



**SNS COLLEGE OF TECHNOLOGY**  
**An Autonomous Institution**  
**Coimbatore – 35**

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Approved by AICTE , New Delhi and Affiliated to Anna University , Chennai.

**DEPARTMENT OF AGRICULTURE ENGINEERING**

**19AGB302 – FARM IMPLEMENTS AND MACHINERY**

**(2020-21 BATCH) III – YEAR V SEMESTER**



# Tractor Operated Subsoil Coir Pith Applicator



Power requirement –tractor (hp) : 45 and above

Field Capacity, ha/h : 0.075

Cost, Rs. : 50000

## Salient features

- Suitable for loosening the subsoil and placing the coir pith at 30 cm depth
- The sub soil coir pith mulch applied at 15-30 cm deep ensures higher moisture retention, crop growth and yield, improved soil structure
- Coirpith act as soil conditioner, subsurface mulch and rooting medium
- Enhanced water holding capacity, Increased yield of rain fed crops



# TWIN ROW COIR PITH APPLICATOR



Power requirement –tractor (hp)	:	50 and above
Field Capacity, ha/h	:	0.125
Cost, Rs.	:	80000

## **Salient features**

- Suitable for accurate and controlled application of organic manure/mulch directly below the root zone of crop.
- Helps in improving the soil nutrient use efficiency, crop yield and soil quality.
- Adjustable spacing between furrows enables to use at different row spacing
- Simultaneous precise placements of organic manure and inorganic fertilizer



## TRACTOR OPERATED SPADING MACHINE



Power requirement – tractor (hp)	:	40 and above
Field Capacity (ha/h)	:	0.09 to 0.12
Cost, Rs	:	100000/-
<b>Salient features</b>		
<ul style="list-style-type: none"><li>➤ Alternative to the Plough for the Primary Tillage</li><li>➤ Used for uniform depth of ploughing.</li><li>➤ Spading enables the root system of crops to access the most fertile, surface layer of the soil</li><li>➤ Spading machines can operate in wet soil, where other implements are unusable</li><li>➤ It mixes manure and other items uniformly</li><li>➤ The clods lifted are in ideal size and soil is left perfectly leveled</li></ul>		



# TRACTOR OPERATED LASER GUIDED LAND LEVELER



<b>Power requirement (hp)</b>	<b>:</b>	<b>45-50 Tractor</b>
<b>Field capacity (ha/hr)</b>	<b>:</b>	<b>3</b>
<b>Cost, Rs.</b>	<b>:</b>	<b>3,50,000/-</b>

## **Salient Features**

- **Perfectly levelled surface enabling quicker and uniform spread of irrigation water, thus reducing time taken for irrigation.**
- **Due to absence of high and low spots in the field, uniform establishment of plants.**
- **Reduction in depth of standing water required due to level surface.**
- **Ensures formation of firm subsoil layer reducing deep percolation of water and nutrients.**
- **Reducing soil leaching due to undulations**





# WETLAND LASER LEVELLER



Power requirement- tractor (hp) : 50 and above

Field Capacity, ha/h : 0.26

Cost, Rs. : 4,50,000

## Salient features

- Suitable for leveling in the wetland
- Levelled puddled surface is obtained with laser control without any difficulty.
- Precision leveling is done with the help of laser beam



# PURPOSE OF SECONDARY TILLAGE OPERATIONS



- **Secondary tillage : Operations performed to create proper soil tilth for seeding and planting.**
- **Lighter and finer operations, performed after primary tillage .**
- **Consists of conditioning the soil to meet the different tillage objectives .**
- **Do not cause much soil inversion and shifting of soil from one place to other.**
- **Consume less power per unit area.**
- **May be tractor drawn or bullock drawn implements.**



# MAIN OBJECTIVES OF SECONDARY TILLAGE



## Objectives

- (i) To improve seedbed by better pulverization of soil**
  - (ii) To destroy weeds**
  - (iii) To cut the crop residue and mix vegetative matter in top soil**
  - (iv) To break clods making the soil tilth better for better germination of seeds**
  - (v) To aerate the soil. (should not be compacted because it will affect germination).**
- (Ex. harrow, cultivators, sweeps, clod crushers, levellers, bund formers, ridge ploughs etc.)**





