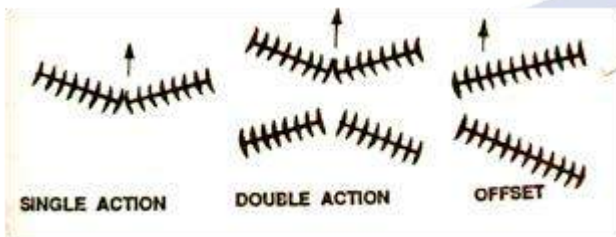


## SECONDARY TILLAGE

**Secondary tillage**, to improve the seedbed by increased soil pulverization, to conserve moisture through destruction of weeds, and to cut up crop residues, is accomplished by use of various types of harrows, rollers, or pulverizers, and tools for mulching and fallowing.

### Implements used for secondary tillage

1. HARROWS
2. DISC HARROW



#### SINGLE ACTION DISC HARROW

It is a harrow with two gangs placed end to end with an angle greater than  $90^\circ$

#### DOUBLE ACTION DISC HARROW (TANDEM DISC HARROW)

The double action disc harrow is often called a tandem harrow

#### 3.OFF-SET DISC HARROW

Offset disk harrow has one right-hand gang (throwing the soil to the right) and one left-hand gang (throwing the soil to the left), operating in tandem.

### PARTS OF A DISC HARROW

- **Disc** - Tractor drawn disc harrows have concave discs of size varying from 35-70 cm diameter
- **Gang** - Each set of discs that are mounted on a common shaft is called the gang
  - **Gang bolt or arbor bolt** - It is a long heavy square headed bolt. 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.
  - **Gang angle** - The angle between the axis of the gang bolt and the direction of travel is called the gang angle.
  - **Gang control lever** - This lever is used to change the gang angle of the gangs which in turn alters the width of operation.
  - **Spool or spacer** - The flanged 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'. Spacer keeps the discs at equal spacing on the gang bolt.



- **Bearing** - Bearing is essential for frictionless rotation of the gang.

- **Transport wheel:** In trailing type disc harrows, transport wheels are provided for transport of the harrow on roads without damage to the edges of the discs.
- **Scraper:** It removes the soil that may stick to the concave side of the disc while working and thus prevents clogging of the discs.
- **Weight box:** A box like frame is provided on the main frame of the harrow for putting additional weight on the implement to increase the penetration of the disc in the soil.

#### ➤ **SPIKE TOOTH HARROW**

- It will stir the soil to a depth of about 5 cm
- These harrows are also known as peg tooth harrow, drag harrow, section harrow, or smoothing harrow.

#### ➤ **SPRING TOOTH HARROW**

- The sections vary in width from 0.9 to 1.7m.
- Spring tooth harrow is also called as **quack grass**, and **Bermuda grass eradicator**

#### ➤ **ACME HARROW**

- It is a special type of animal drawn harrow having a transverse horizontal frame with stiff curved blades. Also known as blade harrow; curved knife-tooth harrow; pulverize.

#### ➤ **PATELA**

- It is good for creating soil mulch
- It is a wooden plank used for smoothening the soil and crushing the weeds

#### ➤ **TRIANGULAR HARROW**

- It is a spike tooth harrow with triangular frame. The frame is made of wood and pointed spikes are fitted in the frame.

#### ➤ **BLADE HARROW (BAKHAR OR GUNTAKA)**

- It is an animal drawn implement used to prepare seedbeds in clayey soils and soil mulch for soil moisture conservation.

#### ➤ **POWER HARROW – TRACTOR DRAWN**

- The width of the operation is 2000 mm. and the field capacity is around 1.5 ha/day.

#### ➤ **ROTARY TILLER**

- The rotor is operated at 180- 200 rpm

#### **Types of blades used in rotary tillers.**

- 'L' type blade** - Works well in trashy conditions. More effective in cutting weeds and but do not pulverize the soil much.
- Twisted blade** - Suitable for deep tillage in relatively clean grounds, but clogging and wrapping of trashes on the tynes and shafts needs frequent cleaning.
- Straight blade** - Employed on mulchers designed mainly for secondary tillage.



