Topic: Introduction to Agronomy

JRF/ SRF Coaching Classes & Examination Series

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Introduction

- Agriculture – Latin words '*ager'* – soil and '*cultura '* – cultivation.
- Agronomy – Greek words '*agros*' – field and '*nomos*' – to manage.
- Father of Agronomy – Peter Decresenzi.
- Father of Weed science – Jethro Tull , Coined – 'Weed', 'Zero Tillage'.

He developed seed drill and horse drawn cultivator and published a book ' Horse Hoeing Husbandry'.

- Van Helmont – He concluded that the main principle of vegetation is water.

Important events in history of agriculture (Reddy & Reddy)

- Boussingault – Father of field plot experiments. He first stated that plants derive carbon from air.
- Father of soil testing technique- M L Troug

- Liebig - Founder of Modern Agricultural Chemistry and proposed Law of minimum (1843).A scientific approach to farming was started in 1840.

- Arthur Young – conducted pot culture experiments and published works in Annals of Agriculture.

- Oldest agricultural experiment station was started in Rothamsted in England on 1843 by Lawes and Gilbert.

Milestones

- 1880 – Famine Commission was appointed.
- 1901- First Irrigation Commission
- 1905 - Imperial Agricultural Research Institute (IARI) was started at Pusa, Bihar
- 1912 - Sugarcane Breeding Institute was established in Coimbatore
- 1929 - Imperial Council of Agricultural Research at New Delhi (then ICAR) after independence becomes ICAR (recommendation of Royal Commission,1926)
- 1936 - Due to earth quake in Bihar, IARI was shifted to New Delhi.
- 1957- AICRP on Maize
- 1960- First Agricultural University was started at Pantnagar
- 1966-67 - Green revolution in India due to introduction of HYV –Wheat, rice, use of fertilizers and pesticides.
- For institutes visit:www.icar.org.119.htm

- 1973-DARE(Department of Agricultural Research and Education)
- 1974- KVK
- 1986- Technology Mission on Oilseeds

  - **Botanical Names of Crops and origins**
  - **Terms and Agronomists related (Nemraj Sunda ,Pg : 44)**
  - **Journals and their Publishers**

