Guidance note to the poster:

How to make good quality compost

This note provides guidance for using the poster in a training set up. It leads through the different aspects presented on the poster and offers extended information for their presentation, as well as suggestions for the didactical implementation. As part of the introduction, a definition of organic agriculture is provided.
For further reading, see the suggested list at the end of the guidance note.

Objectives of the poster

- Explain what composting means and how it can contribute to soil fertility management.
- Outline the process of making good quality compost.
- Highlight the three temperature phases necessary to achieve good quality compost.

Introduction

What is organic farming?

Organic farming is the way of producing good quality farm products in harmony with nature. Organic farmers optimise the growing conditions of crops by enhancing the natural fertility of the soil to ensure good nutrient and water supply, creating diverse cropping systems and promoting natural ennemies of pests, recycling organic materials and manures and using natural inputs while renouncing chemical pesticides and fertilisers.

Exchange on organic farming principles

Ask the participants about their understanding of organic farming. What do organic farmers do with respect to selection of crop cultivars and animal breeds, soil fertility management, pest and disease management, animal husbandry and other aspects? Inform the participants which methods are acceptable in organic farming and which are prohibited.

What is compost?

Compost is the product that results from the controlled decomposition of plant and animal (mainly manure) materials. It is not only a valuable nutrient source for plants, but also improves the quality of the soil.
Compared with the uncontrolled decomposition of organic material, as it naturally occurs, composting results in an accellerated decomposition process with higher temperatures, and gives a product of higher quality. The high temperatures in the composting process kill most weeds, pests and disease-causing organisms.

Assessment of the knowledge on composting

Find out how familiar the participants are with composting and what experiences they have made with compost by asking the following questions:

- Do you engage in composting? If so, for which crops (e. g. vegetable gardens and/or field crops)?
- What materials do you use?
- What materials are not suitable for composting?
- Do you face any challenges in making and/or using compost?

Benefits of compost

Compost contributes to an increase of the organic matter content of the soil, which in turn improves its structure, increases the soil's water holding capacity (and thus its drought mitigation), balances the pH, promotes microbial activity and can suppress soil-borne diseases.
Although the total nutrient content of compost is similar to that of cow manure with about 0.5 % of nitrogen, 0.1 % of phosphorus and 0.5 to 2 % of potassium, the additional benefits of compost are higher than cow manure due to the following reasons:

- Compost holds much water and therefore has proven to be the best type of organic fertiliser in dry climates.
- Compost increases the effect of (even small amounts of) animal manure when added together.
- Compost reduces deficiencies of trace elements.
- Compost also increases the availability of phosphorus to plants in soils rich in iron oxides that are common in Africa.
- Most mature composts have a pH of 6 to 8. Due to their balanced acidity, composts improve the availability of nutrients in soils.
- Compost helps avoid nitrogen losses in temporarily water-logged soils.

Exchange on experiences with the use of compost

Invite the participants to share their experiences with the use of compost by asking the following questions:

- What are your experiences of using compost in your gardens?
- Have you observed any differences to using mineral fertilisers (in conventional farming) or animal manure?

If possible, visit the farm of a farmer, who has made and applied compost for some years. Let him/her tell about his/her experiences making composting and results of compost application.

Composting process with three distinctive phases

Properly made compost goes through three phases: the heating phase, the cooling phase and the maturing phase.
Within three days after setting up the compost heap, temperature in the heap rises to 60 to 70 °C for two to three weeks (heating phase). The high temperature is a result of energy released by the bacteria during the decomposition of easily digestible materials.
After decomposition of the green plant material by the bacteria, the temperature in the compost heap declines slowly to 25 to 45 °C. Fungi then start the decomposition of straw, fibres and wooden material. As this decomposition process is slower, the temperature of the heap does not rise.
During the maturing phase, red compost worms and other soil organisms start to inhabit the compost heap. Nutrients are mineralised and humic acids and antibiotics are built up. At the end of the maturing phase the compost has lost about half of its original volume, has taken on a dark colour and the smell of fertile soil.

The compost making procedure in five steps

Compost heaps should be placed in a easily accessible and shaded place close to the fields and next to a water source. Tools needed for composting include a hand hoe, a machete (panga), a spade or forked hoe, a watering can, wheelbarrows, and a sharp stick or a compost thermometer to monitor the temperature changes in the compost heap. For watering, a watering can or a sprayer should be used rather than a bucket to ensure a good distribution of the water. Large scale production of compost can be made easier by using appropriate machinery such as for chopping raw materials and turning the compost heaps.

Step 1: Collecting materials from non-contaminated sources

To make good quality compost, green and dry plant materials, animal manure, partially or fully decomposed organic materials, and water are used. As most crop residues are low in nitrogen, nitrogen rich sources such as leaves from green leguminous plants, shrubs and trees should be added to ensure sufficient nitrogen for the composting process.
Whenever possible, plant materials should be composted together with (dissolved) animal dung, urine or slurry, or animal manure from stables and pens, as it accelerates the composting process and increases the compost's fertiliser value.
Ash, saw dust, top soil, or fertilizers like ground phosphate or lime can be added in small quantities. Agro-industrial wastes like coffee pulps or husks can also be used. All materials should be free of contaminants like chemical pesticides or heavy metals.
All materials should be chopped into pieces 5 to 10 cm in length or spread on the ground or used as livestock bedding before composting to get them bruised and mixed to increase their surface area for better decomposition.