➤ **LEVELERS**

- **SOIL SCOOP** - Soil scoops are used for excavating ditches , clearing drains and doing cut and fill jobs in land leveling.

- **SECONDARY TILLAGE IMPLEMENTS FOR RICE CULTIVATION**

**1. CAGE WHEELS**

- This is an iron wheel, lugged with L angles.
- The width of full cage wheel is 1 m and that of the half cage wheel is 0.5 m.

**2. PUDDLER**

- Puddler is used for churning the soil with standing water while preparing fields for paddy transplanting.
- Puddling is done in standing water of 5-10 cm depth.
- The weight of the puddler is 30-40 kg

**Sowing**

It is an art of placing seeds in the soil to have good germination in the field.

**SOWING METHODS**

- (i) Broadcasting
- (ii) Dibbling
- (iii) Drilling
- (iv) Seed dropping behind the plough
- (v) Transplanting
- (vi) Hill dropping
- (vii) Check row planting.

**1. Broadcasting**

Broadcasting is the method of random scattering of seeds on the surface of seedbed. It can be done manually or mechanically

**2. Dibbling**

Dibbling is the process of placing seeds in holes made in the seedbed and closing the seed with soil. In this method, seeds are placed in holes made at definite depth at fixed spacing. The equipment used for dibbling is called **dibbler**.

**3. Seed dropping behind the plough**

It is a very common method of sowing followed by farmers in villages. This method is used for seeds like maize, gram, peas, wheat and barley. A woman/ man walk behind a plough ploughing the land and drop the seeds in the furrows made by the plough. Sowing behind the plough can be done by a device known as **malobansa**.



#### 4. Drilling

Drilling consists of dropping the seeds in furrow lines in a continuous stream and covering them with soil. The spacing between the seeds is not uniform. Seed metering may be done either manually or mechanically.

#### 5. Transplanting

Transplanting consists of rising the seedlings in a nursery bed and then planting the seedlings in another field (main field). It is commonly done for paddy, vegetable and flowers. It is a time consuming operation. Equipment used for planting the seedlings in the main field is called *transplanter*.

#### 6. Hill dropping

In this method, **few seeds are dropped as a hill at a fixed place and not in a continuous stream**. The spacing between hill to hill in a row is constant the equipments are called planters

#### 7. Check row planting

It is a method of planting, in which **row-to-row and plant-to-plant distance is uniform**. In this method, seeds are planted precisely **along straight parallel furrows**. The rows are always in two perpendicular directions. A machine used for check row planting is called check row planter.

### SEED DRILL

Seed drill is a machine used for placing the seeds in a continuous stream in furrows at uniform rate and at controlled depth with an arrangement of covering the seeds with soil.

### SEED CUM FERTILIZER DRILL

- They deliver both the seeds and fertilizers simultaneously in an acceptable pattern.
- Minimum diameter of seed and fertilizer tube is 25 mm

### POTATO PLANTER (AUTOMATIC SEED DROPPING)

The fertilizer and pesticide can also be placed simultaneously. It can plant in 2-4 rows. Capacity is 6000- 14000 potatoes /hr

### POTATO PLANTER (SEMI-AUTOMATIC)

The potatoes drop in the furrows due to gravity. It may plant in 2-4 rows. Field capacity is 0.15-0.35 ha/hr.

### MANUAL RICE PLANTER

- The row to row spacing is 200 mm
- It can cover **0.25 ha/ day**.
- Two men labor are required one for pulling the unit and another for transporting the mat seedlings
- The machine consists of a seedling tray, six numbers of forks



### SELF PROPELLED PADDY TRANSPLANTER

- The planter is powered by a 1.2-1.8 HP petrol engine.
- The mat seedlings of age 15-20 days are used for machine planting.
- Four bar linkage mechanism picks up 3 or 4 seedlings in each fork at a time from the mat and plant them in the puddled soil.
- The machine maintains a row to row spacing of 28 cm to 30 cm and plant to plant spacing of 14 to 16 cm.
- The planting capacity of the machine is about 0.05 to 0.1 hectare per hour.

