

Farm Machinery

Farm power is any source of energy used in the farm.

Farm mechanization is the use of any mechanical means in the farm to enhance agricultural production.

1. Engines and Fuel

Power comes from the combustion of fuel in the engine then the power is transmitted to where it is required. Fuel can be used in farm engines to do work anywhere in the farm especially in tractors, generators and vehicles.

Advantages

Is fast, does a fine job and is versatile on the farm, useful in large farms and is labour saving.

Disadvantages:

Require high skills to operate them, cannot be used on steep slopes, is very expensive and the fuel is exhaustible. Its use leads to unemployment.

2. Animal Power

Animals which provide power are oxen, camels, donkeys, horses, elephants (and dogs in other countries). They can be used to dig the land, transport farm produce to the market or where machines are unavailable.

Disadvantages

Are slow, animals are liable to sickness and may suffer shortage of enough feeds.

NB: Bulls/oxen are harnessed by use of a pair of yoke while donkeys and horses are harnessed by use of a bridle.

3. Wind Power

Uses:

- (i) To pump water from boreholes, etc.
- (ii) To winnow crops e.g beans, finger-millet rice, etc.
- (iii) To generate electricity.

Disadvantages

Not easy to control and may not be available when needed.

4. Water Power

Uses

- (i) Irrigation.
- (ii) Production of hydro-electric power.
- (iii) Grinding mills (to grind maize, millet, etc.).
- (iv) Transportation.

Disadvantages

Difficult to use in the farm because it is not easy to control. Rivers are seasonal and in flat areas the low speed of flowing water inhibits transportation. Siltation in rivers may also lower the force of water in the dam.

5. Electricity

Uses

- (i) Runs stationary machines e.g. milling machines, grinding mills, cooling machines and water pumps.
- (ii) Supplies heat and light for operations of brooders.

Disadvantages

- (i) Can be used directly in some farm operations.
- (ii) Lack of electricity in the rural areas.
- (iii) Power failures can lead to high losses.

- (iv) It is costly to install and maintain.

6. Solar Energy

Energy obtained from the sun

Uses

- (i) Provides heat and light.
- (ii) Used by all the plants in photosynthesis.
- (iii) Dehydrating of crops e.g. vegetables, maize grains, beans, hay, etc.
- (iv) Boils water which drive turbines to produce power for minor uses.

Disadvantages

- (i) Low concentration of energy on cloudy days.
- (ii) Expensive in collecting and concentrating equipment.
- (iii) Cannot be used directly in some farm operations.
- (iv) Requires skilled labour to install and maintain.

7. Biogas

Uses

- (i) Provides heat and light for cooking, boiling water and lighting.
- (ii) Produces electricity.

Disadvantages

- (i) Only possible where there are animals under zero grazing unit.
- (ii) It is labour-consuming.
- (iii) Large quantities of dung are required.
- (iv) Cannot be used directly in some farm operations.

8. Charcoal/Wood Fuel Energy

Uses

- (i) Provides heat for boiling water, and cooking.
- (ii) Dehydrating of some crops.
- (iii) Curing of tobacco.

Disadvantages

- (i) Exhaustible.
- (ii) It cannot be used directly in some farm operations.
- (iii) Large quantities are required.
- (iv) They are bulky hence difficult to transport.

9. Nuclear Energy

It is a future potential source of energy. Not yet used in the farms now.

Farm Machinery

Primary Tillage Implements

1. Disc plough.
2. Mouldboard plough (ox-plough).
3. Chisel plough.
4. Rotavator.
5. Sub-soiler.

Functions of Primary Tillage Implements

- (i) To aerate and loosen the soil.
- (ii) Kill insects, their larval stages and breeding places.
- (iii) Destroy weeds and prevent their further growth.
- (iv) Increase the amount of humus in the soil by incorporating vegetation and manure.
- (v) Create a suitable seedbed for water and air to get in.

Parts of a Disc Plough

A disc plough is made up of heavy steel concave discs of diameter 60-70cm.

Functions of the Parts

1. The hitchmast: Is an attachment for the three point hitch. Made up of two side links and a top link. These are parts connected to hydraulic system of a tractor for lifting, pulling, etc.
2. The beam: Supports all other parts. It also adds weight for better penetration.
3. Depth wheel: Used when driving on highway, it also controls the depth of ploughing. May not be present in all disc ploughs.
4. The standard or leg: Connects the discs to the beam.
5. The hub: Allows the discs to rotate smoothly hence does the cutting of furrow slices.
6. The scrapers: Remove the trash and mud or soil which cling to the discs.

