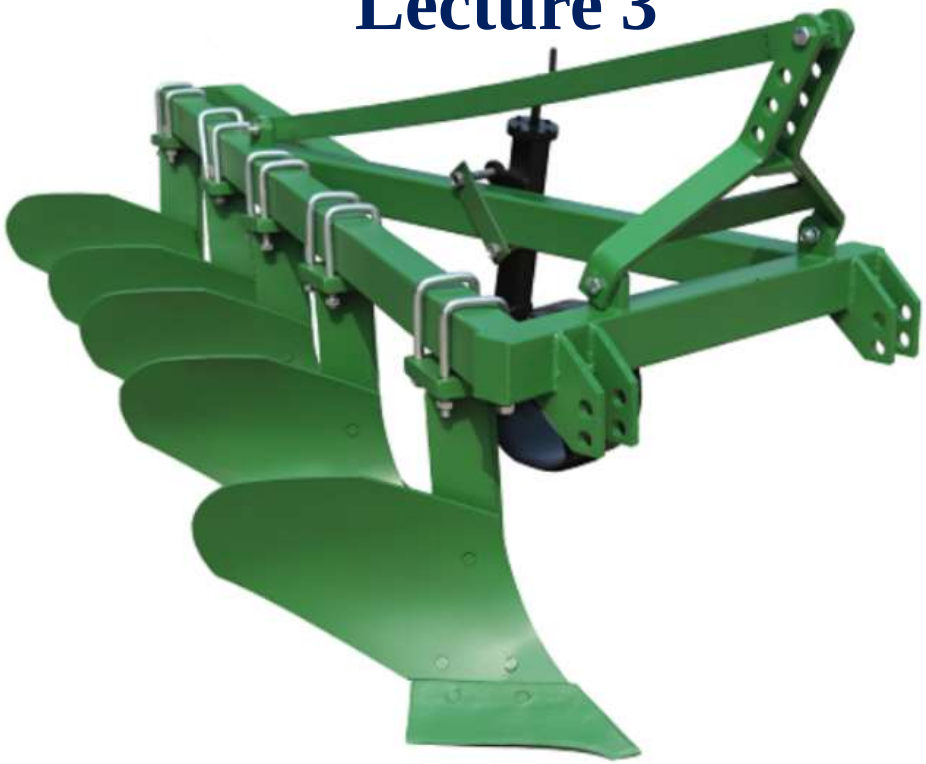
Lecture 3



Primary tillage implements Indigenous plough, mould board plough- components and its accessories, adjustments

Primary tillage: Operations performed to open up any cultivable land with a view to prepare a seed bed for growing crops .

Implements: **TD** - MB plough, disc , subsoiler, chisel & other

AD - indigenous plough and mould-board plough.

Objectives:

- to reduce soil strength
- to cover plant materials
- to rearrange aggregates

Plough

- Main implement for primary tillage
- to cut, break and invert the soil partially or completely.
- opening the upper crust of the soil, breaking the clods and making the soil suitable for sowing seeds.

Objectives of Tillage:

- To obtain deep seed bed, suitable for different type of crops. A granular structure is desirable to allow rapid infiltration and good retention of rainfall, to provide adequate air capacity and exchange within the soil
- To control weeds or to remove unwanted crop plants (thinning)
- To manage plant residues, thorough mixing of trash will add humus and fertility of soil, while retention of trash on surface reduces erosion
- To minimize soil erosion by following such practices as contour tillage, listing and proper placement of trash
- To establish specific surface configurations for planting, irrigating, drainage, harvesting operation etc.
- To incorporate and mix fertilizers, pesticides or soil amendments into the soil
- To accomplish segregation. This may involve moving the soil from one layer to another, removal of rocks and other foreign objects or root harvesting.

Country plough: Penetrates soil and breaks it open. used for dry land, garden land and wetland ploughing

Functional components:

Share - Working part of the plough attached to the shoe with which it penetrates into the soil and breaks it open.

Shoe - Supports and stabilizes the plough at the required depth.

Body - Main part of the plough to which the shoe, beam and handle are attached. body and shoe are integral part.

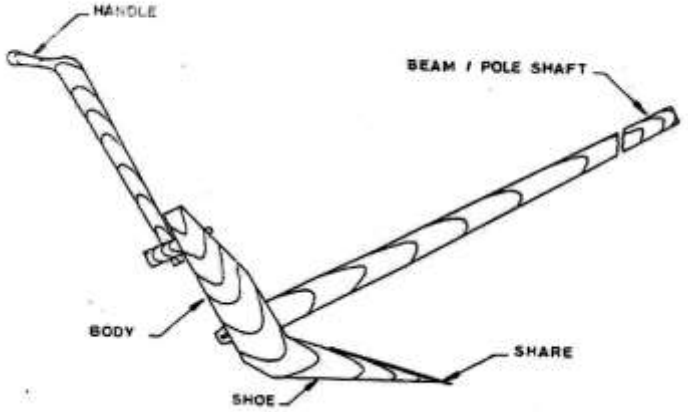
Beam:a long wooden piece, connects main body of plough to yoke.