# HARROWS

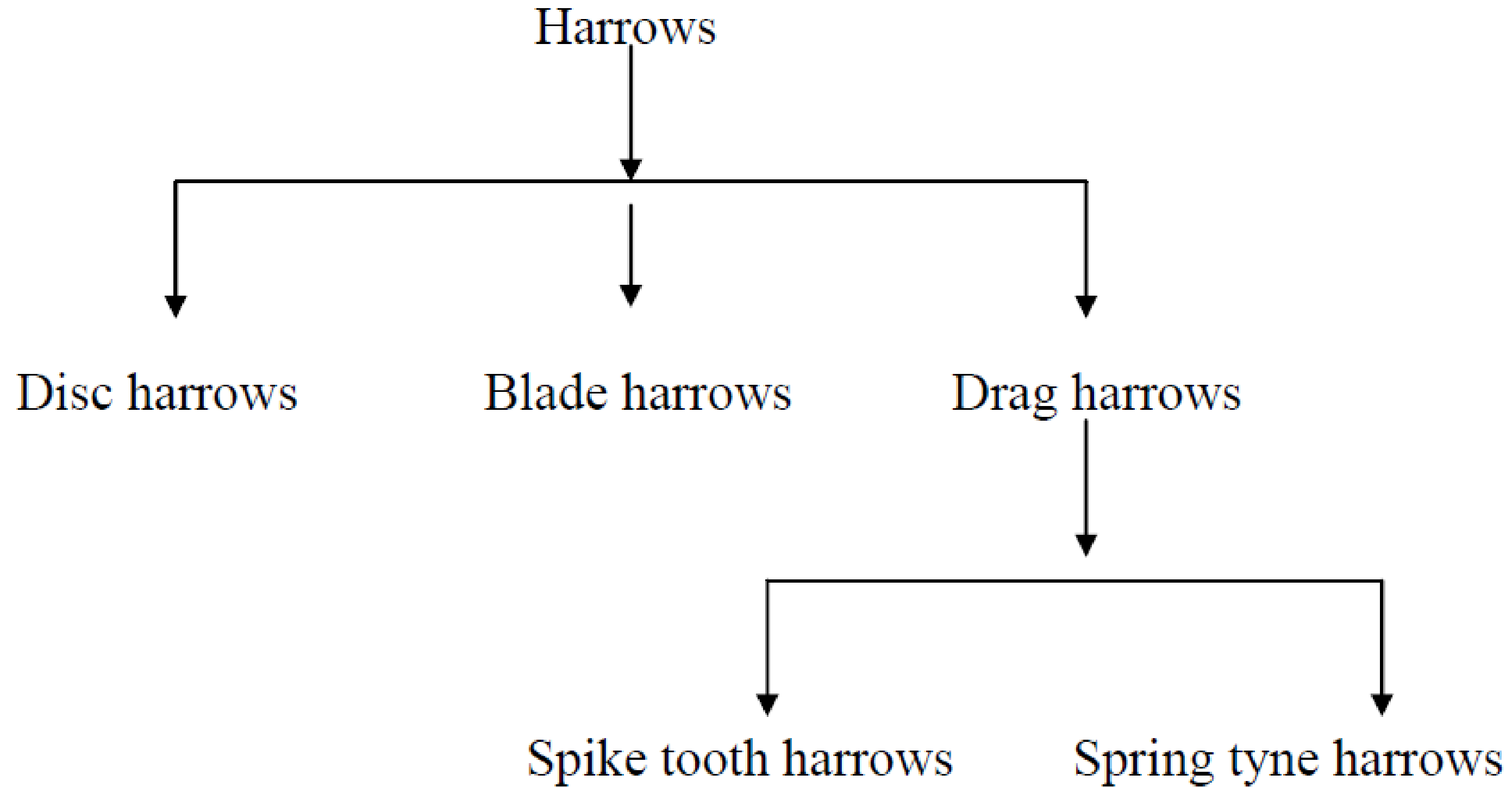


**Harrow : Secondary tillage implement that cuts the soil to a shallow depth for smoothening and pulverizing the soil as well as to cut the weeds and to mix the materials with the soil.**

**Types :disc harrow, spike tooth harrow, spring tooth harrow, acme harrow, patela, triangular harrow, blade harrow,**



# CLASSIFICATION OF HARROWS





# DISC HARROW



- A harrow, performs the harrowing operation by means of a set, or no. of sets of rotating slat discs, each set mounted on a common shaft.
- Suitable for hard ground, full of stalks and grass fields.
- 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 discs rotate on the ground.







