19 • Production of Compost

Chemical fertilizer, manure (animal dung and plant material that has not been systematically decomposed) and compost (systematically decomposed organic material) is food for the plants and for the life in the soil. Such food is necessary to keep the fertility of the soil and to maintain a good crop production.

Compost is made when various materials are broken down by microorganisms. These materials can be a mixture of animal manure, vegetable waste matter, household waste, cooled ashes, sweepings, weeds, leaves, straw, groundnut or cotton cake, etc. Anything that cannot be broken down (decomposed) should be removed: cans, plastics, glass, etc.

Composting is done in pits when it is in a dry climate. This will keep the compost more humid and therefore speed up the process. In a humid climate it is better to use heaps - to prevent the compost from becoming too wet. If the compost is flooded the microorganisms cannot function.

Compost heaps require less work than pits. The figure explains the classic process of preparing compost. The process is the same, whether it is for a "pit" or a "heap".

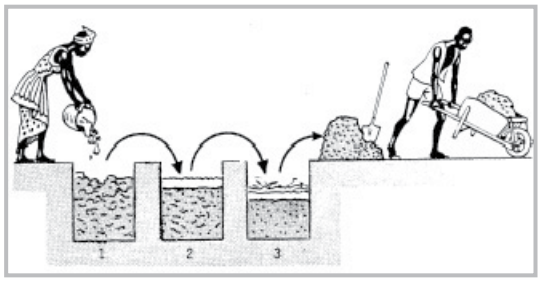
1. Dig three pits of about 1.5 x 1.5m, side by side (or make three heaps). Dig the pits about 50 cm deep, so that it is easy to turn over the plant material and to empty it.
2. Fill the first compost pit. Add layers of plant material, changing with thin layers of animal manure, ash and soil. The soil or dung makes the process work faster since these contain the microorganisms that break down the plant material.

Cut big objects (such as banana tree trunks, maize stalks) into smaller pieces.

Burn woody waste which does not decompose in your stove. Burn also diseased plants or plants infested with insects, and put the ashes on the compost heap.

The contents of the pit should be humid, but not too wet, to decompose well. Water or shelter the pit as the conditions require.

3. After a month, fill pit number 2 with the contents of pit number 1. The reason to move it is to mix it and give access to oxygen. Water it (unless it is very wet) and pack the pit well. Cover it with a layer of earth, which you stamp down and water from time to time. When pit number 1 is empty, you can fill it up again with new waste.
4. After another month fill pit number 3 with the contents of pit number 2 and air it well. Cover it with a little earth and branches to protect it from evaporation and rain, but do not pack it. Fill pit number 2 with the contents of pit number 1 and refill pit number 1 with new waste.
5. At the end of the third month you can empty pit number 3 and use the compost. Continue in the same way every month, emptying and refilling the pits.



Composting with three pits/heaps. 1- being filled, 2- decomposing, 3- ready for use

Work the compost into the soil in the same way as manure. Composting has the advantage that microorganisms spreading plant and human diseases are killed by the high temperatures during this process.

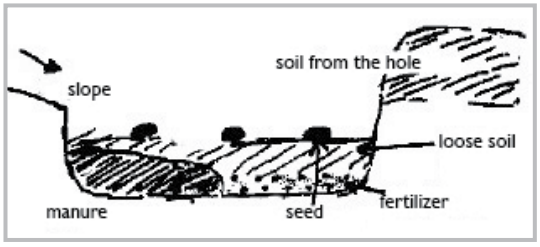
20 • Conservation Farming

Why minimum tillage

The field can be prepared for planting by the time of the first rains

It is necessary that agricultural systems develop as the global population grows. Nature is degraded because the land is abused or misused. Every year many productive fields become unproductive because of degradation of fertile soil.

Minimum tillage is an alternative to such poor farming methods. The main idea behind minimum tillage is not to plough but to disturb the soil as little as possible. This system has been used by commercial farmers in countries like Brazil, US and Zimbabwe for some time and has shown that fields become more fertile and better incomes are reached while using less fertilizer. The system has recently been adopted by small farmers in Southern Africa - with good profits.



