L- 4,5. STUDY OF COUNTRY PLOUGH&MOULD BOARD PLOUGH: accessories, adjustments, operation and material of construction Mould Board Ploughs

Equipment used by the farmer to break and loosen the soil for a depth of 6 to 36 inches is called primary tillage equipment.

Why plowing is done?

1) To obtain a deep seed bed for good structure

2) To add more humus and fertility to the soil by covering, vegetation and minerals.

3) To destroy weeds.

4) To leave the soil in a condition to breath or allow the air to circulate freely.

5) To facilitate the introduction of seed in the soil with better contact.

6) To destroy insects and their eggs along with their breeding places.

7) To leave the surface in the condition to prevent erosion by wind

8) To get greater root protection.

When to plow?

1) Early plowing during rainy season reduces weeds. When buried in soil work it becomes manure and is of great importance.

2) In our country there are high winds which bring with them considerable amount of dust with particles of grass, leaves, crop residue like bhusa and all sort of vegetation which settle on ploughed, rough, cloddy surface of field which otherwise get blown off.

3) In a long period of dry and hot weather a good amount of nitrogen is built up in the air and this is caught by first rainfall and brought to the soil. In case the field is ploughed this rain water with nitrogen gets absorbed in loose soil hence works as fertilizer.

In olden days “Desi” wooden plows were popular throughout the world. In 14^{th} century after introduction of steel, steel plows were popular throughout the world.

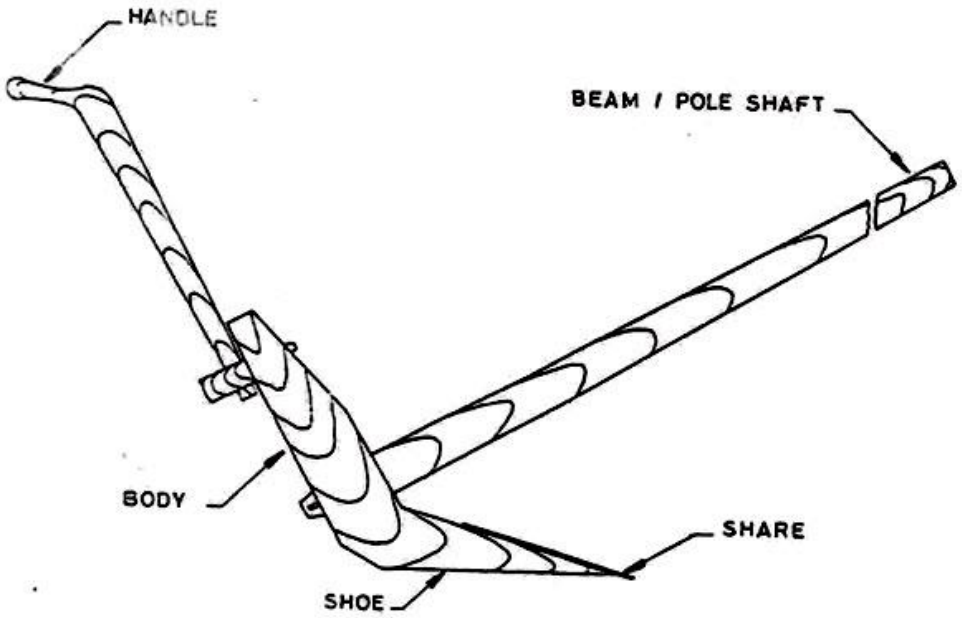


Fig.4 Country Plough

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.

Types of mould board plows:

1) Trailed: It is also known as pull type and it is complete unit in itself supported on two wheels.

The complete unit is hitched by the drawbar of the tractor.

It is available in **1-8 bottoms** depending upon the capacity of the tractor.

Single bottom has one bottom. **Two – Eight bottoms** are called as **gang mould board.**

Sizes available are **36, 41 and 46 cm**.

These are not easily maneuverable.

2) Semi-Mounted: These are more compact and more maneuverable than pull type.

Sizes and number of bottoms are same as that of pull type.

These are less expensive.

These put more vertical load on tractor rear wheels (there by improving tractive ability).

3) Mounted: These are called as direct mounted, tractor mounted or tractor carried plows.

These plows use tractor lift linkages which are controlled hydraulically.

It is available in **2-5 bottoms** depending upon the capacity of tractor.

Sizes available are **30, 36 and 41 cm**.

Increased size of mounted type plows cause tractor instability during transport.

<u>Classification of mould board plows:</u>

1) One way plow: It turns soil to the right hand side.

One way plow require laying out a field in lands, starting with back furrows and ending with dead furrows.

2) Two way plow: It turns soil to both right and left side.

Two sets of bottoms are mounted on a common frame that is rotated about a longitudinal axis to change from one set to other.

Mechanical or hydraulic cylinders are used for rotation

Gage wheels and rear wheels are automatically repositioned as the plow bottom frame rolls over, unless each set of bottoms has its own wheel (which is usually the case of mounted plows).

Two way plows eliminate the back furrow and dead furrow leaving the field more level for irrigation or drainage.

Two way plows are advantageous for terraced fields or contour ploughing and for small irregular shape fields.

Animal drawn two way plow is also called as turn- wrest plow.

