

STUDY ON AGRICULTURAL IMPLEMENTS

Mirza Hasanuzzaman, PhD
Professor
Department of Agronomy
Sher-e-Bangla Agricultural University
E-mail: mhzsauag@yhoo.com

Introduction

The implements are used for different agricultural operation in order to raise crops within a farm are termed as agricultural implements. The different agricultural operation includes all the works done in the field from ploughing to harvesting, threshing, winnowing, cleaning and storing of the agriculture produce.

Some terminologies

Tillage: Tillage refers to mechanical manipulation of the soil that are used to provide necessary soil conditions favorable for the growth of crops.

Intercultural operations: The operations or cultural practices which are done between the periods of seed sowing and harvest of crops are called intercultural operations. e.g. weeding, mulching etc.

Pest: Any agents, which are directly or indirectly harmful to human being are known as pest. e.g. weeds, insects etc.

Ploughing: Ploughing is the process of opening the soil with the help of plough. It is the most important operation for seed bed preparation as well crop production. The depth of ploughing varies from 10 to 30 cm.

Furrow: The 'V'-shaped opening by the country plough at the time of ploughing is known as furrow.

Furrow slice: The soil which comes from the creation of 'V'-shaped furrow by country plough is known as furrow slice.

Ridge: The raised portion of soil between the two 'V' shaped furrow is called ridge.

Plough pan: The hard layer formed under the certain depth of soil surface due to continuous ploughing by a same plough in the same land for several years is known as plough pan.

IMPLEMENTS FOR PLOUGHING

The implements which are used in ploughing operation are known as ploughing implements.

Functions of ploughing:

1. It cuts the soil
2. It inverts the soil partially or completely
3. It sometimes pulverizes the soil
4. It control weeds and insects
5. It helps in mixing manures and fertilizers.

Types of ploughs:

- A. Country plough
- B. Mouldboard plough
 - i. Standard plough
 - ii. Sub-cum plough
 - iii. Kishan plough
 - iv. Chashi plough
- C. Disc plough
- D. Rotary plough/Rotavator



A. Country plough

A country plough is commonly used ploughing implement in our country and also performed tillage operation. It is made of wood except share. Share is used for making furrows. Its grooves are used to join the plough with the yoke and to maintain the depth of ploughing.

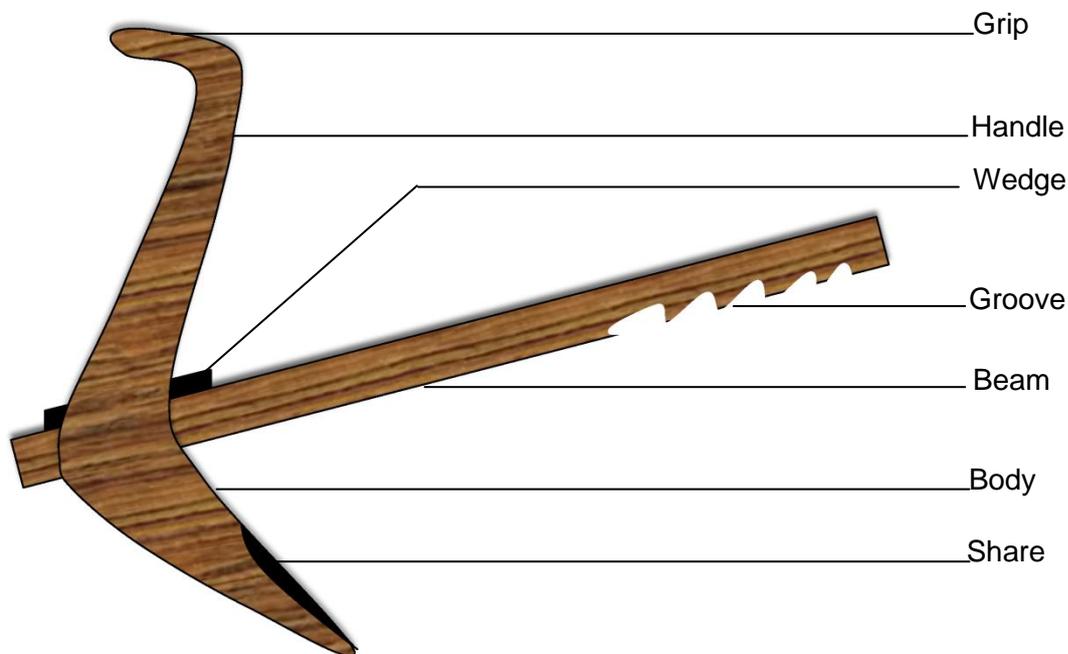


Fig. Country plough and its different parts

Characteristics of ploughing by country plough:

1. The depth of ploughing is about 0–15 cm.
2. It has no mouldboard hence there is no inversion of soil.
3. 'V' shaped furrow is made remaining the unploughed land between the two furrows.
4. When increase the length of the beam the depth of furrow is increased and vise-versa.