Handle - wooden piece vertically attached to the body to enable the operator to control the plough.

Operational adjustments

a. Lowering or raising the beam with respect to the plough body

b. Changing the length of the beam



Mould board plows are:

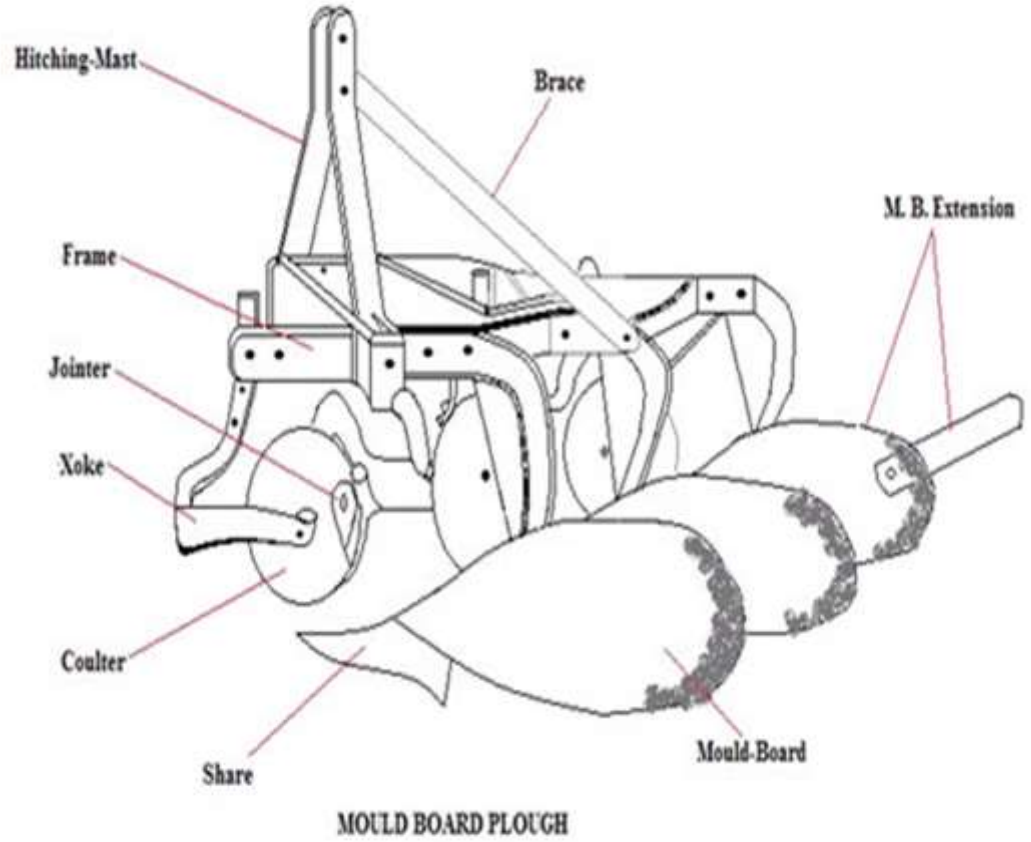
- One of the oldest of all agricultural implements
- It is considered to be the most important tillage implement
- It consumes more traction energy than any other operation
- It cuts loose the furrow slice, inverts the furrow slice more or less in pulverized form
- It is used for covering grass into soil immediately after rains
- But its design largely depends upon cut and try methods.

Mould board plough

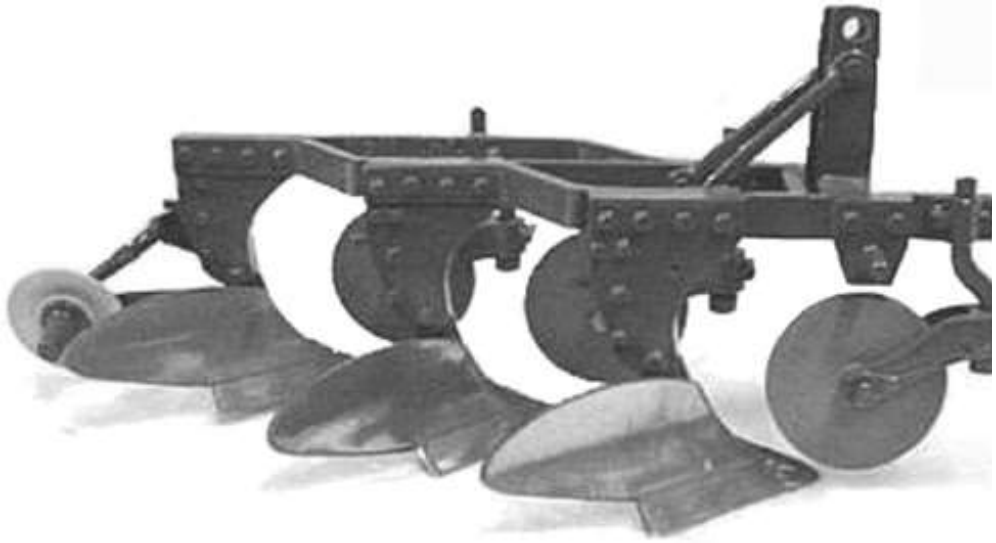
Function: 1) cutting the furrow slice 2) lifting the soil
3) turning the furrow slice and 4) pulverising the soil.

