



Organic Farming: A Healthy Farming System

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Abstract Organic farming works in harmony with nature rather than against it. This involves using techniques to achieve good crop yields without harming the natural environment or the people who live and work in it. A range of organic methods can be used at the same time to allow them to work together for the maximum benefit. For example the use of green manures and careful cultivation, together provide better control of weeds than if the techniques were used on their own. Organic farming provides long-term benefits to people and the environment.

Keywords Organic Farming, Agro ecology, Soil fertility, soil structure

Introduction

Organic farming is a form of agriculture that relies on technique such as crop rotation, green manure, compost and biological pest control. Depending on whose definition is used fertilizer and pesticides (which includes herbicides insecticides and fungicides) if they are considered natural (such as bone meal from animal or pyrethrin from flower), but it excludes or strictly limit the use of various method (including synthetic petrochemical fertilizer and pesticides, plant growth regulator such as hormones, anti-biotic use in livestock; genetically modified organism [1]; human sewage sludge; and nanomaterial [2] for reason including sustainability, openness, independence, health and safety. Organic agriculture methods are internationally regulated and legally enforced by nation, based on large part on the standard set by many nation, based on large part on the standard set by the International Federation of Organic Agriculture Movements (IFOAM), an international umbrella organization for organic farming established in 1972 [3]. The USDA National Organic Standard Boards (NOSB) definition as of April 1995 is “Organic agriculture is ecological production management systems that promotes and enhance biodiversity, biological cycle and soil biological activity. It is based on minimal use off-farm impute and on management practices that restore, maintenance and enhance ecological harmony” [4].

History

Traditional farming (of many kinds) was the original type of agriculture, and has been practiced for thousands of years. Forest gardening, a traditional food production system which dates from prehistoric times, is thought to be the world’s oldest and most resilient agro system [5].

Artificial fertilizer had been created during the 18th century, initially with superphosphate and the ammonia-based fertilizer mass-produced using the Haber-Bosch process developed during World–War I. These early fertilizer were cheap, powerful, and easy to transport in bulk. Similar advance occurred in chemical pesticide in the 1940, leading to the decade being referred to as the ‘pesticide era’. But these new agriculture techniques, while beneficial in the



short term, had been serious longer term side effects such as soil fertility, along with health concern about toxic chemical entering the food supply [6-7].

There are some of soil biological scientist which were developed in 1800s to 1900s to develop theories on how new advancement in biological science could be used in agriculture as a way to remedy side effect, while still maintaining higher production. In central Europe Rudolf Steiner whose lecture were published in 1925 [8-9], created biodynamic agriculture, an early visit of what we now call organic agriculture [10-11]. Steiner was motivated by spiritual rather than scientific consideration.

Organic Farming System

There are several organic farming systems. Biodynamic farming is a comprehensive approach, with its own international governing body. The do nothing farming methods focused on a minimum of mechanical cultivation and labor for grain crops. French intensive and biointensive method are well-suited to organic principal. Other example of technique is holistic management, permaculture, SRI and no till farming (the last two which may be implemented in conventional or organic system [12-13]).

Methods

An organic farming, properly speaking, is not one that uses certain methods and substance and avoids others; it is a farm whose structure is formed in imitation of the structure of a natural system that has the integrity, the independence and the benign dependence of an organism.

Organic farming methods combine scientific knowledge of ecology and modern technology with traditional farming practice based on natural occurring biological process. Organic farming method is studied in the field of agro ecology. The principal method of organic farming includes crop rotation green manure and compost, biological pest control and mechanical cultivation. These measure use natural environment enhance agriculture productivity; legumes are planted to fix nitrogen into the soil, natural insect predators are encouraged, crops are rotated to confuse pests and renew soil and natural materials such as sodium bicarbonate [6] and mulches are used to control disease and weeds. Hardier plants breeding rather than genetic engineering

The many of the method developed for organic agriculture have been borrowed by more conventional agriculture. Example integrated pest management is a multifaceted strategy that uses various organic method of pest control whenever possible, but in conventional farming could include synthetic pesticide only as a last resort [14].

