techniques



### WASTE NOT, WANT NOT ► FINLAND

#### Carbon and nutrient management with industrial by-products

*"This technique gives value to waste products and contributes to putting the carbon back where it belongs!" - Juuso Joona, project initiator*

In Finland, a solution has been developed to use by-products from the pulp and paper industry as compost in organic farming to manage carbon and nutrients in the soil. Adding slowly decomposable wood fibres to it can help restore exhausted soils, add water and nutrient holding capacity and improve microbiological activity. Putting waste from industry to good use is also a great environmental benefit.

Representatives from the pulp and paper industry, the farmers and researchers developed the solution together. "It is important that industrial procedures do not contain chemicals that are dangerous later on in the chain" - says Aira Sevón, Focus Group expert Farmer, researcher and entrepreneur Juuso Joona, who initiated the project, says: "We saw a significant improvement in the soil quality. This technique gives value to waste products and contributes to putting the carbon back where it belongs!"

Using waste from with industry (paper, agro-food...) as compost can be a solution for carbon and nutrient management and for the environment in all regions in Europe.

*More information?  
[Tyynelän maanparannus website](#)*







## Selection of locally appropriate robust varieties, and variety trials



## EVOLVING WITH THE GRAIN ▶ FRANCE

### On-farm research to improve performance of local varieties

*“One of the strong results is the common organisation of research involving diversified actors with several kinds of knowledge”*

*Véronique Chable, Focus Group expert*

In Brittany (France) a group of farmers, millers, bakers, researchers, advisors and skilled consumers formed a group to compare different types of wheat varieties (local landraces and modern varieties) from grain to bread in various organic conditions. Local consumers were calling for traditional Breton products made with natural sourdough and so adapted wheat varieties were needed. Qualities for traditional baking, robustness and stability of yields for the crop had to be optimised. They ran on-farm experiments, integrating the know-how of all the people involved. They identified differences in terms of performance, quality and stability, helping farmers and bakers to choose the appropriate variety type for their activity.

The group formed a ‘seed association’ and through the network ‘Réseau Semences Paysannes,’ they were able to make results of variety trials available to others. The methodology has already been scaled-up in other French regions and other countries. It could be applied in any region and to any other crop: “One of the strong results is the common organisation of research involving people with different skills and knowledge backgrounds”, says Véronique Chable, Focus Group expert

*More information?*

[Réseau Semences Paysannes website](#)





## Knowledge-sharing



Organic farms are often isolated from one another and so knowledge and experience is not easily transferred. They also often grow a high number or different kinds of crops which can complicate access to agricultural advisors with the right knowledge. Farming practices are therefore usually farmer-specific and they can greatly vary from farm to farm. Furthermore, when information struggles to flow, unavoidably, several different farmers and researchers may be working simultaneously to solve a problem without realising. Time is precious and quality is essential, so pooling ideas and optimising the outcomes is a way to produce innovative and complete solutions, saving time and resources which can be applied by many different farmers. Here are a few examples of knowledge-sharing techniques:



### THE RIGHT COMBINATION ▶ THE NETHERLANDS

#### A collective approach to finding solutions to problems on the farm

*"Research, innovation and knowledge circulation should not be separated."  
Wijnand Sukkel, Focus Group expert*

In 1998 in the Netherlands, several regional groups were established to boost the technical development of organic production in arable and vegetable crops. The aim was to combine on-farm research, knowledge circulation, participatory learning and innovation. Each of the groups brought together farmers, researchers and advisors, and depending on the topics in question, they also included machine builders, ICT specialists, suppliers, wholesalers, policy makers etc. The activity required intensive farm data registration. The results of the data and the collective group work led to improvements in the technical performance of the farms involved.

8 groups worked specifically on bottleneck topics such as pest control and developed innovative techniques which are still used today such as the use of onion oil against carrot fly and the use of a giant vacuum cleaner ("beetle eater") to control various insects.



### STRENGTH IN NUMBERS ▶ SPAIN

#### Demonstration activities for organic farmers

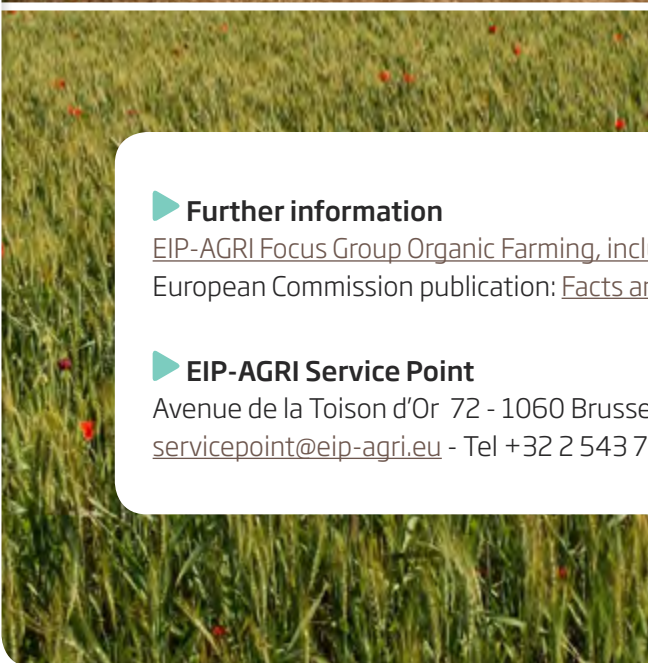
Twenty-five of the most experienced organic farmers in Central Catalonia (Spain) ran demonstration activities for others in the region, including conventional farmers. In groups, in collaboration with researchers from the University of Barcelona, they analysed organic production.

