Lecture No – 8 Tillage

Tillage, objectives of tillage, classification & types of tillage, Tillage implements

Tillage It is a mechanical manipulation of soil to provide favorable condition for crop production. Soil tillage consists of breaking the compact surface of earth to a certain depth and to loosen the soil mass, so as to enable the roots of the crops to penetrate and spread into the soil. Tillage may be called the practice of modifying the state of soil to provide favorable conditions for plant growth. Tillage operation is most labour consuming and difficult operation, compared to all subsequent operation in the field.

Objective of tillage

1. to obtain deep seed bed, suitable for different type of crops.

2. to add more humus and fertility to soil by covering the vegetation.

3. to destroy and prevent weeds.

4. to aerate the soil for proper growth of crops.

5. to increase water absorbing capacity of the soil.

6. to destroy the insects, pests and their breeding places and

7. to reduce the soil erosion.

Classification and types of tillage: Tillage is divided into two classes: 1. Primary tillage, 2. Secondary tillage

Primary tillage: It constitutes the initial major soil working operation. It is normally designed to reduce soil strength, cover plant materials, and rearrange aggregates. **The operations performed to open up any cultivable land with a view to prepare a seed bed for growing crops in known as Primary tillage. Implements may be tractor drawn or animal drawn implements. Animal drawn implements mostly include indigenous plough and mould-board plough. Tractor drawn implements include mould-board plough, disc plough, subsoil plough, chisel plough and other similar implements.**

Secondary tillage: Tillage operations following primary tillage which are performed to create proper soil tilth for seeding and planting are Secondary tillage. These are lighter and finer operations, performed on the soil after primary tillage operations. Secondary tillage consists of conditioning the soil to meet the different tillage objectives of the farm. The implements used for secondary tillage operations are called Secondary tillage implements. **They include different types of harrow, cultivators, levelers, cited crushers and similar implements. These operations are generally done on the surface soil of the farm. Secondary tillage operations do not cause much soil inversion and shifting of soil from one place to other. These operations consume less power per unit area compared to primary tillage operations. Secondary tillage implements may be tractor drawn or bullock drawn implements. Bullock drawn implements include harrows, cultivators, hoes etc.**

Objectives of Secondary Tillage operations:

1. To pulverize the soil of seed beds in the field.
2. To destroy grasses and weed in the field.
3. To cut crop residues and mix them with soil of the field.
4. To break the big clods and to make the field surface uniform and leveled**.**

Types of Tillage: There are various types of tillage

Minimum Tillage - It is the minimum soil manipulation necessary to meet tillage requirements for crop production.

Strip Tillage - It is a tillage system in which only isolated bands of soil are tilled.

Rotary Tillage -It is the tillage operations employing rotary action to cut, break and mix the soil.

Mulch Tillage -It is the preparations of soil in such a way that plant residues or other mulching materials are specially left on or near the surface.

Combined Tillage -Operations simultaneously utilizing two or more different types of tillage tools or implements to simplify, control or reduce the number of operations over a field are called combined tillage.

Difference between tools/Implements/Machines:

Tool - It is an individual working element such as disc or shovel.

Implement - It is equipment generally having no driven moving parts, such as harrow or having only simple mechanism such as plough.

Machine -It is a combination of rigid or resistant bodies having definite motions and capable of performing useful work. Secondary tillage consists of conditioning the soil to meet the different tillage objectives of the farm. The implements include different types of harrow, cultivators, levellers, clod crushers etc.

Implements for Primary Tillage

Plough – The main implement for primary tillage is plough**. Ploughing is the primary tillage operations, which are performed to cut, break and invert the soil partially or completely. Ploughing essentially means opening the upper crust of the soil, breaking the clods and making the soil suitable for sowing seeds.**

The purpose of ploughing can be summarized as below:

Objective of tillage :

1. to obtain deep seed bed, suitable for different type of crops.

2. to add more humus and fertility to soil by covering the vegetation.

3. to destroy and prevent weeds.