Soil and Nutrient Management on Organic Farming

Soil Fertility

'Soil fertility' can be considered to be a measure of the soil's ability to sustain satisfactory crop growth, both in the short- and longer-term. Organic farming recognizes the soil as being central to a sustainable farming system. Soil fertility is determined by a set of interactions

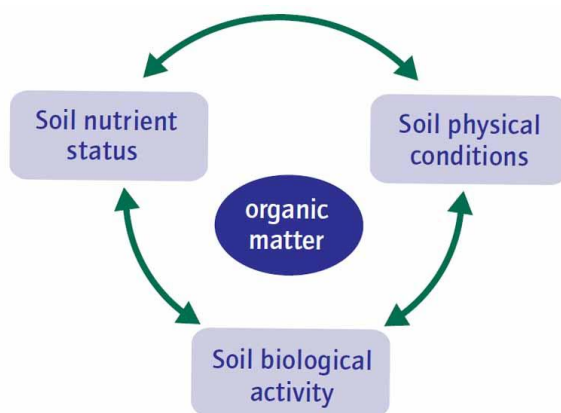


Figure 1: Interactions of Soil fertility



Organic matter is essential for soil fertility. It maintains good soil physical conditions (e.g. soil structure, aeration and water holding capacity). It also contains most of the soil reserve of nitrogen (N) and large proportions of other nutrients such as phosphorus (P) and sulphur (S). It is important to note that soil fertility is markedly affected by quantity and quality (type) of organic matter.

Organic farming relies on sound crop rotations to include fertility building and fertility depleting stages, returns of crop residues, nitrogen fixation by legumes/Rhizobium, and nutrient retention by green manures and effective use of manures/composts. Certain other materials, which are essentially slow release nutrient forms, are also permissible under various organic certification schemes. The emphasis is clearly on efficient nutrient cycling, especially as the import of manure on to organic farms is being looked upon less favorably.

The changes that organic management should aim to bring about are:

- An increase in soil nutrient reserves.
- A change in processes of soil nutrient supply
- Changes to the soil physical attributes

How Organic Farming are Different from Others

The International Federation of Organic Agriculture Movements (IFOAM) defines organic agriculture as “... a whole system approach based upon a set of processes resulting in a sustainable ecosystem, safe food, good nutrition, animal welfare and social justice. Organic production therefore is more than a system of Production that includes or excludes certain inputs”.

Legal Aspects

Organic farming is a legally defined production system within the EU (Council Regulation (EEC) 2092/91). Each Member State has to establish a competent authority to implement the regulation. The UK, authority is the Advisory Committee on Organic Standards (ACOS), which provides baseline organic standards.

The UK ACOS has approved 10 private UK Certification Bodies to implement and police the regulation. These register organic producers and processors and monitor operations to their own organic approved standards (based on, and with, basic standard as a minimum) through a routine and spot inspection system. In all cases, it is the system of production and produce from that system that is being certified

Main Feature of Organic Farming

- Concept of recycling, less reliance on external inputs
- Often lower levels of nutrients with the challenge of making nutrients available when the crop needs them
- Greater emphasis on the whole-farm system (rotations, matching crops to differing levels of fertility through the rotation)
- Often, but not necessarily, a wider range of enterprises and more mixed systems
- Evidence or otherwise of differences in biological activity/ functioning
- Supported by legislation (the only system of production that is legally defined)

Fertility Building

Building Soil Fertility

Nutrients can be imported onto organic farms by several routes:

Nutrient sources	Nutrient loss
• Fixation of atmospheric N	• Nitrate leaching
• Purchased feed stuffs	• Ammonia volatilisation
• (Cover crops)	• N ₂ and (NO _x) emissions
• Imported manure/compos	• Crop/animal produce
• Rainfall	• Exported manures

However, the cornerstone of the organic philosophy is the use of alternating fertility-building and fertility-depleting phases:



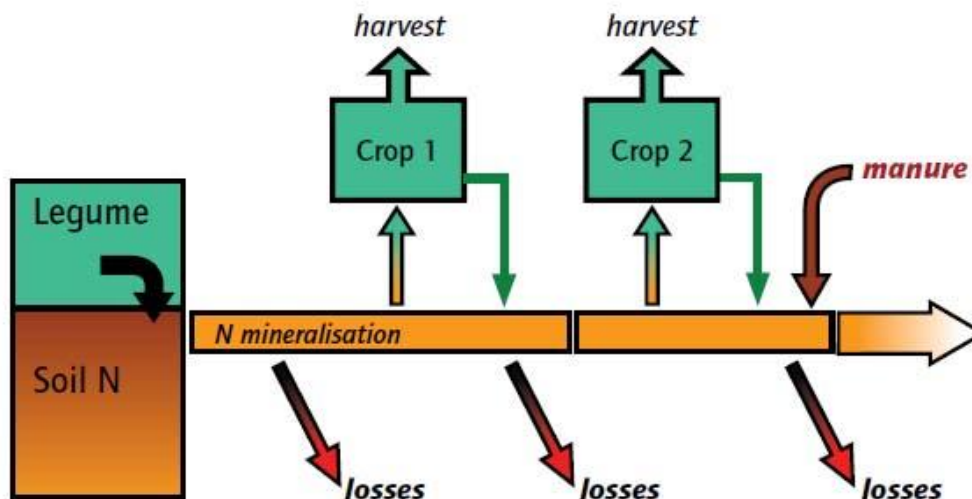


Figure 2: Fertility Building-Depleting Phases

It is especially important to minimize losses of nutrients from the soil to the wider environment. This helps to maintain the efficiency of the organic system.