Efficiency: 0.135 ha /working day (8 hours).

Merits:

1. Low cost of making.
2. It can be made easily.
3. It is easy to operate.
4. It can be transferred easily from one location to another.
5. It is light in weight. So, our country bullocks can draw it easily.

Demerits:

1. Depth of ploughing is low.
2. It can not invert and pulverize the soil properly.
3. It makes plough pan.
4. Unploughed land remains between two furrows.

B. Mouldboard plough

In Indian sub-continent, a more improved plough that had the specialty of having mouldboard was developed. This special type of plough is known as mouldboard plough.



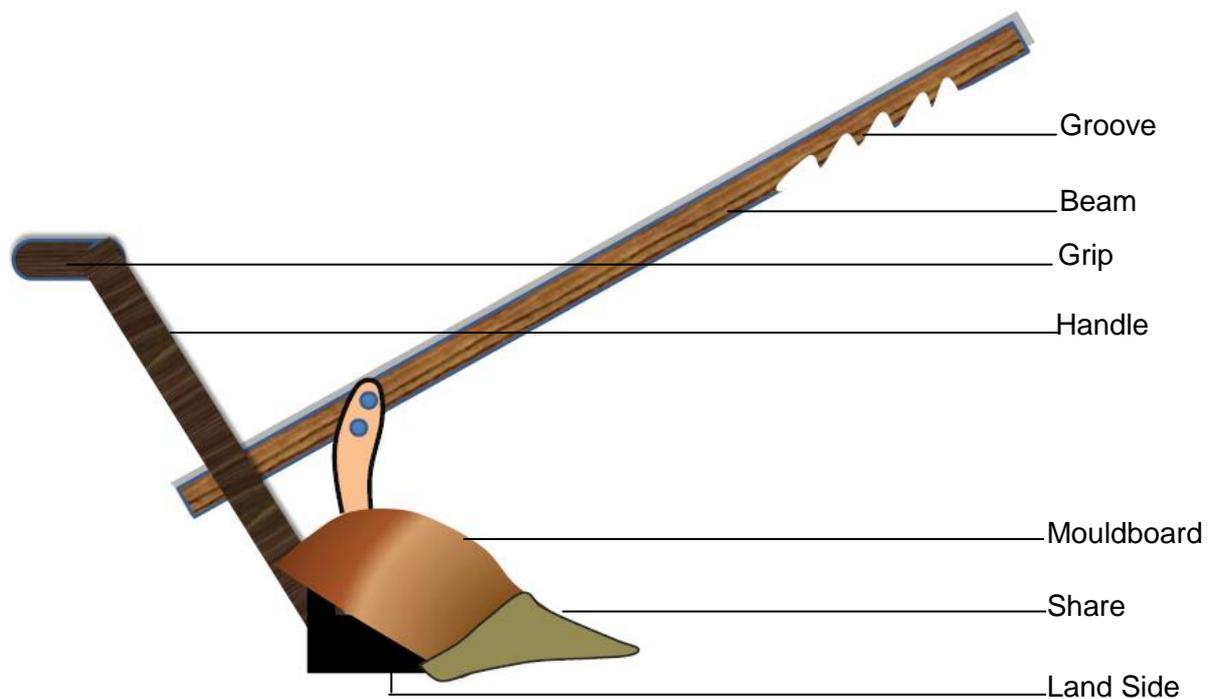


Fig. Mouldboard plough and its different parts

Characteristics of ploughing by mouldboard plough:

1. It can invert the soil completely due to presence of mouldboard.
2. Depth of ploughing is more than country plough (0- 25 cm).
3. 'U' shaped or 'L' shaped furrow is made, so there is no unploughed land between two furrows.
4. It can pulverize the soil properly.

Efficiency: 0.404 ha/ working day.

Merits:

1. Deep ploughing is possible.
2. Complete inversion of soil.
3. Absence of unploughed land between two furrows.
4. It can be suitably used in weed infested and hard land.

Demerits:

1. It is more costly than country plough.
2. Sometimes difficult to drawn by our country bullock.
3. It is heavier than country plough.
4. Repairing is difficult.
5. Requires experienced labors to operate.

C. Disc plough

Disc plough does not bear any resemblance to the other plough. The plough bottom consists of one to eight large concave discs set at angle to the line of draught. The discs are mounted on a frame, which supported on the wheels. The discs enter the soil under the heavy weight of the frame aided by the scarping action of the discs.





Fig. Disc plough

Efficiency:

Tractor drawn : 2.8-3.2 ha/ working day.
 Power tiller drawn : 1.0- 1.25 ha/ working day.

Merits:

1. It is suitable for clay soil where mould board plough cannot be used.
2. It is suitable for clay and hard soils where mould board plough cannot be penetrate.
3. It is suitable for land having hard plant roots, stubble and concrete mould board plough can work properly.

Demerits:

1. It requires heavy power to operate.
2. Maintaining and repairing is expensive.
3. It unsuitable for small areas.
4. It is not available.

