

# Soil tillage methods

Soil is one of the most important elements of an ecosystem, and it contains both biotic and abiotic factors. Soils perform storage functions and have the ability to convert organic material into nutrients only with the addition of water, oxygen and soil organisms, thereby helping to regulate the circulation of substances and protect and restore groundwater. Soil is a non-renewable and non-reproductive source - it can take centuries and even millennia for new soil to form. Agricultural productivity is inevitably declining, and in some cases the destruction of ecosystems is irreversible. This undermines both food security and economic development and has a direct impact on rising hunger and poverty.

## Conventional tillage

The cultivation of the soil using plough harrow and other farm tools or mechanical implements to prepare the field for crop production.

### Advantages

- Destroys pests' shelters and disrupts their lifecycles
- Exposes pests to predators and unfavorable conditions
- Distributes soil nutrients throughout the soil
- Aerates the soil
- Controls weeds
- Makes other farm cultural practices easier to undertake

### Disadvantages

- Destroys the soil cover and its structure
- Enhances soil erosion
- High moisture loss
- Disrupts the lifecycle of beneficial soil organisms
- Needs more labor cost for the soil preparation



Plough



Plowing the field



Leveling the seedbed by harrow  
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## Conservation tillage

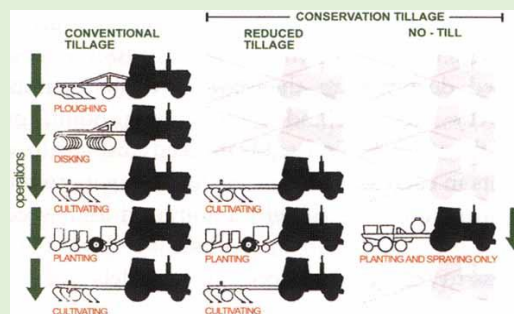
The planting or sowing in the previous crop's residues that are purposely left on the soil surface. Zero tillage (no-till, minimum tillage, or direct seeding), ridge tillage and mulch tillage are methods of conservation tillage.

### Advantages

- Conserves water. The mulch reduces water to evaporate.
- Reduces erosion because the topsoil is protected.
- Reduces soil compaction.
- Protects impact from rain and wind.
- Improves the soil condition with the increased organic matter content.
- Lessens the overall production cost.

### Disadvantages

- Needs a thorough understanding of the concept and requires careful farm management practices to be successful.
- Weeds compete with the main crops.
- It needs patience and waits a longer time to have an excellent soil.



Source: FAO, 2003. On-farm trials for adapting and adopting good agricultural practices

## Minimum tillage

No-till farming or reduced-till seed bed preparation is a prerequisite and a logical technology for intercropping because it preserves soil water content. The residues of the crops provide organic matter and moisture as well as increases the physical properties of the soil.

Hence, it becomes more common to use minimum tillage approaches and mulch seeding methods, aiming at minimal soil manipulation. Both methods are characterized through flatter, non-turning tillage methods. With view to mulch seeding method, in addition to minimal tillage practices, the biomass of the previous planted crop e.g. green cover crop will be left on the soil surface before and after sowing. Both methods have positive effects on soil life and foster the presence of earthworms and other animals in the soil and increase the organic matter of the soil. At the same time, it decreases soil disturbance and improves soil aggregate stability and hence also reduces the risk of erosion and surface runoff. It also is an effective method to increase soil water holding capacity.

Objectives of the implementation of the minimum tillage:

- Reduction of energy
- Increase of soil organic matter
- Reduce GHG



Chopping of biomass



Implementing ripper



Implementing disk harrow  
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Plowing consumes a lot of non-renewable energy by the pulling tractor. The reduction of this energy is the most obvious target of reduced till cultivation. Studies on the effect of no-till or reduced-till consider a reduction of energy consumption of 10-20% to be realistic. Reduced-tillage or no-tillage soil cultivation is one of the pillars of a sustainable soil health and soil fertility strategy. Plowing changes, the natural layers of soil and increases denitrification of the soil causing GHG emissions. At the same time reduced-till increases soil organic matter by not disturbing the natural structure and conserving the microorganisms.

During the pilot activities, a minimum cultivation method is applied, and field days were organized for small farmers. Kurdamir Regional Agrarian Science and Innovation Centre was recommended to apply the minimum cultivation method.

Indicator	Target and unit	Source of information
Energy consumption during soil cultivation	Minus 20% of non-renewable energy consumption	Records at the farm
Soil organic matter	+ 0,4 % increase of soil organic matter per year	Soil analysis
GHG emissions	Minus 10% of GHG emissions	Records at the farm

## Challenges and Learned lesson

- Farmers have less information about minimum tillage and its benefits
- Challenge in finding the machineries for minimum tillage
- Monthly rent prices are not affordable for farmers
- Due to the high cost of machineries farmers have difficulties obtaining them
- Organization of mass demonstration field days for farmers in each district on the use of minimum cultivation techniques as awareness-raising measures

### References

- GIZ, 2016. Modules on Sustainable Agriculture (MOSA)
- FAO, 2003. On-farm trials for adapting and adopting good agricultural practices
- [http://www.cisat.org/control\\_methods/cultural\\_practices/soil\\_tillage.html](http://www.cisat.org/control_methods/cultural_practices/soil_tillage.html)
- <http://www.cropwatch.unl.edu/>