Parts of Plow:

1) Plow Bottom

2) Plow Frame

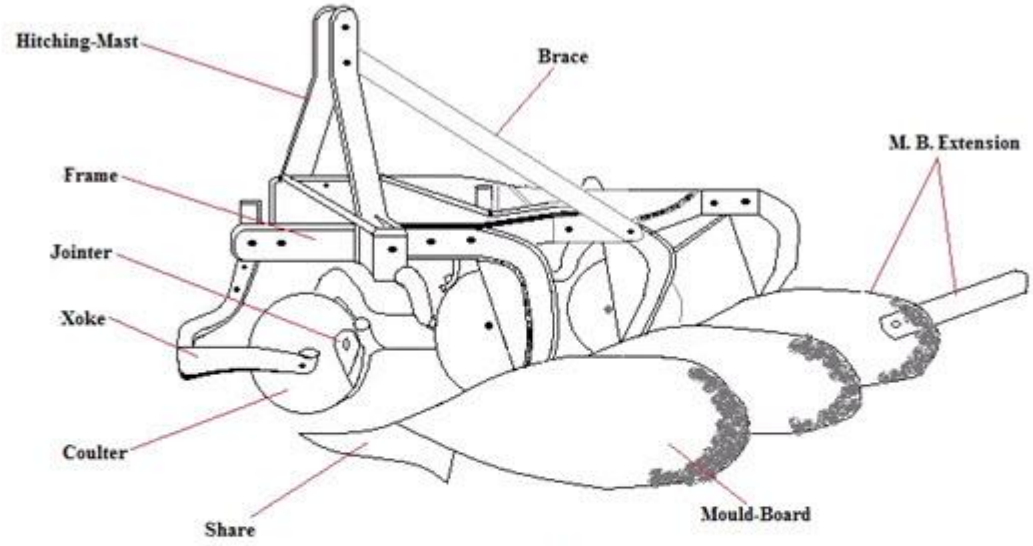
3) Attachments (Coulters & Jointers)

4) Wheels

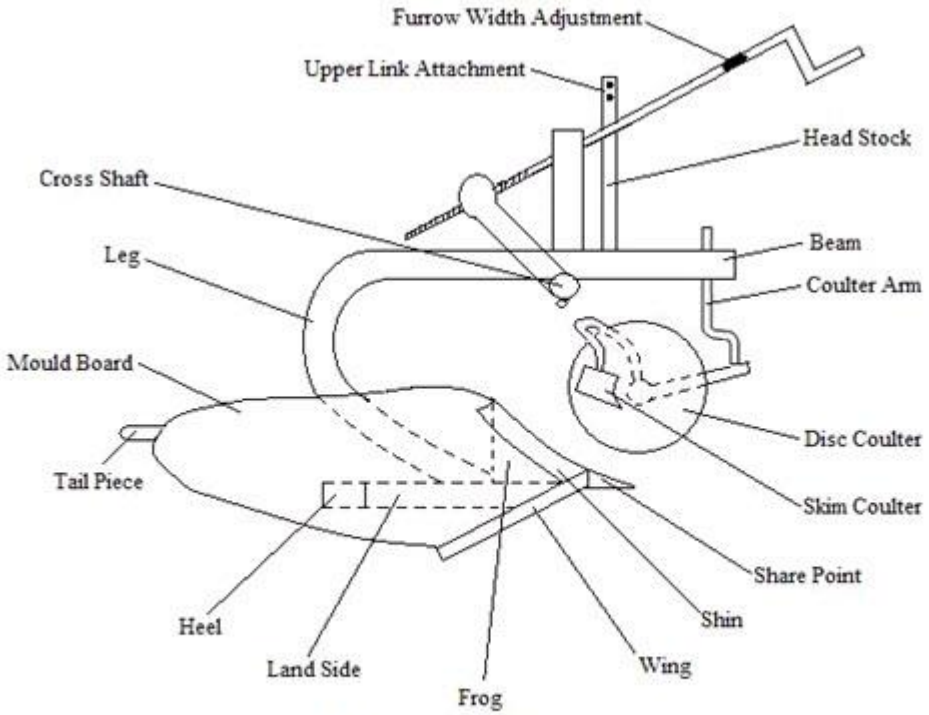
5) Lifting Mechanism

6) Plow Hitch

7) Depth Adjusting Mechanism



MOULD BOARD PLOUGH



Parts of a mounted mouldboard plough

1) Plow Bottom: It is the actual part of the plow.

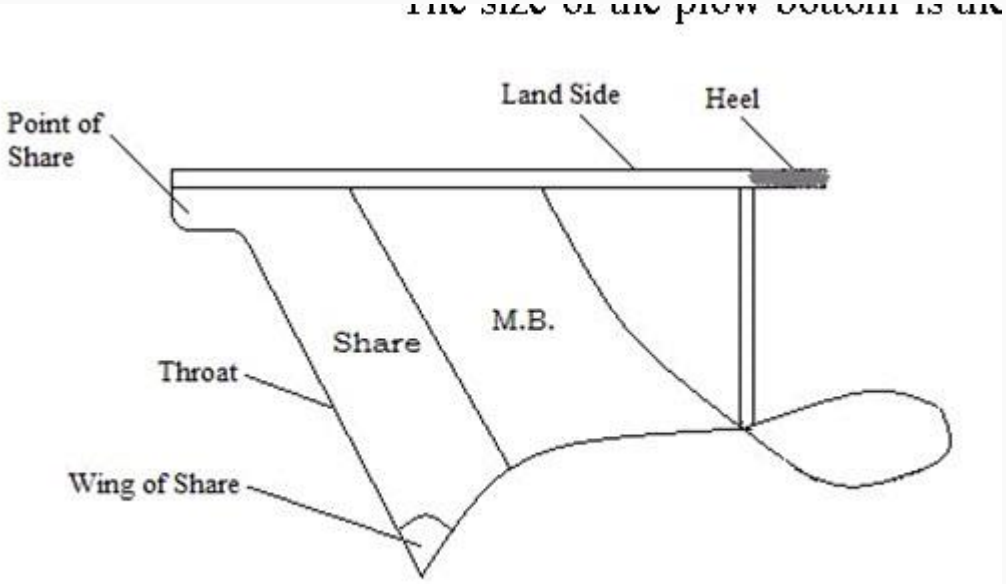
It is three sided wedge.