❑ Kheti , Phal Phool, Krishi Chayanika –ICAR

❑ Indian Journal of Agricultural Sciences –ICAR

❑ Indian Journal of Agronomy -Indian Society of Agronomy, IARI, New Delhi

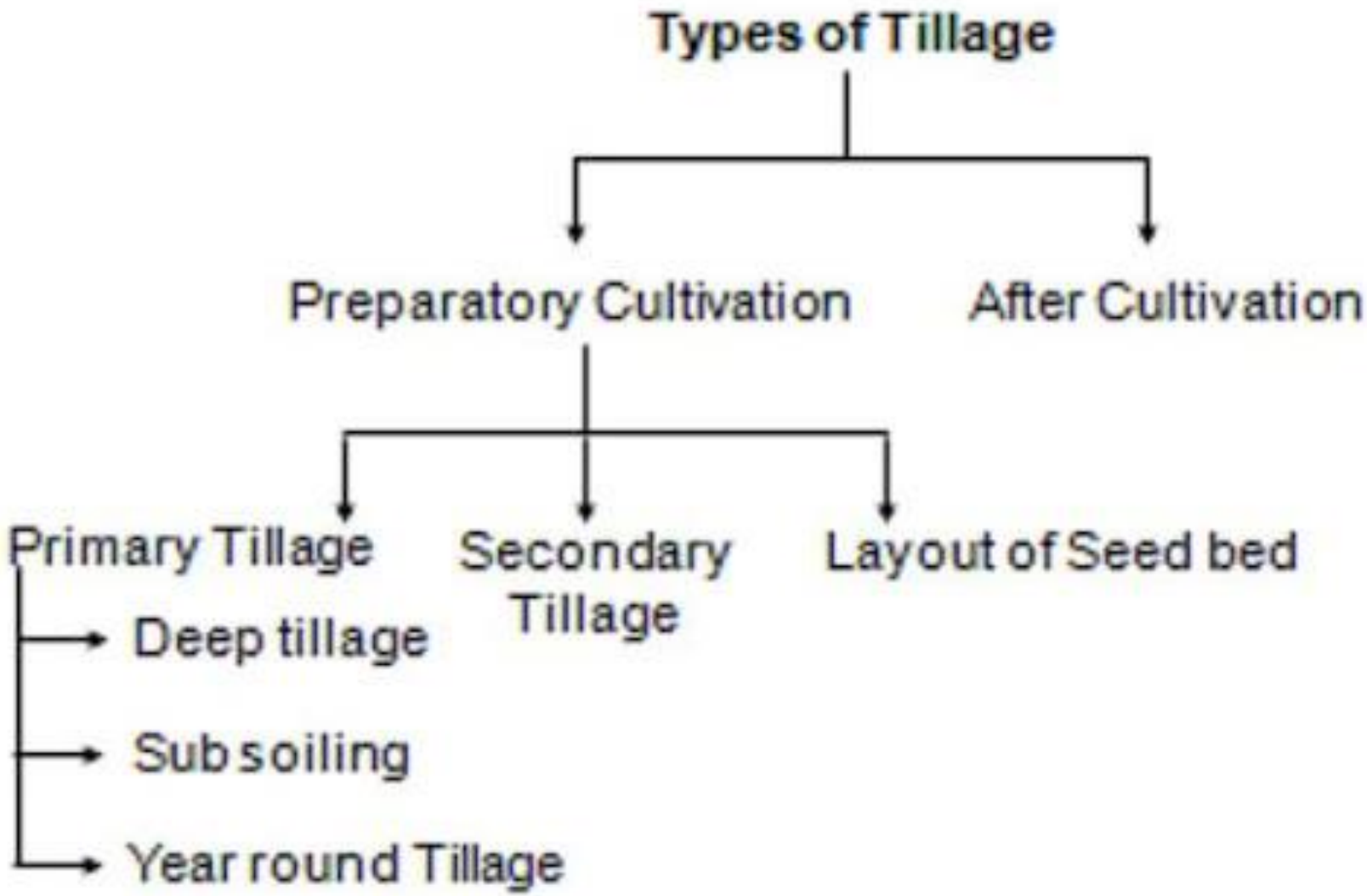
❑ Indian Journal of Weed Science-Indian Society of Weed Science, NRCWS, Jabalpur

Tillage

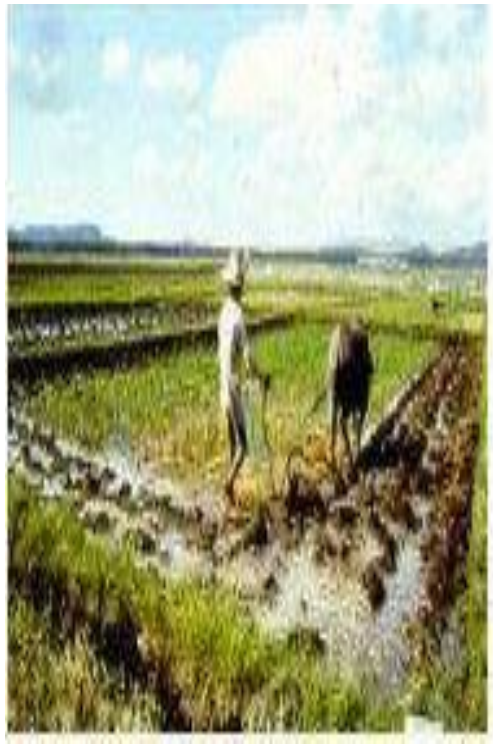
Tillage

- Tillage - 'Anglo-Saxon' words *Tilian* and *Teolian*, meaning 'to plough'
- Tillage-Physical manipulation of soil to get good tilth.
- Tilth – Physical condition of soil from tillage.
- Jethrotull- Father of tillage. He suggested that plant roots directly absorb soil particles.
- Good Tilth-size distribution + friability of soil
- Irrigated agriculture – larger aggregates > 5mm dia
- Dryland agriculture – smaller aggregates – 1-2 mm dia
- Soil aggregates -1-5 mm size –favourable for growth
- Capillary and non capillary pores are equal
- BD decreases,WHC increases,pore space increases

- Tillage at improper moisture- Hard pans
- Soils with good structure- Crumbly and granular
- Tillage loosens the soil surface and decreases thermal conductivity and heat capacity.
- Tillage increases oxidation and decomposition of organic matter resulting in fading of colour.