*"The initiative required the close collaboration of a significant number of farmers in the area"  
Joan Romanyà, Focus Group expert*

They took into account the most relevant organic farming practices in the specific geographical area and made comparisons with the conventional practices. Pilot fields on each farm were used to look at fertilisation, tillage, rotations and plant protection. The groups sometimes for example sampled the soil for analysis and measured crop and weed growth. With the information they collected, the farmers were able to identify links between certain farming practices and the performance of the pilot fields. "The farmers benefitted from these activities and many started to use the techniques on their own farms" Joan Romanyà, Focus Group expert

*More information?  
[Redbio website](#)*





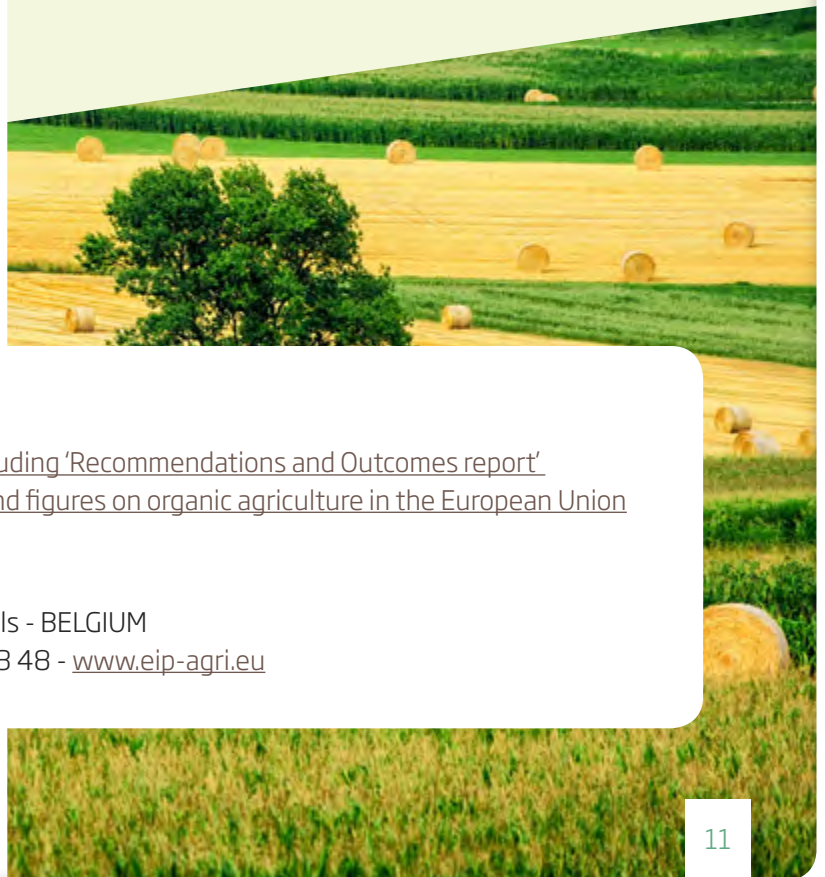
## A PROBLEM SHARED IS A PROBLEM ... SOLVED ▶ GERMANY

### Involving researchers at farm level

*“Usually 80-90% of the farmers apply the solution if they were involved in its development.”  
Karl Kempkins, Focus Group expert*

In the North Rhine-Westphalia (Germany) since 1993, research, advisory services and farmers have been working together in groups with the idea of testing solutions to similar problems on different types of farms (eg. potato blight). Researchers are involved on farm level, they discuss the issue with farmers, test possible solutions on different farms, collect and analyse data, and work together with the farmers to see how the solutions have been successful in the different contexts. “Usually 80-90% of the farmers apply the solution if they were involved in its development, a rate that is to be considered a great success”, says Karl Kempkins, Focus Group expert

*More information?  
[Organic eprints website](#)*



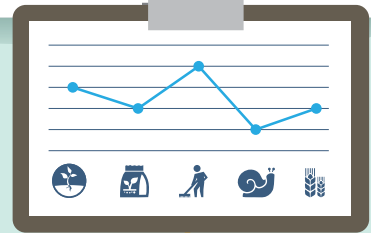
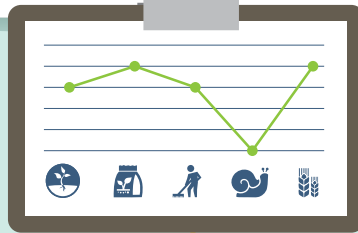
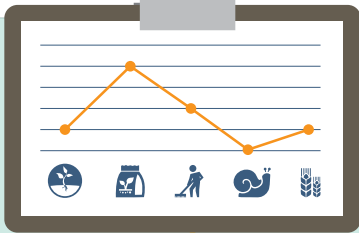
#### ▶ Further information

EIP-AGRI Focus Group Organic Farming, including ‘Recommendations and Outcomes report’  
European Commission publication: [Facts and figures on organic agriculture in the European Union](#)

#### ▶ EIP-AGRI Service Point

Avenue de la Toison d’Or 72 - 1060 Brussels - BELGIUM  
[servicepoint@eip-agri.eu](mailto:servicepoint@eip-agri.eu) - Tel +32 2 543 73 48 - [www.eip-agri.eu](http://www.eip-agri.eu)

# Why do yields vary so much between organic farms?



How can the yield gap be minimised?