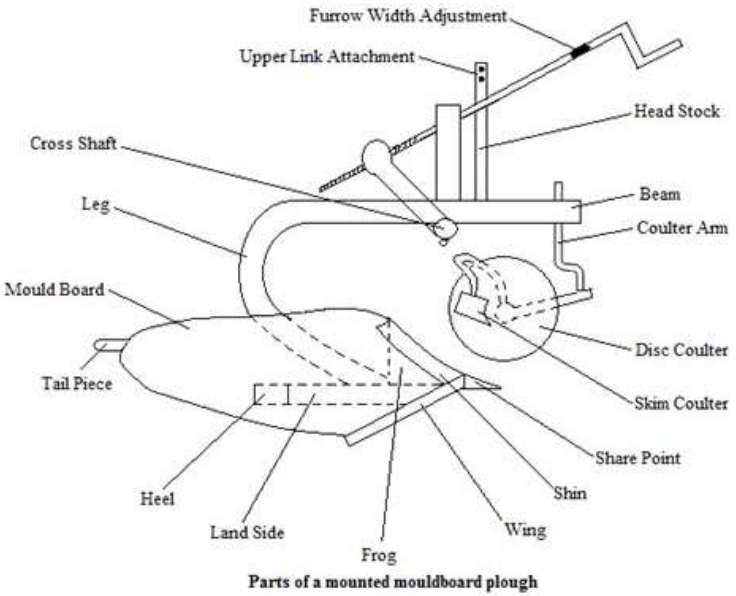
Parts :

1) Plow Bottom
2) Plow Frame
3) Attachments (Coulters & Jointers)
4) Wheels
5) Lifting Mechanism
6) Plow Hitch
7) Depth Adjusting Mechanism



MOULD BOARD PLOUGH





Parts of a mounted mouldboard plough

Plow Bottom:

- Actual part of the plow., three sided wedge.
- 3 main parts i.e. mould board, landslide and share which are rigidly fastened to the frog.
- Main function is to cut the furrow slice, shatter the soil and invert the furrow slice to cover trash.
- Size of plow bottom is the width of furrow designed to cut.

Components of plough bottom/ mouldboard plow

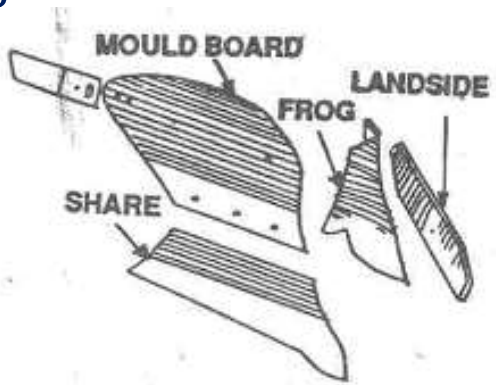
Share - Part of the plough bottom, penetrates into the soil and makes a horizontal cut below the surface.

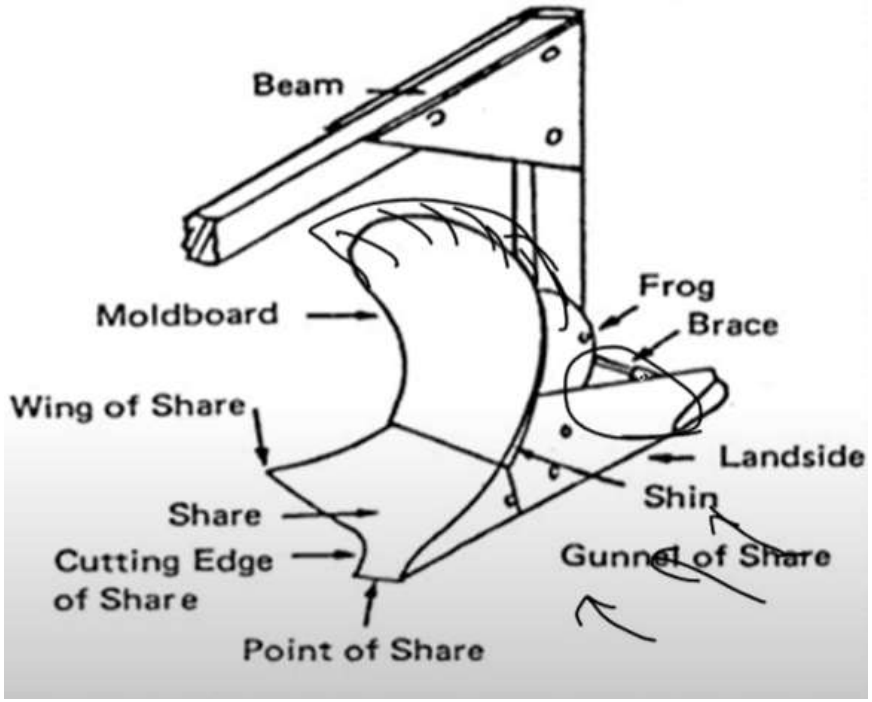
Mould board -Curved part which lifts & turns furrow slice.