D. Rotary plough/Rotavator

It is a power operated plough. It consists of a rotating shaft having several tines.



Fig. Rotary plough/Rotavator



Merits:

1. It can be used in wet land.
2. It is used to soften the soil.
3. Efficiency is high.

Demerits:

1. It cannot be used in dry land.
2. It requires high power to operate.

IMPLEMENTS OF LADDERING

The implements, which are used to level the land, break the clods after ploughing and collect the weeds, are known as laddering implements.

Functions of a ladder:

1. It is used to break the clods after ploughing.
2. It is used to level the surface of the field.
3. It is used to collect weeds.

Merits:

1. Construction is very simple.
2. Price is very low.
3. It is light in weight. So, our country bullock can pull it easily.
4. It can be made locally.

Demerits:

1. It is not suitable for breaking the larger clods.
2. Ladder may be broken easily.

There are different types of ladder, such as i) Triple bar ladder ii) Double bar ladder ii) wooden ladder.

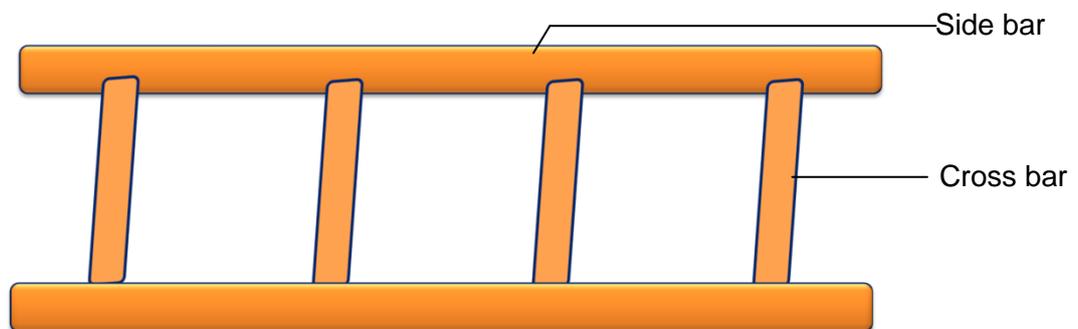


Fig. Double Bar Ladder

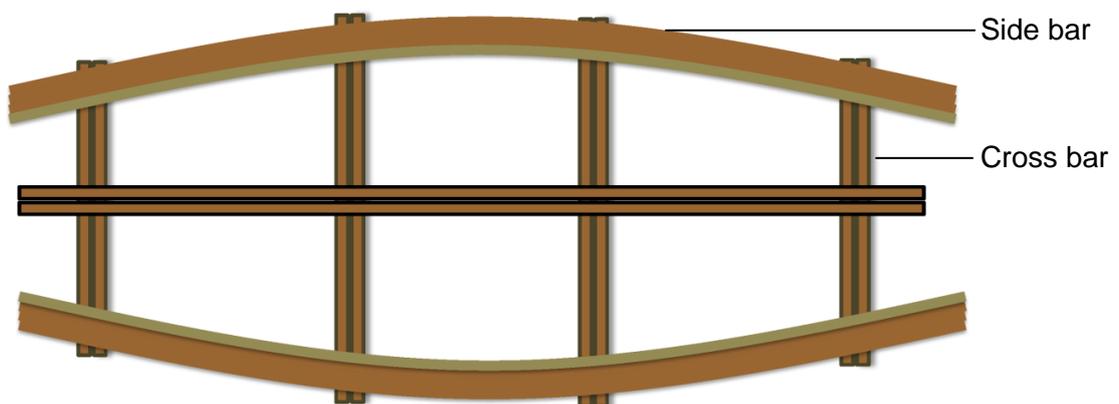


Fig. Triple Bar Ladder





Fig. Wooden Ladder

IMPLEMENTS OF INTERCULTURAL OPERATIONS

The operations, which are done after seed sowing/seedling transplanting until crop harvest in the crop field for successful crop production, are known as intercultural operations. The implements, which are used in different intercultural operations, are grouped into the following classes:

a. Raking implements

The operation, by which the upper crust of the soil is broken, is known as raking. The implements, which are used in raking operation, are known as raking implements.

Functions of a rake:

1. The main function of rake is to break the upper crust of the soil.
2. It is used to loosen the soil.
3. It maintains plant population in the field.
4. It controls weeds.