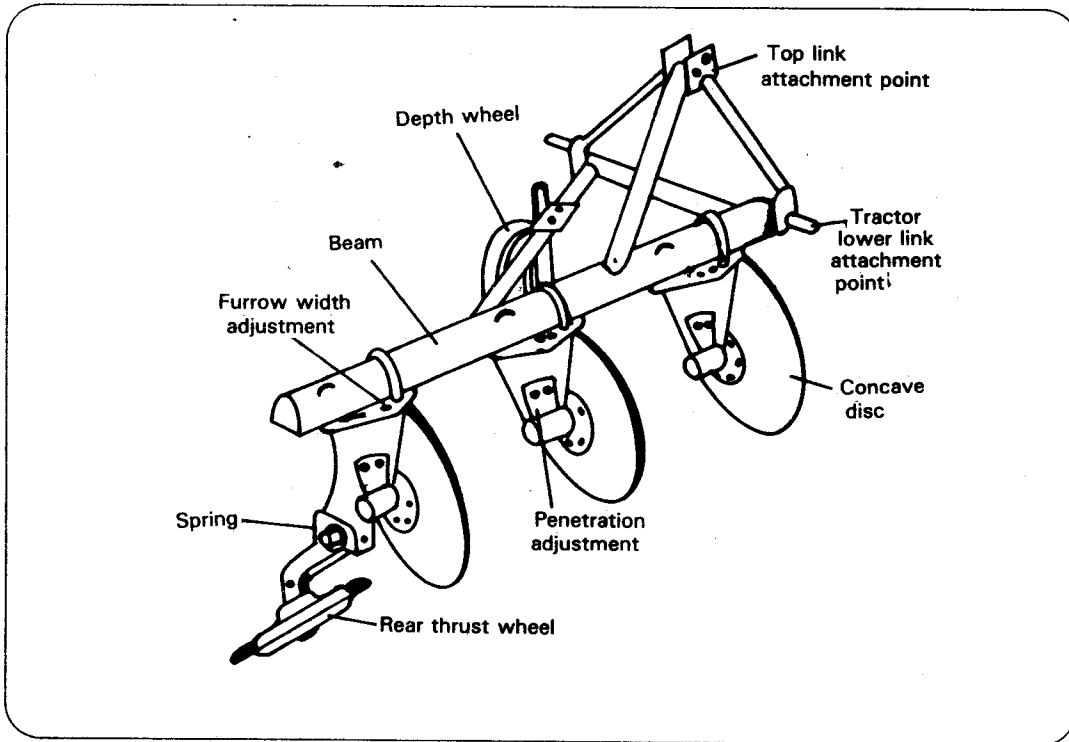


Fig. 17(a): Parts of a disc plough.

7. Disc blades: Cut and invert the furrow slices.
8. Rear furrow wheel: Controls the depth of digging and stabilises the discs.

Advantages of using a disc plough over mouldboard plough.

- (i) It requires less power to pull.
- (ii) Can be used where there are obstacles like rocks, stumps etc. because it rolls over the obstacles.
- (iii) Doesn't require constant replacement as in a mouldboard plough share.
- (iv) Less skill is required to operate than mouldboard plough.
- (v) Works well in sticky soils e.g. clay soil.

Disadvantages of a disc plough as compared to mouldboard plough.

- (i) Leaves a rough seedbed hence more operations are required to create a suitable seedbed.

- (ii) Cannot do a fine job in areas which are uneven.
- (iii) Cannot dig properly at high speed in a piece of land with a lot of trash.

Adjustments

- (i) The cutting angle should be adjusted at 35° - 50° from the line of travel. Achieved by pivoting the beam or the standard.
- (ii) Depth of digging: This is corrected by changing the height of depth wheel or adjusting hydraulic system.

Care and maintenance of a disc plough

- (i) Check for loose nuts and bolts and replace them.
- (ii) Sharpen the disc blades if blunt.
- (iii) Lubricate the rotating parts by use of oil/grease to reduce friction.
- (iv) Paint the parts which require painting e.g. the beam/framework.
- (v) Clean the implement at the end of each day's work before storage.

