

3.6 Mulching

Introduction

Mulching is the process of covering the topsoil with plant material such as leaves, grass, twigs, crop residues, straw etc. A mulch cover enhances the activity of soil organisms such as earthworms. They help to create a soil structure with plenty of smaller and larger pores through which rainwater can easily infiltrate into the soil, thus reducing surface runoff. As the mulch material decomposes, it increases the content of organic matter in the soil. Soil organic matter helps to create a good soil with stable crumb structure. Thus the soil particles will not be easily carried away by water. Therefore, mulching plays a crucial role in preventing soil erosion (see chapter 3.4).

In some places, materials such as plastic sheets or even stones are used for covering the soil. Here, the term 'mulching' refers only to the use of organic, degradable plant materials.

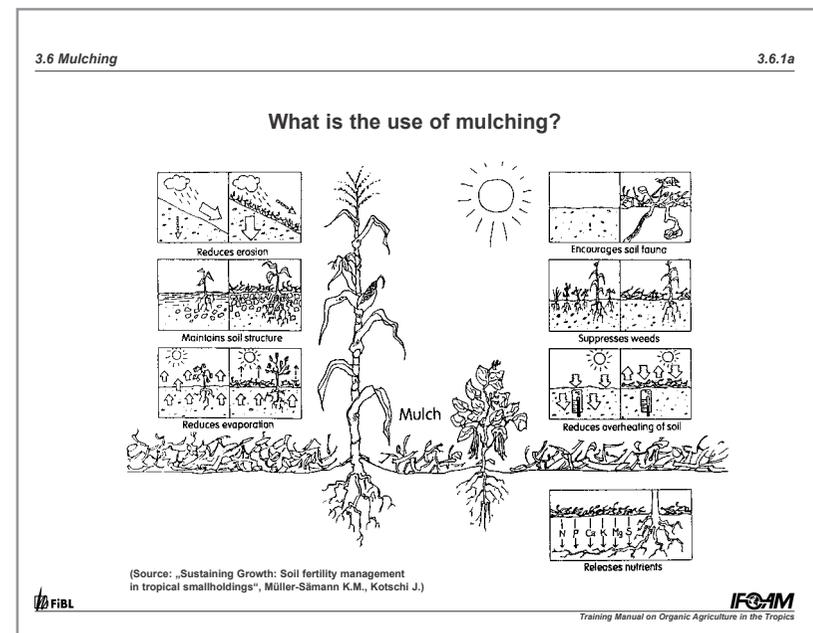
3.6.1 Why to Use Mulch?

What is the use of mulching?

- Protecting the soil from wind and water erosion: soil particles can not be washed or blown away.
- Improving the infiltration of rain and irrigation water by maintaining a good soil structure: no crust is formed, the pores are kept open.
- Keeping the soil moist by reducing evaporation: plants need less irrigation or can use the available rain more efficiently in dry areas or seasons.
- Feeding and protecting soil organisms: organic mulch material is an excellent food for soil organisms and provides suitable conditions for their growth.
- Suppressing weed growth: with a sufficient mulch layer, weeds will find it difficult to grow through it.
- Preventing the soil from heating up too much: mulch provides shade to the soil and the retained moisture keeps it cool.
- Providing nutrients to the crops: while decomposing, organic mulch material continuously releases its nutrients, thus fertilizing the soil.
- Increasing the content of soil organic matter: part of the mulch material will be transformed to humus.

Lessons to be learnt

- Understanding the value and functions of mulch.
- Learning about which materials to use for mulching and how to apply them.
- Knowing the constraints of mulching and being able to assess where mulching becomes useful.



Transparency 3.6.1a: Sketch on the effects of mulching.

Selection of mulch materials

The kind of material used for mulching will greatly influence its effect. Material which easily decomposes will protect the soil only for a rather short time but will provide nutrients to the crops while decomposing. Hardy materials will decompose more slowly and therefore cover the soil for a longer time (see also chapters 4.4 (Green Manures) and 4.5 (Compost)). If the decomposition of the mulch material should be accelerated, organic manures such as animal dung may be spread on top of the mulch, thus increasing the nitrogen content.