Land side - Flat plate ,bears & transmits the rear side lateral thrust

Frog - Part to which components of plough bottom attached.

Tail piece - adjustable extension, fastened to rear of a mould board to help in turning a furrow slice.





Land side -

Flat plate which bears against and transmits lateral thrust of the plough bottom to the furrow wall,

Helps to resist the side pressure exerted by the furrow slice on the mouldboard.,

Helps in stabilizing the plough while it is in operation.

Rear bottom end of the land side is known as heel which rubs against the furrow sole.

Frog -part of the plough bottom to which the other components of the plough bottom are attached. an irregular piece of metal. cast iron for cast iron ploughs or welded steel for steel ploughs.

Share

Important part of plough, penetrates into the soil and makes a horizontal cut below the soil surface. A sharp, well polished and pointed component.

Parts:

1. Share point : Forward end of the cutting edge which actually penetrates into the soil

2. Cutting edge: Front edge which makes horizontal cut in the soil. beveled to some distance.

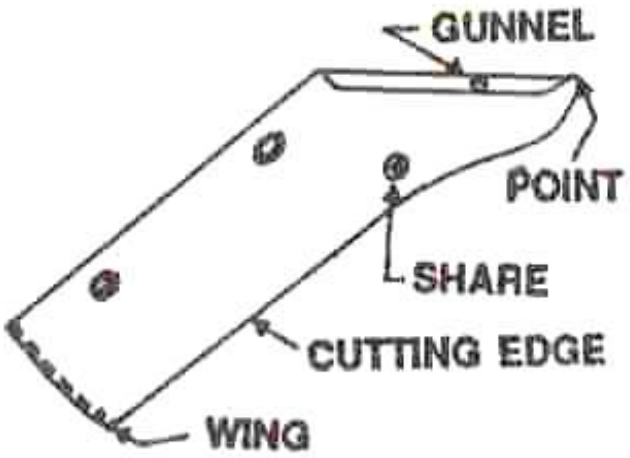
3.Wing of share: Outer end of the cutting edge of the share., supports the plough bottom

4. Gunnel: Vertical face of the share which slides along the furrow wall, takes the side thrust of soil & supports plough bottom against furrow wall

5.Cleavage edge: Edge of the share which forms joint between moulboard and share on the frog .

6. Wing : Level portion of the wing of the share, providing a bearing for the outer corner of the plough bottom.

Material : chilled cast iron or steel.



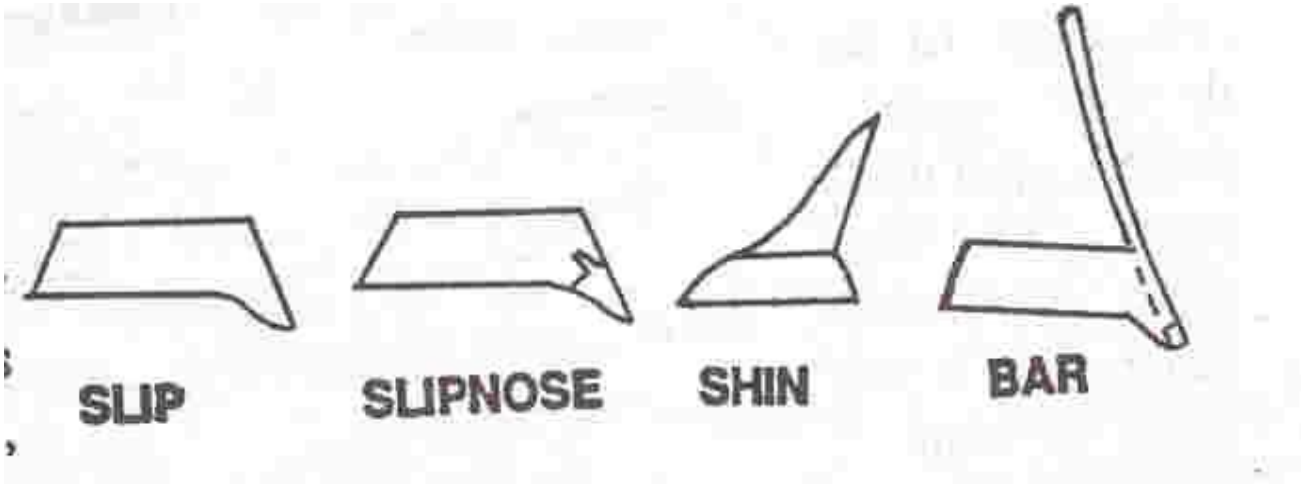
Type of Share

i) Slip share - one piece share with curved cutting edge, no additional part. entire share has to be replaced if it is worn out .

ii) Slip nose share - share in which the point of share is provided by a small detachable piece, share point can be replaced .

