

# FIELD MANAGEMENT DURING THE CONVERSION FROM CONVENTIONAL TO ORGANIC FARMING SYSTEMS

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## ABSTRACT

Organic farming wants to follow the laws of nature. Does it mean that organic farms must be as close to natural systems as possible? Within the organic movement one will find farmers who focus on natural farming, and others who take a purely commercial approach. The majority of organic farmers probably is somewhere in between these two extremes. Most farmers will expect to get sufficient production from the farm to make a living. For them the challenge is to follow the principles of nature as defined in the different standards to achieve a high productivity.

The conversion from a conventionally managed farm to organic farming should not only improve the farm ecosystem, but also assure the economic survival of the farm. Therefore, the adjustments which are required on the farms for a conversion and the related risk assessment have to be analysed carefully.

Step by step conversion is possible as long as the different production units are clearly distinct and organic products cannot get mingled with conventional ones. Products can be certified after the farm has finished a conversion period, during which all the relevant standard requirements must have been met from the beginning. For certification of annual crops, the standards ought to be met at least for 24 months prior to the start of the production cycle, i.e. before planting or sowing the crop. For perennial plants at least 36 months of fully organic management are required before the first harvest.

### **The changes in the conversion period concern technical aspects:**

Production techniques: New farming methods need to be introduced and applied. These concern soil management, nutrient management, weed management, pest and disease control, animal husbandry, fodder cultivation

etc. In order to be successful, the necessary know-how has to be acquired. The farmer will need to exchange information with experienced organic farmers, attend trainings, test methods and observe their effect, read publications etc.

In order to improve the conversion process and to overcome the possible obstacles, the present situation of the farm should be analysed carefully.

## **INTRODUCTION**

Organic Agriculture is often defined by organic standards which explain what the principles are and which methods and inputs are not permitted. While standards are well suited to define a minimum common ground for the various kinds of organic agriculture, they do not provide many guidelines on how an ideal organic farming system should look like.

Conversion to organic farming needs a new way of thinking. The whole farm family should get ready for the conversion in many aspects, too. The first and probably the most important conversion has to take place in the mind of the farmer .

### **The conversion process**

#### **Regulations concerning the conversion process**

Regulations concerning the conversion period vary. Below, the conditions for the IFOAM Basic Standards and EU Regulation (1) for producers are listed. IFOAM Basic Standards (2) are not laws for implementation, but rather guidelines for the establishment of such laws, while the EU Regulation is an international law. National Regulations may, however, be still different, therefore it is necessary to consult them in advance.

According to IFOAM Basic Standards the totality of crop production and animal husbandry shall be converted to organic management. Step by step conversion is possible as long as the different production units are clearly distinct and organic products cannot get mingled with conventional ones. Products can be certified after the farm has finished a conversion

period, during which all the relevant standard requirements must have been met from the beginning. For certification of annual crops, the standards ought to be met at least for twelve months prior to the start of the production cycle, i.e. before planting or sowing the crop. For perennial plants at least eighteen months of fully organic management are required before the first harvest.

The start of the conversion period is usually calculated from the date of application to the certification body, when farmers commit themselves in following the standards. However, a full conversion period is not required where de facto full standards requirements have been met for several years and where this can be verified through numerous means and sources. Still inspection needs to be carried out prior to the first harvest. During the conversion period, products can be labeled as "produce of organic agriculture in the process of conversion" or the like, provided standard requirements have been met for at least 12 months.

Requirements for the conversion process vary considerably from standard to standard. The EU regulation, for example, demands a conversion period of 2 years for annual plants and three years for perennials. In some private standards, partial farm conversion or step by step conversion are not allowed.

The most important regulations of the IFOAM Basic standards concerning the conversion process

### **Social, technical and economical adaptations**

The changes in the conversion period concern social, technical and economical aspects. Each sector poses its own challenges to the farming family.

Socially: Organic farming is more than an innovative technology but involves a holistic way of thinking. Therefore, farmers should compare their personal values with the principles of organic farming. The more they match, the easier it will be to follow organic farming, as the motivation needs to come from inside rather than from mere economic considerations. For many farmers, it is also important how relatives, neighbours and friends

perceive organic farming, because not everybody has the strength to oppose his/her social environment.

**Production techniques:** New farming methods need to be introduced and applied. These concern soil management, nutrient management, weed management, pest and disease control, animal husbandry, fodder cultivation etc. In order to be successful, the necessary know-how has to be acquired. The farmer will need to exchange information with experienced organic farmers, attend trainings, test methods and observe their effect, read publications etc.