## FEATURES OF DISCS



- **Disc is a circular, concave revolving steel plate used for cutting and inverting the soil.**
- **Disc is made of high grade heat treated hardened steel.**
- **TD disc harrows have concave discs of size varying from 35 to 70 cm dia.**
- **Concavity of the disc affects penetration and pulverization of soil.**

### Two types of disc :

- **(a) Plain disc:** plain edges-used for normal works, effective pulverization.
- **(b) Cut-away discs**
  - **Cut-away discs have serrated edges, Cut stalks, grasses and other vegetative matter better than plain discs. Cut-away discs are not very effective for pulverization of soil**
  - **Very useful for puddling the field especially for paddy cultivation.**



## CLASSIFICATION OF DISC HARROW

- **Classification of disc harrow:** based on disc arrangement as **Single action**, **Double action disc harrows**, **tandem disc harrows** and **Off-set disc harrows**.
- **Based on power source**, classified as Tractor drawn and **bullock drawn disc harrows**.

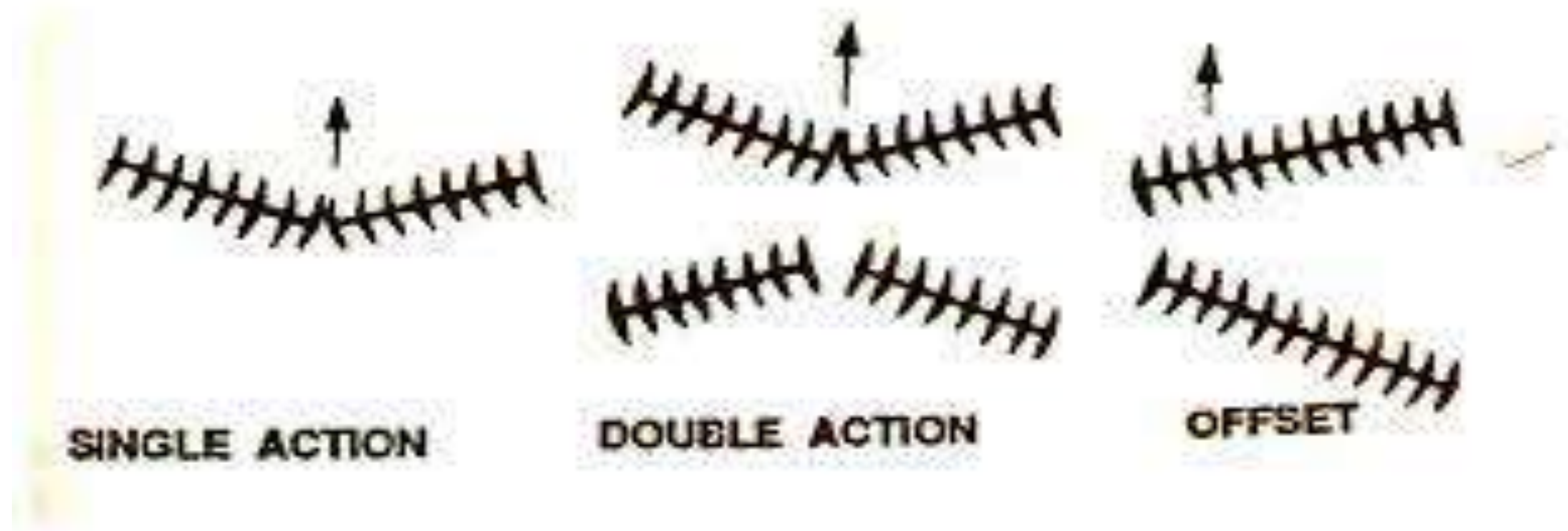


Fig.1. Types of disc harrow.



# SINGLE ACTION DISC HARROW



- a) Single action disc harrow

A harrow with two gangs placed end to end, which throw the soil in opposite directions.

- 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 .



Fig.1: Types of disc harrow





# DOUBLE ACTION DISC HARROW - OFFSET DISC HARROW



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 front and rear gangs throw the soil in opposite directions .

- Entire field is worked twice in each trip. Two types i) Tandem and ii) Off-set type.



**Fig. OFFSET DISC HARROW**





## FEATURES OF OFFSET DISC HARROW



- 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. Soil is thrown in both directions because discs of both gangs face in opp. directions.
- Useful for orchards and gardens.
- Travels left or right of the tractor.
- Line of pull is not in the middle, that's why it is called off-set disc harrow.
- Principle : side thrust against the front gang is opposed by the side thrust of the rear gang. Gangs are arranged at suitable angles so that both thrusts are counter balanced with each other.