- (vi) Store the implement in a rain-proof structure.
- (vii) Shiny parts should be coated with old engine oil to prevent rusting.

Uses of a disc plough

Used in areas with following conditions:

- (i) New lands with many obstacles.
- (ii) Land with too much trash or tall vegetation.
- (iii) Opening up pasture land.

Parts of a Mouldboard Plough

There are two types of mouldboards; one way and two way.

Functions of Parts

- (i) Share: This makes the horizontal cut and starts the turning of the furrow slices.
- (ii) Mouldboard: Continues the turning of the furrow slices and pulverizes the soil.
- (iii) Disc coulter: Makes a vertical cut in

the soil to separate the furrow slice from the unploughed land.

- (iv) Skim coulter: Removes any trash from between the furrow slices.
- (v) Frog: It is the part where the share, mouldboard and the landside are attached.
- (vi) Landside: Stabilises the plough and absorbs the side forces created when furrow is turned.
- (vii) Shin: Leading edge of a mouldboard.
- (viii) Knife Coulter: Is a vertical knife which cuts the trash and earth ahead of the share.

Care and Maintenance

- (i) Lubricate the rolling parts e.g. wheel bearings and disc coulter bearing.
- (ii) Paint scratched parts of the plough.
- (iii) Sharpen the share or replace if worn out.
- (iv) Check all loose nuts and bolts and replace where necessary.

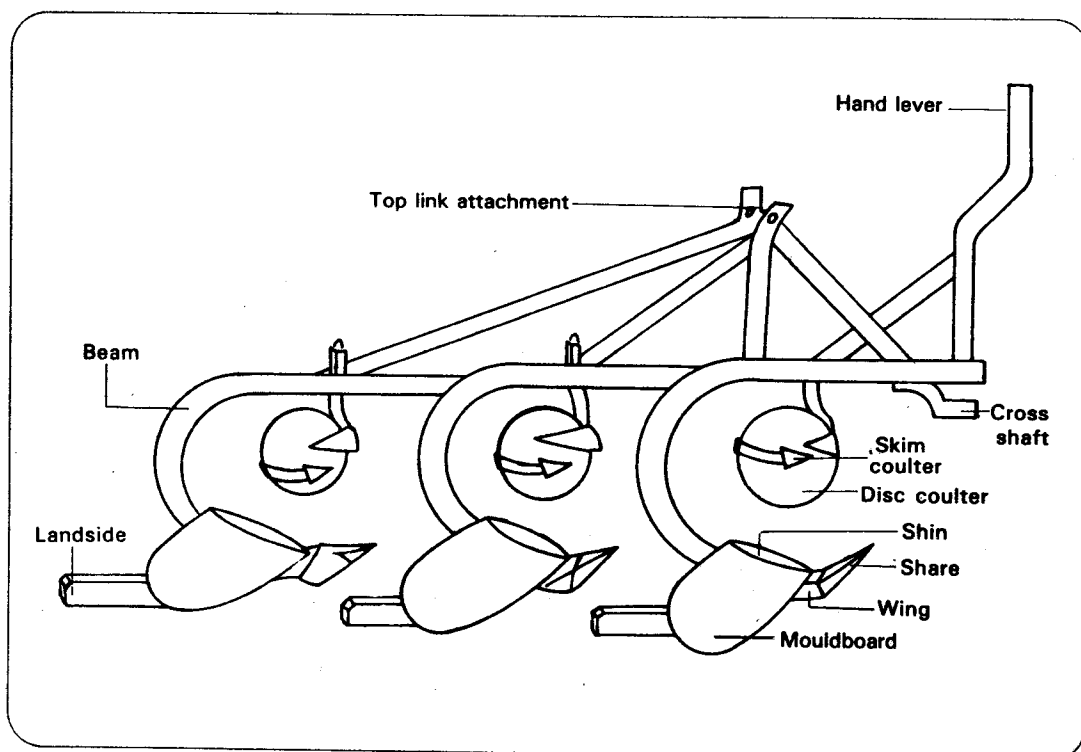


Fig. 17(b): Parts of mouldboard plough.

- (v) Clean the implement after each day's work to remove soil, mud, etc.
- (vi) For long storage, keep under a shed and apply lubricants.

Adjustments

- (i) **Depth:** Controlled by raising or lowering the depth wheel.
- Controlled by hydraulic control lever setting.
- (ii) **Pitch:** Controlled by altering the length of the top link.
- (iii) **Front furrow width:** Controlled by cross shaft adjustment lever or by rotating the cross shaft crank.
- (iv) **Lateral levelling:** Controlled by tractor lift rod.