There are different types of ladder, such as:

- i) Field rake ii) Hand rake iii) Garden rake

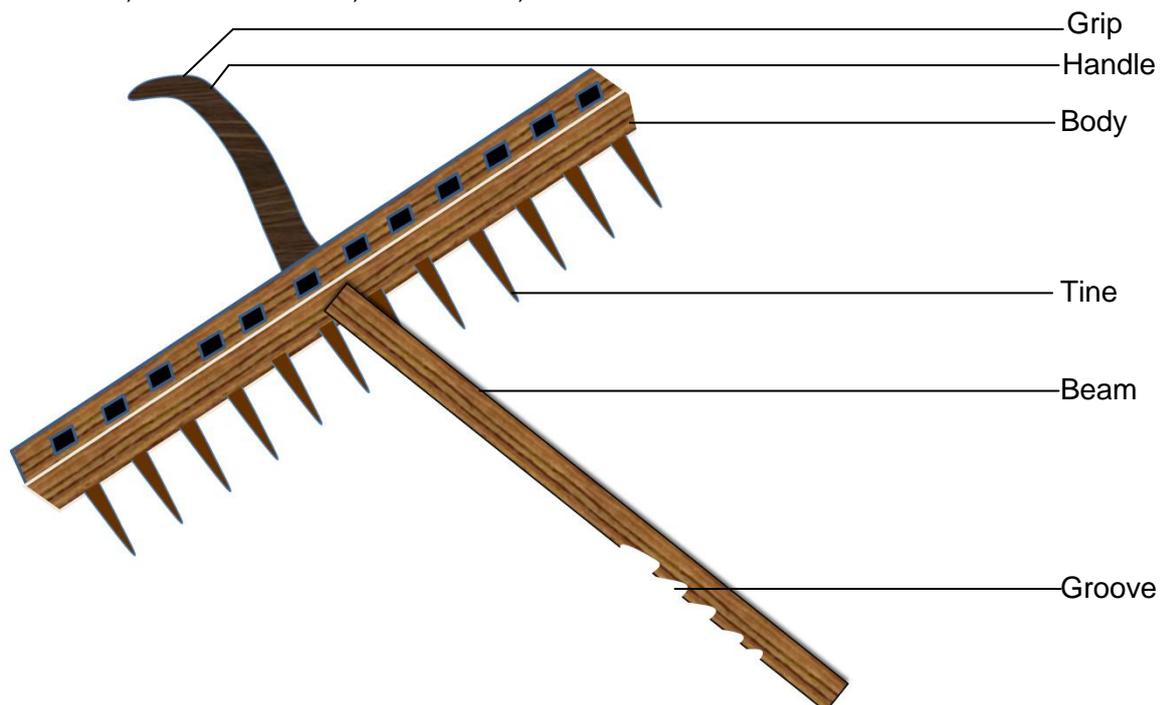


Fig. Field rake and its different part





Fig. Hand rake

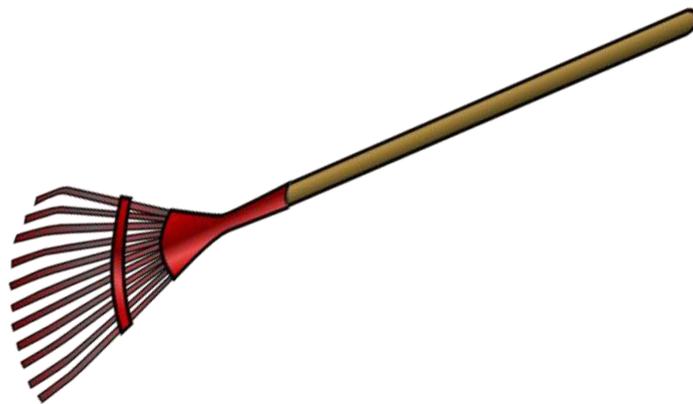


Fig. Garden rake

Difference between field rake and hand rake:

Field rake	Hand rake
1. It has beam.	1. It has no beam.
2. It has groove on beam.	2. It has no groove.
3. It has grip on handle.	3. It has no grip on handle.
4. It is used in large area.	4. It is used in small area.

SEEDING IMPLEMENTS

The implements which are used to sowing seeds or transplanting seedling are known as seeding or transplanting implements. These are:



- i. Seed drill
- ii. Furrower
- iii. Rice transplanter
- iv. Drum seeder

Seed Drill

The equipment is used to drill seed in line in the optimum depth of soil to ensure proper germination of seed with optimum moisture for optimum growth, development and yield of crop. The equipment contains the following parts.

- Handle:** To hold the equipment firmly and make it functional
- Hopper:** To receive seeds and lets the seeds to be canalized
- Tube:** To facilitate seeds to enter in the metering device
- Metering device:** To keep line to line distanced fixed as required
- Line marker:** To facilitate seeds to be drilled with required plant spacing
- Furrow opener:** To open the furrows to be drilled with seeds
- Furrow closer:** To close the furrows with loose soil
- Press wheel:** To ensure light compaction of soil of closed sown furrows
- Front Wheel:** To keep the equipment moveable



Advantages:

- i. It maintain proper seed rate of crop
- ii. It maintains proper plant spacing to ensure required plant population of crop per unit area of land
- iii. It drills seed in optimum moisture zone of soil to ensure maximum germination of crop.
- iv. The sown furrows are covered with loose soil followed by light compaction of soil thus having proper germination of soil
- v. It converses soil moisture during drilling seeds
- vi. It controls weed in the sown furrows
- vii. It facilitates intercultural operation for grown crops
- viii. It requires less time to complete sowing

Limitations:

- i. It is costly to prepare
- ii. It needs graded seeds
- iii. It is not ideal for hard and wet soils
- iv. It is not suitable for uneven soils



DRUM SEEDER:

The equipment is used to sow rice seeds in line on the puddle soil as direct seeding. The length of the drum seeder is 2 meters. The seed loading capacity of the seeder is 12 kg. The equipment contains the following parts:

Handle: To pull the equipment on the soil.