There are three main parts i.e. mould

board, landslide and share which are rigidly fastened to the frog.

Its main function is to cut the furrow slice, shatter the soil and invert the furrow slice to cover trash.

The size of the plow bottom is the width of furrow it is designed to cut.



Top view of M. B. Plow Bottom

a) Share: It is the part of plow bottom which actually penetrates into the soil and makes a horizontal cut below the surface.

b) Mould Board: It is the curved part which lifts and turns the slice.

c) Landslide: It is the flat plate which bears against and transmits the rear side lateral thrust of plow bottom to the furrow wall.

d) Frog: It is the base of the plow bottom to which other parts are attached.

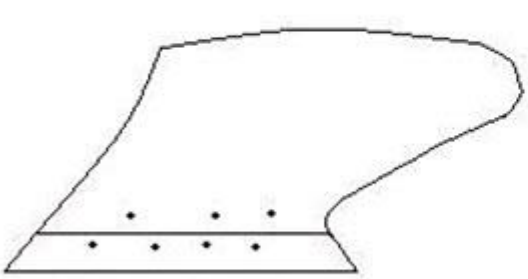
e) Tail Piece: It is the extension of mould board which helps in turning the furrow slice.

Types of Mould Board:

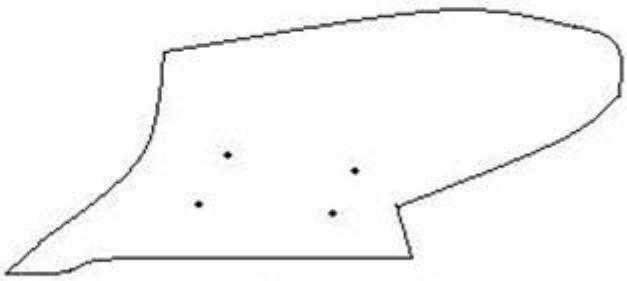
Different soil conditions require plow bottoms of different shapes. The moisture in the soil and texture of soil determines whether it should pulverize thoroughly or merely turned over to be pulverized later on.

a) General Purpose and High Speed:

These are mostly used and suitable for wide range of conditions. It mostly meets the general demand of seedbed preparation.



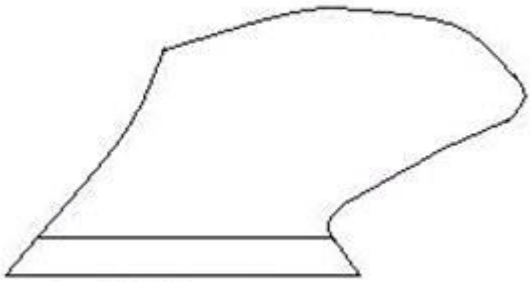
High Speed Bottom



General Purpose Bottom

b) Stubble Bottom:

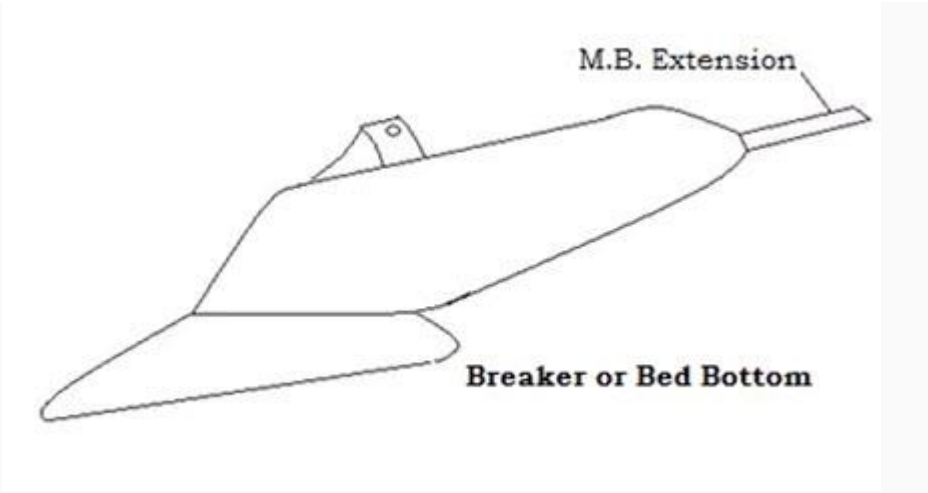
It is generally used for old ground where good pulverization is required. It has relatively short and broad mould board which is curved rather abruptly near the top, resulting in a greater degree of pulverization than with other types.



Stubble Bottom

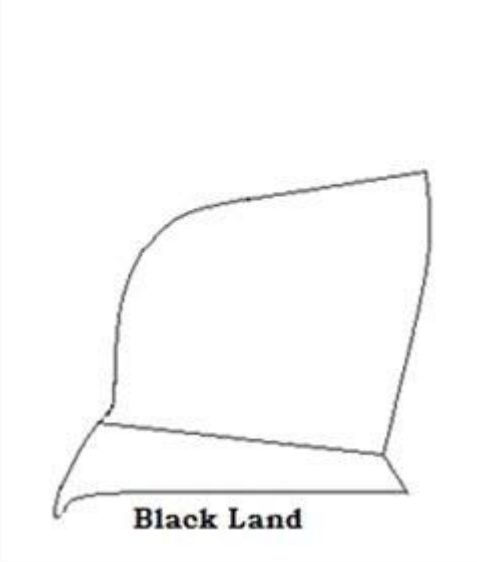
c) Sod or Breaker Bottom:

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.