4. to improve the soil aeration.

5. to increase water holding capacity of the soil.

6. to destroy the insects, pests and their breeding places and

7. to prevent the soil erosion.

Normal Ploughing: It is the ploughing up to a depth of about 15 cm.

Contour ploughing: It is the method of ploughing which the soil is broken and turned along the contours.

Types of plough: Different types of plough are used at different place. They may be classified as

1. Indigenous plough
2. Mould board plough
3. Disc plough
4. Chisel plough
5. Sub soiler
6. Rotary plough

CLASSIFICATION OF TILLAGE IMPLEMENTS:

A. <u>According to source of power:</u>

1. **Hand operated**:

Hand Tools- operated by human beings by pulling, pushing or swinging action.

The tool consists of handle of wood and working part of tool, which is made of iron or steel.

Type:

i. <u>Handle Type</u>- spade, showel, hand hoe, Kudal

ii. <u>Wheel Type</u>- Wheel hoe

2. **Animal drawn implements**:

i. Walking type

ii. Riding type

3. Tractor drawn implements:

i. ***<u>Trailed implements-</u>*** **The** implements attached to single hitch point by pin joint; the main body of implement is supported on ground by wheels. Such implements quickly attached or detached from the tractor.

ii. ***<u>Semi mounted implements-</u>*** Rigidly attached to the tractor and has a rear wheel to support part of its weight. Control is very easier.

iii. ***<u>Mounted implements</u>-*** Attached to the tractor with the help of <u>three-point linkages</u> as an integral part, by hydraulically controlled and is kept raised during transport. These implements are easy for turning and are either

B. <u>According to Tillage operation:</u>

1. Primary Tillage Implements-

All ploughs

i. Indigenous plough- Breaking hard pan

ii. Soil turning plough- to cut, pulverize, inverting the soil.

a) Mould board plough

b) Disc plough

2.Secondary Tillage Implements-

I. Harrows-

i. Disc harrow-

a. Single action

b. Double action

c. Offset

ii. Blade harrow-

iii. Other harrows-Guntaka (Improved blade harrow),

Triangular harrows.

II. Cultivators- Inter-culturing in standing crop.

i. Rigid type ii. Spring loaded

III. Hoes- i. Hand hoes ii. Animal drawn hoes

C. Sowing and seeding machine

I. Seed drill- Row to row distance

II. Planter- Row to row and plant to plant distance

D. Sprayers and Dusters:

I. **Sprayers**

i. Hand operated ii. Power operated iii. Air plane

II. Dusters

i. manual operated ii. Power operated

III. **Harvesting machines**

i. Sickle ii. Mower(only cutting – grasses and forages)

iii. Reaper- cuttting and gathering

Harvesting and collecting harvests

IV. **Threshing machine-**

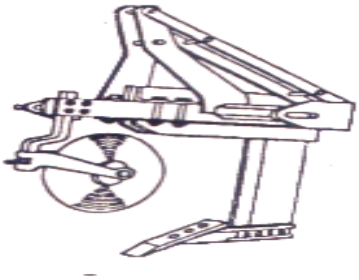
i. Hand operated thresher

ii. Animal drawn iii. Power thresher

Other plough:

1.Chisel plough: To cut through hard soils by means of a number of narrow tynes. It is useful for breaking up hard layer of soil just below the regular ploughing depth. This layer of soil which is called **Hard pan or plough sol**e is very tough and hard.

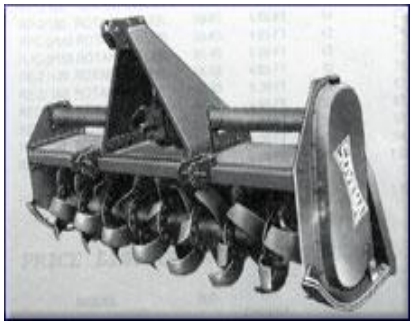
2.Sub Soiler: It is like a chisel plough with a single tyne which penetrate upto the 100 cm depth or more.