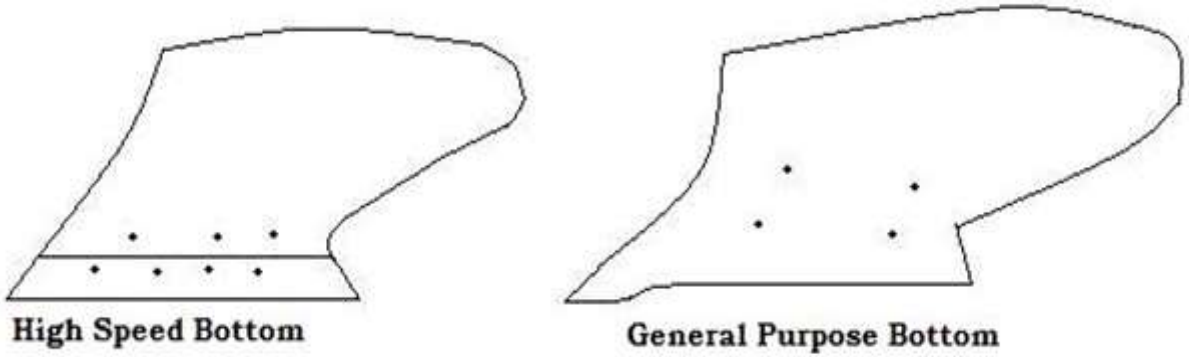
iii) Shin share - share having a shin as an additional part, similar to slip share with the difference that an extension is provided to it by the side of the mouldboard

iv) Bar point share - share in which the point of the share is provided by an adjustable and replaceable bar. Serves the purpose of point of the share and land side of the plough.

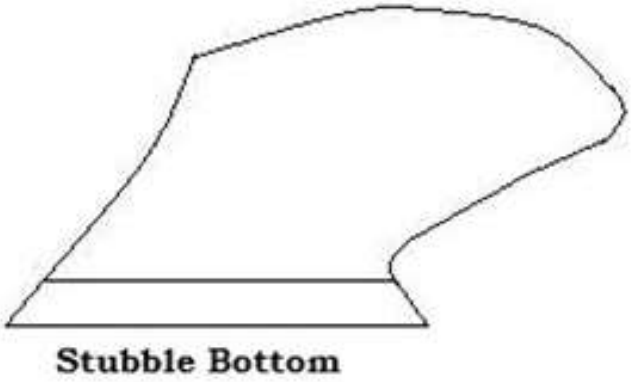


Types of mould board

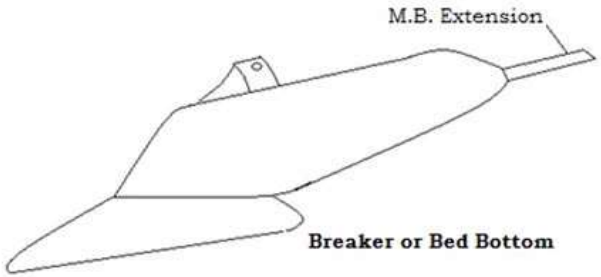
a) **General purpose -**having medium curvature lying between stubble and sod. has a fairly long mouldboard with a gradual twist, the surface being slightly convex.

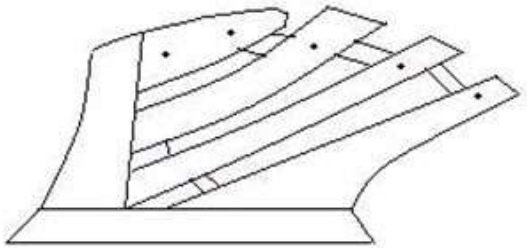


b) Stubble type - short but broader mould board with a relatively abrupt curvature which lifts breaks and turns the furrow slice used in stubble soils. Used for old ground where good pulverization is required. Relatively short and broad mould board, curved rather abruptly near the top, resulting in a greater degree of pulverization than with other types.



c) Sod or Breaker type - a long mouldboard with gentle curvature which lifts and inverts the unbroken furrow slice. useful where complete inversion of soil . designed for use in sod soils. It is used in tough soil where furrow slices are completely turned over so that grass doesn't grow. It has a long and low mould board with a gradual twist (spiral) that completely inverts the furrow slice with a minimum of breakup, thus covering vegetative matter thoroughly.

