

Session 12: MINIMUM TILLAGE

Objective

1. To know why and how to avoid the hard pan.
2. To know how to use a ripper and prepare planting holes.
3. To know how to combine minimum tillage with pot holing and mulching.

Are you familiar with the word minimum tillage?

Tillage is preparing your land for planting. In conventional agriculture this includes ploughing. What could minimum tillage mean?

Minimum tillage to avoid the plough pan

Minimum tillage basically means reducing tillage to the minimum. Instead of ploughing whole fields, you open up only a planting line or a planting hole for your seed. In other words, this means planting crops without using the conventional moldboard plough. Now, why is it recommended to change from conventional ploughing to minimum tillage?

When ploughing, the soil is cut, moved and turned. The plough cuts through the soil and the pores under the share get closed. The fine particles from ploughing move downwards and complete the closing of the pores. The trampling of the draught power will also compact the soil. The problem of closed pores is most severe in moist soils.

After a while a plough pan is formed which prevents water and roots penetrating into the soil. The pan has almost no air pores. The pan

gets thicker and harder after each ploughing. Soon the plough will slide on top of the pan. The plough pan formed by an ox plough is found between 5 - 10 cm below the surface. For a tractor disc plough, the pan is found between 10 - 20 cm below the surface.



**List some of the advantages of ploughing.
List the disadvantages. Read the text below. Have
you experienced these negative effects of ploughing?**

Problems with plough pans

Conventional ploughing promotes the development of artificial drought situations. After 2 to 5 cropping seasons, a shallow, highly drought-sensitive and low-yielding cropping system develops on top of the plough pan. Crops growing on soil with plough pans have poor root systems and have difficulties in finding nutrients lower in the soil. Aggressive weeds can have devastating effects on shallow crops with poorly developed root systems and with an inability to absorb nutrients. Another problem of the plough pan is the lodging (falling) of tall crops. Crops fall because their root systems are too shallow to support them.

A soil with a plough pan quickly becomes saturated with water. This means that the soil cannot hold much water and even small amounts of rainfall can cause run-off. So instead of the water trickling down to the roots, it runs on top of the soil. This is why a plough pan results in very poor utilization of rainwater. Another serious problem is the loss of crop nutrients dissolved in the runoff water.

Solution to the plough pan

The hard pan can be broken by the use of rippers. We will discuss the Magoye ripper and planting holes (or basins).

Benefits of minimum tillage

Using a ripper or a hoe allows you to prepare the land and plant earlier. Instead of waiting for the first rains to be able to plough you can prepare planting lines or holes just after harvest or at least before the rainy season starts. Doing so, you may plant immediately when rains are established. And, you may spread your work load over several months instead of having to do it all at once when rains come.

Since minimum tillage is a precise way of planting, it will concentrate water and nutrients to where it is needed, to the growing seed. You will actually do a bit of water harvesting since rains concentrate in the holes.

You are able to put seeds and any compost with greater precision. Also, when using the same lines or holes year after year, you are likely to improve the structure and fertility of the soil below the hole or line. If one crop for instance does not use all nutrients applied, these nutrients can be used by the following crop. You can also plant deep rooting crops in rotation with weaker rooting crops. The stronger roots will then make root channels for the weaker rooting crop, and pull nutrients from below.



A ripper allows you to plant with a minimum of land preparation

By not disturbing the soil in between the lines or holes, and by weeding thoroughly during the first years, you will eventually have a weed free field (or at least a field less weedy).

Planting lines with the Magoye ripper

The Magoye ripper is ideal as it can be used for making planting lines. It also requires less draught power than a standard plough. The ripping should be done in the dry season to maximize breaking of the soil. With a Magoye ripper, two runs on the same line should be done to ensure that the hard pan is broken. The seed will later be sown in the lines so that the plant roots can penetrate into the deep soil through the broken pan. The ripped lines will also increase infiltration of water. The lines should be placed at 75 - 90 cm intervals, so inter row weeding can be done later. This means that a weeding yoke of 150 - 180 cm should be used. Always rip across the prevailing slope.

The Magoye ripper has the advantage of making parallel lines of even depth allowing for even germination. It can also facilitate early planting, and be used for weeding, making ridges and aerating the soil.