### MODIFIED MAT NURSERY FOR MACHINE PLANTING

- **Establishing a Modified Mat Nursery**
- **Seed:** To plant 1 ha (with 2 seedlings/hill at 20 X 20 cm spacing), use 18-25 kg good quality seeds (i.e., >80% germination and establishment) and Good seeds result in 5-20% higher yields.
- **Nursery area:** Prepare 100 m<sup>2</sup> nursery for each 1 ha to be planted.
- **Pre-germinating seed:** Soak the seeds for 24 h
- **Sowing:** Sow the pre-germinated seeds uniformly and cover them with a thin layer of dry soil. (Approximately 1 seed/cm<sup>2</sup>)
- **Watering:** Protect the nursery from heavy rains for the first 5 days. If the nursery can be flooded then at 7 DAS, maintain a 1-cm water level around the mats. Drain the water 2 days before removing the seedling mats for transplanting
- **Lifting seedling mats:** Seedlings reach sufficient height for planting in 15-20 DAS.

#### ➤ FIELD PREPARATION FOR RICE TRANSPLANTING

- Plough the field 20-25 cm deep using a mould board plough or wooden plough to expose the eggs of harmful insects, pests and rhizomes of weeds.
- Apply uniformly half of nitrogen and total quantities of phosphorus and potash on drained surface at the time of last Puddling and incorporate in the top 10-15 cm deep soil.

### IMPLEMENTS FOR INTERCULTURAL OPERATIONS – HOES, LONG HANDLED WEEDERS, CULTIVATORS, AND ROTARY TILLERS

#### 1. HAND HOE

- The operator holds the handle and cuts the soil with the blade to a shallow depth of 2-3 cm thereby weeds are cut and soil is stirred.
- The coverage is 5-7 cents per day.





### 1. LONG HANDLE WEEDERS

#### ➤ Star type weeder

- It is suitable for weeding in dry lands. It can be used in garden lands also when the soil moisture is low (10-15 %).
- Star wheel is designed for **loamy soils**. The operating width of the blade is 120 mm. The coverage is 0.05 ha/day.

#### ➤ Peg type weeder

- It is suitable for weeding in dry lands. It can be used in garden lands also when the soil moisture is low (10-15 %).
- Peg type wheel is designed for **clayey soils**. The operating width of the blade is 120 mm. The coverage is 0.05 ha/day.

**Note** Both star type and peg type weeders are also called as dry land weeders.

#### ➤ Wheel hoe

- The coverage is **0.05 ha/day**.

## CULTIVATORS

### 1. ANIMAL DRAWN CULTIVATOR

#### a) Sweep

- It consists of V shaped blades with bevel edged wings called sweeps.
- By skimming action under the soil at a shallow depth of 2 to 3 cm
- The coverage is 1.75 to 2.5 ha/day.

#### a) Junior hoe

- The coverage is 1.5 ha per day

#### a) Duck foot cultivator

- Usually, this cultivator is about 225 cm long; 60 cm wide with 7 sweeps.

### 2. ENGINE OPERATED WEEDER

- a) It consists of a 3-hp engine (petrol start kerosene run)
- b) The field capacity is 0.75 – 1.0 ha per day.
- c) Useful for weeding in row crops whose rows spacing is more than 60 cm.

### 3. ENGINE OPERATED ROTARY TILLER

- a) It consists of a 3-hp engine (petrol start kerosene run)
- b) The field capacity is 0.75 – 1.0 ha per day.
- c) Depth of cut is 8-12 cm
- d) Useful for weeding in row crops whose rows spacing is more than 60 cm