Nitrogen

Organic farming aims to be self-sufficient in N through fixation of atmospheric nitrogen (N_2), recycling of crop residues and careful management and application of manures and composts. As well as legume-based leys, organic rotations often include an extra N boost by growing a legume (for example, field beans or peas) during the fertility depleting phase. However, it is the legume based ley that is the most important element of fertility-building.

Fertility Building Crops

Typical crops under UK conditions include red clover, white clover, vetch, lucerne, sanfoin, sown as pure stands or grass/clover leys (white clover or red clover sown in combination with perennial ryegrass), peas and beans. Lupins and soya are also being used in southern Britain. Recent work in NE England has indicated that two new legumes may also be suitable: lentil (*Lens culinaris Medik.*) and pinto bean (*Phaseolus vulgaris*).

Organic Matter

Additions of organic matter occur from the ley phase of rotations and from green manures, crop residues, animal manures and composts. The benefit of these additions depends on the amount and quality of organic material added. Grazed or mulched crops will add more organic matter to the soil than where crops have been harvested and much of the growth removed from the field. Legumes will generally accumulate more organic matter than non-fixing crops, whose yields are limited by the small amounts of soil-N that are likely to be present at the start of the fertility building phase. In pure clover and grass/clover leys with a high proportion of clover, most of the build-up of organic matter occurs in the first three years and there is relatively little additional benefit from extending the ley period much beyond this. Periodic inputs of crop residues and manures at other stages of the rotation, outside of the fertility-building phase, are also important as sources of fresh organic matter.

Phosphate and Potash

Soil phosphorus supply relies both on microbial activity to convert ('mineralise') organic P sources and on chemical transformations within the soil. The fraction associated with soil organic matter accounts for 30 to 50% of the total P in most soils, with the present as inorganic forms. Most P compounds in soil are either insoluble or poorly soluble.



The large reserves of P that have accumulated under conventionally managed fields may act as a source of P when farms are first converted to a less-intensive, organic management. However, the conversion of poorly soluble P compounds into crop available P is dependent on the maintenance of a neutral to slightly acidic pH.

Managing Nutrient Supply

Within most organic systems, there are two main aspects to nutrient management:

- The fertility building ley, containing legumes to add N to the system.
- Manures used to redistribute nutrients around the farm.

Nutrients, other than N, are imported onto the farm mainly in bought-in feed and animal bedding, though other sources such as green waste compost and permitted fertilizers may be important in some systems.

Fertility Building Leys

The fertility building ley is the cornerstone of most organic rotations. A well-managed ley will provide N to cash crops, forage for animals and aid in the control of weeds, pests and diseases.

Despite the importance of the ley in fixing atmospheric N, there is a remarkable degree of ignorance within both the farming and research communities about how much N a ley will fix, and how this N is released after incorporation ('mineralization'). Being able to predict these two aspects more accurately would prevent N losses due to excess N and crop failures due to too little N.

The challenge with trying to determine N fixation and mineralization is that many factors are involved, such as legume species, soil type, climate, pests and disease. However, for a particular legume species, there is generally a close relationship between total N content and yield. Management can maximize the amount of this N that is fixed, as opposed to taken up from the soil, i.e. maximize the N input to the farm. Legumes only fix significant amounts of N if they cannot obtain it from the soil. Thus, anything that adds N to the ley potentially reduces fixation, anything that removes N increases fixation.

This is an important consideration when deciding how to manage the ley. For instance, it is common practice to add manure to the ley. Ground conditions make spreading easy and it provides P and K, especially important if the ley is cut for silage. However, the N in manure could reduce fixation and repeated applications could reduce the proportion of legume in the ley.

Manure Management

The main route of entry for nutrients brought onto the farm is usually via animal feed and bedding. Animal manure provides an important method for redistributing nutrients around the farm, particularly N, P, K, S and Mg. Manure also supplies valuable organic matter.

But, some nutrients in manure are all too easily lost, causing loss of a valuable resource and environmental pollution. Despite the obvious importance of manure to the organic farmer, there is plenty of scope for improved management on many organic farms.