Types of Tillage
Preparatory Cultivation
After Cultivation
Primary Tillage
Secondary Tillage
Layout of Seed bed
Deep tillage
Subsoiling
Year round Tillage

Primary Tillage/Ploughing



- Opening of compacted soil using ploughs.
- Optimum soil moisture – 25 to 50% depletion of available soil moisture.
- Depth of Ploughing - Effective root zone depth.
- Heavy soils : 3 to 5 ploughings
- Light soils : 1 to 3 ploughings

Types Of Primary Tillage

1. Deep Tillage

- The rhizomes and tubers of perennial weeds(world' s problematic weeds *viz.,Cynodon dactylon* and *Cyperus rotundus*) dies.
- Summer deep ploughing kills pests due to exposure of pupae.

CRIDA ,Hyderabad

shallow ploughing: 5-6 cm

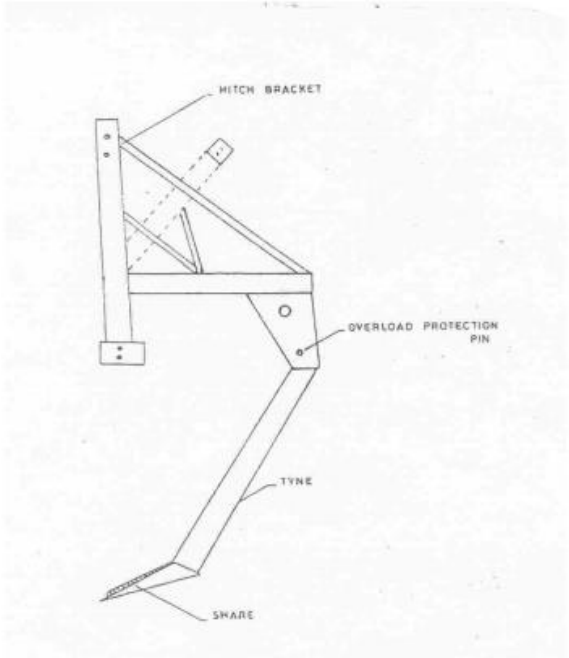
medium deep ploughing: 15-20 cm

deep ploughing: 25-30 cm

Subsoiling

- Subsoiling is breaking the hard pan without inversion and with less disturbance of top soil.
- Hard pans may be present in soil which may restrict root growth of crops.
- Cotton roots grow to a depth of 2m in deep alluvial soil without any pans.
- When hard pans are present, cotton roots grow only upto 15-20cm.

- Chisel ploughs - break hard pans present even at 60-70 cm.
- Effect of subsoiling does not last long.
- To avoid closing of subsoil furrow, vertical mulching is adopted.