Ox-Plough

Ox-plough is a simple type of a mouldboard plough which is pulled by a pair of oxen or donkeys.

- (i) Requires reasonably large farm so as to make the use economical.
- (ii) Common in mixed farming systems.
- (iii) Requires fairly flat land.

Advantages of an Ox-plough over Tractor-drawn Plough

- (i) Less skill is required to operate it.
- (ii) Useful where tractors cannot be used e.g. steep slopes, etc.
- (iii) Cheap to buy and maintain.

Disadvantages of an Ox-plough

- (i) Much time is wasted in training oxen.
- (ii) Tedious and laborious to the driver of the animals and the controller of the implement.
- (iii) Animals can be sick or in poor physical state.
- (iv) Extra land is required as grazing fields for the oxen.

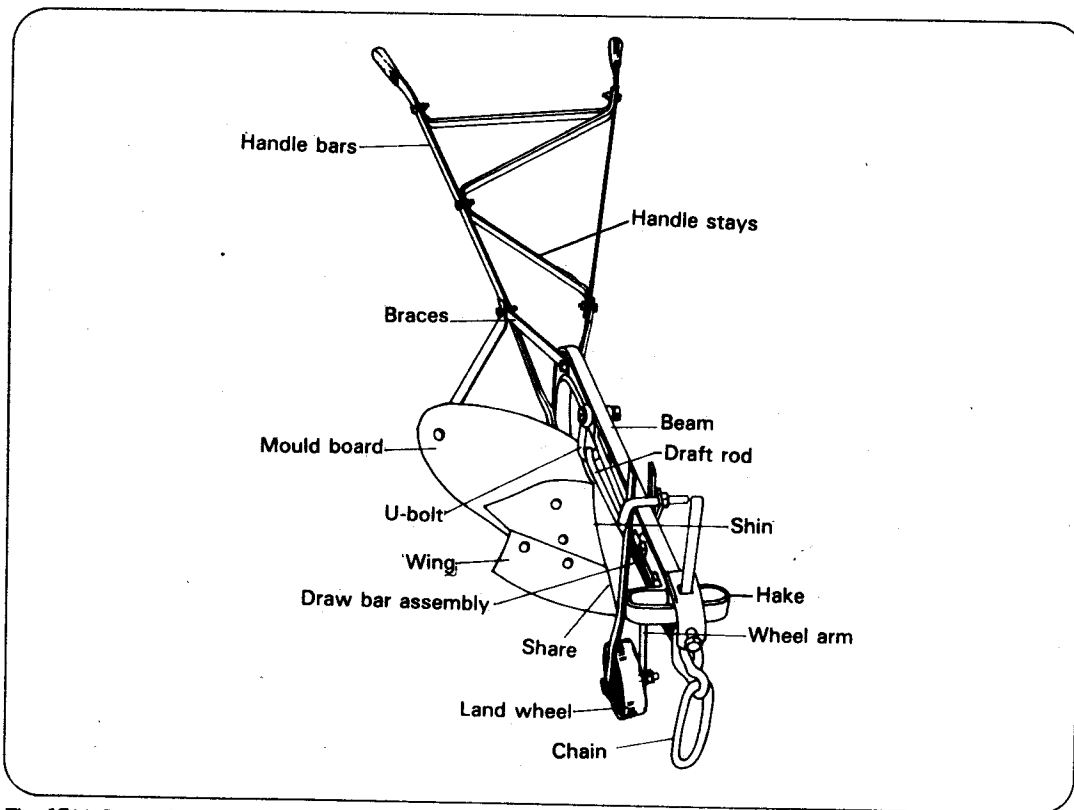


Fig. 17(c): Parts of an ox-plough.

Adjustments

Depth of ploughing is controlled by the land wheel and draft rod.

Care and Maintenance

- (i) Sharpening or replacing of the worn out share.
- (ii) Replacement of worn out parts e.g. hooks and draw bar assembly.
- (iii) Oiling the shiny parts e.g. mould-board.
- (iv) Wash off the soil after use.
- (v) Paint the handles, beam and braces to prevent rusting.

Uses

- (i) Breaks up large soil particles into small ones.
- (ii) Mixes the vegetation and the soil.
- (iii) Achieves two operations in one pass.