Profile of a hole before the seeds are covered

The basic concept of minimum tillage

When soil is tilled the good structure that has been formed naturally is destroyed. The valuable humus is then buried deeper down. The soil structure is spoiled and the soil is left without a protective cover. The result is soil erosion when heavy rains fall.

With minimum tillage one works together with nature and not against nature. Never plough the soil. A method is instead to dig planting holes where the new crop is planted. These holes attract water. The residues from former crops should be left as a protective mulch to prevent evaporation of water from the soil. This will also prevent high soil temperatures that destroy living conditions for many soil organisms.

Another advantage of the minimum tillage system is that it gives the possibility for farmers to begin to prepare their land as soon as they have harvested. This is not possible with conventional tilling because the soil is too hard to till before the rains fall. Farmers are therefore not able to plant early and benefit from the period of the first good rains.

Land preparation can also be spread over several months and is therefore more suitable for women farmers.?

In minimum tillage the compost, manure or fertilizer is placed directly in each planting hole. It is thus used more efficiently than when it is spread over the whole field.

This makes it easier for the farmer to have enough manure for all his fields.

Minimum tillage is thus a way to save water, soil and money.

It is essential to use crop rotation to avoid that some insects develop uncontrollably and that a lack of specific nutrients in the soil is developed.

Minimum tillage initially requires more time for weeding. The farmers must avoid planting on a larger area than they have the capacity to maintain. But if the weeding is done well from the beginning, the land will after a few years have fewer weeds because less and less seeds will get the chance to germinate.

Example on how to prepare a model field

Organize the model field so that one part is worked conventionally and that minimum tillage is used on the other part.
Tell the members of the farmers' club/students/ children to bring:

- *a water can full of water,*
- *a handful of maize or other kind of seeds, such as beans and peanuts,*
- *a handful of fertilizer,*
- *a bucket filled with compost or manure,*
- *a 50 m string with marks every 70 cm. These marks can be made with paint, knots, bottle caps pressed around the string, etc.*
- *two sticks/branches of 90 cm to measure the distance between the lines,*
- *40 pegs to mark the lines (20 cm long and sharp).*

a. Weed the field with a hoe
Do not remove or burn the weeds. Leave it as a protective mulch.

b. Measure the field
Use the string to measure an area of 50 x 50 m. Mark each corner of the square with a peg.

c. Determine in which direction the land slopes
Decide where to place the planting lines so that they follow the contours of the soil (the opposite of up-down). If the land is sloping more than one metre over the 50 m then it is necessary to establish vetiver contours to avoid erosion (see section 23).

d. Mark the lines
Mark the lines precisely so that the holes are easy to find each year. An advantage of planting on top of the old roots is that this will provide oxygen for the new plants as the roots decompose. The distance between the lines should be 90 cm. Use a 90 cm long stick. Mark each line with a peg on each end.

e. Dig the holes where you will plant
- *Use the string that is marked every 70 cm.*
- *Move the string to the first line and place it on the two pegs.*
- *Make the holes where there is a mark.*
- *While people are digging the holes, check if it is being done properly and correct them if necessary.*
- *The holes should be 15cm deep and 35cm wide.*
- *All holes must be on the same side of the string and be evenly spaced.*
- *When all the holes of the first line are ready, move on to the next planting line.*

It is possible for 5 people to prepare one hectare in one day.

f. Demonstrate how to apply manure/ fertilizer and seeds
- *Put a soft drink can filled with well decomposed manure or a bottle-top of fertilizer at one side of the hole.*
- *It is best to apply the manure in August - but it can be done up to the time of planting.*
- *Cover the manure or fertilizer with soil so that the hole is still 5 cm deep.*

g. Demonstrate the start of the rains
- *Use a water can filled with water to demonstrate rain. Say "Today is November, 15 - it rained a little" and sprinkle some water over the holes. Explain that you have to wait for more rain and not to plant after the first weak rains.*

- *Continue with the demonstration: "Today is November, 20. Now it is really raining". Pour much water over the holes. Ask people to watch how the holes absorb the water.*