Where soil erosion is a problem, slowly decomposing mulch material (low nitrogen content, high C/N) will provide a long-term protection compared to quickly decomposing material.

Sources of mulching material can be the following:

- Weeds or cover crops
- Crop residues
- Grass
- Pruning material from trees
- Cuttings from hedges
- Wastes from agricultural processing or from forestry

A list of different mulching materials, their nitrogen content and their C/N ration is given in chapter 4.4 (Composting).

Group Work: Use of mulch in local cropping systems

The selection of mulching material and the timing of its application will very much depend on the local conditions and the prevailing cropping systems. Interaction with the partners therefore is important to find out the potential and constraints of mulching in the region.

Form groups, discuss the following questions, note down the main points:

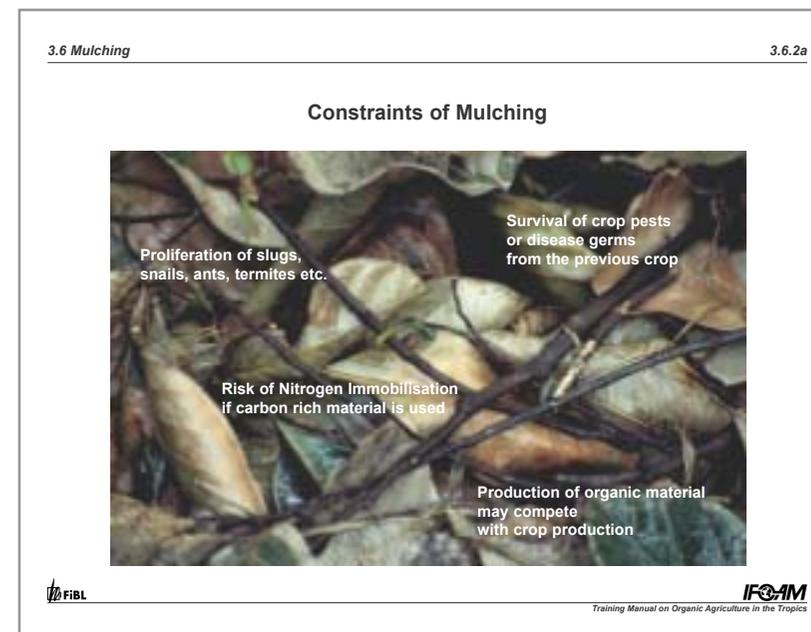
- 1.) Which materials are available in the region suitable for mulching?*
- 2.) Which problems in which crops might be overcome with mulching?*
- 3.) Select an example of a crop. When would be the point of time in the cropping cycle ideal for applying mulch?*
- 4.) What problems might occur when using mulch in this crop, and how to overcome them?*

Present the results of the group discussions in the plenum and try to derive common aspects and conclusions.

3.6.2 Constraints of Mulching

While mulching has a lot of advantages, it can also cause problems in specific situations:

- Some organisms can proliferate too much in the moist and protected conditions of the mulch layer. Slugs and snails can multiply very quickly under a mulch layer. Ants or termites which may cause damage to the crops also may find ideal conditions for living.
- When crop residues are used for mulching, in some cases there is an increased risk of sustaining pests and diseases. Damaging organisms such as stem borers may survive in the stalks of crops like cotton, corn or sugar cane. Plant material infected with viral or fungal diseases should not be used if there is a risk that the disease might spread to the next crop. Crop rotation is very important to overcome these risks.
- When carbon rich materials such as straw or stalks are used for mulching, nitrogen from the soil may be used by microorganisms for decomposing the material. Thus, nitrogen may be temporary not available for plant growth (risk of N-immobilisation, see Box below).
- The major constraint for mulching usually is the availability of organic material. Its production or collection usually involves labour and may compete with the production of crops. Recommendation of how to overcome shortage of organic matter are given in chapter 3.2.



Transparency 3.6.2a: Potential problems related to mulching.
Background: photo of a mulch layer.