Adjustments

- (i) Forward speed of the tractor gives a fine tilth of the seedbed done through the gearbox.
- (ii) Depth of work done by control of depth wheel.
- (iii) Slip clutch may break in case the knives come across obstruction.

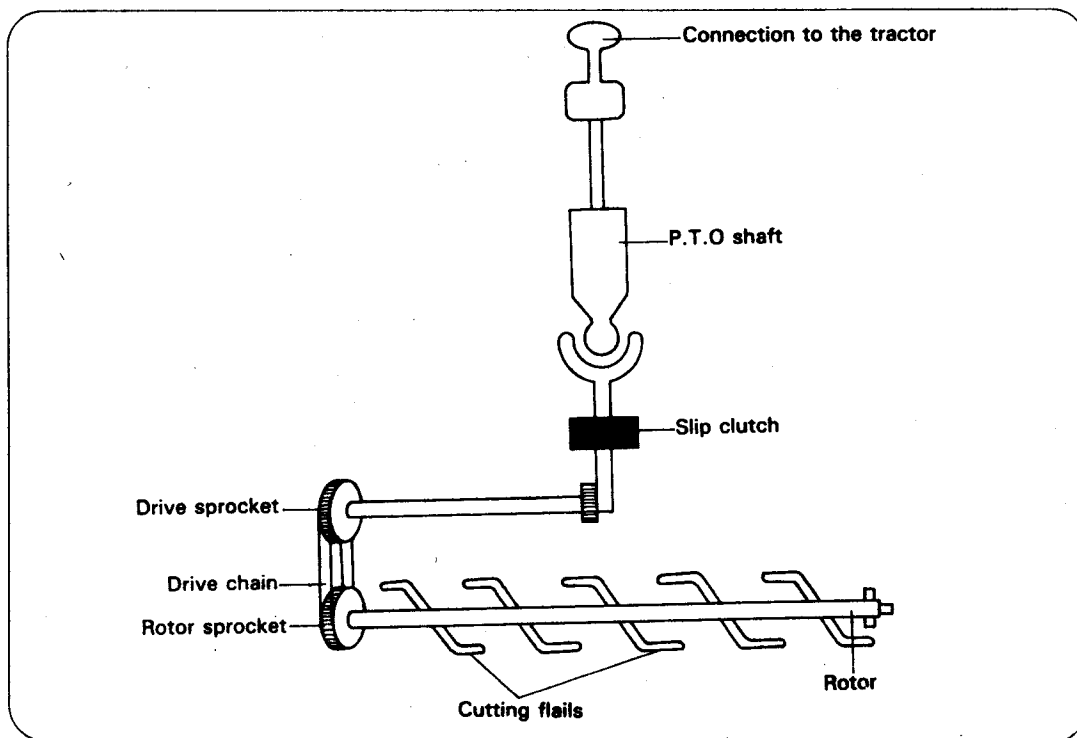


Fig. 17(d): Parts of a rotavator.

Rotavator: (Rotary Cultivator)

Work on the principles of high speed of revolving flail blades which beat and cut the soil together with trash.

It is an equipment for both primary and secondary tillage operations. It is driven by the P.T.O. shaft of a tractor.

Subsoiler

Heavier and stronger than the chisel plough. Digging depth of 51-90cm. High horse power required to pull it.

Functions

- (i) Break up compacted soil.
- (ii) Break up the hardpan.

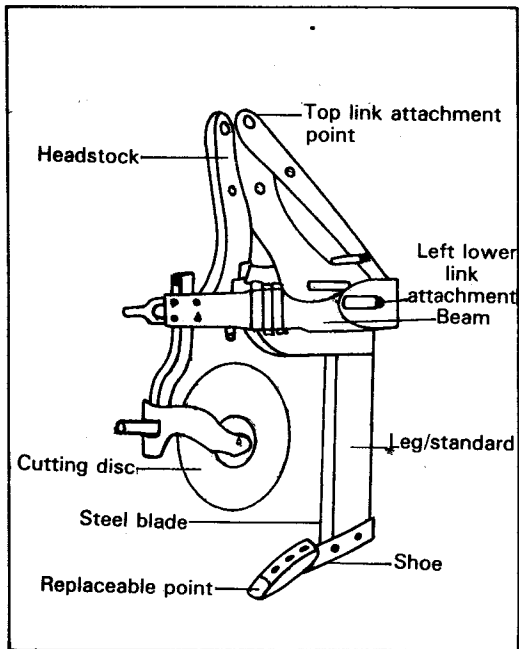


Fig. 17(e): Parts of a sub-soiler.