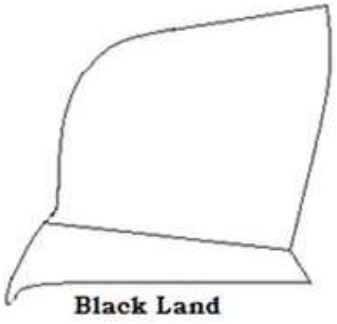



Slatted Bottom

d) Slat type - Less common type. Highly favorable in light and sticky soils where general purpose plow doesn't scour. Slates fitted give high pressure between soil and mould board scours better.

e) Black land Bottom:

It is used for plowing gumbo or buckshot soil where scouring (cleaning) is a problem. It has relatively small mould board area, and its shape tends to promote scouring soils.


Black Land

Material Used for Mould Board:

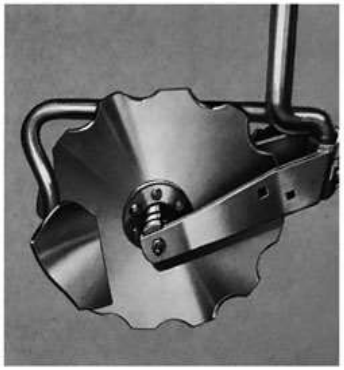
General Purpose	High Carbon Steel
Stubble Bottom	-----do-----
Sod or Breaker	-----do-----
Slat Bottom	-----do-----
High Speed	-----do-----

Plough accessories

Jointer: Small piece of metal and looks like a miniature plough bottom. Function is to cut and turn a small ribbon like furrow slice directly in front of the main plough bottom.

Coulter:Small disc provided in front of the share. Cuts the soil vertically from the land ahead of the share point& leaves a clear furrow wall. It also cuts trashes covered .

1. **Rolling type disc coulter**
2. **Sliding type knife coulter**



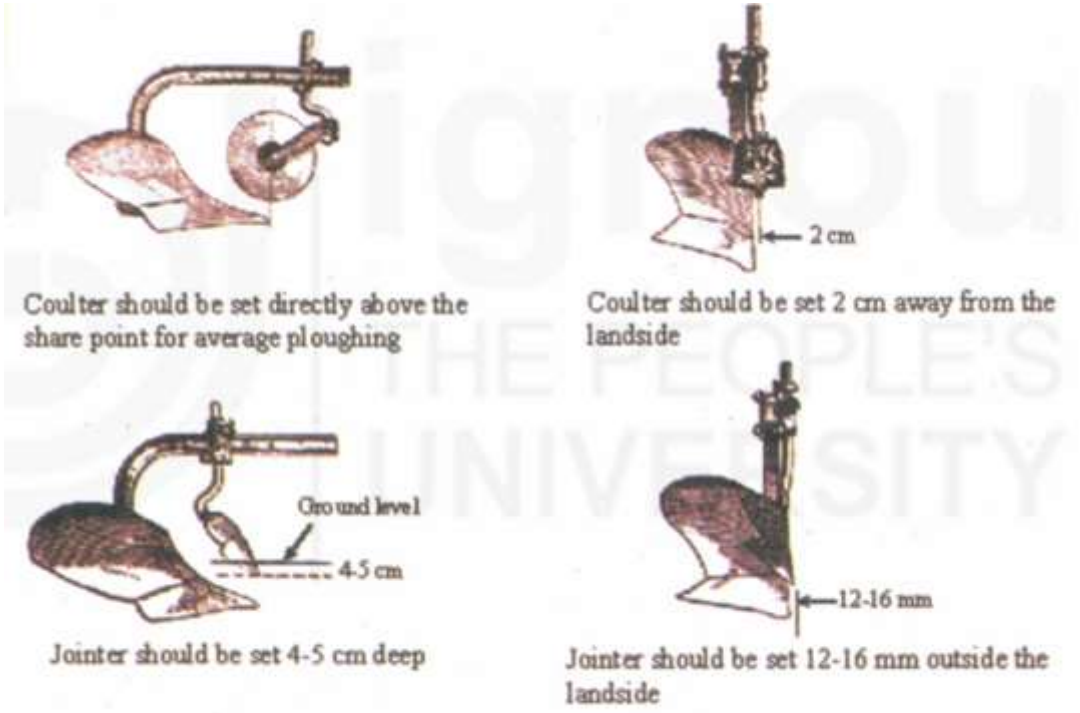


Fig. 1.8: Coulter and jointer positions in mould board plough

Gauge wheel/depth control wheel is provided to maintain uniform depth. Used when working in extreme variable ploughing condition.

Furrow wheel: used in tractor drawn ploughs. Main function is to absorb the side thrust of the plough against the furrow wall.

On larger mounted type ploughs, the rear furrow wheel supports the rear end of the ploughs also.
It carries 1/3rd weight of the plough.
It helps to control the depth of rear bottom of the plough.
It reduces the landside pressure.
It should have a clearance of 12 – 20 mm from the furrow wall.
Front furrow wheel - front wheel of plough which runs in furrow.
Rear furrow wheel - rear wheel of plough which runs in furrow.