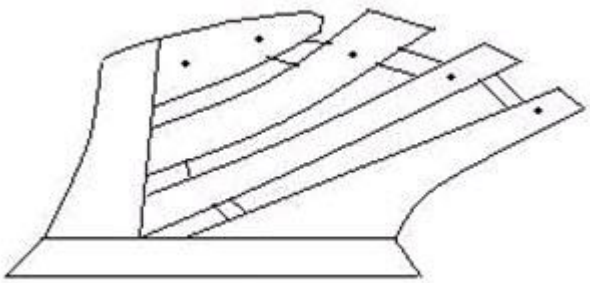
d) Black land Bottom:

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.



e) Slat Bottom:

It is the less common type. It is highly favorable in light and sticky soils where general purpose plow doesn't scour. The slates fitted give high pressure between soil and mould board scours better.



Slatted Bottom

Material Used for Mould Board:

General Purpose High Carbon Steel

Stubble Bottom -----do-----

Sod or Breaker -----do-----

Slat Bottom -----do-----

High Speed -----do-----

Parts of Share:

a) Share Point:

It is the forward end of the cutting edge, which actually penetrates in the soil.

b) Cutting Edge:

Front edge of the share, which makes horizontal cut in the soil.

c) Wing of Share:

Outer end of cutting edge of share. It supports the plow bottom.

d) Gunnels:

It is vertical face of share, which slides along the furrow wall. It takes side thrust of soil and supports the plow bottom against the furrow wall.

e) Cleavage Edge:

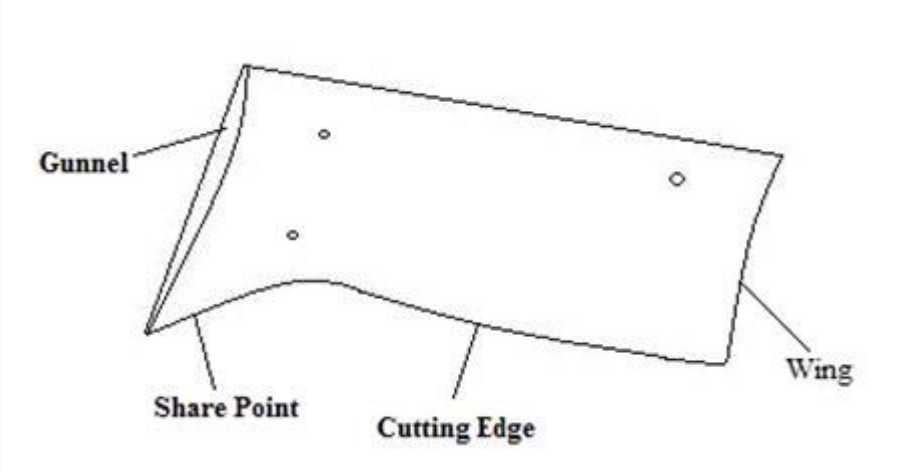
It is the edge of the share which forms joint between mould board and share on frog.

f) Wing Bearing:

Level portion of wing of the share providing a bearing for outer corners of plow bottom.

g) Throat:

Principle parts of the share i.e. share point, wing and cutting edge is also called as throat. Point is the first part to penetrate in the soil, the wing is the outside corner of the cutting edge. The cutting edge extending from the point to the wing is curved and forms the throat of the share.



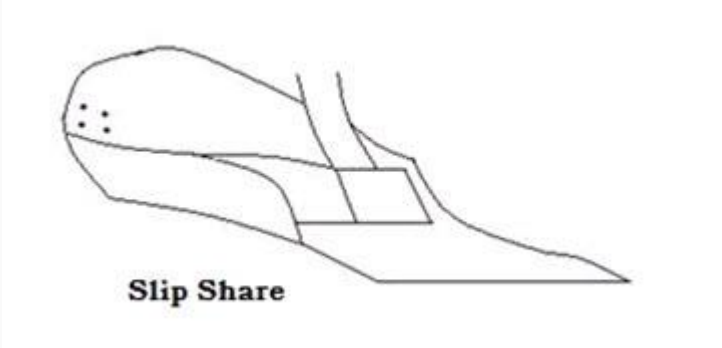
Types of Shares:

a) Slip Share:

One piece share with curved cutting edge, having no additional part.

Common type of share generally used by the farmers, as it is simple in design.

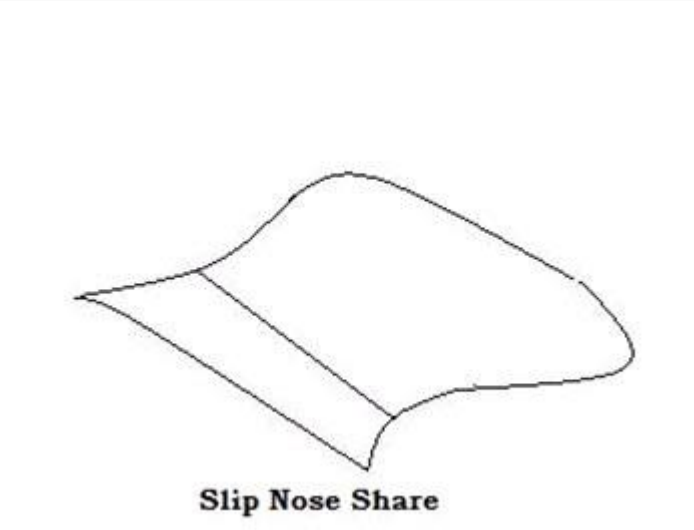
Disadvantage is that entire share has to be replaced if it is worn out due to constant use.



b) Slip-nose Share:

It is a share in which point of share is provided by a small detachable piece.