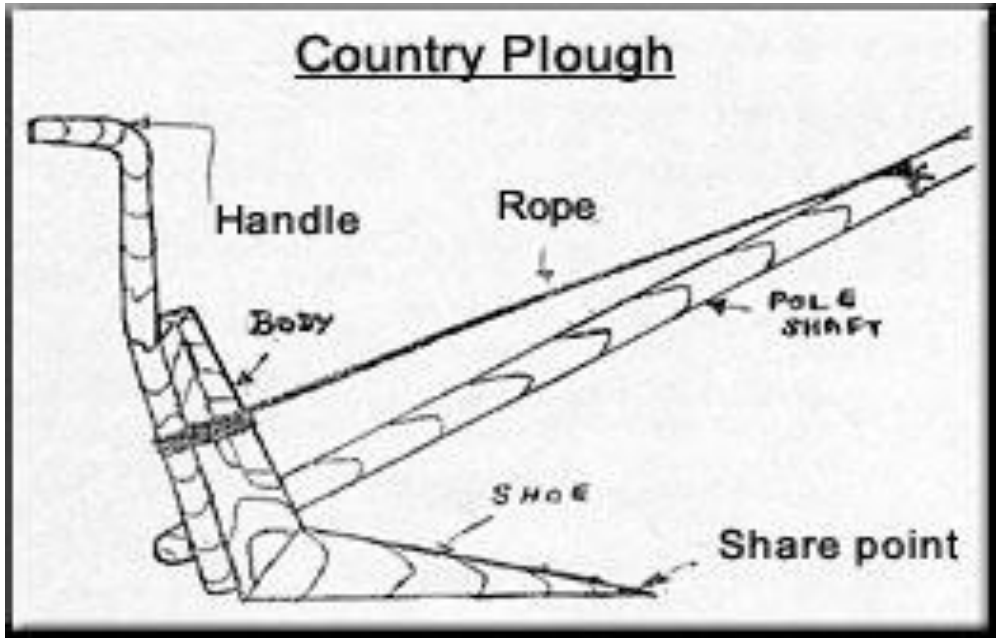


Primary Tillage Implements

- Country plough/wooden plough/Indigenous plough

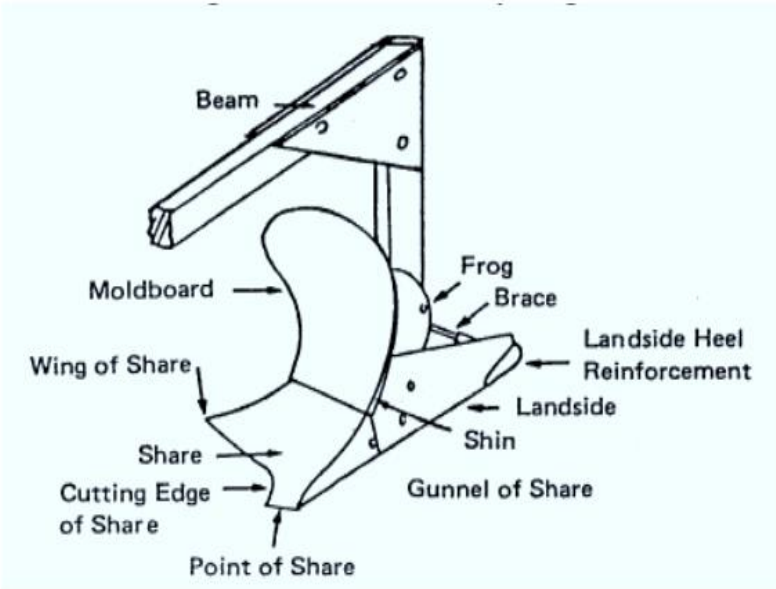
  Used for multiple purposes.

  Cuts V-shaped furrows,no inversion.



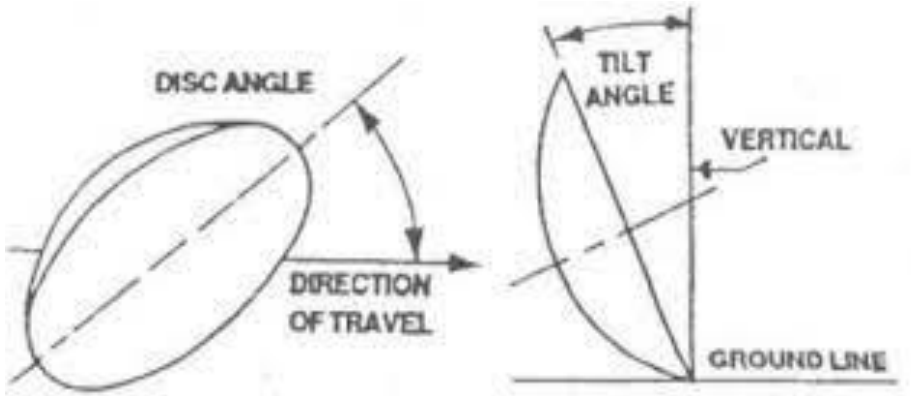
Mould board plough

- This type of plough leaves no unploughed land as the furrow slices are cut clean and inverted to one side resulting in better pulverization.
- MB ploughs are used where soil inversion is necessary.



Disc Plough

- A large,revolving,concave steel disc ,replaces the share of MB plough.
- The usual size of the disc is 60 cm in diameter and this turns a 30-35 cm furrow slice.
- The disc turns the furrow slice to one side with a scooping action
- The disc plough is more suitable for land in which there is more fibrous growth of weeds as the disc cuts and incorporates the weeds.