3.. Rotary plough/Tiller/rotavator: It is a plough used to cut & pulverize soil by impact forces by means of no. of rotary tynes or knives which are mounted on a horizontal rotar.

It is useful for distributing & mixing organic matter and other material throughout fields.

Rotary plough also called as Rotary tiller. It consists of a power driven shaft on which knives or tynes are mounted. It has got several types of tynes fitted on shaft having a speed of200 to 300 rpm. **One of main problem with this tiller is that tynes are bent or broken in hard ground. For this reason, various shock resisting devices are used on rotary tillers**.



Rotavator

Rotavator (Tractor Mounted)- It is used for seed bed preparation, weed control, mixing of soil with top crop residue and fertilizer and puddling of soil. It is operated by pto shaft of the tractor, attached to the 3-point linkage. The depth can be controlled by linkage and hydraulic system.

Safety guard is provided at the rear.

4.Rotating auger plough: It is a plough with a short plough bottom followed with vertical rotors having blades.

Ploughing of Land: The ploughing of land separates the top layer of soil into furrow slices. The furrows are turned sideways and inverted to a varying degree, depending upon the type of plough being used. It is a primary tillage operation, which is performed to shatter soil uniformly with partial or complete soil inversion.

There are a few important terms frequently used in connection with ploughing of land.

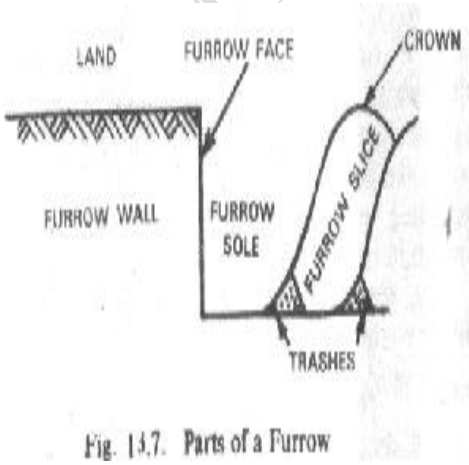


Fig. 13.7. Parts of a Furrow

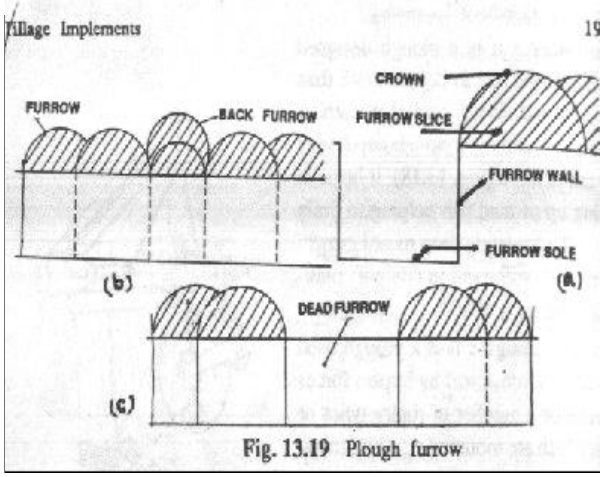


Fig. 13.19 Plough furrow

(i) Furrow -It is a trench formed by an implement in the soil during the field operation (Fig.7 a).

(ii) Furrow slice - The mass of soil cut, lifted and thrown to one side is called furrow slice.

(iii) Furrow wall - It is an undisturbed soil surface by the side of a furrow.

(iv) Crown - The top portion of the turned furrow slice is called crown.

(v) Back furrow - A raised ridge left at the centre of the strip of land when ploughing is started from centre to side is called back furrow. When the ploughing is started in the middle of a field, furrow is collected across the field and while returning trip another furrow slice is lapped over the first furrow. This is the raised ridge which is named as back furrow (Fig.7b).

(vi) Dead furrow - An open trench left in between two adjacent strips of land after finishing the ploughing is called dead furrow (Fig.7c).