**Economically:** For some adaptations on the farm level, new materials are needed and therefore it requires some investments. Some adaptations involve also an increase on the work load or labour requirement. As the quantity of the production may decrease at least in the first years of conversion, farmers need to find ways to overcome the constraints. New marketing channels may be explored in order to receive a premium price for the products, which again needs a very different kind of know-how.

## **Favourable conditions**

### **Favourable conditions for a conversion include:**

- Motivation for a sustainable farm management
- Readiness to try new things
- Interest in continuous learning
- Harmony among the generations about the orientation on the farm
- Solid knowledge on organic farming methods
- Ability to secure livelihood if the income drops in the conversion period
- Farm system is appropriate to the location site of the farm

### **Ready for conversion ?**

Before taking a decision on whether to convert the farm to organic management, farmers should get a clear understanding on what would organic management mean to their farm. Training courses, suitable print materials and professional advice are possible sources of knowledge. It is important that all persons involved in the farm, usually the farmer's family,

are involved in the decision making process. In the next step, the situation of the farm should be analysed carefully, considering the requirements of organic farming. Thus, the necessary adaptations can be identified. Support from field advisors or experienced organic farmers can be of great help in this analysis. To get familiar with the methods of organic farming and to see whether they would work in the prevailing conditions, some methods can be tested in small scale. Based on the results of the discussions, analysis and experience, the farmer and his/her family are in a better position to take a decision on whether to go organic or not.

### **Defining the aims of the farm**

Do all family members have the same idea about conversion to organic farming? What are their individual expectations, what are their aims? The farming family needs to sit together and define what they wish to achieve through a conversion to organic farming. This is a crucial process, as it has consequences on all the following steps in the conversion process. Besides the income, other factors like the availability of food for own consumption (cereals, tubers, fruits, vegetables, milk, eggs, meat etc.), the amount of fire wood produced in the farm, the work load for the each family member (gender aspects!) etc. need to be taken into consideration. At the same time, it should be analyzed whether all the aims are realistic.

An important question when defining the aims of a farm is whether the products shall be sold at a premium price or not. If the farmer wants to use an organic claim or label when selling the products, certification becomes an important issue (see chapter 2.3).

### **Possible conversion aims of the family members**

#### **Farm analysis**

In order to improve the conversion process and to overcome the possible obstacles, the present situation of the farm should be analysed carefully. Some aspects of the present farm may be favourable for a conversion while others can be obstacles for which solutions must be identified.

### **The following aspects should be analysed:**

- \* The farming family, their capacity to try new things, the know-how and motivation.
- \* Size and quality of the land holding, the climatic and environmental conditions
- \* Soil type, fertility and structure, water availability, and present management
- \* Present cropping system, crops suitable to the conditions, dependency on single crops
- \* Nutrient supply with own manures from the farm and fertilizers brought from outside
- \* Present pest, disease and weed management, and the pressure of infestations
- \* Number and kind of farm animals, significance of farm yard manure, fodder cultivation
- \* Mechanization (tools, machines), constructions (sheds, pits, terraces etc.)
- \* Marketing of products, subsistence
- \* Availability of labour, overall work load, peak seasons
- \* Economical situation of the farm, its sources of income, debts, access to loans

### **Testing organic farming methods**

The closer the present farming system is to organic farming principles, the easier the conversion will be. Before taking a decision on converting to organic farming full scale, farmers may make some trials with organic methods in their farm. If new methods are applied, it is always advisable to try them first on a small scale, as this allows the farmers to check their suitability to local conditions and it avoids big losses in case of failure.

In plant production the following methods could be tested on single plots:

- integrating a new crop in rotation or as a mixed crop
- the effect of commercial organic manures
- use of a leguminous cover crop in perennial cultivations
- use of natural pesticides to control pests and diseases

In animal husbandry, experience could be gained by:

- increasing the outdoor and pasture access of the animals
- growing a fodder crop to replace feed concentrates
- trying herbal remedies for veterinary treatment

## **Conversion Planning**

### **The conversion plan**

A good plan is half the success! Once a decision is taken to go for organic farming, the implementation of the necessary adaptations identified in the farm analysis needs to be planned. The conversion plan should prevent the transition period from being too tough: it should prevent major problems, minimize the risks, avoid bad investments and, last but not least, encourage the concerned persons for their endeavour. Generally, one should be aware that the higher the investments and the more adaptations needed on a farm, the higher is the risk and therefore the more important is a good plan.