Angles of disc plough

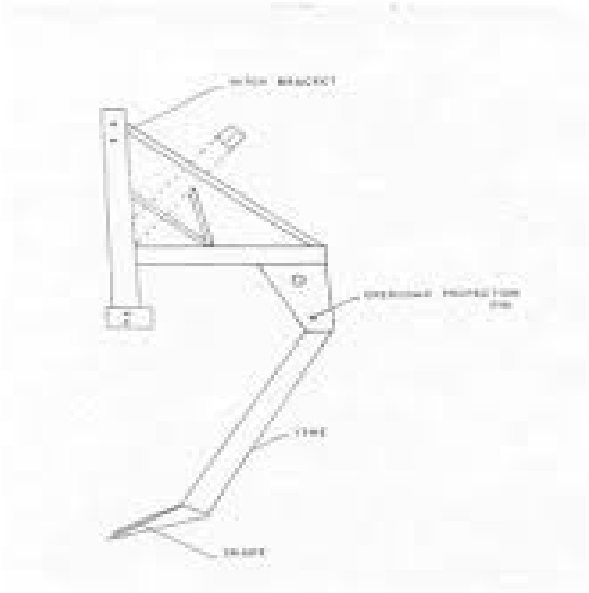
Special Ploughs

Subsoil ploughs

- Subsoil plough is designed to break up hard layers or pans without bringing them to the surface
- The body of subsoil plough is wedge shaped and narrow
- Share is wide so as to shatter the hard pan and making only a slot on the top layers

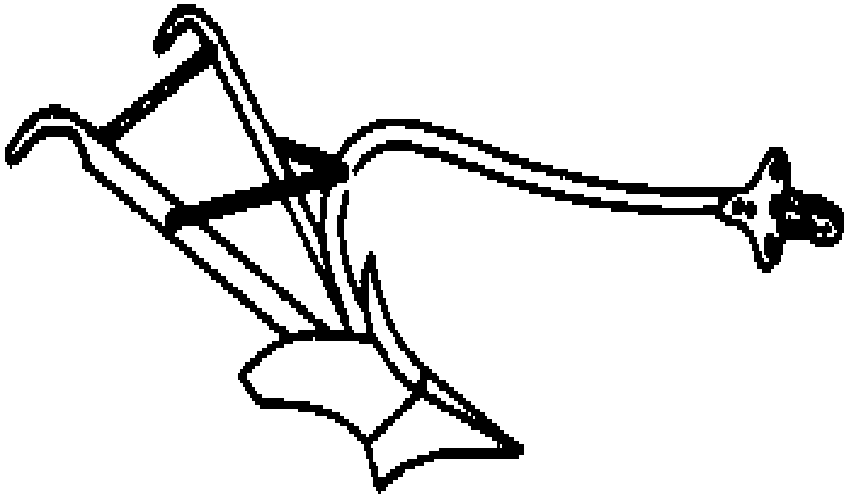
Chisel plough

- Chisel plough is used for breaking hard pans and for deep ploughing with less distrurbance to the top layers.
- Its body is thin with replaceable cutting edge so as to have minimum disturbance to the top layers.



Ridge Plough

- Ridge Plough has two mould boards,one for turning the soil to the right and another to the left.
- The share is common for both the mould boards i.e. double winged.These mould boards are mounted in a common body.



Basin Lister

- It is a heavy implement with one or more boards or shovels whivh are mounted on a special type of frame on which they act alternatively.
- They are used to form listed furrows(broken furrows with small dams and basins)to prevent free runoff and blowing off the soil in low rainfall areas.

Secondary Tillage/Harrowing

- Lighter or finer operations performed on the soil after primary tillage are known as secondary tillage.
- Harrowing is done to a shallow depth to crush the clods and to uproot the remaining weeds and stubbles.
- Disc harrows,cultivators ,blade harrows etc., are used.

Types of Secondary Tillage

1.Cultivators

Tractor Drawn Cultivator

- Used for breaking clods and working the soil to fine tilth in seed bed preparations.
- Also called as Tiller/Tooth Harrow
- Cultivator has 2 rows of tynes attached to frame in staggered form.
- The number of tynes ranges from 7-13.
- Also controls weeds that germinate after ploughing.

Sweep Cultivators

- It consists of large inverted V shaped blades,run parallel to the soil surface at a depth of 10-15 cm
- They are arranged in two rows and are staggered.
- Used in Stubble mulch farming where due to clogging,preparation of land is difficult.
- Used to control weeds and also for harvesting Groundnut.