Land wheel - wheel of the plough which runs on unploughed land.

Adjustment of MBP

For proper penetration and efficient work

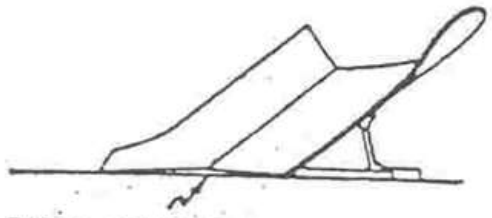
Vertical suction (Vertical clearance)

Maximum clearance under the land side and the horizontal surface when the plough is resting on a horizontal surface in the working position.

It is vertical distance from ground, measured at joining point of share and land side. Helps the plough to penetrate into the soil to a proper depth.

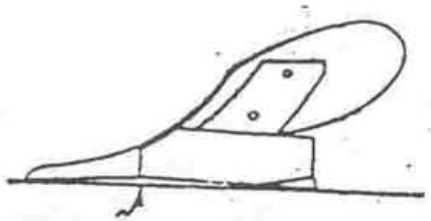
Horizontal suction (Horizontal OR side clearance)

Maximum clearance between land side and a horizontal plant touching point of share at its gunnel side and heal of land side. This suction helps plough to cut proper width of furrow slice.



SIDE CLEARANCE - 5 mm

HORIZONTAL SUCTION

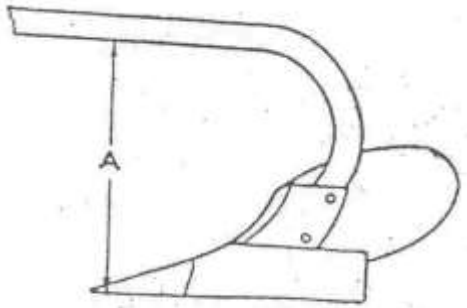


CLEARANCE - 3 to 5 mm

VERTICAL SUCTION

Throat clearance

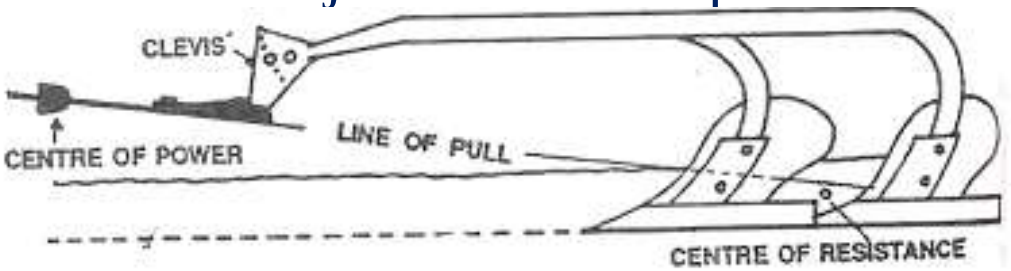
Perpendicular distance between point of share and lower position of beam of the plough.



THROAT CLEARANCE

Vertical clevis

It is a vertical plate with a number of holes at the end of the beam to control the depth of operation and to adjust the line of pull.



Horizontal clevis

It is a device to make lateral adjustment of the plough relative to the line of pull.

Plough size: the width of furrow that it is designed to cut.

- Measured as the horizontal distance between the wing of the share and the landside.
- TD ploughs, 30,35 & 40 cm plough bottoms are most commonly used.
- In multi bottom ploughs, the rated / working width of the plough is the product of number of bottoms and the size of one bottom.

Centre of power

True point of hitch of a tractor.

Centre of resistance

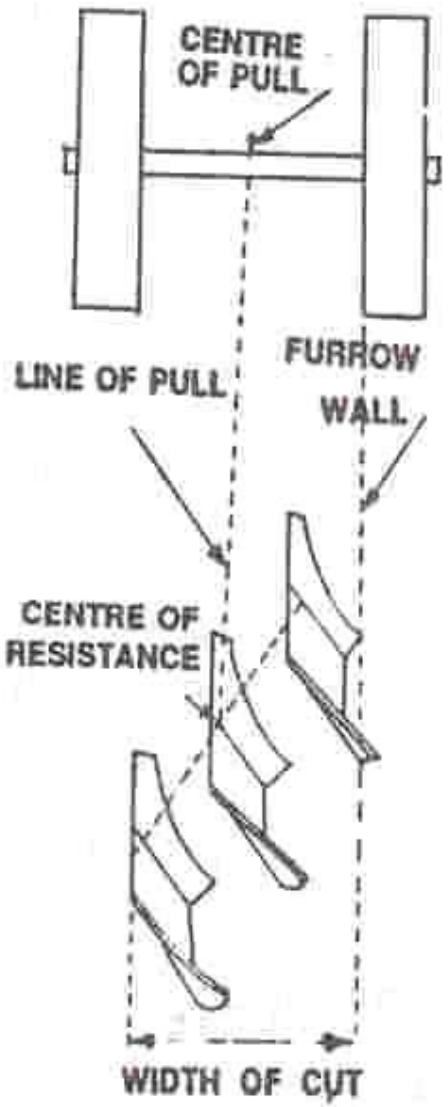
It is the point at which the resultant of a the horizontal and vertical forces act. Th centre lies at a distance equal to 3/4th siz of the plough from the share wing.