(vii) Head land - While ploughing with a tractor to turn, a strip of un ploughed land is left at each end of the field for the tractor to turn, that is called head land. At the end of each trop, the plough is lifted until the tractor and the plough have turned and are in position to start the return trip. The head land is about 6 metres for two or three bottom tractor plough and one metre more for each additional furrow.

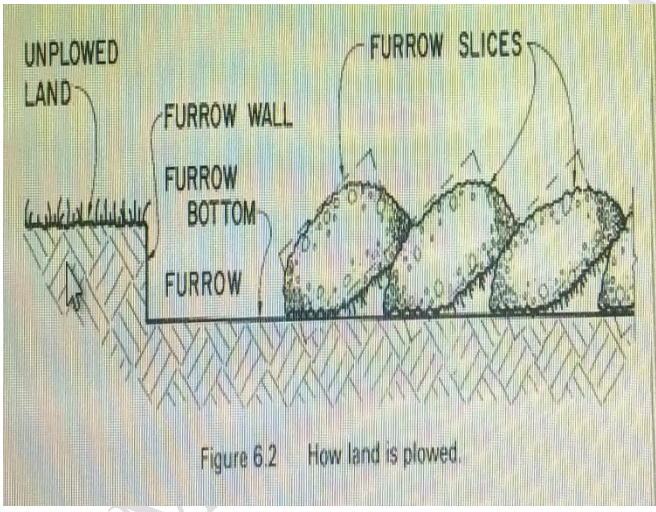


Figure 6.2 How land is plowed.

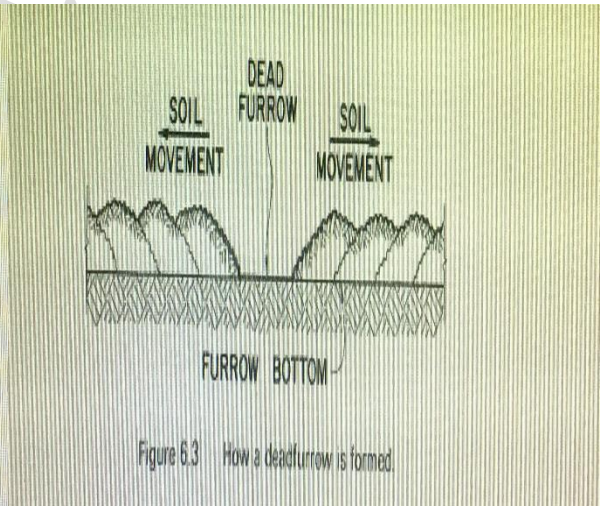


Figure 6.3 How a deadfurrow is formed

Methods of ploughing In order to provide furrows at all times on the right hand side of the plough two method of working are mm used a) Gathering b) Casting.

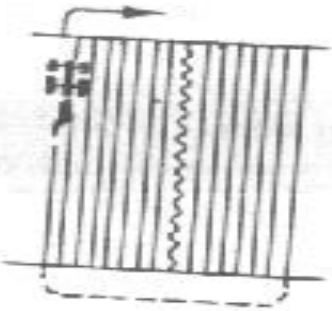


Fig. 13.20 Gathering

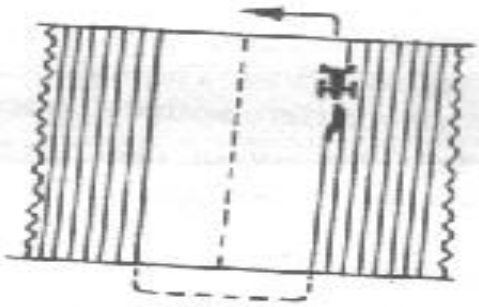


Fig. 13.21 Casting

a) Gathering - Whenever a plough works round a strip of ploughed land, it is said to be gathering.

b) Casting - Whenever a plough works round a strip of unploughed land, it is said to be casting. Ploughing of a field by casting or gathering alone is normally uneconomical. The following are a few important methods used in tractor ploughing.

i) Continuous ploughing method and ii) Round and round ploughing