Axe: To keep the wheels straight and easy movements.

Wheel: To pull the equipment easily

Plastic drum: Six number of drum each of 25 cm length and 55 cm diameter to keep seeds to be sown. Each drum is 450 g. Distance between two drums is 11 cm.

Drum hole: To facilitate seeds to be sown with required plant spacing. Each drum has holes at two end having distance of 20 cm and 2cm between two holes in each line. The height of holes from soil as 60 cm. Each drum contains one row of short distance and other is of close distance. The diameter of each hole is 5 cm.



Fig. Drum seeder

Advantages:

- i. It maintains proper seed rate of rice
- ii. It maintains proper plant spacing to ensure required plant population of rice per unit area of land
- iii. It requires low cost as no requirement of seed bed preparation, seed bed management, seedling uprooting etc. than transplanting method
- iv. It requires less time to complete sowing
- v. It requires minimum seed rate
- vi. It requires minimum number of laborers to sow seeds.
- vii. It is very simple to use
- viii. Spare parts are available

Limitations:

- i. It is not suitable for uneven soil
- ii. It needs proper wash of different parts of the seeder after use of seeder and after washing all to be kept separately
- iii. It is not suitable for water logged soil
- iv. It needs well germinated seed with very little root
- v. It should take care during sowing that the drum holes are not closed with mud
- vi. Each drum should fill with germinated seed upto its two third capacity

Efficiency: 35-58 kg seed sown /ha



IMPLEMENTS OF INTERCULTURAL OPERATIONS

Weeding and mulching implements:

Weeding is the removal of unexpected plant from the land and mulching is the making of artificial layer on the soil surface to conserve soil moisture. The implements, which are used to carry out these operations, are known as weeding and mulching implements. The implements are as follows:

- i. Nirani
- ii. Khurpi
- iii. Hand hoe or wheel hoe
- iv. Japanese rice weeder

Nirani:

It is small sized weeding and mulching implements and consists of iron blade & wooden handle.

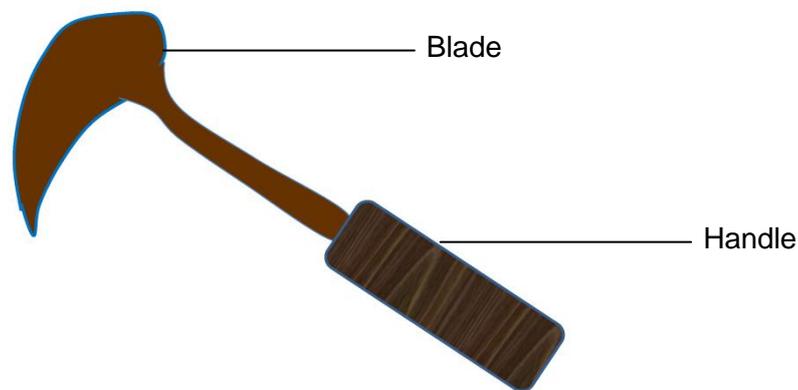


Fig. Nirani

Functions :

It controls weeds

- i. It breaks the upper crust of the soil
- ii. It makes the soil loosen

Merits:

- i. It can be made locally
- ii. It can be used in broadcast crops

Limitations:

- i. Weeding efficiency is low
- ii. It is not suitable for large area

Khurpi

It is a small sized implement used for weeding and mulching. It consists of iron blade and wooden or bamboo handle.



Fig. Khurpi

Functions of a khurpi:

- i. It breaks the upper crust of the soil
- ii. It controls weeds of fallow land
- iii. It is used to loosen the soil

Merits:

- i. It is light in weight
- ii. It can be made locally

Limitations:

- i. It is not suitable for large area
- ii. Weeding efficiency is low

Hand hoe/ Wheel hoe:

It is an implement, which is used for weeding and mulching of row crops in dry condition. It is made of iron & wood and consists of the different parts, which has been shown in the figure.