Line of pull

It is an imaginary straight line passin from the centre of resistance through th clevis to the centre of pull (power).

Pull

Total force required to pull an implement.



Draft:

Horizontal component of the pull, parallel to the line of motion.

$D = P \cos \theta$ where D is draft (kgf) and P = pull in (kgf)

θ = angle between line of pull and horizontal.

$$\text{Metric hp} = \frac{\text{Draft (kgf) x speed (metres per second)}}{75}$$

Draft depends upon 1) sharpness of cutting edge 2) working speed 3) working width 4) working depth 5) type of implement 6) soil condition and 7) attachments.

Side draft

Horizontal component of the pull perpendicular to the direction of motion. Developed if the centre of resistance is not directly behind the centre of pull.

Unit draft

Draft per unit cross sectional area of the furrow.

Fixed type (one way) mouldboard plough

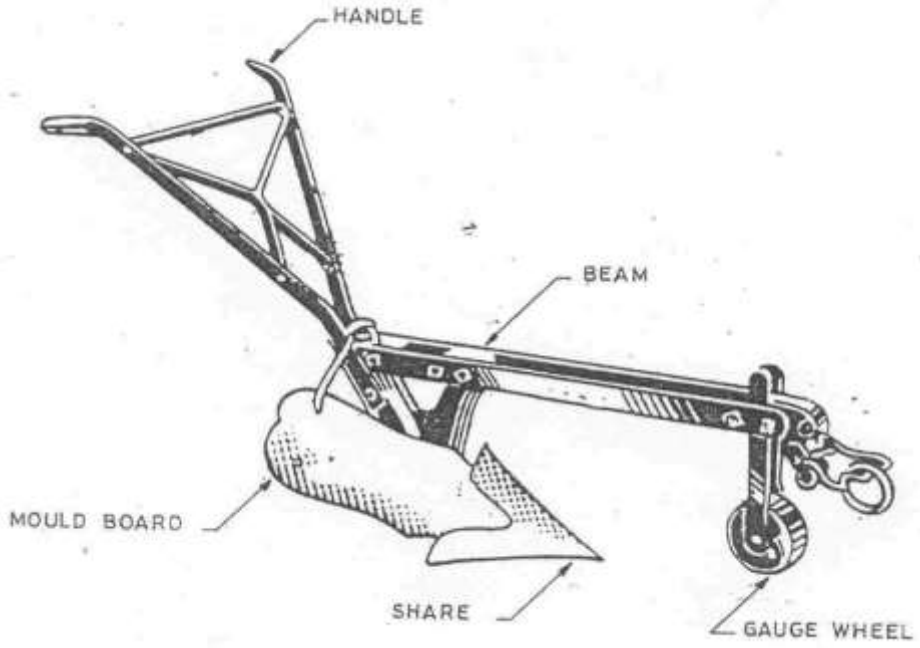
One way plough throws furrow slice to one side of direction of motion and is commonly used everywhere.

Two-way or Reversible plough

A MBP which turns furrow slice to the right or left side of direction of travel as require. They have two sets of opposed bottoms. Two way ploughs have the advantages that they neither upset the slope of the land nor leave dead furrows or back furrows in the middle of the field.

Turn wrest plough

Reversible ploughs which have single bottom with such an arrangement that the plough bottom is changed from right hand to left hand by rotating it through approximately 180° about a longitudinal axis.



Tractor Drawn Implements

higher working capacity and operated at higher speeds.

a) Trailed b) Semi-mounted c) Mounted

a) Trailed type implement

pulled and guided from single hitch point but its weight is not supported by tractor.

b) Semi-mounted type implement

attached to tractor along a hinge axis and not at a single hitch point. controlled directly by tractor steering unit but its weight is partly supported by the tractor.

c) Mounted type implement

attached with three point hitch system, controlled directly by the tractor steering unit,

Name of the part	Material	
	Animal drawn	Tractor drawn
Beam	Wood/mild steel	Forged steel
Handle	Wood/mild steel	-
Standard	Cast iron/mild steel	-
Share	Chilled cast iron	Chilled cast iron/high carbon steel
Mould board	Chilled cast iron/mild steel	Soft centre steel/chilled cast iron/crucible steel
Landside	Cast iron/mild steel	Cast iron/mild steel
Frog	Cast iron/mild steel	Cast iron/mild steel
Braces	Mild steel	Mild steel
Gauge wheel	Cast iron	Cast iron
Furrow wheel	Cast iron/mild steel	Cast iron/mild steel

Materials of Construction of Mould Board Plough Parts