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Unit 2

Primary And Secondary Tillage Implements

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The following are a few important functions performed by a cultivator.

- Interculture the fields.
- Destroy the weeds in the field.
- Aerate the soil for proper growth of crops.
- Conserve moisture by preparing mulch on the surface.
- To sow seeds when it is provided with sowing attachments.
- To prevent surface evaporation and encourage rapid infiltration of rain water into the soil.
- Depending upon the type of power available for the implement, the cultivator can be classified as either tractor drawn or Animal drawn.

  The tractor drawn cultivators are further classified as Trailed type or Mounted type.

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Trailed type cultivator

- It consists of a main frame which carries a number of cross members to which tines are fitted.
- At the forward end of the cultivator, there is a hitch arrangement for hitching purpose. A pair of wheels is provided in the cultivator.
- The life is operated by both wheels simultaneously so that draft remains even and uniform.
- The height of the hitch is adjusted so that main frame remains horizontal over a range of depth setting.
- The tines in each row are spaced widely to allow free passage of the soil and trash around them.
- The tines in subsequent rows are staggered so that the implement can cover the entire width nicely.
- The depth of working is set roughly by adjusting the tine in their clamps and the final depth control is done by a screw lever.
- Usually the tines are damaged due to turning the implement at the headland without lifting it up. Care should be taken to lift the tines off the ground before turning.

Mounted type cultivator

- Tractors fitted with hydraulic system operate the mounted type cultivators.
- A rectangular frame of angle iron is mounted on three point hydraulic linkage of the tractor.
- The cross members carry the tines in two staggered lines. For actual cutting the soil, different types of shovels and sweeps are used.
- A few important shovels and sweeps are a) Single point shovel b) Double point shovel
- c) Spear head shovel d) Sweep e) Half sweep f)Furrower.
- Depending upon the type of soil and crop, shovels are chosen for use on the cultivators.
- Usually tractor drawn cultivators are of two types, depending upon the flexibility and rigidity of tines
  (i) Cultivator with spring loaded tines
  (ii) Cultivator with rigid tines.

Tractor drawn cultivators

Cultivator with spring loaded tines

- A tine hinged to the frame and loaded with a spring so that it swings back when an obstacle is encountered, is called spring loaded tine
- Each of the tine of this type of cultivator is provided with two heavy coil springs pre tensioned to ensure minimum movement except when an obstacle is encountered.
- The springs operate, when the points strike roots or large stones by allowing the tines to ride over the obstruction, thus preventing damage.
- On passing over the obstruction, the tines are automatically reset and work continues without interruption.
- The tines are made of high carbon steel and are held in proper alignment on the main frame members.
- This type of cultivator is particularly recommended for soils which are embedded with stones or stumps.
- A pair of gauge wheel is provided on the cultivator for controlling the depth of operation.
- The cultivator may be fitted with 7, 9, 11, 13 tines or more depending upon the requirements.

Cultivator with rigid tines

- Rigid tines of the cultivators are those tines which do not deflect during the work in the field.
- The tines are bolted between angle braces, fastened to the main bars by sturdy clamps and bolts.
- Spacing of the tines are changed simply by slackening the bolts and sliding the braces to the desired position.
- Since rigid tines are mounted on the front and rear tool bars, the spacing between the tines can be easily adjusted without getting the tines choked with stubbles of the previous crop or weed growth.
- A pair of gauge wheel is used for controlling the depth of operation.

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Disc harrow

- Disc harrow is a tractor drawn secondary tillage implement which has concave steel discs of 400 to 600 mm diameter mounted on long gang bolts. The discs are spaced at a distance of 150 to 250 mm by means of spacers. Each disc is provided with a scraper to remove soil sticking to the disc. Cut-away or notched discs are provided in the front gang to cut the crop residues in the field. Disc angle of the discs in a disc harrow is less than 25°.
- The angle between gang bolt and the direction of travel is called gang angle. Width of operation by the disc harrow is changed by altering the gang angle. The center line of the implement is offset to the center line of the tractor and therefore it is called offset disc harrow. Two gangs are provided one behind the other. The discs in the front gang and rear gang face opposite direction. The offset disc harrow is suitable for tilling orchards.

It is a harrow, which performs the harrowing operations by means of a set of rotating disc, each set being mounted on a common shaft.Disc harrow is found very suitable for hard ground with full of stalks and grasses.It cuts the lumps of soil, clods and roots

Discs are mounted on one, two or more axles which may be set at a variable angle to the line of motion. As the harrow is pulled ahead, the disc rotate on the ground

Depending upon the disc arrangements, disc harrow are divided into two classes

a) Single action

It is a harrow with two gangs placed end to end, which throw the soil in opposite directions. The discs are arranged in such a way that right side gang throws the soil towards right and left side gang throws the soil towards left.