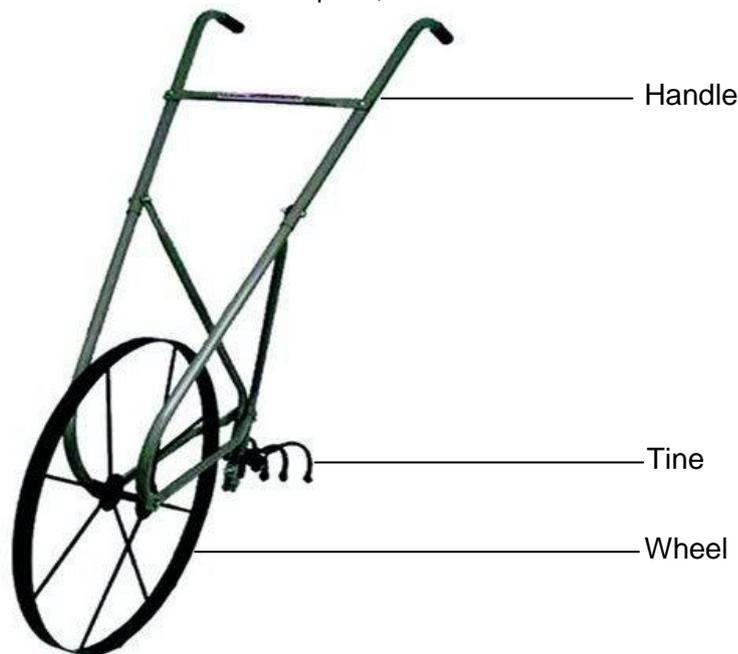


Fig. Hand hoe/ Wheel hoe

Functions of hand hoe:

- i. It is used to control weeds
- ii. It is needed to loose the soil for mulching.

Advantages:

- i. It is suitable for dry land when Japanese rice weeder can not be used
- ii. Weeding efficiency is higher than other manual operated implements like nirani, khurpi etc.

Limitations:

- i. It cannot be used in clay soil
- ii. It is heavy in weight (about 8 kg)

Efficiency: 0.4-0.8 ha/ working day

Japanese rice weeder:

It is an important weeding implements in rice field having 10-12 cm water. The different parts of a Japanese rice weeder have been shown in the figure.



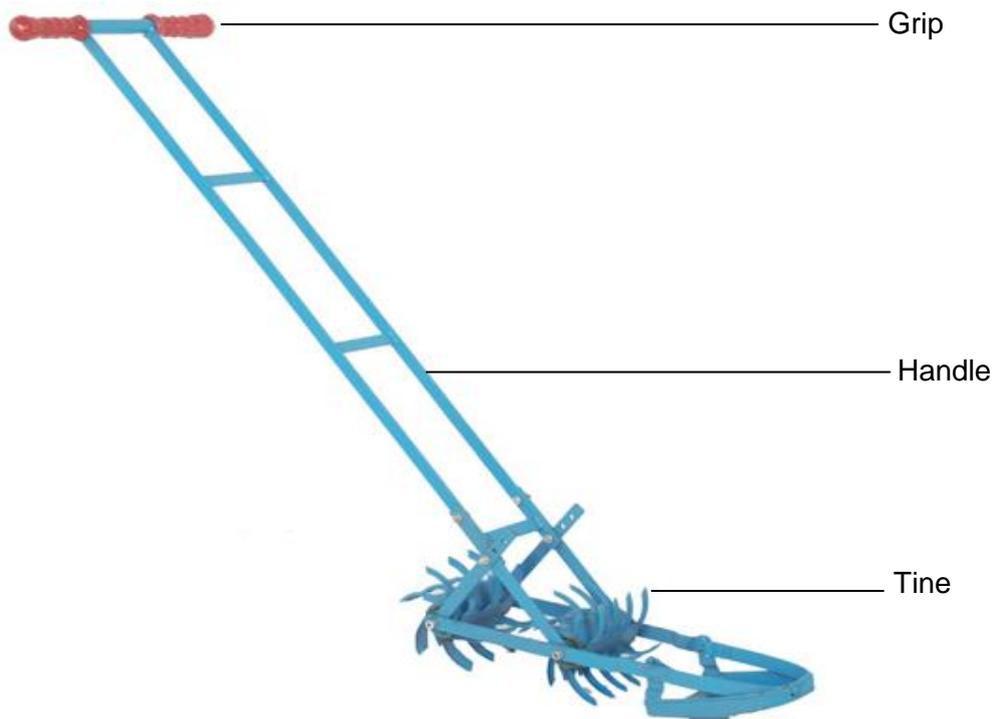


Fig. Japanese Rice Weeder

Functions of Japanese rice weeder:

- i. It is used to control weeds of transplanted rice field
- ii. It is also used to loosen the soil for mulching.

Merits:

- i. It can be used when land is wet where hand hoe cannot be used.
- ii. Efficiency is higher than nirani, khurpi etc.

Limitations:

- i. It cannot be used in dry soil.
- ii. It can be used only in row spaced rice field

Efficiency:

0.4-0.5 ha/ working day.

IMPLEMENTS FOR IRRIGATION AND DRAINAGE:

Irrigation is the artificial application of water to the crop field for successful crop production. Drainage is the provision of suitable system for the removal of excess irrigation or rain water from the land surface so as to provide suitable soil conditions for better plant growth.

