

Tillage Systems

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INTRODUCTION

Tillage is usually defined as the mechanical manipulation of soil aimed at improving soil conditions affecting crop production. Soil tilth is generally used to describe the fitness of a soil to grow plants. Tillage is the cause and tilth is the effect. Tillage process involves a series of primary and secondary operations. Primary operations are done to break soil surface into clods and secondary operations are done to pulverize, repack and/or smoothen soil surface. Tillage is done to achieve three objectives viz. preparation of seed bed with optimum tilth, weed control and reduction of mechanical impedance to root growth.

Types of Tillage Systems

- (I) Conventional tillage systems
- (II) Conservation tillage systems

(I) Conventional tillage systems

These involve maximum tillage operations and these are primary tillage operations and secondary tillage operations. Primary tillage operations include cutting and loosening of soil and incorporating crop residues/stubbles into the soil whereas secondary tillage operations are done for pulverization and compaction of pulverized soil, sowing, weed controlling and intercultural operations.

(II) Conservation tillage systems

Conservation tillage is an umbrella term and covers all tillage systems that are less intensive than the conventional tillage. According to Conservation Tillage Information Center (CTIC,1993), Indiana, USA, conservation tillage is defined as tillage and planting system in which at least 30 % of the soil surface is covered by plant residues after planting to reduce erosion by water and wind.

Types of conservation tillage systems

- (i) Zero tillage/no-tillage (slot planting)
- (ii) Mulch tillage
- (iii) Strip or zonal tillage
- (iv) Ridge till (including no-till on ridges)
- (v) Reduced or minimum tillage

(i) Zero tillage/ No-tillage

The zero tillage system is a specialized type of conservation tillage consisting of a one-pass planting and fertilizer operation in which the soil and the surface residues are minimally disturbed. The surface residues of such a system are of critical importance for soil and water conservation. Weed control is generally achieved with herbicides or in some cases with crop rotation. Zero tillage system excludes all pre-planting mechanical seedbed preparation except for the opening of a narrow (2-3 cm wide) strip or small hole in the ground for seed placement to ensure adequate seed/soil contact. The entire soil surface is covered by crop residues. Zero tillage is best option for conserving moisture in dry land areas. A major disadvantage of zero tillage is its heavy use of herbicides for weed control.

(ii) Mulch tillage

Mulch tillage techniques are based on the principle of causing least soil disturbance and leaving the maximum of crop residue on the soil surface and at the same time obtaining a quick germination, and adequate stand and a satisfactory yield. A chisel plough can be used in the previously shredded crop residue to break open any hard crust or hard pan in the soil; care should be taken not to incorporate any crop residues into the soil. The use of live mulch and crop residue in situ involves special

mulch tillage techniques or practices. In situ mulch, formed from the residue of a dead or chemically killed cover crop left in place, is generally becoming an integral component of mulch tillage techniques.

(iii) Strip or zonal tillage

The seedbed is divided into a seedling zone and a soil management zone. The seedling zone (5 to 10 cm wide) is mechanically tilled to optimize the soil and micro-climate environment for germination and seedling establishment. The interrow zone is left undisturbed and protected by mulch. Strip tillage can also be achieved by chiselling in the row zone to assist water infiltration and root proliferation.

(iv) Ridge tillage

In this system, the soil is scraped and concentrated in a defined region to deliberately raise the seed bed above the natural terrain. In this system crops may be grown on ridges or in furrows depending on moisture status of soil.

(v) Reduced or minimum tillage

This system is less intensive than the conventional tillage and attempts are made to minimize tillage operations by eliminating one or more tillage operations from a conventional tillage system but meets the 30% residue requirement. Primary and secondary tillage operations are generally combined together. Land preparation and seeding is completed in one operation. Only those tillage operations are performed that are absolutely necessary for crop production under a given set of soil, crop and climatic conditions.