Group work: Developing an Assessment List

Farmers have to assess whether the benefits of mulching will prevail over potential disadvantages on a specific plot and at a certain point of time. It is also necessary to decide case by case whether the best option is to utilise the available biomass as mulch or as material for making compost.

To facilitate these decisions, the participants can commonly develop a checklist for farmers in their region. To start with, use the assessment list for mulching given in Annex 8.1. Divide the participants into groups. Each group shall discuss the points of the assessment list based on a specific cropping system they feel familiar with. Based on the discus-

sion, the groups shall adapt the assessment list to the local conditions. At the end, each group shall present the results of their discussion to the plenum and present their new assessment list.

Nitrogen Immobilisation

When organic material is applied to the soil, the decomposing microbes multiply quickly. For growth, they need nutrients, especially nitrogen, as plants do. If the applied plant material does not contain sufficient nitrogen (i.e. it has a high C to N ratio, see chapter 4.4), the micro organisms take it from the soil. This process is called nitrogen immobilisation, as the nitrogen is fixed temporarily in the microbes and released only after some time. During this time, the microbes compete with the plants for nitrogen and the crop may suffer from malnutrition.

- Old or rough plant materials should be applied to the soil at least two months before planting or sowing the main crop
- nitrogen immobilisation can occur when the following materials are applied: straw or grain husks, material containing wood (e.g. twigs, saw dust), half rotten compost

Examples: How to understand nitrogen immobilisation

It is of high relevance for farmers to understand the concept of nitrogen immobilisation, especially when it comes to mulching or use of agro-industrial wastes as manures. As the concept may appear too complicated to practitioners, the trainer can think of a simple story or parable to illustrate the competition between microbes and plants for nitrogen uptake. The following example has proved to be useful in Indian conditions:

«Indians are very keen on rice and they eat large quantities of it every day. However, they will not touch it if there is not at least a little curry or chutney served with it. If plain rice is served, they will do everything to find some curry or chutney. Similarly, soil microbes are very keen on carbon-rich materials such as straw, stalks or husks, but they need a certain amount of nitrogen to eat it. If carbon-rich material is available, they will do everything to find some nitrogen to eat it. In this, they are much better than plant roots, so that the plants will go hungry. Only once the microbes are saturated and die, the incorporated nitrogen gets available to the plants again.»

Even if such stories are not always scientifically valid, they can help a lot to understand the most important message of complex issues.

3.6.3 Application of Mulch

If possible, the mulch should be applied before or at the onset of the rainy season, as then the soil is most vulnerable.

If the layer of mulch is not too thick, seeds or seedlings can be directly sown or planted in between the mulching material. On vegetable plots it is best to apply mulch only after the young plants have become somewhat hardier, as they may be harmed by the products of decomposition from fresh mulch material.

If mulch is applied prior to sowing or planting, the mulch layer should not be too thick in order to allow seedlings to penetrate it. Mulch can also be applied in established crops, best directly after digging the soil. It can be applied between the rows, directly around single plants (especially for tree crops) or evenly spread on the field.

The Fukuoka system of mulching rice fields

The Japanese organic pioneer Fukuoka developed a system of growing rice which is based on mulching. White clover is sown among the rice one month before harvesting. Shortly thereafter, a winter crop of rye is sown. After threshing the harvested rice, the rice straw is brought back to the field where it is used as a loose mulch layer. Both the rye and the white clover spring up through the mulch which remains until the rye is harvested. If the straw decomposes too slowly, chicken manure is sprinkled over the mulch. This cropping system does not require any tillage of the soil, but achieves satisfying yields.

3.6 Mulching 3.6.3a

Protecting the Soil with Mulch

- Apply before the rainy season.
- Not a too thick layer.
- Application in rows or around single plants.
- ... or evenly spread on the field.



FIBL IFOAM
Training Manual on Organic Agriculture in the Tropics

Transparency 3.6.3a: Mulch applied in vegetable fields in the Philippines, with recommendations for the application of mulch in key words

Recommended Readings

- «Soil fertility management», Agromisa, Agrodok-series No.2.
- «Sustaining Growth: Soil fertility management in tropical smallholdings», Müller-Sämann K.M., Kotschi J.