Focus Group
Organic Farming

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Discussion paper

EIP-AGRI Focus Group on Organic farming optimising arable yields

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1. Basic figures on organic agriculture

Agricultural land managed according to the organic agriculture methods world-wide covers about 37 million hectares. In Europe, this is almost 11 million hectares which represents 2.2% of the total European agricultural area, while the percentage of "organic land" in the EU is 5.4%. Within the EU, some Member States reach a high share of organic land, for example Austria 19.7%, while in absolute terms the largest surfaces can be found in Spain (1.6 million ha), Italy (1.1 million ha), and Germany (1 million ha).

The largest part of EU organic land is grown with permanent grassland, about 4.5 million ha in 2011, and 3.6 million ha are grown with arable crops (cereals, pulses, open field vegetables etc.) representing the main crop group in economic terms. Of course large variations occur between Member States, in terms of surface run organically and also in terms of crops as they largely depend on farming conditions (climate, soils, farm structure etc.) and on market demand and organisation. For example in France, Italy and Spain, permanent crops occupy a large share of the organic surface: wine, olive oil and fruit (apple, citrus, nuts etc.) have a high demand on the organic market. Growing conditions of vineyards, olive grows and orchards in specific regions of these countries as well as the farmers' skills make organic management possible with good qualitative and quantitative results.

2. Scope of the discussion of the Focus Group

How to reduce the "yield gap" between organic and conventional and how to enhance the performance of less productive organic farms to the level of the "best organic practices" are the topics of the FG discussion.

Two recently published meta-analyses can contribute to the debate starting from the more widely discussed issue of "yield gaps". The first meta-analysis (de Ponti et al.4) shows how organic is on average producing 80% of conventional yield but it also shows the wide variations (standard deviation 21%) between regions, systems and also between real farm data compared to experimental trials data. The second meta-analysis (Seufert et al. 20125) shows an average 75% of organic productivity compared to conventional, but stresses the fact that good management practices, particular crop types and growing conditions can bring organic systems nearly to the same yield as conventional.

In both the meta-analyses it is clearly stated how the productivity gap is wide during very productive conditions and years, when the crop is brought to its maximum potential, but how it is narrow or even reversed (organic more productive than conventional) during less favorable conditions and years and regarding system, scale and labor intensity.

To overcome the gap, there are several elements of the farming system that have to be considered which differ depending on the region and the system. All the elements have to be matched within the crop rotation and the economic sustainability of the farm. The concept of eco-functional intensification may give guidance to achieving a 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 livestock7. It is not just about more tons per hectare, better economic results are to be achieved sustainably which requires a thorough consideration of the quality of the

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product, production costs and environmental services provided by the farming system at farm scale and along the whole value chain.

3. What are the factors causing the yield gap?

Several factors may hold certain organic farmers back from reaching their full potential. The relevance of these factors may change depending on the farming system, on the area, on the farmer's skills etc.

Organic agriculture works as complex system managed by the farmer, who has fewer "emergency" tools to adjust production. The organic farmer needs a higher knowledge level to be able to foresee the evolution of the farm and of specific crops, and consequently plan the farm management as a whole.

The need for knowledge exchange among practitioners cannot be easily satisfied due to the still limited number of organic farms and their being spread out widely on a national and European scale, and with extremely limited knowledge networks acting as link.

Practical experience and scientific evidence allows us to identify the major factors causing a reduced yield and they are:

3.1 Inadequate nutrients supply

It more frequently concerns nitrogen deficiencies but it also relates to other nutrients (P, K and meso-nutrients). The reason is that fertilisation in organic farming is based on long-term management that includes crop rotation, crop residue incorporation, use of compost etc. The effects of such management become evident after some years, when the soil reaches a balance, but it needs an initial "investment" that not all farmers can do or know how to do. Organic fertilisers are used only in emergency cases but they have a low concentration of nutrients. Low release of nutrients and their efficiency depends very much on the crop management and climatic conditions, they cannot be used to correct deficiencies when they are visible (slow effect) but must be used in a "preventive way". Moreover they are expensive (much more than conventional fertilisers) so it is often economically unsustainable to spend a lot on fertilisers in order to obtain a limited increase of production. Last but not least, organic farmers strive to not pollute the environment, while the more fertilisers are used, the higher the risk of leaching - something not acceptable in the organic concept.