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Fig.1. Types of disc harrow

b) Double action disc harrow

It is a disc harrow consisting of two or more gangs, in which a set of one or two gangs follow behind the set of the other one or two, arranged in such a way that the front and back gangs throw the soil in opposite directions and it generally covers the width ranging from 5 to 15 ft. Thus the entire field is worked twice in each trip. It may be of two types: a) Tandem and b) Off-set.

a) Tandem disc harrow

It is a disc harrow comprising of four gangs in which each gang can be angled in opposite direction

b) Off-set disc harrow

It is a disc harrow with two gangs in tandem, capable of being off-set to either side of the centre line of pull. Two gangs are fitted one behind the other. The width covered by these types of harrows ranges from 4 to 30 ft. The soil is thrown in both directions because discs ofboth gangs face in opposite directions. It is very useful for orchards and gardens. It travels left or right of the tractor. The line of pull is not in the middle, that is why it is called off-set disc harrow. Off-set disc harrow is based on the basic principle that side thrust against the front gang is

opposed by the side thrust of the rear gang. Hence the gangs are arranged at suitable angles so that both thrusts are counter balanced with each other.

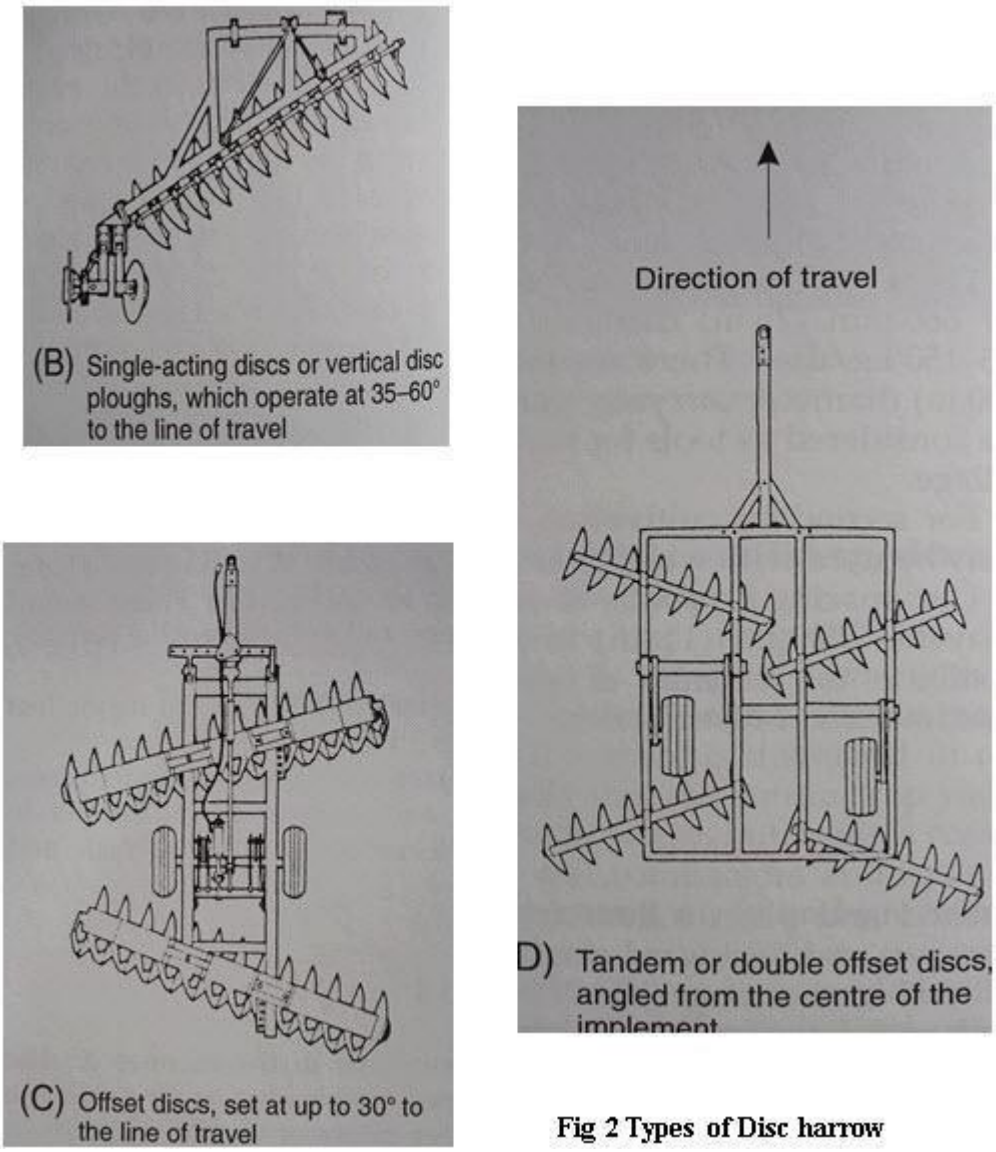

Fig 2 Types of Disc harrow

Disc harrows are of two types depending upon the source of power:

Tractor drawn and animal drawn. A disc harrow mainly consists of disc, gang, gang bolt, gang central lever, spool or arbor bolt or spacer, bearings, transport wheels, scraper and weight box

i. Disc: It is a circular concave revolving steel plate used for cutting and inverting the soil. Disc is made of high glass heat-treated hardened steel. Tractor drawn disc harrows have concave discs of size varying from 35-70 cm diameter. Concavity of the disc affects penetration and pulverization of soil. Usually two types of discs are used in disc harrows, plain disc and cut away disc. Plain discs have plain edges and are used for all normal works. Most of the harrows are fitted with plain discs only. Cut away discs have serrated edges and cut stalks, grass and other vegetations.

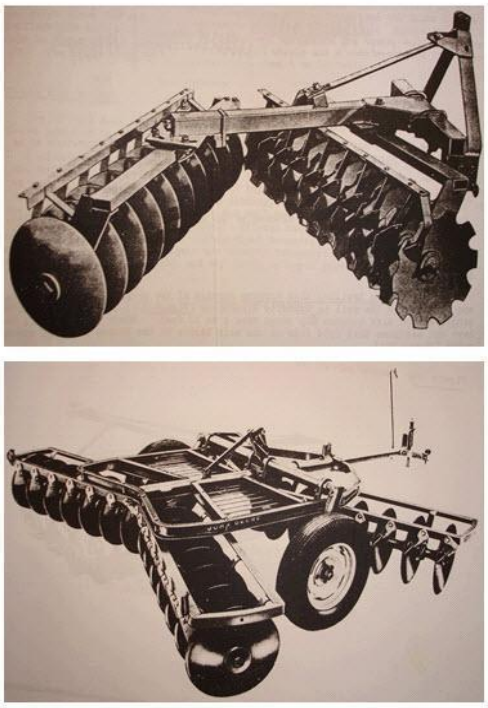

Fig.3. Disc harrow

ii. Gang: Each set of discs that are mounted on a common shaft is called the gang.

iii. Gang bolt or arbor bolt: It is a long heavy square headed bolt from the other end. A set of discs are mounted on the gang bolt. The spacing between the discs on the gang bolt ranges from 15 to 25 cm for light duty and 25 to 30 cm for heavy-duty harrows. The angle between the axis of the gang bolt and the direction of travel is called the gang angle.

iv. Gang control lever: A lever, which operates the gang mechanism of the disc harrow, is called the gang control lever.

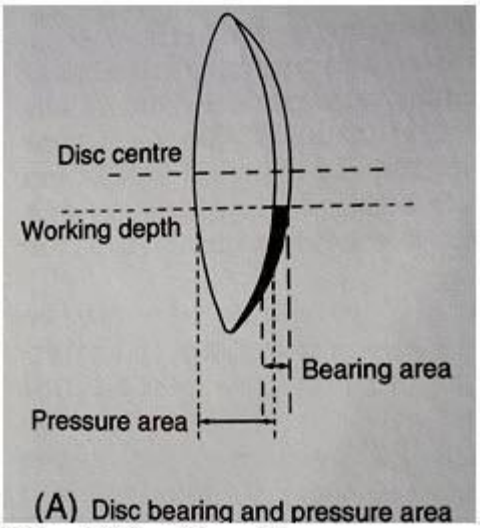

Fig. 4 Disc Bearings

v. Spool or spacer: The flanked tube, mounted on the gang bolt between every two discs to prevent the lateral movement of the disc on the shaft is called the `spool' or `spacer'. It is just a device for keeping the discs at equal spacing on the gang bolt. The standard disk spacing is 7 inches.

vi. Bearing: Bearing is essential to counter at the end thrust of the gang due to soil thrust. The harrow bearings are subjected to heavy radial and thrust loads. Chilled cast iron bearings are used to heavy radial and thrust loads and are also used due to their durability.

vii. Transport wheel: In trailing type disc harrow, the transport wheels are provided for transporting on roads and for preventing the edges of the discs from damage. Mounted type disc harrows do not require wheels for transportation.

viii. Scraper: It prevents disc from clogging. It removes the soil that may stick to the concave side of the disc.

ix. Weight box: A box like frame is provided on the main frame of the harrow for putting additional weight on the implement. Additional weight helps in increasing the penetration of the disc in the soil.

There are several factors which affect the penetration of disc harrow in the field.

The following are a few adjustments for obtaining higher penetration:

i. By increasing the disc angle

ii. By adding additional weight in harrow

iii. By lowering the hitch point

iv. By using the sharp edged discs of small diameter and losses concavity

v. By regulating the optimum speed.