Care and Maintenance

- (i) Clean it after use.
- (ii) Check the point and if worn out, replace it.
- (iii) Oil when not in use.

Chisel Plough

Parts

These are frame, cultivator and tines. Tines are 60cm long.

Uses

- (i) Bursting up the sub-soil.
- (ii) Improving drainage.
- (iii) Aerating the soil.
- (iv) Breaking up hardpan.
- (v) Pulling up deep rooted weeds e.g. couch grass, etc.

Adjustment

- (i) Depth by hydraulic system or gauge wheels.
- (ii) Adjusted by use of toplink to make it

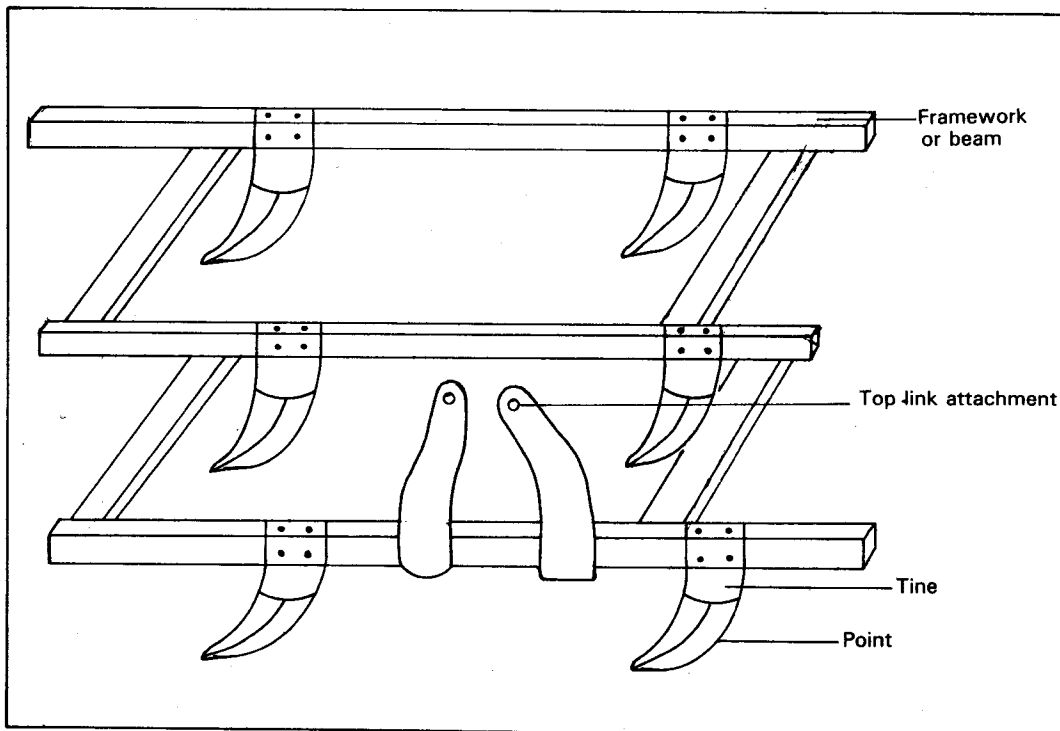


Fig. 17(f): Parts of a chisel plough.

parallel to the ground.
Care and maintenance as of subsoiler.

Secondary Tillage Implements

- (i) Harrows: These are disc harrow, spring tine harrow and spike tooth harrow.
- (ii) Cultivators.
- (iii) Ridgers.
- (iv) Rollers.

Disc harrows

It comprises a set of gangs of concave discs.

Uses

- (i) Mixing the soil particles.
- (ii) Leveling the seedbed by breaking large lumps of soil.
- (iii) Killing weeds.

Harrows can be classified according to the arrangement of the gangs e.g. single tandem, double tandem and offset tandem.

Depth adjustments

- (i) Adding weights on the harrows.
- (ii) Use of Hydraulic force.
- (iii) Use light or Heavy harrows.
- (iv) Use of regulating wheels.

Care and maintenance

- (i) Check for loose nuts and bolts daily.
- (ii) Lubricate the shafts and bearings.
- (iii) Clean and oil before storage.