Exchange on materials for compost production

Brainstorm with the participants which materials from their farms can be used for making compost.

- Are sufficient quantities of the source materials available?
- If not, where could more materials be found on the farm or in proximity? Are there possibilities to increase the quantities on the farm (e.g. planting hedges or introducing farm animals)?
- Which materials should not be used for making compost?
- Would it be an option to work with neighbouring farmers?

Step 2: Mix and water the materials

For a good composting process, 1 part of fresh plant materials and manure are mixed with 2 parts of medium sized rough dry materials. During mixing, the materials should be well watered. Some methods suggest piling the materials in layers instead of mixing them.
If too much fresh material is used, aeration of the heap will be poor. As a result the heap will start to smell and nitrogen will be lost. If too much dry material is used, the bacteria, which decompose the materials, will lack adequate food (nitrogen) and the composting process will not start. Very dry or woody materials are thus best left in the field as mulching material or used to cover the compost heap.

Step 3: Piling of the mixed materials

The materials are piled onto heaps of about 2 m wide, 4 m long and 1.2 m high. When a heap has reached its final size, it is covered with dry materials like grass in the dry season, or banana leaves during the rainy season to protect it from drying out.
To determine the temperature during the composting process, a wooden or metal rod can be inserted into the heap (see further details in step 4 below).
In dry climate, it is recommended to produce compost in pits 0.5 m deep.

Step 4: Checking moisture and temperature

Throughout the composting process, the conditions in the heap must be monitored regularly. 2 to 3 days after preparation of the compost, the first temperature check should be made. If the pulled-out stick is warm, this indicates that decomposition by the bacteria has started.
To check the moisture of the material, a sample is collected and pressed in the hand. If it falls apart, it is too dry. If it smears, it is too wet. If the material keeps its form without dripping, it has the ideal moisture.
If the stick is cool, it indicates that the conditions for decomposition are not ideal: The heap is either too dry inside or lacks nitrogen rich green material or manure. In this case, the materials need to be watered and/or remixed adding more green materials or manure to kick-start the process.

Step 5: Turning of the heap

When the temperature starts to decline after about 10 days, the heap needs to be turned and re-watered well. This procedure is repeated after 20 and 40 days at least, however the more frequent the turning, the faster the decomposition. Before each turning, the covering material is removed. After each turning, the heap is covered again.
When the temperature in the heap does not rise anymore, the heap is going through the cooling phase, during which fungi decompose the dry material. At the end of the cooling phase a last turning is needed, before the compost goes through maturation by red compost worms. The riper the compost gets, the more it has a smell of forest soil.

Practical demonstration

Engage the participants in a practical demonstration of compost making: Obtain the different materials required for compost making together and practically demonstrate to the participants how compost is made. During the compost making, explain to the participants the main points in each step. All participants are encouraged to undertake all stages of the composting.

Application of compost

How much compost to make

The following factors help one to determine the amount of compost to produce and apply to crops.

- A general recommendation is at least 20 tons (or 14 m^3) of compost per hectare for soils with low fertility. On soils with elevated fertility, the amount of compost can be reduced, though it may be complemented by other nutrient sources like leguminous cover crops and/or green manures, plant leaf teas and mulch like Tithonia, and others.
- Compost should be applied every year to ensure sufficient phosphorus for the vegetable crops. Ideally, compost applications are based on laboratory analysis of the soil status every season. As the nutrient content of compost can vary strongly from season to season, thereby affecting its quality, the composition of compost should also be determined. Lack of information on the nutrient content of compost can lead to either under application or over application of nitrogen to the soil.
- Most nitrogen is organically bound, and thus not immediately available to plants. Nitrogen from compost is released slowly over time. Therefore, it mainly benefits tree crops. However, with increasing soil humus content, nitrogen supply to crops increases. Vegetables and other food crops that are grown over a period of 2 to 6 months depend on readily available nitrogen sources such as manure or plant tea to satisfy the crops' nitrogen demand.
- Woody and fresh composts with a high carbon-to-nitrogen ratio (C/N ratio) can temporarily block the availability of nitrogen in the soil for crops. A leguminous green manure can largely prevent nitrogen blockage for the following crop by releasing nitrogen readily during decomposition.

Discussion on investment into compost production

Discuss, with the farmers, the advantages and constraints of compost production under local circumstances. Compare it to green manuring, mulching and other approaches that improve soil fertility.

Instead of making compost by one-self, it may be produced as a group, or purchased from a nearby producer.

- Are there commercial compost producers in the area?
- Are there products suitable in terms of availability (quantity and distance to the farm), costs and quality (including the risks of heavy metal or other residues)?

Discuss the feasibility of such an approach and the acceptance of such products with the farmers.

Further readings

Organic farming definition

- www.ifoam.bio › Why Organic?
- www.organic-africa.net › Training manual › Module 1

Composting

- www.organic-africa.net › Training manual › Module 2

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