Practical solutions implemented by farmers:

More skilled or longer experienced farmers usually introduce **more legumes** in the crop rotation (either as cash crop or green manure) and **catch-crops** to prevent leaching and nutrient loss. Where possible, **innovative mixed-farming systems** that allow recycling animal waste are established. As stockless arable farming are becoming the majority also in the organic sector, the mixed farming concept can be more easily implemented at landscape/valley/regional level, but how to do it, remains to be defined.

Farmers looking for shortcuts ask for **cheaper organic fertilisers** to be able to rely more on annual external inputs (faster) instead of implementing a longer fertilisation policy. Nevertheless, so far input producers have not been able to supply farmers with cheaper fertilisers which fulfill the demands of organic principles and regulations. This strategy can be used for high value crops, such as vegetables or herbs but it is not easily feasible for arable crops of lower value.

Concerning the help of **know-how**, it is commonly reported that there is a the very limited number of farmers who make soil analyses or are simply able to "look" and decide consequently. An investment in developing awareness and skills can be highly beneficial.

What can be done to improve it?

- Disseminate existing examples of mixed-farming systems and develop new ones?
- Further elaborate efficient decision making tools to guide fertilisation in practice?

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- Further develop ITC tools for the advisory services and for the farmers?
- Develop efficient training programmes for farmers?
- Launch breeding programmes for more efficient leguminous crops?

Why is it not happening?

The situation strongly differs between regions, also considering that extension services in many Member States have been closed down or reduced in the last 10 years. Often organic farms are small to medium size and as a consequence, they cannot invest much money in tools or equipment, or time in training. Besides they are often spread-out geographically which makes exchange among practitioners difficult.

- Which innovative tools for dissemination of existing knowledge and experiences could be elaborated? They need to be cheap, adaptable to different farming conditions and farmer types and able to rapidly deliver their "benefits" in order to convince practitioners.
- A lot of farmers are aware of the importance of soil analysis, but prices for these analyses are rather high. Cheaper analyses and simple techniques that farmers can do themselves could be useful.
- The availability of organic manure is limited to specific areas. Where it is available, there are constraints in its proper and efficient use, while where it is not available there is a need to find other cheap and efficient nutrients sources.

3.2 Poor soil fertility management

It is very much linked to the previous point but it influences not only the availability of nutrients but also the overall capacity of the soil to host the plants and, as a consequence, the resilience to stress (too much or too little water, low or high temperature, etc). The solution stays in the accurate planning (of the rotation, of the organic matter use, of the crop residues use, of the soil labors, of irrigation, etc.) and requires time (this is why new organic farmers usually have poorer soils). Several experimental long term rotations in organic farming confirm the need of 5-8 years for the establishment for a proper soil fertility that grants nutrition and resilience to crops. Many organic farmers are still in the building phase or have difficulties in coping with maintaining the balance they have reached due to lack of organic matter, market pressure that clashes with rotation, lack of good equipment and skills. The quality of the soil is a key point in the organic management. Poor soil conditions and inadequate investment in its improvement seriously affect the farm performance over the years.

Organic farmers who rely exclusively on external inputs (organic fertilisers= practising a substitution agriculture) end up with too high input costs and decreasing soil fertility.

Practical solutions implemented by farmers:

The key point is the correct management of organic matter, by gathering locally available organic materials (cheap), fine-tuning soil labor, taking measures against soil compaction (ex. reduce pressure in tires), tillage practices and the correct structuring of crop rotation.

Machinery available for soil labor can have an impact as well because it influences timeliness and accurateness of soil labor.

What can be done to improve it?

- Improve knowledge of alternative organic matter sources locally available and develop processing methods for their safe and efficient use as fertilisers?
- Strengthen farmer knowledge on overall farm management and specifically on soil management and crops planning?
- Invest in more adapted machinery?

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Why is it not happening?

This is the key point of successful organic farm management and it is largely based on knowledge and on the capacity to identify the optimal production level for the specific farm. Due to the very limited availability (depending on regions) of knowledge and training centers and advisory services specialised on organic farming, it heavily affects the production and environmental performance.

3.3 Insufficient weed management

It is a major obstacle especially for spring sown crops and crops with a slow early development (i.e. corn). It induces more problems in newly converted farms as appropriate crop rotation slowly but efficiently reduces the seed bank. Nevertheless the need for specialisation in few crops (market pressure) often negatively affects the rotation and as a consequence the agronomic weed management.

If the majority of annual weeds are managed mainly with **agronomic tools**, certain perennial weeds (i.e. thistle or Jonhson grass) are more problematic and need direct measures, not easy without herbicides.