Share your experience of using the Magoye ripper or other rippers. Would it be a good idea to buy a Magoye ripper as a group to share during planting? What else can you use to open up planting holes? How about a hand hoe?

Planting holes (planting basins or potholes)

Planting holes is a good alternative to planting lines. Planting holes are permanent holes which means that you will spend much time preparing holes the first year but then in the following years your work load will reduce since the holes are already dug. Note that the holes are hard to dig unless done immediately after harvest.

Step-by-step directions for planting holes

1. Remove weeds.
2. Use a string to evenly space out the holes. Take your time measuring the exact spot for the hole since these holes will be permanent.

The distance will depend on the crop or tree. A rule of thumb is 30-40 cm between holes in the same row, and 90 cm between rows.

3. Dig planting holes with a hoe. A good size is 35 cm long and 15 cm wide. Depth will depend on the particular crop.
4. If available, apply manure or compost in the holes and cover with soil.
Use a measuring cup for the right amount.
5. There are different recommendations for planting different crops. Maize for instance can be planted dry and deep. Most other crops should be planted in moist soils. For these crops you:
 - Wait for the first rains. When the soil is moist, drop the seeds in the planting holes and cover with soil. Cover the seeds with enough soil so that it can emerge properly.

- A rule of thumb is to plant the seed twice as deep as it is wide. If you plant the seed too deep the seedling will die before it emerges. If you plant the seed too shallow the soil may become too dry and the seed might die.
 - After planting, the soil in the hole should be less than 2.5 cm below the surface.
 - You may plant 2-12 seeds in each hole depending on the crop. See Page 66.
6. Weed as soon as weeds appear.
 7. If you have planted maize or cotton, these should be thinned. Leave the 3 strongest maize plants per hole, or the 2 strongest cotton plants at one station (which means 2 at each end of the basin).
 8. If early rains are poor, dig pot holes in between the rows. Dig them 1m apart and as big as the planting holes. These holes will harvest the rain and let it infiltrate into the soil.
 9. Continue weeding. Although weeds may not compete with the existing crop, it is important to remove also the late weeds before they develop and drop their seeds. If they do, you will have more weeds to remove the following year.

How many seeds to plant and at which depth

Crop	Row spacing	Seeds per basin (Basin are 30cm long, 20cm deep, the width of a hoe and 40cm apart)	Seeds per meter in Magoye rip line	Planting depth
Maize	75 to 90cm	3-4 along the basin	4-5 per m	5cm
Cotton	90 to 100cm	4-6 at either end (thin to 2 at each end)	4 seeds per station, thin to 2 every 25-30cm	On the surface of the soil (1.5cm)
Cowpea and gram	50 to 60cm	5 seeds per basin	1 seed every 15 to 25cm	2.5cm
Pigeon pea	100cm	1 seed at either end of basin	1 seed every 60cm	2.5cm
Soybeans	50 to 75cm	10 along the basin	30-40 seeds per metre	2.5-3cm
Ground-nuts	75 to 90cm	4-6 along the basin	8-10 per m	2.5-5cm
Sorghum	50 to 75 cm	10-12 along the basin	A pinch of 5-6 seeds at each 25cm	2cm
Sun-flower	70 to 90cm	2 seeds at each end of the basin	1 seeds every 25-30cm	2-3 cm



I. What could be the benefits of combining minimum tillage with mulching?

Hard work?

From a study on Conservation Farming in Zambia, some farmers complained of higher labour requirements in both weeding and field preparation when using planting holes. One farmer said that labour demands caused him to lose a lot of energy and grow thin. Another said that the hard labour of digging holes reduces the lifespan of an individual. More experienced farmers agree that you will find that digging holes is difficult in the first year. But you will also find that land preparation declines substantially in later years. While first year farmers require an average of slightly over 70 person-days to prepare a hectare of planting holes, a fifth-year farmer requires about half those days. By maintaining permanent planting holes, farmers not only concentrate soil fertility but also reduce land preparation in the following years.

Source: Haggblade S. and Tembo G., 2003

Step-by-step for planting with mulch

1. Leave crop residues on the surface as mulch after harvest.
2. Open up planting lines with a ripper or planting holes with a hoe.
3. Apply manure or compost in the planting lines or holes.
4. Plant seed and cover with soil.



Remember that good practices can be combined for an even better effect