

Are reduced tillage practices suitable for growing maize?

Maize has been grown under conventional agricultural practices for centuries. The basis of conventional tillage is annual plowing or tilling of the soil, but this is usually supplemented with a number of other practices, including the removal or burning of soil residues, land leveling, harrowing, fertilizer application and incorporation, inter-row cultivation, etc. All of these practices cause soil disturbance, compaction, and deterioration. Consequently, **in many areas conventional agriculture has led to a decline in crop yields and profitability.**

Plowing causes the rapid breakdown of soil organic matter. The soil collapses and compacts, reducing aeration and the number of soil organisms. The topsoil becomes susceptible to erosion and water runoff, so that after heavy rainfalls a great deal of soil is lost and little water is retained, leading to shallow and infertile soils which are no longer able to produce good yields. The cost of production also increases as the farmer needs to apply more fertilizer and use fuel to plow his lands.

Conservation agriculture (CA) is one possible answer to the deterioration caused by conventional farming practices. It encourages soil protection and care through reduced tillage practices and the maintenance of surface residues. This minimizes soil disturbance, encourages build-up of organic material, preserves the soil structure, and conserves soil water. Conservation agriculture is radically different from the conventional farming practices. Therefore, if farmers are to successfully implement the system, a change to their entire mindset is necessary.

Under conservation agriculture, the number of tillage operations is reduced or entirely

eliminated (zero-tillage). Direct sowing is used. Cultivation of green manure (e.g. legumes) is encouraged to enrich the soil. Instead of hoeing to remove weeds, cover crops and residues help to smother emerging weeds. After harvesting, crop residues are left on the land. Crop rotation and intercropping are encouraged in order to break-up pest cycles and to avoid soil exhaustion from continuous monocropping. **Conservation agriculture has led to maize crop yield increases and greater profitability as production costs are reduced.**

When changing from a conventional tillage system to a reduced tillage system the following should be done:

- It is recommended that farmers start CA in a small area to learn the system and gain confidence. The success of the system depends more on the farmer's actions than on the inputs applied. It is therefore crucial for a farmer to experiment and find practices that suit the soil conditions of the area.
- Gather information on the system by talking with other farmers who have adopted conservation agriculture, discussing the system with extension agents, and obtaining relevant literature.
- Plan how to implement CA methods before the harvest of the current crop. Consider what to do with the residues, how the crop will be planted, which fertilizers to apply, and which varieties and rotations to use.
- A suitable field should be chosen. Start with a good, fertile field with no serious weed problems.
- Rectify any compaction or hardpan problems caused by previous plowing operations. Loosening the soil will allow the crop roots to penetrate deeper into the soil and obtain more nutrients and water. *A tine*

ripper is a chisel-shaped implement pulled by animals or a tractor. A *subsoiler* looks like a ripper but works at a greater depth and has a narrower but longer blade. It is used to break up hardpans and operates at a depth of 20 – 30 cm below the soil. If the farmer does not have access to a tine ripper or a subsoiler he can use a hoe to loosen the soil.

- If a field has ridges from the previous season these might make it difficult to use direct (zero-till) planter machines, but pose no problem to hand planting. In fact, ridges that are aligned with contours of the field are useful for water and soil conservation and should be maintained, if possible.
- If the farmer has access to soil testing services, the soil pH and fertility status should be checked. Ideally, the soil pH should be at least 5.5. If the soil is acidic, lime should be incorporated prior to CA adoption.

Different tillage methods for planting maize

The method that the farmer uses to plant maize depends on the size of his land and the resources available. A number of options are available.

- **Planting basins** – these are small shallow holes dug in the ground along the rows. They are about the size of a man’s foot and as deep as his hand. These can be dug during the dry season to enable timely planting. A string with marks on it is used to space the holes in the field. The planting spaces are determined by the rainfall in a particular area and the best planting population of the crop being grown. Fertilizer, manure and lime can be placed in the basin. Maize seeds should be planted at a depth of 2.5 cm and separated from the fertilizer in the basin.
- **Ripping and planting** – a tine ripper opens a narrow slit or furrow in the soil surface along the rows of the intended crop. Manure and fertilizer are applied in the furrow,

either in a continuous band or in small heaps at the ideal spacing for the crop. Seeds are planted directly into the furrow by hand at the ideal spacing or with a mechanical planter. For maize, the ripped planting lines should be 75 to 90 cm apart. If there is a lot of residue on the field it can be difficult to use a ripper. This can be overcome by using a special cutting blade attached to the ripper.

- **Direct seeding** – Seeds are planted directly into the soil with a mechanical sowing system. In its simplest form, a small planting hole is made with a planting stick or hoe into which the seed is placed. Alternatively a “jab planter” can be used. This is a simple, hand-operated instrument that pushes the seed through the mulch into small planting holes. Some jab planters have two hoppers, one for seed and one for fertilizer, so that fertilizer and seed may be applied in one operation. Another way in which direct planting can be achieved is with the use of a direct (zero-till) seeder. These may be single-row animal drawn machines, or multi-row tractor operated machines. These implements sow the seeds directly into the soil through the mulch, and most of these seeders can also apply fertilizer at the same time. Direct seeders are very efficient and cause very little soil disturbance, but sometimes it is difficult to achieve uniform seeding depths if the machines are not operated carefully.

Conservation agriculture using reduced tillage and maintaining crop residues on the soil surface is a means of promoting sustainable farm livelihoods. Reduced tillage is a completely different approach to farming compared to conventional agriculture, and requires thoughtful adoption. Overall, maize grown with conservation agriculture can be highly productive and economically viable.