# FEATURES OF TANDEM DISC HARROW



- **Consists of two or more gangs.**
- **Discs from front gang operate in such a manner, so as to deliver soil in one way, while discs on the rear gang throw the soil in the different direction and it usually spreads the width varying from 5 to 15 ft.**







# COMPONENTS OF DISC HARROWS



- 1.Disc** is a circular, concave revolving steel plate used for cutting and inverting the soil.
- 2.Gang:** An assembly of concave discs mounted on a common shaft with spools in between.
- 3. Gang axle:** A shaft on which a set of discs are mounted. Spacing between the discs on the gang bolt ranges from 15cm to 23cm for light duty harrows and 25 to 30 cm for heavy duty harrows.
- 4. Gang angle:** Angle between the axis of the gang & the line perpendicular to direction of travel.
- 5.Gang control lever:** A lever which operates the angling mechanism of disc harrow.
- 6.Spool or Spacer:** Flanged tube, mounted on the gang axle between every two discs to retain them at fixed position laterally on the shaft .(a device for keeping the discs at equal spacing on the axle).



## COMPONENTS OF DISC HARROWS



- 7. Bearing:** To counteract the end thrust of the gangs due to soil thrust. Disc harrow bearings are subjected to heavy radial and thrust loads.(Chilled cast iron bearings, ball bearings or tapered roller bearings ). Oil soaked wooden bearings are very common for disc harrows.. Chilled cast iron bearings are also used due to their durability.
- 8. Transport wheel:** In trailing type discs harrows, transport wheels are provided for transport work on roads and for preventing the damage of the roads and helps in protecting the edges of the discs.
- 9. Scraper:** Prevents the discs from clogging. Removes the soil that sticks to concave side of the disc.





## 10.Weight box



- **A box frame is provided on the main frame of harrow for putting additional weight on the implement. Additional weight helps in increasing the penetration of the disc in the soil.**
- **Several factors affect the penetration of disc harrow in the field. If the disc gangs are set perpendicular to the line of draft, the penetration is not adequate.**
- **For obtaining maximum penetration, the gangs should be set with the forward edges of the discs parallel to the direction of motion.**
- **If the hitch point is lowered, better penetration is achieved.**
- **A sharp edged disc has more effective penetration compared to blunt edged disc.**
- **It is observed that penetration is better in low speed than in high speed.**