The implements, which are used in irrigation and drainage purposes, are known as irrigation and drainage implements. These implements are as follows:

- i. Swing basket
- ii. Swing shovel
- iii. Watering can
- iv. Shallow tube-well
- v. Deep tube-well
- vi. Persian wheel
- vii. BRRP pump
- viii. Paddle Pump



Swing Basket:

It is a conical like basket of 4-14 liter capacity, which is made of tin or bamboo and has two ropes of about 1.8 m long in each side.

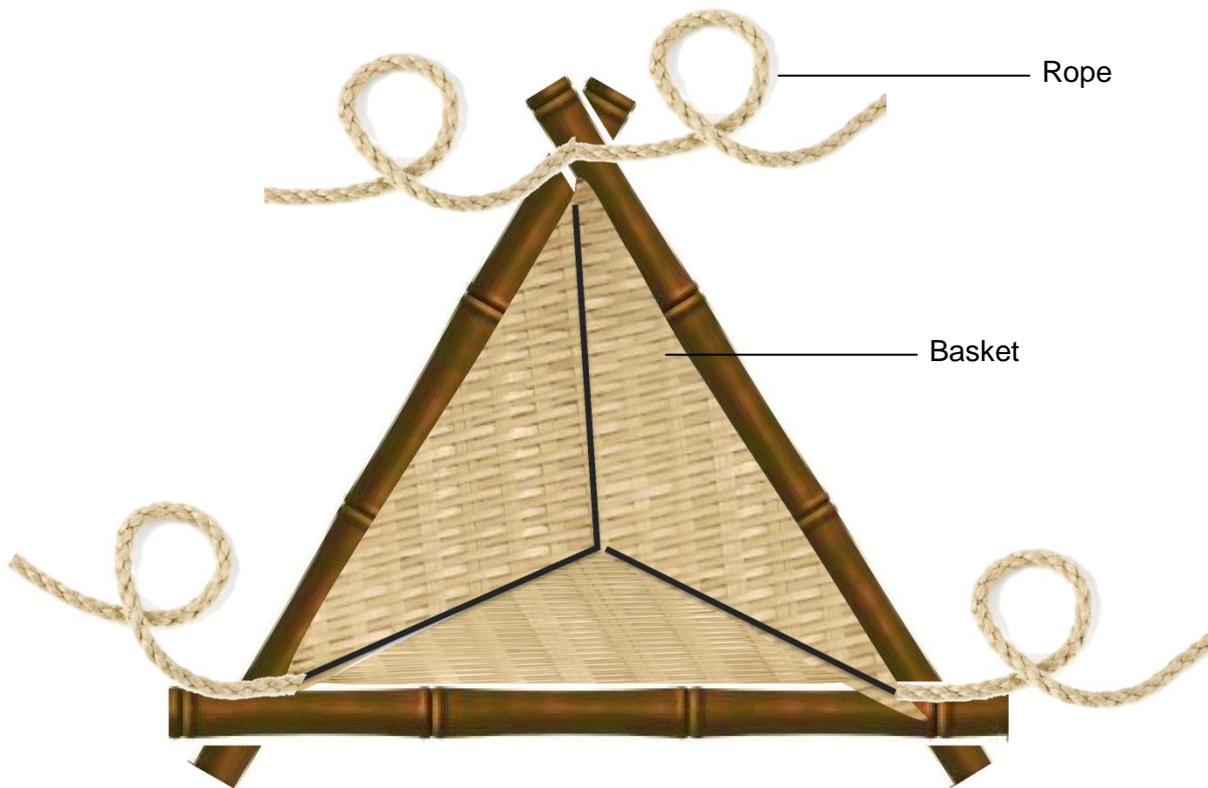


Fig. Swing Basket

Functions of a swing basket:

It is generally used for irrigation purposes. Sometimes it is also used to drain out the excess water from land.

Merits:

- i. It can be made locally
- ii. Low cost of making
- iii. Maintenance is easy

Limitations:

- i. Efficiency is lower than swing shovel
- ii. It is impossible to lift water where water surface is so below the land.

Surface efficiency:

This implement can lift 1300-1800 liter water per hour and 0.3 ha of land can be irrigated within a working day.

SWING SHOVEL:

It is a boat shaped implement having 40 cm width; 18 cm depth and 3.5-6.0 m length. It is made of tin, iron sheet or wood.