2.Harrows: Shallow cultivation operations like seed bed preparation, covering seeds and control weeds.

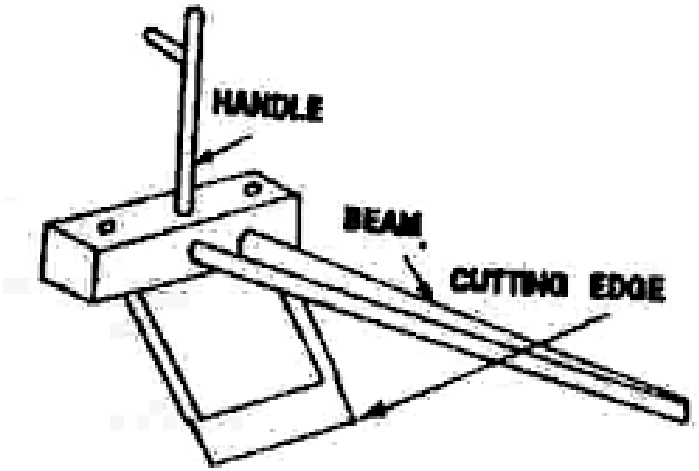
1. Disc harrow

- It consists of a number of concave discs of 45-55 cm dia.
- Discs are smaller in size than disc plough, but more number of discs are arranged.
- These discs are fitted 15 cm apart on axles.
- Discs cuts through soil and effectively pulverize the clods.