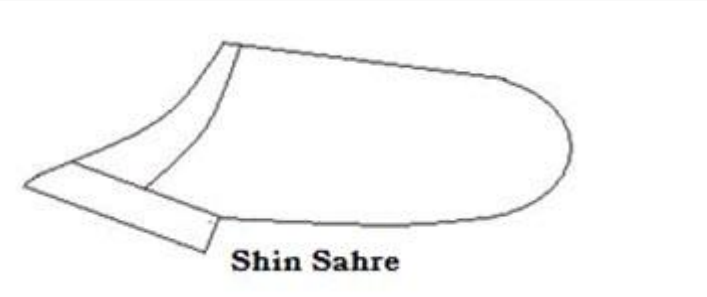
Advantage is that share point can be replaced as and when required. So it is economical.



Slip Nose Share

c) Shin Share:

It has a shin as an additional part.



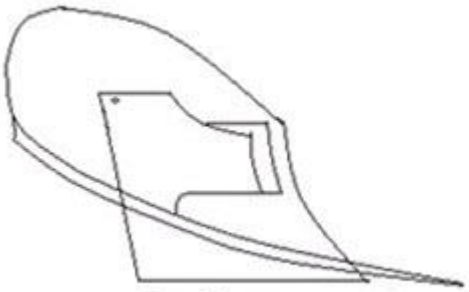
Shin Sahre

It is similar to slip share with a difference that an extension is provided by side of the mould board.

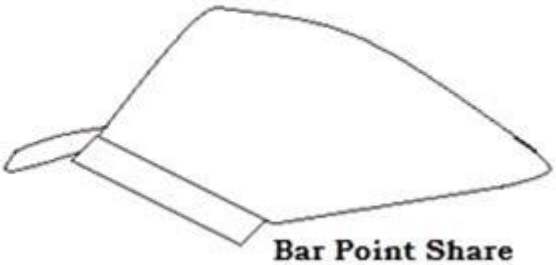
d) Bar Point Share:

It is the share in which point of share is provided by an adjustable and replaceable bar.

This bar serves the purpose of point of share and landslide of the plow.



Bar Share



Bar Point Share

Materials Used for Share:

Slip Share	HCS, soft center steel, cast iron
Slip-nose Share	Cast iron
Shin Share	HCS
Bar Point Share	HCS

1) Cast Iron Share:

These are made for cheap type of plow.

Require careful handling, as these are brittle and can break easily with sharp blow. If it is broken it has to be replaced. But if it is worn it can be sharpened with the help of grinding stone.

2) Chilled Cast Iron Shares:

These shares have comparatively longer life as these do not rust and do not wear quickly.

These are recommended for sandy and strong soils.

3) Soft Center Steel Shares:

These are used in the soils where soil doesn't stick to the surface of share or mould board.

These have very hard surface and long life but are costly.

4) Solid Steel Share:

These are used where soil is not abrasive.

These are quite sturdy and can withstand shocks.

These are made out of high carbon steel by forging process.

Types of Landslide:

a) This landslide is about 23 cm long and is used for plows where landslide pressure is not a factor.

b) This landslide is 28 cm long and is used for normal plowing conditions.

c) This landslide is 36 cm long and has landslide heel used for abrasive soils.

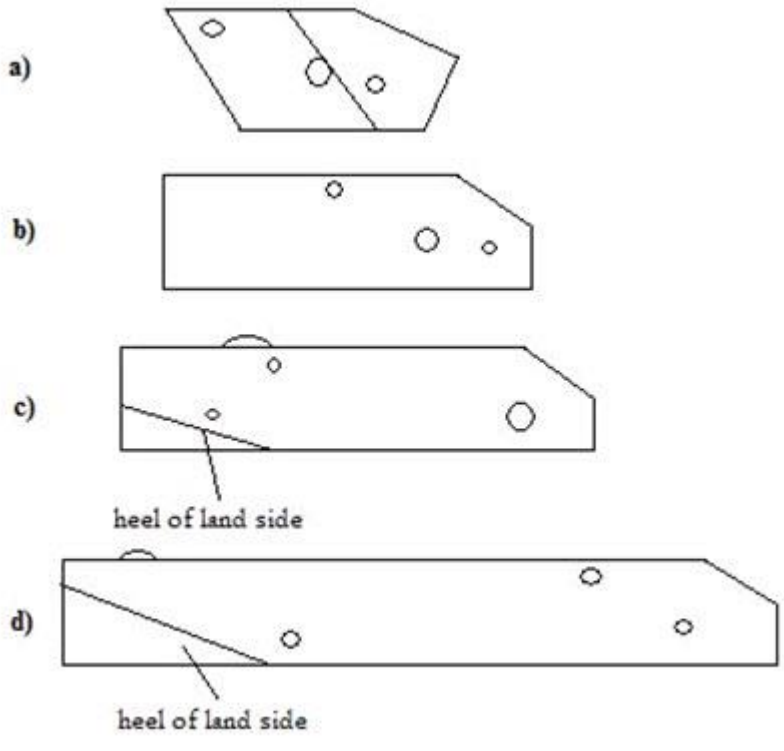
d) This landslide is 50 cm long and has a landslide heel. It is used in plows which don't have rear furrow wheel, it gives support to plow bottom.

Material used for Landslide:

Soft center steel/ MS/ cast iron

Material used for Frog:

MS/ cast iron



PRIMARY TILLAGE

The initial major soil working operation designed to plough the soil deeply to reduce soil strength, cover plant materials and rearrange aggregates is called primary tillage.

Objectives of primary tillage

a. To reduce soil strength
b. To rearrange aggregates
c. To cover plant materials and burry weeds
d. To kill insects and pests

The implements used for primary tillage are called as primary tillage implements. They include many animal drawn and tractor drawn implements. Animal drawn implements mostly include indigenous ploughs and mould-board ploughs. Tractor drawn implements include mould-board ploughs, disc ploughs, heavy duty disk harrows, subsoil ploughs, chisel ploughs and other similar implements.

