

5. Land preparation

Land preparation often costs the highest amount of labour and time particularly if carried out by hand. Weeds that germinate and grow before planting are often the major reason why farmers need to plough or till their fields before planting. Traditionally land preparation is the operation of tilling the land by turning over the soil that leads to a fine weed free seedbed that is suitable for planting crops. Conventional tillage using hoes, ox-drawn or tractor drawn ploughs often results in excessive soil erosion and loss of water. However the turning over of the soil through tillage incorporates organic materials usually left on the surface and accelerates their decomposition which results in the release of soil nutrients such as nitrogen, potash and phosphorus, making them available to crops. Yet soils loosened using conventional tillage often quickly get compacted resulting in higher run-offs leading to soil erosion.

Where farmers must till their land, it is recommended to plough down to a depth of 20-25 cm to create a fine seedbed into which seeds may be planted. Preparing a conventional maize seed bed by hand using hoes requires about 8 -10 days of manual labour per hectare compared to 8 -10 hrs per ha using oxen and 4 - 4.5 hrs per ha using a tractor. Farmers who try to prepare their land at the onset of the season thus always find themselves not being able to plant on time. Land preparation should therefore be started well before the onset of the crop season so that all fields are ready for planting by the start of the wet planting season. For this reason, practices such as conservation agriculture help to reduce the energy demands associated with land preparation.

Conventional tillage

Land that is tilled annually often suffers a lot from erosion particularly if it lies on sloppy areas. To ensure erosion and water losses through run-off are minimized, it is important to ensure tillage operations are carried out across the main slope. Although commonly practiced by many farmers in Eastern and Southern Africa, important measures that can help reduce soil degradation include the following:

1. Ploughing or tillage should run across the main slope to reduce the loss of both soil and water
2. On sloppy ground, farmers should install mechanical barriers commonly known as channel terraces, contour ridges or use grass or hedge strips at intervals of 20 to 40 m depending on slope. The main objectives behind the use of mechanical channel terraces are to reduce the slope length and minimize soil erosion, and to intercept the runoff and divert it to a safe point. The common structures used in the region include level channel terraces or contour ridges *Fanya Juus* and *Vetiver* or *other grass strips*.

However, to be sustainable, conventional tillage should be used in conjunction with biological erosion control methods and intercropping with effective cover crops such as cow peas and pumpkins, which can help protect the soil from erosion. Crop rotations and fallowing could also be used to enhance soil fertility. The major advantages and disadvantages of the conventional ploughing techniques are as follows:

Advantages

- Provides for less troublesome performance of cultural operations
- Results in greater soil nutrient mineralization
- Distributes soil nutrients throughout the soil
- Enables effective weed control at planting
- Exposes pests to predators and unfavorable conditions
- Aerates the soil

Disadvantages

- Leaves a surface susceptible to splash and sheet erosion
- Results in high nutrient leaching
- Smooth surface susceptible to crusting
- Results in a decline in soil organic matter content and increases erosion
- Results in a limited rooting volume due to high resistance layer (plough pan) formed at shallow depths.
- Requires high draft power
- High moisture loss
- Disrupts the lifecycle of beneficial soil organisms
- Needs more labour cost for the soil preparation

Conventional tillage is best used on relatively flat land where erosion risks are minimal, and on fields where weeds are a serious problem. It may also be used to incorporate manure and crop residues as well as where fertility management is possible through application of organic and inorganic fertilizers.

Conservation Agriculture

The Conservation Agriculture (CA) started in 1930s in the United States following a severe soil erosion crisis in the Mid-West which became known as the 'Great Dust Bowl' and later spread to South America, Australia and into Africa. In Africa, use of CA started in the 1970s in Zimbabwe and then to Zambia, Malawi and elsewhere. CA is premised on three key principles: minimum soil disturbance, provision of permanent soil cover and the use of rotations or associations (Figure 5.1). These CA principles are applicable to a wide range of crop production systems from low-yielding, rainfed conditions to high-yielding, irrigated conditions. However, the techniques used may vary from place to place

depending on farm power, system management conditions and farmer circumstances. CA is based on the principles of rebuilding the soil, optimizing crop production inputs especially labour, and optimizing profits. The combined social and economic benefits gained from combining production and protecting the environment under CA, including reduced input and labour costs, are greater than those from production alone. With CA, farming communities become providers of more healthy living environments for the wider community through reduced use of fossil fuels, pesticides, and other pollutants, and through conservation of environmental integrity and services.

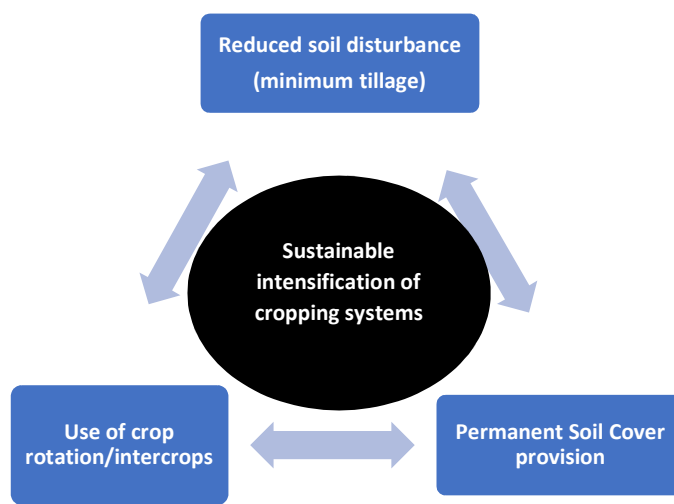


Figure 5.1 The three principles of conservation agriculture

Other complementary principles also often known as good agronomic practices (GAPs) governing the implementation of CA comprises of (i) timely implementation: carrying out all operations at the best time of the year (preparation, planting, manuring and fertilization, controlling weeds and pests), (ii) precise operations: paying attention to detail and doing all tasks carefully and completely, and (iii) efficient use of inputs: not wasting any resources including labour, time, seeds, stover, manure, fertilizer and water. Other techniques such as the tied ridging system are often used by farmers who cannot apply residues as surface cover in CA.

Tied ridging

Tied ridging is a system of constructing ridges and furrows with cross ties at 2 to 3 m intervals along the furrows that help to reduce run-off along the furrows for maximizing water infiltration as well as for harvesting water in rainfed cropping systems. Ridges 15 to 20cm high are normally constructed across the slope at crop row spacings of 75 to 90 cm. Crops are planted on the ridges to maintain the same plant populations as for the flat planting systems. This system is known as banking in Malawi and other Southern African countries.