Fresh manure, especially slurry and poultry manure, contains a considerable proportion of N in readily available (principally ammonium-N) forms, which can be easily and rapidly lost to the atmosphere. Similarly, nutrients (particularly N and K) can be washed out by rainwater. Both ammonia and nitrate losses can cause environmental pollution as well as representing a loss of N that could be used by the crop.

Effective Manure Management

Effective manure management can minimize nutrient losses and maximize the benefits to the crop. There are two main treatment options available, actively composting and stacking for solid manure, and aerating slurries. For slurry, there is the additional option of mechanical separation, which can reduce the volume of material to be transported and enable irrigation of the separated liquid.



Organic standards encourage the active composting of manure and aeration of slurry, however, on many farms this does not occur. Both approaches to dealing with manure have their merits and problems as far as nutrient management is concerned.

Composting

Effective composting of solid manures and aeration of slurry has a number of benefits:

- Reduced odours
- Weed seeds and pathogens killed
- Reduced volume of material
- Production of a more uniform product
- Nitrogen stabilized in an organic form (solid manure)

However, the turning process in composting solid manure can cause a large loss of N as ammonia, while the aeration of slurry can also increase N losses, particularly if the aeration is either too or not thorough. Carbon is also lost as carbon dioxide. The N in composted solid manures is also less available to the following crops in short term. These problems can be overcome, to some degree, by a number of methods. Increasing the amount of organic carbon in manures can reduce N losses, so using more straw per animal will be beneficial. Covers are often recommended to reduce N losses or, better still, storing FYM under a roofed structure. Covering will reduce losses of N (and K) by stopping rainwater leaching through solid manure stacks, and can reduce gaseous losses by c. 60%. Undertaking composting in buildings after turnout is one method to avoid rainwater reducing the quality of the FYM and avoiding potential pollution. Covering slurry stores is also the most effective method of reducing losses of N from a liquid manure system.

To prevent gaseous losses of ammonia, rapid incorporation is the most effective method. Avoiding spreading in hot and /or windy weather will also reduce gaseous losses. The Table below shows the effect of delaying the soil incorporation of manure on nitrogen losses.

Managing Soil Structure

Soil structure affects the size and the distribution of soil pores, which are important for the movement of air and water and for root penetration.

Bad structure leads to poor root penetration, reduced access to nutrients, impeded drainage, poor microbial activity, soil erosion and ultimately crop failure. More power will also be required for cultivations and animal health may suffer in grassland systems

Soil structure, to some extent, is determined by soil texture (the proportions of sand silt and clay particles). These individual soil particles, along with organic matter, form clusters known as aggregates. It is the type and arrangement of these aggregates that determines soil structure.

Soil Examination

Recognizing structural problems early on before they become difficult and expensive to correct is an important skill.

Indications of structural problems include:

- Fields slow to dry and quick to become wet
- Poor seed germination and or emergence due to capping
- Patches of poor crop growth
- Increased pests, diseases and weeds
- Increased problems with producing a good seedbed

Assessing the structural condition of a soil is easily done in the field and should help spot problems before they begin to affect the crop.

Method

The best time to assess structure is when the soil is moist with a growing crop in place; assessment in dry soils is very difficult. Also, soil structure tends to deteriorate during the season, which should be taken into account when



doing assessments. Repeat at points across the field - areas such as gateways and around feeding troughs are especially prone to poor structure and may provide an early warning of more general problems.

- Dig and remove a block of soil about 30 cm deep
- Bang the spit of soil on the ground to see how it breaks up
- Assess the soil visually and compare with Table opposite
- As well as assessing the plough layer, a further assessment should ideally be made at deeper levels with fewer pits to determine if deep compaction is occurring

Table 1: Soil Indicators

Indicators of good structure	Indicators of bad structure (very bad structure in italics)	
	Medium to heavy soils	Light soils
<ul style="list-style-type: none"> • small to medium aggregates • easily broken when moist • loose friable overall • lots of pore spaces • good root penetration • plentiful earthworms 	<ul style="list-style-type: none"> • mainly large clods • clods resist breaking • clods have smooth surfaces • poor root penetration • persistent crop residues • few earthworms • compacted layers • <i>flattened clods</i> • <i>horizontal cracking</i> • <i>mottled orange grey colours sulphurous smell</i> 	<ul style="list-style-type: none"> • lack of cohesion • surface capping • persistent crop residues • compacted layers • poor root penetration

As well as being able to assess soil structure it is important to know how to avoid problems and deals with any that arise. Broadly speaking good management of soil structure involves a combination of avoiding operations that damage the soil, such as excessive trafficking and overstocking, and maximizing operations that benefit structure, such as appropriate cultivations, and addition of organic matter.