The first step of a conversion plan is to analyse carefully the necessary adaptations in the farm based on the current situation, the farm aims and the requirements of an organic system. As an 'ideal' system cannot be established at once, single steps to achieve the necessary adaptations are defined, if possible with a schedule. Remember that for obtaining organic certification, the conversion period officially starts only after all minimum requirements of the standards are met.

## **I. Soil Fertility**

### **What has an influence on Soil Fertility?**

Farmers know that the fertility of the soil depends on many factors. For the plants to grow they need to get from the soil suitable conditions for root growth, appropriate supply of water and nutrients available for uptake by roots. If certain soil conditions are not suitable, plant growth can be inhibited. For example water logging, acidity, compaction or shortage of nutrients can tremendously decrease the yields of some crops.

### **Factors influencing soil fertility**

- soil depth: the exploitable volume for plant roots
- availability of water: moisture retention for continuous water supply

- drainage: most crops can't bear water logging
- aeration: necessary for a healthy root growth and a high activity of soil life
- pH (range of acidity): the soil should neither be too acidic nor too alkaline
- mineral composition: has an influence on the amount of nutrients released by weathering, the nutrient holding capacity and the soil structure
- content of organic matter: has an influence on the nutrients released by decomposition, the nutrient holding capacity, water retention, soil structure and soil life
- activity of soil organisms: they are crucial for nutrient availability, water retention, a good soil structure, decomposition of organic material and soil health
- contamination: high concentration of salt, pesticides or heavy metals can inhibit plant growth

### **How to improve and maintain soil fertility**

Farmers can improve the fertility of their soil by various management practices. It is important to achieve:

- protection of the soil from strong sunlight and heavy rain by means of plant cover: e.g. mulching with plant residues, green manure crops or cover crops, in order to prevent soil erosion and to preserve moisture
- a balanced crop rotation or mixed cropping: a suitable sequence of annual crops grown on a field for preventing a depletion of the soil
- an appropriate tillage method: suitable for getting a good soil structure without causing erosion and compaction
- a good nutrient management: application of manures and fertilizers according to the demands of the crops in their respective growth stages
- balanced feeding and protection of soil organisms: enhancing the activity of beneficial soil microbes and organisms like earth worms by supplying organic material <sup>(3)</sup>.

### **How to improve the soil structure?**

A good soil structure is important for easy penetration of plant roots, good aeration, sufficient infiltration, active soil life and many other functions. Some soils are generally of a poor structure because of their mineral composition (e.g. high clay content). What is most important for improving the soil structure is to increase the content of organic matter. It sticks soil particles together and helps to support the work of soil organisms by providing food and shelter.



### **Activities that improve soil structure:**

- Apply organic matter as manure, compost, mulch etc.
- Encourage the activity of soil organisms
- protect the soil surface with mulch or plant cover

### **Activities that harm the soil structure:**

- Cultivating the soil in wet conditions can cause soil compaction
- Frequent soil cultivation reduces the content of soil organic matter
- Intensive mechanical cultivation like rotary tilling destroys the soil crumbs (3).

### **How to increase the amount of organic matter in the soil?**

Organic matter permanently undergoes a process of decomposition. In order to maintain or increase the content of soil organic matter, organic material must be applied again and again. The speed of decomposition depends on the climate (in warm and damp conditions, the organic matter is broken down much faster than in cold or dry conditions) and on how green the material is (C/N-ratio).

#### Activities that increase the Level of soil organic matter:

- leaving crop residues on the field, instead of burning or wasting them, as they are the major source of biomass
- applying compost: this is very effective, as part of the organic matter in compost is already stabilised and will remain in the soil for a longer time than fresh plant material
- applying organic manures: as they contain organic material, they help to increase the content of organic matter; at the same time, they can speed up decomposition as they are rich in nitrogen and thus stimulate soil organisms
- mulching with plant materials or agro-wastes: especially applying hardy material (rich in fibres or wood) will increase the organic matter content, as it will remain in the soil for a long time; in addition, it helps to reduce erosion
- using green manures or cover crops: green manures grown on the same field will contribute biomass both from the leaves and roots; material grown on another site contributes only the leaves; the younger the plant material is, the faster will it decompose, thus releasing the nutrients faster but adding less to the built up of soil organic matter

- Suitable crop rotation: including crops in the rotation which build up soil organic matter (e.g. pastures); especially perennials and crops with a dense root system (e.g. pastures) are very beneficial
- reducing soil tillage: each tillage will speed up the decomposition of organic material, as it aerates the soil and stimulates soil organisms
- avoiding soil erosion: all methods listed before will be in vain unless soils are prevented from erosion; it carries away those parts of the soil which contain most humus and are most fertile

## **Composting**

### **The Phases of the Composting Process**

Within the process of composting 3 main phases can be distinguished: the heating phase, the cooling phase and the maturing phase. However, these phases can not be clearly separated from one another.