Spring tine harrow

Is made up of flat and curved tines which act as springs.

Uses

- (i) Levels and smoothens the seedbed.
- (ii) Breaks the soil clods.
- (iii) Mixes trash and soil thus preventing wind erosion.
- (iv) Because of the vibrating motion it aerates the soil.

Adjustments

Depth is controlled by the horizontal connecting link and depth wheel. For individual tine, use crossbar by loosening the screw.

Care and Maintenance

- (i) Check for loose nuts and bolts and tighten them if necessary.

- (ii) Clean it after use.
- (iii) Oil the lever mechanisms.

Spike Tooth Harrows

Consist of a metal framework with rigid metal spikes which break up the soil by vigorously hitting large lumps of soil as it is pulled through the soil.

Uses

- (i) It smoothens and compacts the soil.
- (ii) It breaks big lumps of soil into small particles.
- (iii) Can be used for cultivating small crops if well set.

Ridger

It is double mouldboard plough used to make ridges and furrows. It is used to prevent water logging by draining through furrows and for easy harvesting of root crops.

Roller

This is an equipment used to compact the soil gently especially where tiny seeds are to be planted e.g. pasture seeds.

Mower

Uses

Cutting grass for hay or silage making, cutting overgrown grass and clearing the field.

Reciprocating Mower

Functions of Parts

Swath stick: Keeps the cut crop falling correctly.

Swath board: To remove the cut crop.

Shoe: Has a runner to absorb the weight and wear.

Cutter bar: Is a flat bar which guides the fingers.

Wear plate: Counter act downward force and holds the knives.

Adjustments

- (i) To adjust knife register by moving the whole bar away or towards the yoke.
- (ii) Knife lead: The outer shoe should be adjusted to be outer than the inner shoe by 4cm.

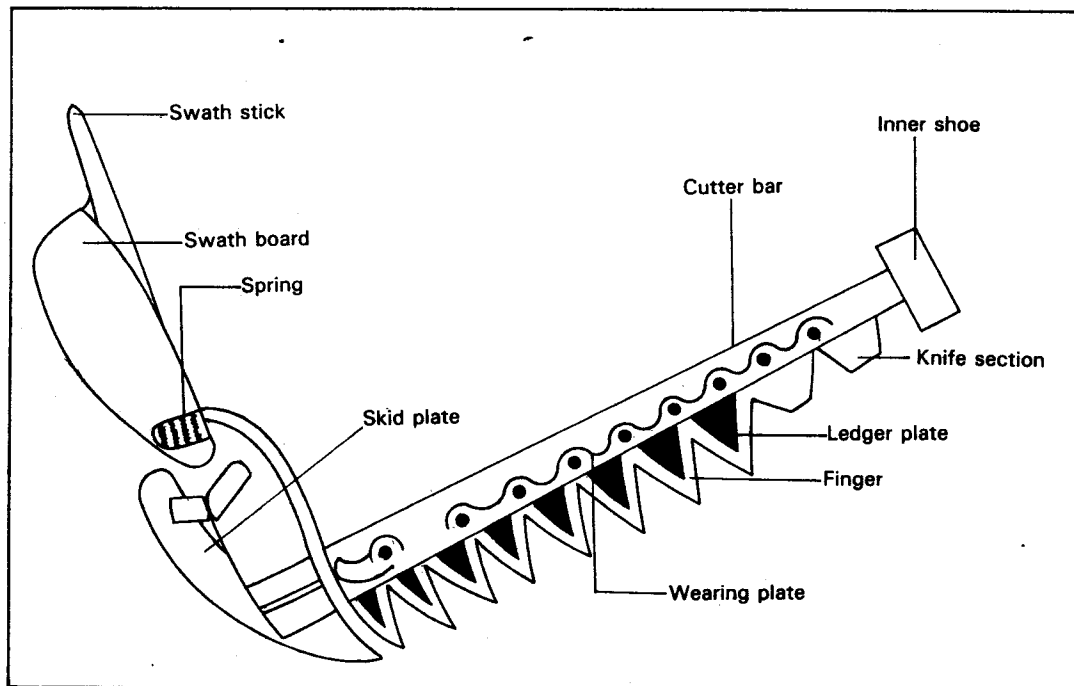


Fig. 17(g): Reciprocating mower.