Explain that:
When it rains heavily (after November 15) and the holes get filled with water, soak the seeds overnight (see section 37) and plant them the next morning, when the water has soaked into the holes.
If you are using chemical fertilizers (along with manure) it is best to apply these when you apply the seeds. Use one side of the hole for the seeds and the other for the manure/fertilizer. Keep the fertilizer 3 cm from the seeds.
Burry four maize seeds (see the planting guidelines on the next page regarding other seeds) in the soil at the other side of the hole. Do not put them in contact with new manure or fertilizer. Cover them with a 2,5 cm deep layer of earth (2-3 fingers deep). Break up any lumps of soil, so that the seeds have good contact with the earth.

h. Explain how to weed
Explain that people should weed every 2 weeks to get rid of weeds while they are still small. It is much faster to weed the field with small weeds. When the weeds are 5-7 cm, one hectare can be weeded by 1 person in 3- 4 days. If the weeds are left until they are 15 cm, the crop will suffer and the same job will take 10 days. Weed on time and do less work.
Explain also that they must keep weeding until the harvest. This is to prevent the weeds from spreading their seeds.
People should be prepared for extra weeding the first years.

What everyone should know

1. What is minimum tillage

Mulch between the holes reduces evaporation

Minimum tillage means that the land is not ploughed, or dug deeply. Permanent planting holes are made, and only these are tilled. Residues from early crops are left in the field as mulch to protect the soil. A minimum of 30% ground cover is recommended, but the more the better.

2. Advantages of minimum tillage
The farmers can get the land ready before the rains start. This way they can plant earlier and benefit from the first rains.

In areas where animals are traditionally used to till the fields, this is especially good for farmers who do not have animals. With minimum tillage they do not need to wait to borrow or rent animals until the other farmers have tilled their lands.

- The soil becomes more and more fertile because humus is formed in it.
- Mulching with plant residues helps to reduce soil erosion.
- The mulch also helps to keep water in the soil.
- More water is available for the crop because it accumulates in the holes.
- The plants do not dry so fast during drought spells.
- It is easier to give the exact amount of manure/fertilizer that the plants need.
- Gradually there will be less weeds because they are prevented from spread-

ing seeds, and no old seeds are dug up.

3. How to do minimum tillage

See the instruction on the previous page.

4. Planting guidelines

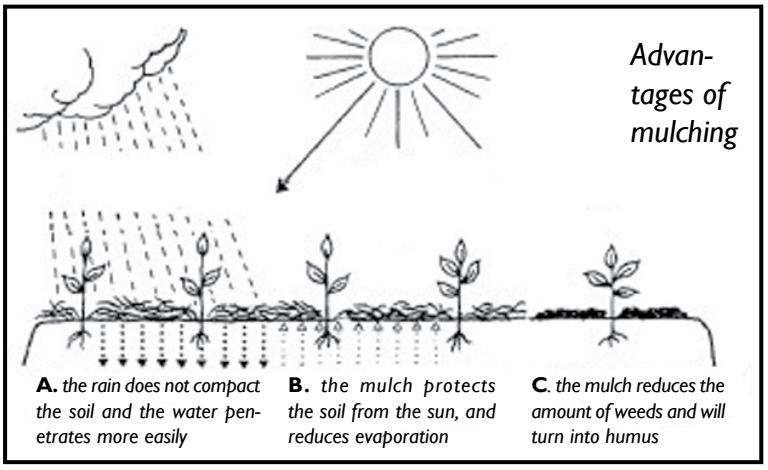
The following planting guidelines (from Conservation Farmers Union) apply for Zambia. It applies to all of them that the farmer must select the correct variety for the area:

- Maize: plant 4 seeds in each hole after November 15, when at least 50 mm of rain have fallen. Plant the day after heavy rains. Never plant in soil that is getting dry. The hole should not be more than 2.5 cm deeper than the rest of the field.
- Cotton: Fill most of the soil back into the planting hole. Plant a pinch of (5-6) seeds in each end of the holes, very close to or on the surface. Plant in dry soil from mid October.
- Pigeon pea, cowpea, gram: Plant after a good shower of rain into moist soil. The area should be kept free of weeds which means that the farmer sometimes needs to weed before planting! Plant 5-6 seeds across the hole at a depth of 2.5 cm.
- Groundnuts: Groundnuts should be planted on lighter sandy soils. Plant as early as the rains allow. Plant 8-10 nuts across the hole, at a depth of 2.5 cm.
- Soya beans: Soya beans should be planted December 15-30. Plant into moist soil after a good shower of rain. After backfilling, plant 10- 12 seeds across the hole at a depth of 2.5 cm.
- Sorghum: Sorghum should be planted December 1-15. Plant 5-6 seeds at each end of the planting hole after a good shower of rain and cover with 2.5 cm of soil.
- Sunflower: Sunflower should be planted December 1-15. Plant 2-3 seeds at each end of the planting hole after a good shower of rain. Sunflower should not be planted deeper than 2 cm. Otherwise germination will suffer.

Water accumulates in the holes

5. Thinning

Thin the crop early when the plants are 7.5 cm or smaller. Late thinning will disturb the surviving plants. Cotton should be thinned to 2 plants at either side of the planting hole, so that there are 4 cotton plants in each hole. Thin the weakest plants out, leaving a space between the plants you choose to

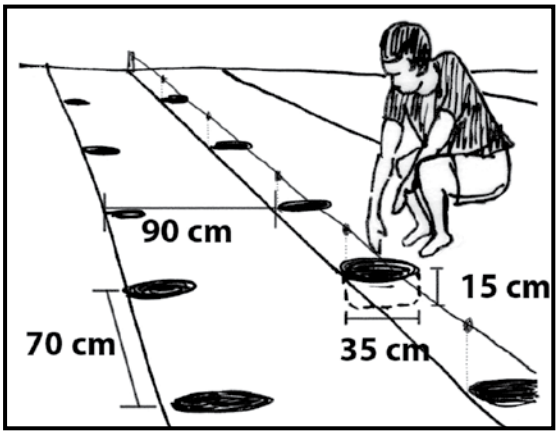


A. *the rain does not compact the soil and the water penetrates more easily*

B. *the mulch protects the soil from the sun, and reduces evaporation*

C. *the mulch reduces the amount of weeds and will turn into humus*

Advantages of mulching



Use the same distances and use the same holes every year

grow. Maize should be thinned to 3 plants per hole. However, if only 2 plants have emerged in a hole, leave 4 plants in the next one to compensate. If germination is poor, it may be necessary to supply extra seeds. The earlier this is done the better. No thinning is recommended for other crops as long as planting has been done correctly.

6. Pot holing

If the early rains are poor, pot holes should be dug in the areas between the rows. The holes should be dug one metre apart and be the same size as the planting holes. Pot holes help to hold rainfall and let it infiltrate into the soil. After 3 or 4 rains they will fill up with soil, but by this time they have done their job.

7. Topping maize

When the maize plants are mature (not the cobs), it is a good idea to top the stalks just above the cobs. Drop the tops in the area between the rows. This will speed up drying and reduce damages from termites and wind. Termites will harvest the toppings rather than attacking the crop. Some farmers believe that residues attract termites. This is correct, but the termites harvest the residues rather than attacking the drying crop. This happens when the ground is bare.

8. Ripping

A farmer can carry out minimum tillage using a ripper. A ripper does not turn around the soil, but loosens the soil in a furrow, in which the crop can be planted. This work can be done in the dry season, since it is not so heavy to pull as a plough. This enables the farmers to plant early. The ripper does not get disturbed by the residues lying on the ground. This methods is also promoted in areas with less rain.

9. It is important to remember

Do crop rotation. If you plant maize on the same land every year, diseases will appear.

Leave at least 1/3 of the residues on the field. Talk to your neighbours in order to avoid animals from eating all the residues.

Get extra workforce for tilling the land and it will become more fertile year after year - so do not give up if your first experience is not great.

Drawings and text adapted from the Zambian Conservation Farmers Union and DAPP Zambia