#### **The heating phase:**

- Within 3 days of setting up the compost heap, the temperature in the heap rises to 60 to 70 °C and usually stays at this level for 2-3 weeks. Most of the decomposition occurs during the heating phase.
- In this phase, it is mainly bacteria which are Active. The high temperature is a result of energy released during conversion of easily decomposable material by the bacteria. The warm temperature is a typical and important part of the composting process. The heat destroys diseases pests, weed roots and seeds.
- During this first phase of the composting process the bacteria have a very high oxygen demand due to the rapid development of their population. High temperatures in the heap signal that there is an adequate supply of oxygen for the bacteria. If there is not enough air in the heap, bacterial development will be hindered and the compost will develop an unpleasant odor.
- Humidity is also essential to the composting process as bacteria require humid conditions for their work. The need for water is greatest during the heating phase because of high biological activity and strong evaporation occurring during this phase.
- As the heat increases, the pH of the compost heap rises (i.e. acidity decreases).

**The cooling phase:**

- Once the material which is easily digested by the bacteria has been converted, the temperature in the compost heap declines slowly and will remain at 25-45 °C.
- With the decline in temperature, fungi settle and start the decomposition of straw, fibers and wooden material. As this decomposition process is slower, the temperature of the heap does not rise.
- As the temperature drops, the pH of the composting material declines (i.e. acidity increases).

**The maturing phase:**

- During the maturing phase nutrients are mineralized and humic acids and antibiotics are built up. .
- Red compost worms and other soil organisms start to inhabit the heap during this phase.
- At the end of this phase the compost has lost about half of its original volume, has the color of dark, fertile soil and is ready to use.
- The longer it is stored from now on, the more it loses its quality as a fertilizer, while its capacity to improve soil structure increases.
- In the maturing phase, the compost needs much less water than in the heating phase.

**Advantages of Compost**

During the composting process, some organic material is transformed into humic substances, which are relatively resistant to microbial decomposition. Composting thus helps to maintain or increase soil organic matter content. The other components of compost provide nutrients and micro-nutrients in the right proportion (as compost is built from plant materials) for plants to utilize. Compost has both a long and short.

**How to Make Good Compost****Different systems and methods**

Compost systems can be divided into 'continuously' and 'batch fed' systems:

- Continuously fed systems: These systems do not heat up during the composting process. They are handy if there is a continuous supply of

wastes (e.g. kitchen waste). However, they lack the advantages of the heating phase.

- **Batch fed systems** (all material is composted at once): These systems lead to a hot composting process. They offer the advantages of reduced nutrient loss death of weed seeds and diseases as a result of the high temperature of composting, the process is fast (within a few weeks) and it results in a compost of superior quality.

If little water is available, composting in pits may be more appropriate since humidity is conserved better in pits than in heaps.

### **What to consider when planning a compost heap?**

- **Location:** The compost is ideally located near the source of the composting material and the fields to which the compost will be applied. The site should be shady and near a water source. Water logged sites should be avoided. The compost heap should not be placed too close to houses as the heap may attract rats, snakes and termites etc., and sometimes a bad odor can not be avoided ..
- **Composting materials:** A compost heap should be set up when a lot of plant material is available. If the farm does not supply enough plant material, it may be collected from outside sources. .
- **Timing:** It is easier to produce good compost during the wet season as the rain saves on labor for watering.
- **Size:** The compost heap should reach a size of at least 1 m<sup>3</sup> to allow for the correct composting process and so as to allow sufficient aeration should not be more than 2.5 m wide and 1.5 m high. - **Method:** The chosen method should be appropriate to the climatic conditions.

### **Selecting the primary materials**

The composition of the composting material is of major importance. The C/N-ratio and the structure of the material have a major influence on the composting process. Material which is rich in nitrogen (low C/N-ratio) does not usually contribute to a good structure and thus does not allow for good aeration if composted separately. Material which has a good structure usually has a low nitrogen content (high C/N-ratio) and does not offer enough nitrogen for the bacteria to feed on. Mixing different materials thus

helps to achieve a balanced nutrient composition and a structure which allows for good aeration.