Maintenance

- (i) Check for loose nuts and bolts and tighten where necessary.
- (ii) Keep knife section sharp.
- (iii) Lubricate the knife parts.
- (iv) Check knife to ledger plate cup for best cutting.
- (v) Keep all the parts tight.

Rotary Mowers

Cutting edge consists of two blades fitted opposite to each other on horizontal disc. The cutting blades swing round at high speed horizontally to the ground hence cutting is effected.

Adjustments and Maintenance

- (i) Blades should be sharp.
- (ii) Guards to be fitted around the blades to protect the operator from flying objects.
- (iii) Lubricate the P.T.O. shafts.
- (iv) Check the gear-box oil regularly and fill to the right level if necessary.

Planters

They are machines used for sowing seeds.

There are two types:

- (a) Row crop planters.
- (b) Seed drills.

Functions of the Planters

- (i) Meter the seed and fertilisers (from seed and fertiliser hopper).
- (ii) Open the seed furrow.
- (iii) Deposit the seed in the furrow through the delivery tubes.
- (iv) Cover the seed.

Functions of Parts of a Seed Plate

- (i) Filler plate: gives proper seed depth.
- (ii) False ring: allows the seed to fall from the seed plate into the boot.
- (iii) Knockout pawl: pushes the seed out of the cell by the roller action.
- (iv) Cut-off pawl: prevents more than one seed remaining in a plate cell.
- (v) Cells: shaped holes to hold the seed.

Adjustments

- (i) Adjust the coulters depth for the right crop.
- (ii) Fix the right seed-plate
- (iii) Place the planter in the level position.
- (iv) All the shafts should be free to turn.

Care and Maintenance

- (i) Check all loose nuts, bolts and tighten them.
- (ii) Clean and oil the planter after use.
- (iii) Grease the drive sprockets regularly.

Seed drills

The grain drill sows grains of wheat, barley, oats, peas, beans and alfalfa seeds.

Parts that can be adjusted to change the sowing rate:

- (i) Select the side of the feed wheel recommended on the drill charts for the seed-rate.
- (ii) Change the speed of the wheels by changing the gears or sprockets or both.
- (iii) Change the position of the feed gate in the cup.
- (iv) Use reducers below the feed wheel.

Care and Maintenance

- (i) Keep seed and fertiliser hoppers dry and clean after each day's work.
- (ii) Check the drive shafts and lubricate them.
- (iii) Paint the parts e.g. fertiliser hopper to be shiny.

Tractor Hire Services

Agricultural Mechanisation Services (A.M.S.).

There are three major units of tractor hire services:

- (a) Tractor hire services.
- (b) Plant hire services.
- (c) Mapping and survey unit.

Tractor hire services deals with farm mechanisation. There are three basic objectives of this units.

1. Assist small scale farmers to prepare their land using tractors provided by the government at subsidized rates.
2. Assist public works in laying out cut-offs and laying out terraces.
3. Survey and mapping unit help the farmers in land planning to enhance better land use and future development.

There are 19 A.M.S. stations in Kenya. Some of them are at Narok, Kitale, Garissa, Garsen, Mariakani, Marigat, Nakuru, Kipkelion, Mumala, Migori, Kitui, Siaya, Naromoru and Kajiado.

WORK TO DO

1. Tractor implements or attachments can be classified into three categories. Name them.
2. (a) State the use of trailers in the farm.
(b) State the maintenance practices carried out on trailers.
3. Give the advantages of using animal-drawn implements as compared to tractor-drawn implements.
4. Write short notes on the following sources of tractors hire services:
 - (a) Private contractors.
 - (b) Individual farmers.
 - (c) Co-operative societies.
5. Give the functions of the following parts in a tractor.
 - (a) Draw bar.
 - (b) Three point hitch.
 - (c) Levelling box.
6. Write short notes on the following:
 - (a) Winnowers.
 - (b) Disc harrows.
 - (c) Propeller shaft.
 - (d) P.T.O. shaft.
7. (a) Name four types of sprayers.
(b) State the precaution to be taken when spraying chemicals in the farm to prevent livestock and human poisoning.
(c) Give types of maintenance carried out on sprayers.

8. Under what farming conditions would one use the following:
 - (a) Mouldboard plough.
 - (b) Disc plough.
 - (c) Subsoiler.
9. Name four sources of farm power.
10. Explain maintenance practices carried out on a moldboard plough.