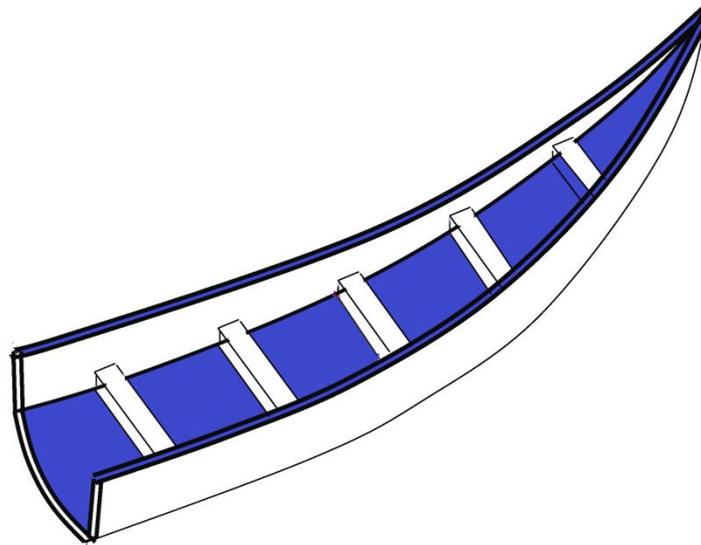


Fig. Swing Shovel

Function: It is needed for irrigation purpose

Merits:

- i. It is possible to lift water from 1.2-1.5 m depth by this implement.
- ii. Irrigation efficiency is higher than swing basket
- iii. Only one labor can easily operate it

Limitations:

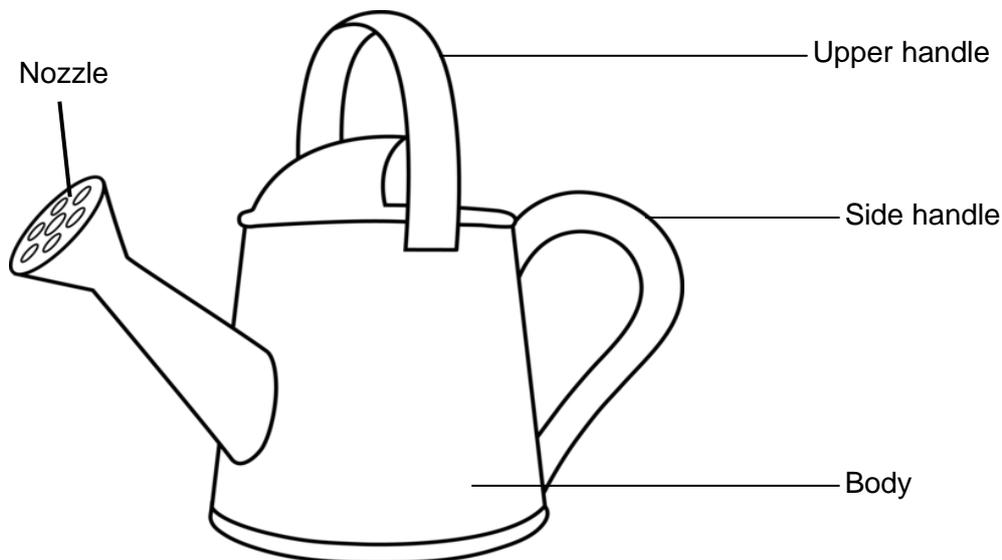
- i. It is more difficult to carry
- ii. More labor required for setting the implement

Efficiency:

It can lift 4500-6700 liter water per hour and 0.808 ha of land can be irrigated per working day by this implement.

Watering can:

It is generally used for irrigation in garden and mostly in limited area. It consists of body, supply tube nozzle, upper handle and side handle.



IMPLEMENTS FOR APPLYING PESTICIDES

The chemicals, which are used to kill or control pests (insect, pathogen, weed etc.) are known as pesticides and the implements, which are used to apply these pesticides, are known as pesticide applying implements. These are as follows:

1. Sprayer
 - a) Hand sprayer
 - b) Knapsack sprayer
 - i. Semi automatic
 - ii. Automatic
 - iii. Motor or Power sprayer
2. Duster
3. Basket pump

Hand sprayer:

During operation, the liquid container is remaining in hand. The hand sprayer is two types: i. Hand sprayer (single action) ii. Hand sprayer (double action).



Fig. Hand Sprayer

Knapsack sprayer:

There are two types of knapsack sprayer. These are as i. Semi-automatic ii. Automatic

An automatic knapsack sprayer consists of the following parts:

- a) Handle
- b) Lock
- c) Body or barrel
- d) Position
- e) Hose pipe
- f) Filling can or lid
- g) Pressure gauge
- h) Trigger
- i) Spray gun
- j) Nozzle



Fig. Knapsack Sprayer

IMPLEMENTS FOR HARVESTING, THRESHING AND WINNOWING

Harvesting implements

- i. Sickle
- ii. Spade
- iii. Hashua
- iv. Corn picker
- v. Boll picker
- vi. Rice cutter
- vii. Combined harvester

Threshing implements

- i. Paddle thresher
- ii. Cane thresher
- iii. Wheat thresher
- iv. Corn thresher

Winnowing implements

- i. Seed cleaner
- ii. Kula or winnowing fan
- iii. Sieve

MISCELLANEOUS IMPLEMENTS

- i. Yoke
- ii. Seed dresser
- iii. Dibbler
- iv. Moisture meter
- v. Shovel
- vi. Belcha
- vii. Rope
- viii. Spade
- ix. Hammer