### **Which material, size and mixture?**

#### **Material suitable for composting :**

- Plant material: has a balanced mixture of N-rich and C-rich material
- Animal dung: cow, pig (rich in K and P), poultry (very rich in P), goat, horse etc.
- Wood ash: contains K, Na, Ca, Mg etc.
- Rock phosphate: the phosphorus binds to the organic material and is thus less fixed to soil minerals. It is therefore better applied to the compost heap than directly to the soil.
- Small quantities of soil, especially soil rich in clay, or ground rock improve the composting process and the quality of the compost. They are mixed with the other material or used to cover the heap to reduce nutrient losses.

#### **Materials not suitable for composting:**

- Infected plant material by diseases like rust or virus.
- Persistent perennial weeds unless first dried in the sun.
- Material with hard prickles, thorns, metal or plastic.

The finer the material, the greater its surface and it can be digested by bacteria. An ideal length is 2 to 5 cm. If some of the material is smaller (e.g. short grass, kitchen waste, ash), it must be mixed with more bulky material to ensure a good aeration of the heap.

To allow an ideal composting process, the mixture should consist of approximately:

- one third bulky material with a rich structure (chopped branches and tree bark, bulky material separated from previous composts)
- one third medium to fine material with a high C/N-ratio (straw, leaves, crop residues etc.)

- one third fine material with a low C/N-ratio (household wastes, animal manure etc.)

5 to 10 % soil.

### **Setting up a compost heap**

- Prepare the composting material properly: Chop coarse woody material to increase its surface area and encourage decomposition by fungi and bacteria.
- If dry, soak the composting material before mixing it.
- At the bottom of the heap, put twigs and branches to allow for good drainage of excess water.
- Pile up coarse carbon rich and nitrogen rich material in alternating layers.
- Manure or old compost applied to each layer enhances the composting process.
- Thin earth layers between the compost help to prevent nitrogen loss.
- A 10 cm thick cover of straw or leaves in the initial stage, and an impermeable cover (sacks, plastic sheet etc.) in the final stage prevent potassium and nitrogen being washed out of the heap. In dry climates, cover the heap with a 15 cm thick layer of mud.
- If the heap is not moist enough, from time to time pour water or liquid manure over the compost.

### **Turning the compost**

Two to three weeks after building up the compost heap, it will have decreased to about half its original size. This is the right time to turn it. Turning the compost helps to accelerate the process, but it is not essential.

### **Turning has a number of advantages:**

- It improves aeration and encourages the process of composting.
- It ensures that material from the outside of the heap can decompose properly by being put into the centre.
- It allows the quality of the composting process to be checked and for any non ideal conditions to be improved.

### **Vermi-Composting**

Earthworms are highly efficient in transforming dead biomass such as leaves into excellent humus. They usually become very active in a compost heap after the heating phase. Vermi-Composting is mainly based on the activity of worms and does not go through a heating phase at all. As worms transform biomass into excrement within a short period of time, the process can be faster than ordinary composting. The excrement of worms is stable crumbles of soil closely bound to organic matter. They have high nutrient

levels and good water retention. In addition, the excrement has a growth promoting effect on plants. Some experienced farmers use "vermi-wash", the liquid collected from the compost heap after sprinkling, as a leaf fertilizer and plant tonic. This can even help plants to get rid of pests (e.g. aphids) and diseases.

Worms are very sensitive to fluctuations in moisture and temperature. They need a continuous supply of "food", i.e. compost material. They are also attacked by ants and termites. Therefore, a solid base is needed which protects the worms from predators. To remove the compost, let the top of the heap dry out so that the worms move to the deeper layers.

Though vermi-compost is definitely a very good manure, it requires more investments (tank and worms), labor and permanent care when compared with ordinary composting methods.

### **Application of compost**

There is no one definite stage of maturity. Compost ripens in an endless process. Compost can be used as soon as the original composting material is not recognizable anymore. The compost has then turned into a dark brown or blackish color and has a pleasant smell.

Compost is scarce and valuable manure for most organic farmers. Usually it is not possible to produce sufficient amounts for fertilizing all fields. Therefore, farmers should think carefully about where compost application would be most beneficial. High efficiency is achieved in nurseries and when planting seedlings or saplings (3).

## **REFERENCES**

1. EU-Regulation 834/2007.
2. IFOAM-Basic standards (2007).
3. IFOAM-Training Manual (2002).