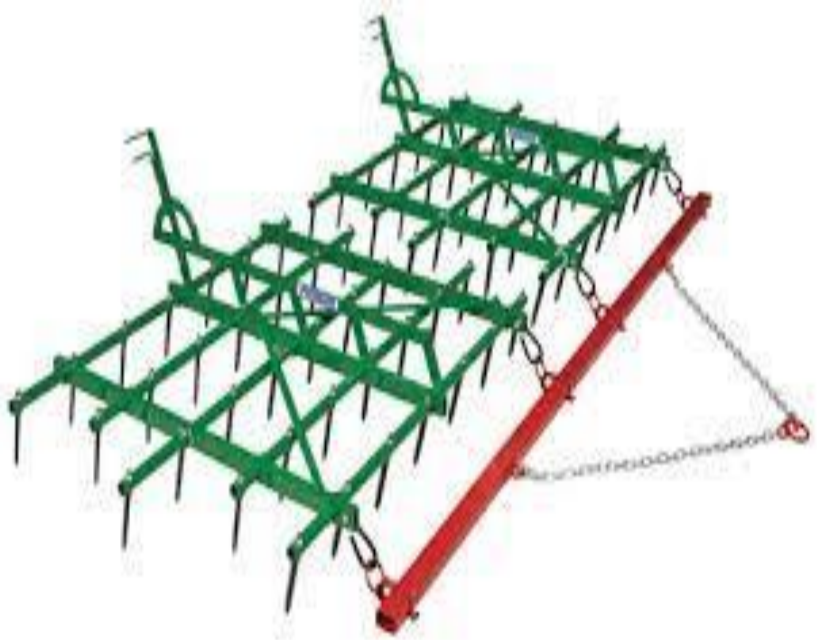
Disc Harrow

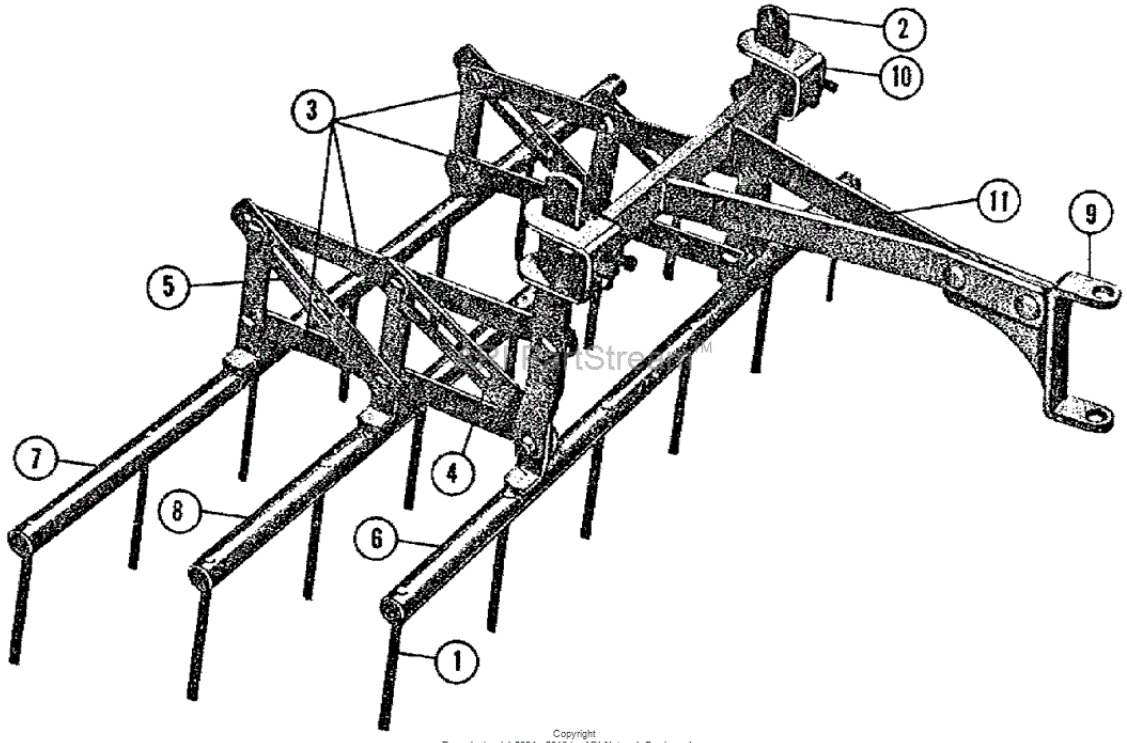
Disc Plough

2. Blade harrow: removal of weeds ,crushing of clods

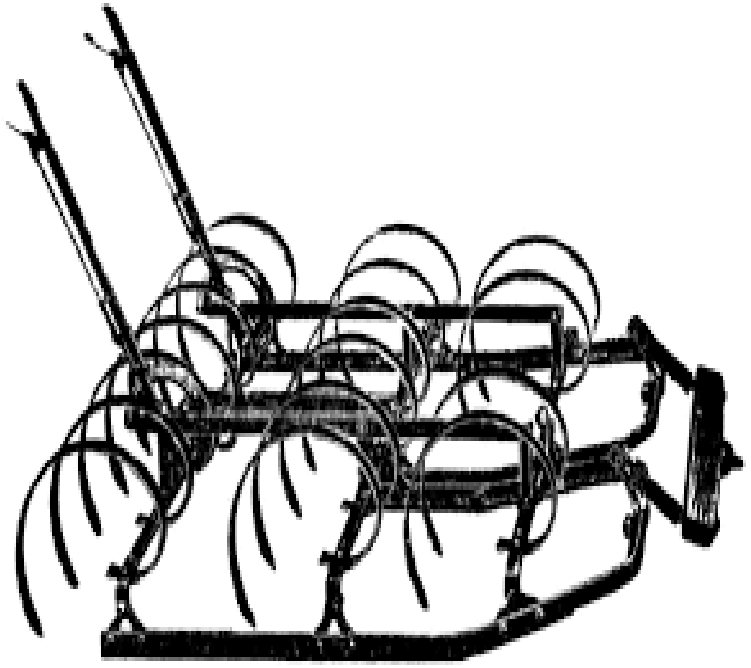


Spike Tooth harrow





Spring Tooth harrow



Modern Concepts Of Tillage

- Minimum Tillage/Reduced Tillage
- Zero Tillage/No Till
- Stubble mulch tillage

Minimum Tillage

- Aims at reducing tillage to minimum necessary for good seedbed,germination and establishment.
- USA -1974
- In 2 ways:
- 1. By omitting operations which do not give much benefit when compared to the cost.
- 2. By combining agricultural operations like seeding and fertilizer application.

The advantages of minimum tillage

- Improved soil conditions due to decomposition of plant residues.
- Higher infiltration caused by the vegetation present on the soil and channels formed by the decomposing of dead roots
- Less resistance to root growth due to improved structure.
- Less soil compaction due to reduced movement of heavy tillage implements.