PLOUGH

Chisel Plough (Video) **Ploughing (Video)**

The main implement used for primary tillage is a plough. Ploughing essentially consists of 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 follows

- To obtain a deep seed bed of good texture.
- To increase the water holding capacity of the soil.
- To improve soil aeration.
- To destroy weeds and grasses.
- To destroy insects and pests.
- To prevent soil erosion and
- To add fertility to the soil by covering vegetation.

Classification of ploughs according to power used

- Bullock drawn ploughs- indigenous types

ii) Walking type

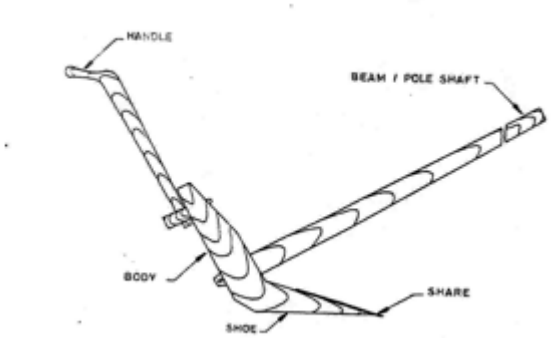
- Short beam
- Long beam

ii) Riding type

- Tractor drawn ploughs
- mounted type
- Semi mounted type

INDIGENOUS PLOUGH

It is an animal drawn plough. It penetrates into the soil and breaks it open. It forms V shaped furrows with 15-20 cm top width and 12-15 cm depth. It can be used for ploughing in dry land, garden land and wetlands. The size of the plough is represented by the width of the body and the field capacity is around 0.4 ha per day of 8 hours. The functional components include share, body, shoe, handle and beam. Except share all other parts are made up of wood. In villages local artisans make the plough and supply to the farmers. These ploughs are also called as country ploughs



Indigenous plough

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

Shoe - It supports and stabilizes the plough at the required depth.

Body - It is the main part of the plough to which the shoe, beam and handle are attached. In country ploughs both body and shoe are made in a single piece of wood..

Beam - It is a long wooden piece, which connects the main body of the plough to the yoke.

Handle - A wooden piece vertically attached to the body to enable the operator to control the plough while it is working

In each state farmers use indigenous ploughs of their own make.

Operational adjustments

a. Lowering or raising the free end of the beam with respect to the plough body results in an increase or decrease in the share angle with respect to the horizontal surface which in turn increase or decrease the depth of ploughing.

b. Changing the length of the beam between plough body and yoke of the animals will also alter the depth of ploughing. Reducing the beam length will decrease the depth of cut and vice versa.

MOULD BOARD PLOUGH

Mouldboard plough is one of the oldest of all agricultural implements and is generally considered to be the important tillage implement. Ploughing accounts for more traction energy than any other field operation. Mouldboard ploughs are available for animals, power tiller and tractor operation. While working, a mouldboard plough does four jobs namely a) cutting the furrow slice b) lifting the furrow slice c) inverting the furrow slice and

d) pulverizing the furrow slice

Two bottom mouldboard plough

Tractor with two bottom mouldboard plough

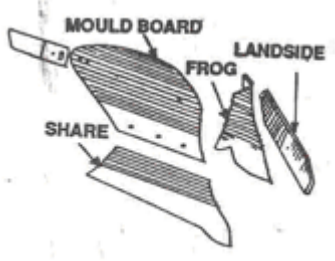
Land ploughed by a mouldboard plough

COMPONENTS OF A MOULDBOARD PLOUGH

A animal drawn mouldboard plough consists of a) plough bottom b) beam and c) hitch bracket or clevis. A tractor drawn mouldboard plough consists of a) plough bottom b) beam or standard c) main frame and d) hitch frame

a)Plough bottom – The part of the plough which actually cuts, lifts, pulverizes and through the soil out of the furrow. It is composed of those parts necessary for the rigid structure required to cut, lift, turn, and invert the soil.

Parts of the mouldboard plough bottom are a) Share b) Mould board c) Land side d) Frog and e) Tail piece. Share, landside, mouldboard are bolted to the frog which is an irregular piece of cast iron.



Components of Mould Board plough

b) Share: It is that part of the plough bottom which penetrates into the soil and makes a horizontal cut below the surface.

c) Mould board: It is the curved part which lifts , turns, and pulverizes the soil slice.

d) Land side: It is the flat plate which presses against the furrow wall and prevents the plough from lateral swinging. The rear part of land side is called heel which slides on the bottom of the furrow

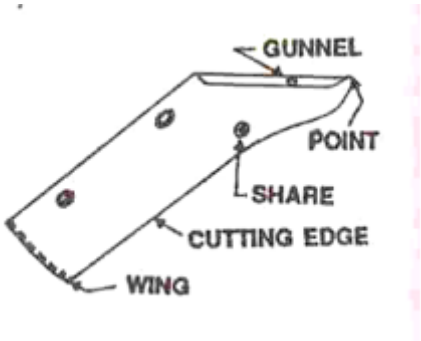
e) Frog: It is the part to which share, land side and mouldboard are attached.

f) Tail piece: It is an adjustable extension, which can be fastened to the rear of the mould board to help in turning the furrow slice.

DETAILS ABOUT DIFFERENT COMPONENTS OF MOULDBOARD PLOUGH

1. Share - It penetrates into the soil and makes a horizontal cut below the soil surface . It is a sharp, well polished and pointed component. Different portions of the share are called by different names such as

- Share point 2) Cutting edge 3) Wing of share 4) Gunnel 5) Cleavage edge and 6) Wing bearing.