# ADJUSTMENTS FOR OBTAINING HIGHER PENETRATION OF DISC HARROWS



## 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 lesser concavity
- v. By regulating the speed.





# DRAG HARROWS



**Drag harrows are used to.....**

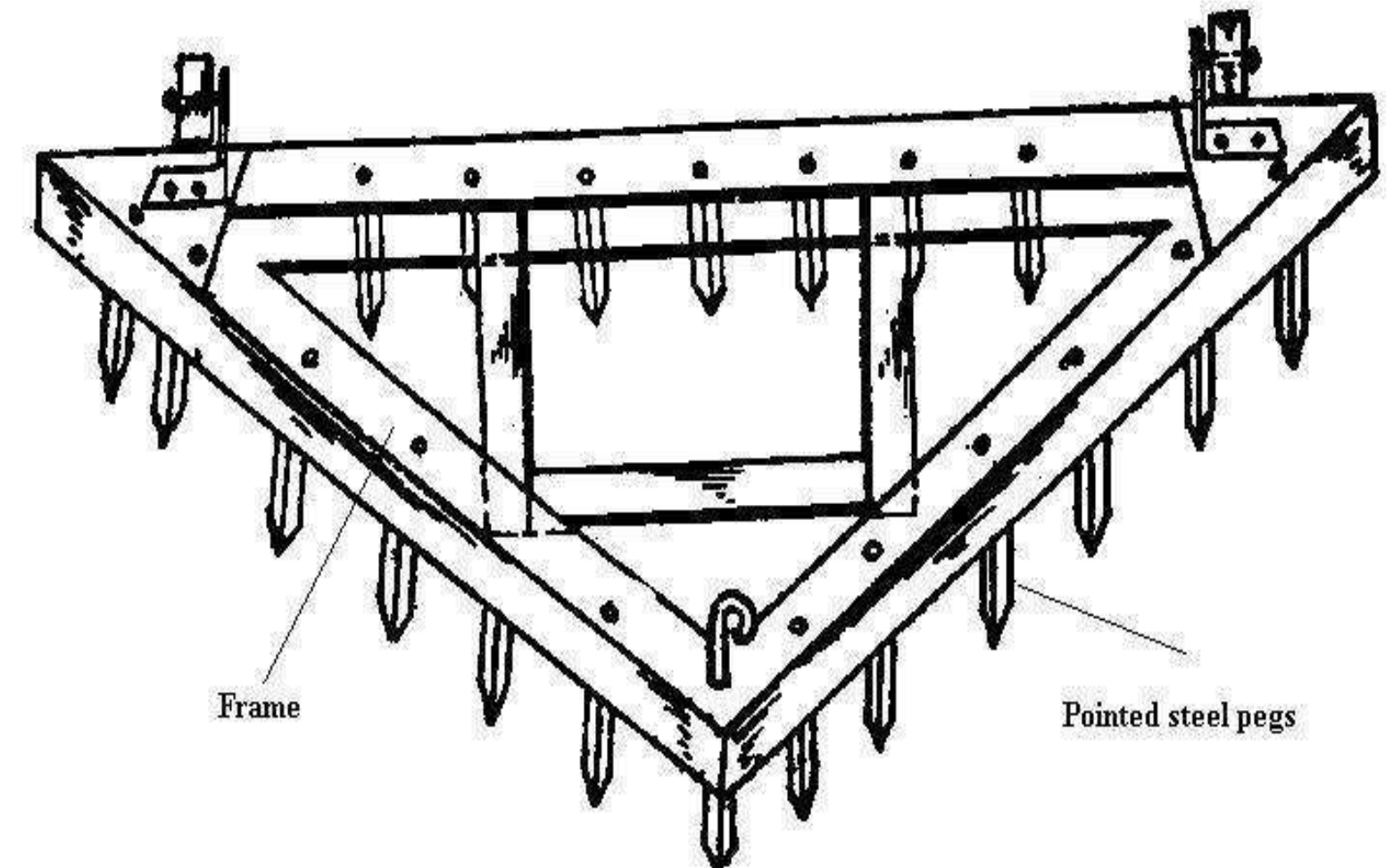
- break the clods,**
- stir the soil,**
- uproot the early weeds,**
- level the ground,**
- break the soil crust and cover the seeds.**
- Two principal kinds of drag harrows,**
- (1) spike tooth**
- (2) spring type harrow.**



# SPIKETooth or PEGTOOTH HARROWS (TRIANGULAR HARROW)



- Spiketooth harrows are either rigid or flexible. Flexible type tractor drawn can be rolled up for transporting. Animal drawn harrows are always of rigid frame type.
- Basic frame of the harrow may be triangle. It has pointed steel pegs (teeth) with their pointed ends towards ground.
- Peg point is tilted backward vertically so that soil is not accumulated in the front. Dragged over the surface by a chain or rope tied to the yoke.
- AD harrows cover almost 1 to 1.2 m width and are







## SPRING TYNE TRACTOR DRAWN HARROWS



- TD Spring tyne harrows have looping, elliptical or spring like tynes.
- AD unit is provided with elliptical tynes. Basic frame of harrow is rectangular.
- Used extensively to prepare ploughed land before planting.
- Penetrate deeper than spike tooth harrows & are used in soil where obstructions like stones, roots and weeds are hidden a few cms below the surface.
- Spike tooth and spring tyne harrows do not require lubrication.
- Teeth may also be removed for sharpening.







## TEXT BOOKS

- |    |  |
|----|--|
| 1. | Michael, A.M. & Ojha, T.P. “Principles of Agricultural Engineering Vol. I & II”, Seventh Edition, Jain Brothers, New Delhi, 2011. (Unit I,II,III,IV,V) |
| 2. | D. N. Sharma and S. Mukesh. 2010. Farm Machinery Design Principles and Problems. Second Edition. Pusa Agri-Book Service, IARI, New Delhi.              |
| 4. |  |



## REFERENCES



- |    |   |
|----|---|
| 1. | Harry L. Field, John B. Solie, Introduction to Agricultural Engineering Technology – A problem solving approach, Springer Science, NY, USA, 2007. (Unit III,IV,V) |
| 2. | 1. Ajit K. Srivastava et. al. 2012. Engineering Principles of Agricultural Machines. Second Edition. American Society of Agricultural and Biological Engineers.   |
| 3. | Jagdishwar Sahay. “Elements of Agricultural Engineering”, Standard Publishers and Distributors, 2010.   |
| 4. |   |