The disadvantages of minimum tillage

- Seed germination is lower than in minimum tillage.
- Sowing operations are difficult with ordinary equipments.
- More nitrogen has to be added as rate of decomposition of organic matter is slow.
- Nodulation is affected in crops like peas and broad beans.
- Continuous use of herbicides causes pollution and resistance of problematic weeds.

The minimum tillage systems can be grouped as:

1. Row zone tillage

Primary tillage is done with mould board plough in the entire area of the field; secondary tillage operations like discing and harrowing are reduced and done only in row zone.

2. Plough plant tillage

After the primary tillage, a special planter is used for sowing. In one run over the field, the row zone is pulverized and seeds are sown by the planter

3. Wheel track tillage

Primary ploughing is done as usual. Tractor is used for sowing; the wheels of the tractor pulverize the row zone in which planting is done.

Zero tillage (No tillage)

- Zero tillage is an extreme form of minimum tillage.
- Primary tillage is avoided.
- Secondary tillage is restricted to seedbed preparation in the row zone only.
- Father Of Zero Tillage: GB Triplets
- Before sowing ,the vegetation is destroyed by broad spectrum, nonselective herbicides witrh short residual effects (Paraqaut,Glyphosate) are used
- Seedling establishment in zero tillage is 20% less
- 50-100% residue on soil surface

- Till planting is one method of practicing zero tillage

  4 tasks in one operation:Clean ,Open,Place,Cover.

Advantages

- Reduction in the crop duration and thereby early cropping can be obtained to get higher yields.
- Reduction in the cost of inputs for land preparation and therefore savings around 80%.
- Organic matter is added.
- Residual moisture can be effectively utilized.
- Environmentally safe- carbon sequestration.
- No tillage reduces the compaction of soil.

Disadvantages

- Higher amount of nitrogen has to be applied for mineralization of organic matter in zero tillage.
- Perennial weeds may be a problem.
- High number of volunteer plants and buildup of pests.

No Till leaves 100 % residue on the soil surface.

Conservation Tillage leaves 30% of residue on the soil surface.

Conventional Tillage leaves less than 15% of residue on the soil surface.

Stubble mulch tillage or stubble mulch farming

- Soil is protected at all times either by growing a crop or by leaving the crop residues on the surface during fallow periods.
- Two methods for sowing crops in stubble mulch tillage are:

1. Similar to zero tillage, a wide sweep and trash bars are used to clear a strip and a narrow planter shoe opens a narrow furrow into which seeds are placed.

2. A narrow chisel of 5-10 cm width is worked through the soil at a depth of 15-30 cm leaving all plant residues on the surface. The chisel shatters the tillage pans and surface crusts. Planting is done with special planters.

Sweep plough

Puddling

- Ploughing with standing water to create an impervious layer below the surface to reduce the deep percolation losses of water.
- Create soft bed for rice.
- Destroys soil structure – sand ,silt, clay gets separated.
- Increases Bulk Density from 1.4 to 1.7 g/cc.
- How is it done?
- Objectives – reduce percolation ,reduce weeds
- Wetland puddler /wetland plough

Thank You!

AgriGates

Exploring frontiers in agriculture

Lets Discuss Now..

Let ‘s Discuss

Statement 1

The environment of crop constitutes both soil and aerial environment, as part of the plant inside the soil and other part exposed to atmosphere.

Statement 2

The soil and aerial environment of the crop can be altered easily.

1. Both statement 1 and 2 are true.
2. Both statement 1 and 2 are false.
3. Statement 1 is correct but Statement 2 is false.
4. Statement 1 is incorrect but Statement 2 is true.

- The special plough used to break hard pans and for deep ploughing with fewer disturbances to top layers is

a) Chisel plough
b) Subsoil plough
c) Rotary plough
d) Basin lister

- Self Tilled soils?

a. Alfisols
b. Vertisols
c. Inceptisols
d. Entisols

- Smallest wooden Plough is..

a. Danti
b. Black soil plough
c. Wetland plough
d. Dryland plough

- Which of the following is not a soil turning plough?

a. MB plough
b. Disc plough
c. Sweep cultivator
d. Turn wrest plough

- A pair of oxen can produce a power of?

a. 1 hp
b. 0.5 hp
c. 0.8 hp
d. 0.4 hp

- Identify the odd one out:

a. MB plough
b. Disc plough
c. Cultivator
d. Basin lister