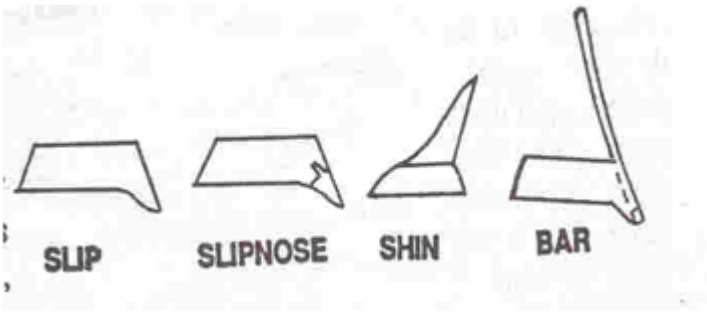
Share

- **Share point :** It is the forward end of the cutting edge which actually penetrates into the soil
- **Cutting edge:** It is the front edge of the share which makes horizontal cut in the soil. It is beveled to some distance.
- **Wing of share:** It is the outer end of the cutting edge of the share. It supports the plough bottom
- **Gunnel:** It is the vertical face of the share which slides along the furrow wall. It takes the side thrust of the soil and supports the plough bottom against the furrow wall .
- **Cleavage edge:** It is the edge of the share which forms joint between moulboard and share on the frog.
- **Wing bearing:** It is the level portion of the wing of the share, providing a bearing for the outer corner of the plough bottom.

Material of share: The shares are made of chilled cast iron or steel. The steel mainly contains about 0.70 to 0.80% carbon and about 0.50 to 0.80% manganese besides other minor elements.

2. Types of Shares

Share is of different types such as i) Slip share ii) Slip nose share iii) Shin share and iv) Bar point share.



Types of shares

i) Slip share: It is one piece share with curved cutting edge, having no additional part.

It is a common type of share, mostly used by the farmers. It is simple in design, but it has got the disadvantage that the entire share has to be replaced if it is worn out due to constant use .

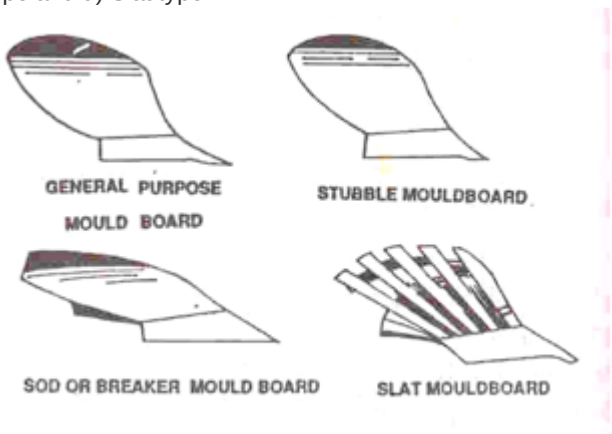
ii) Slip nose share: It is a share in which the point of share is provided by a small detachable piece. It has the advantage that the share point can be replaced as and when required. If the point is worn out, it can be changed with a new nose without replacing the entire share, effecting considerable economy.

iii) Shin share: It is the share having a shin as an additional part.

It is similar to the slip share with the difference that an extension is provided to it by the side of the mouldboard.

iv) Bar point share: It is the share in which the point of the share is provided by an adjustable and replaceable iron bar. This bar serves the purpose of share point and land side of the plough.

3. Mouldboard: It is that part of the plough which receives the furrow slice from the share. If lifts, turns and breaks the furrow slice. To suit different soil conditions and crop requirements, mouldboard has been designed in different shapes. The mouldboard is of following types: a) General purpose b) Stubble type c) Sod or Breaker type and d) Slat type.



Types of mould board

a) General purpose: It is a mouldboard having medium curvature lying between stubble and sod types. The mouldboard is fairly long with a gradual twist, the surface being slightly convex. The sloping of the surface is gradual. It turns a well defined furrow slice and pulverizes the soil thoroughly.

b) Stubble type: It is short but broader mouldboard with a relatively abrupt curvature which lifts, breaks and

turns the furrow slice. .This is best suited to work in stubble soil that is under cultivation for years together. Stubble soil is that soil in which stubble of the plants from the previous crop is still left on the land at the time of ploughing. This type of mouldboard is not suitable for lands with full of grasses.

c) Sod or Breaker type: It is a long mould board with gentle curvature which lifts and inverts the unbroken furrow slice.. It turns over thickly covered soil. This is very useful where complete inversion of soil is required by the farmer. This type has been designed for used in sod soils (soil with much of grass).

d) Slat type: It is a mouldboard whose surface is made of slats placed along the length of the mouldboard, so that there are gaps between the slats. This type of mouldboard is often used, where the soil is sticky, because the solid mouldboard does not scour well in sticky soils.

4) Land side: It is the flat plate which presses against and transmits lateral thrust of the plough bottom to the furrow wall (Fig.6). It helps to resist the side pressure exerted by the furrow slice on the mouldboard. It also helps in stabilizing the plough while in operations. Land side is fastened to the frog with the help of plough bolts. The rear bottom end of the land side is known as **heel** which rubs against the furrow sole.

Mould board bottom

5) Frog: Frog is that part of the plough bottom to which the other components of the plough bottom are attached. It is an irregular piece of metal. It is made of cast iron for cast iron ploughs or it may be welded steel for steel ploughs.

6) Tail piece: It is an important extension of mouldboard which helps in turning a furrow slice.