- **Time consuming** – significant amount of time and energy are required to execute the detailed methods and technique that are required for a farm to be called an organic farm. Failure to comply with any of these requirement could result in loss of certification, which the farmer will not be able to regain in up to three years

The father of the modern green revolution, Norman Borlaug, argues that while organic farming practice are capable of catering to the demand of very small consumer fraction, the expanding cropland is dramatically destroying world eco system . Research conducted by the Danish environmental protection agency revealed that organic agriculture is hardly able to address or combat global climate change through regenerative organic farming practices are recognized as effective strategy for reducing CO₂ emission to an extent, the impact is not dramatic. Despite the various advantages and disadvantages of organic farming, farms where organic method for cropping and experimented with, displays more profitability than conventional farms. Organic agriculture is definitely more sustainable in the more suitable in the long run, improving soil fertility and terrain drought resistance greatly. These farming practices completely waive of external cost, incurred due to investment in chemical pesticides and nutrient runoff and a number of help issue that result from agro chemical residue.

Benefits of Organic Farming

Over the years, organic has proved to be more cost –effective and eco-friendly than conventional farming. Now in this paragraph some of the benefits of organic farming are given below-

- Organic farming proves to be more profitable than the age-old traditional farming methods.
- It has been found that organic farming reduces about 25-30%, as it does not involve the use of synthetic fertilizers and pesticides, which thus makes organic farming very cost-effective.



- This type of farming leads to a less toxic environment as far as the air, water and soil is concerned.
- Soil is the most important component in farming, and organic farming preserve the soil by reducing by soil erosion up to a large extent
- Organic farming is also enables the farmer to use the soil for a longer period of time to grow crops , as soil fertility is maintained for a long time in such a case
- Organic farming has a positive effect on the ecosystem, as it proves vital in supporting the survival of wildlife in the lowlands. It evens provide safe pasture lands for grazing
- The kind of farming is not only beneficial to the farmer, but it also has proved useful for the dairy industry. cattle grazing on organic farmland have been found to be less prone to disease , and they also yield more milk
- Consumption of products is obtained from organic farming minimizes the risk of physical ailments such as heart attacks, cancer and ever strokes. It is scientifically proven that organic food are often healthier than the inorganic ones.

Proponents of Organic Farming

"Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved..."

—International Federation of Organic Agriculture Movements [15].

Critical Analysis of Organic Farming

Norman Borlaug (father of the "Green Revolution" and a Nobel Peace Prize laureate), Prof A. Trewavas and other critics have contested the notion that organic agricultural systems are friendlier to the environment and more sustainable than conventional farming systems. Borlaug asserted that organic farming practices can at most feed 4 billion people, after expanding cropland dramatically and destroying ecosystems in the process [16-18]. Borlaug and his coauthors advocated using organic matter in addition to inorganic fertilizers in soil fertility management, but opposed advocating only organic agriculture for the developing world [19]. The Danish Environmental Protection Agency estimated that phasing out all pesticides would result in an overall yield reduction of about 25%. Environmental and health effects were assumed but hard to assess.

Equipment Used in Organic Farming

Organic farming equipment need not be any different from the equipment used on conventional farms, but some farmers choose to take a more sustainable approach to selecting equipment for their fields.

Basic Organic Equipment

No matter the size of your organic farm, it's likely you'll need at least some equipment to make your job a little easier. While a relatively small plot of land could be cultivated and harvested by hand, if you've got any kind of large-scale production, you'll want some organic farming equipment to help you out.

Just a few of the machines you might consider buying include:

- Tractor
- Cultivator
- Plow
- Tiller
- Harrow
- Broadcast or air seeder
- Seed drill, air seeder or precision gun



- Transplanter
- Harvester or combine
- Equipment for transportation or moving earth, such as a backhoe, front-end loader or motorized cart

Conclusion

Organic farming is very much different from traditional farming concept. Many of the traditional farming methods are still useful today. Organic farming takes the best of these and combines them with modern scientific knowledge. The farm should not be left to be taken over by nature; we should use all the knowledge, techniques and materials available to work with nature. In this way we can create a healthy balance between nature and farming, where crops and animals can grow and thrive. To be a successful organic farmer, the farmer must not see every insect as a pest, every plant out of place as a weed and the solution to every problem in an artificial chemical spray. The aim is not to eradicate all pests and weeds, but to keep them down to an acceptable level and make the most of the benefits that they may provide.

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