Practical solutions implemented by farmers:

Mechanical weed management developed innovative tools that are now available and in use by farmers. For large specialised farms, the choice of using mechanical tools is satisfactory and economically sustainable but for small-medium farms they are not specialised and too expensive and the investment often does not increase profit.

Physical (mulching films) and **flame weeding** fit to some specific crops (carrots, onions, etc.) but it cannot be used (for practical and economic reasons) on main arable crops. Recent developments try to fit biodegradable mulching films to corn cultivation, but the cost is still the limiting factor.

"Organic herbicides" were debated for years and several attempts were made with vinegar and microbiologic herbicides. Nowadays their use is marginal and input producers stopped investing in them.

In summary, overall management (crop rotation, including cover crops, as first) is the main tool, but the attention to machinery is very high as well as the demand for more precise (close to the crop) weeding tools. Several farmers adapt machines to their systems but there is much space for technological development, as long as it leads to cheap machines which are not too crop-specific as organic farmers tend to grow more crops in their crop rotation and cannot invest in different machinery for each crop.

What can be done to improve it?

- Invest in the development and improvement of machinery and ICT tools?
- Invest in breeding for more competitive crops (i.e. early emergence)?
- Again knowledge? Improve knowledge concerning weeding at the right stage (weeds growth, weather conditions...).
- Identify tools from other types of farming which are suitable for organic farming (and adapt them if necessary)

Why is it not happening?

Low interest to invest from machinery companies (too small market) and no breeding programmes on this aspect from seed companies.

3.4. Pest and disease pressure not sufficiently managed

Common bunt, phytophthora, corn borer and other pests and diseases are affecting organic crops usually with less strength due to the diversification of the farm and of the crops. Nevertheless, in areas and years with difficult conditions they cause huge losses. This is due to the use of non-treated

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seeds and the plant protection products allowed in organic have a preventive effect but their effect is limited when the pest or the disease is already attacking the plant.

Practical solutions implemented by farmers:

The first measure is **prevention**, starting from the choice of the appropriate crop/location combination and including rotation, fertilisation and irrigation policy, etc. Besides the choice of **varieties** (or combination of varieties) that fit to the place of cultivation and resist to major pest and diseases have high relevance.

Soil borne diseases are usually not so important thanks to the overall organic management, in case of need they are managed also with the use of **cover-crops** with sanitary effects.

Farmers are asking for more appropriate genetic materials (see next point), more than for new **plant protection products** or new tools.

What can be done to improve it?

- New plant protection products? Review of authorised inputs and harmonisation of their availability in the Member States?
- Breeding for resistance? Defining genes of resistance towards diseases?
- Further develop intercropping systems, to keep diseases under control?
- Improve knowledge of practitioners and optimise overall management (knowledge intensive)? Including the use of plant protection products?
- Increase the knowledge of functional agro-biodiversity and natural control of pests and diseases?

Why is it not happening?

No commercial interest from seed and input companies, that means that investments in research and development of new products and varieties is extremely limited. Constraints on knowledge available, as in previous points.

3.5. Variety choice

As organic farmers mainly use varieties selected for conventional systems, there is insufficient availability of adapted genetic materials. This means materials **resistant to major pest and diseases but also adapted** to local climate and soil, to the organic cropping system, as well as qualitatively fit to organic demands and processing needs.

Locally and "organically" adapted seeds would contribute to solve the majority of problems illustrated in the previous points.

Practical solutions implemented by farmers:

Some seed companies have started to take an interest in organic breeding in the last few years but their supply is still insufficient. So several farmers have started to **select their own seeds 'on-farm'** or in cooperation with colleagues and local research stations. They are also **increasing inter-crop biodiversity** by seeding/planting combinations of varieties or populations. **Legal issues** however are major constraints in their search for solutions.

What can be done to improve it?

- Set up local breeding systems? Support smart breeding techniques?
- Involve seed companies in the research for adapted materials?
- Simplify legal framework to allow farmers to produce and exchange their seeds?

Why is it not happening?

Legal constraints make it difficult for farmers to regain a role in breeding. At the same time, the organic sector's limited size and its demand for diversity of varieties make investments very difficult

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for seed companies. Public breeding has fewer and fewer resources to work with and so far, it has been rarely involved in organic breeding.

Conventional breeding, done by seed companies, often neglects the resistance to pests and the sensorial quality of the product, while concentrates on productivity in conventional conditions. For organic farming overall resilience and product quality are of higher importance.

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