PLOUGH ACCESSORIES

There are a few accessories necessary for efficient function of the plough. They are (i) Jointer (ii) Coulter (iii) Gauge wheel (iv) Land wheel and (v) Furrow wheel.

a) Jointer

It is a small irregular piece of metal having a shape similar to an ordinary plough bottom. It looks like a miniature plough. Its purpose is to turn over a small ribbon like furrow slice directly in front of the main plough bottom. This small furrow slice is cut from the left and upper side of the main furrow slice and is inverted so that all trashes on the top of the soil are completely turned down and buried under the right hand corner of the furrow.

b) Coulter

It is a device used to cut the furrow slice vertically from the land ahead of the plough bottom. It cuts the furrow slice from the land and leaves a clear wall. It also cuts trashes which are covered under the soil by the plough. The coulter may be (a) Rolling type disc coulter or (b) Sliding type knife coulter.

Rolling type disc coulter

It is a round steel disk which has been sharpened on the edge and suspended on a shank and yoke from the beam. The edge of the coulter may be either smooth or notched. It is so fitted that it can be adjusted up-down and side ways. The up-down adjustment takes care of depth and sideways adjustment is meant for taking care of

width of cut.

Sliding type knife coulter

It is a stationary knife fixed downward in a vertical position on the beam. The knife does not roll over the ground but slides on the ground. The knife may be of different shapes and sizes.

c) Gauge wheel

It is an auxiliary wheel of an implement to maintain an uniform depth of working.

Gauge wheel helps to maintain uniformity in respect of depth of ploughing in different soil conditions. It is usually placed in hanging position.

d) Land wheel - It is the wheel of the plough which runs on the ploughed land.

e) Front furrow wheel - It is the front wheel of the plough which runs in the furrow.

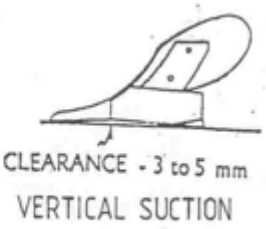
f) Rear furrow wheel - It is the rear wheel of the plough which runs in the furrow.

ADJUSTMENT OF MOULDBOARD PLOUGH

For proper penetration and efficient work by the mouldboard plough, some adjustments are made from time to trime. They are (i) Vertical suction and (ii) Horizontal suction.

a) Vertical suction (Vertical clearance)

It is the 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 also defined as the vertical distance from the ground, measured at the joining point of share and land side. (Fig.7a). It helps the plough to penetrate into the soil to a proper depth. This clearance varies according to the size of the plough.



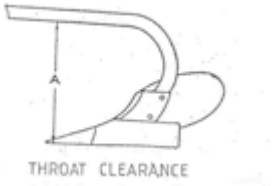
Vertical clearance horizontal clearances

b) Horizontal suction (Horizontal clearance)

It is the maximum clearance between the land side and the furrow wall. This suction helps the plough to cut the proper width of furrow slice. This clearance also varies according to the size of the plough. It is also known as side clearance.

c) Throat clearance

It is the perpendicular distance between share point and lower position of the beam of the plough .



Throat clearance of plough

TYPES OF MOULDBOARD PLOUGHS

- **Fixed type (one way) mouldboard plough**

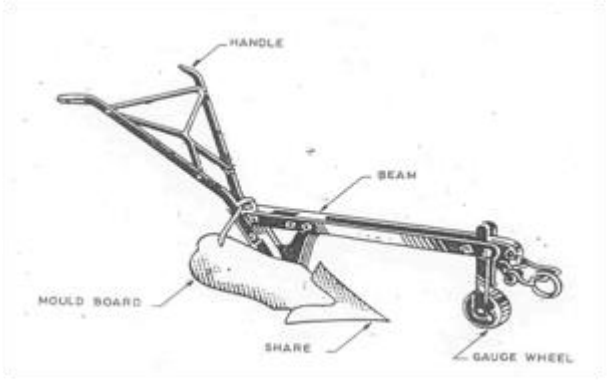
One way plough throws the furrow slice to one side of the direction of travel and is commonly used everywhere. It may be long beam type or short beam type

2) Two-way or Reversible plough

It is a mouldboard plough which turns furrow slice to the right or left side of direction of travel as required. Such ploughs have two sets of opposed bottoms. In such a plough, all furrows can be turned towards the same side of the field by using one bottom for one direction of travel and the other bottom on the return trip. Two sets of bottom are so mounted that they can be raised or lowered independently or rotated along an axis. Two way ploughs have the advantage that they neither upset the slope of the land nor leave dead furrows or back furrows in the middle of the field.

3) Turn wrest plough

There are some reversible ploughs which have single bottom with an arrangement that the plough bottom is changed from right hand to left hand or vice versa by rotating the bottom through approximately 180° about a longitudinal axis. This type of plough is called turn wrest plough . While moving in one direction, the plough throws the soil in one direction and at the return trip the direction of the plough bottom is changed, thus the plough starts throwing the soil in the same direction as before.

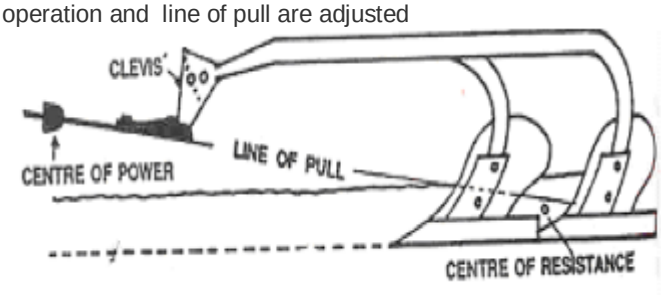


Turn wrest plough

OTHER TERMS CONNECTED WITH PLOUGHS

a) Vertical clevis

It is a vertical plate with a number of holes and fitted at the end of the beam. By using the clevis depth of operation and line of pull are adjusted



Clevis and line of pull