

Unit 2



Land Preparation and Planting



17906CH02

INTRODUCTION

Land preparation involves tillage of a field in order to provide favourable soil environment for plant growth. Tillage ensures that the field is ready for planting, and will support plant stand and growth. It involves ploughing, harrowing and levelling of the field. Land preparation, therefore, helps in weed control. It also provides congenial conditions for transplanting and a suitable soil surface for direct sowing of the crop to obtain high productivity. In olden days, draft animals were used for harrowing. But today, in this era of mechanisation, tractor operated implements are used for land preparation.

Ploughing

Timely ploughing is an important tillage operation and the crop yield, generally, depends on the quality of the seedbed. It is done soon after a rain (7–8 mm) or after normal irrigation. During *Kharif* season, early ploughing helps in moisture retention and controls weed population.

Advantages of ploughing

- Helps in seed establishment and contact of roots with the soil
- Improves soil fertility as crop residues, stubbles and roots are ploughed into the soil

- Uproots, cuts and destroys the weed population
- Creates conducive soil conditions for soil aeration and better seed germination
- Helps destroy insects and harmful pathogens

Harrowing

This tillage operation is performed after ploughing. Here, the soil is tilled at a shallow depth with the help of harrows. The harrows smoothen and pulverise the soil by breaking large clods into fine tilth and making the soil structure suitable for seed sowing. It is also helpful in carrying out other field operations, for example, cutting weeds in the field, mixing FYM and compost in the soil, etc.

Levelling

Levelling helps modify existing land undulations for carrying out efficient agricultural production and provides adequate slope to a cropped area for surface irrigation along with ensuring unrestricted drainage.

Purpose of levelling

- To ensure efficient application of irrigation water
- To enhance rainwater conservation
- To minimise soil erosion
- To encourage efficient mechanisation
- To check weed population
- To improve nutrient management
- To improve crop stand and establishment

In paddy, minor land levelling is done at the time of puddling by bullock or tractor operated land leveller. These days, laser guided land levellers are also used for carrying out land levelling, especially, when a fresh stretch of land is to be brought into paddy cultivation.

Table 2.1: Implements and machines used in land preparation

S. No.	Implements and machines
1.	Equipment used for land development
	Laser land leveller: helps achieve fine levelling in an agricultural field



NOTES

2.	Tillage implements
	Mouldboard plough: helps in cutting furrow slices into pulverised form of soil
	Reversible two bottom mouldboard plough: a plough that brings up lower soil to the top
	Disc plough: a set of round discs to open up the soil and dry mix the top soil till a depth of 15 cm
	Tyne-type cultivator: a set of narrow tines to disturb the top soil for fine tilth
	Disc harrow: a tractor drawn set of round discs, which cut the soil surface at a shallow depth
	Rotavator: an equipment that can overturn top soil to bottom and vice versa
	Paddy harrow or puddler: a rotary device to churn and mix top soil with water
3.	Sowing or planting equipment
	Direct paddy seeder: a drum-type device for direct seeding of a large area in short time
	Tractor mounted direct rice seeder: a normal seed-cum-fertiliser drill for sowing
	Rice transplanter: a device for transplanting rice mechanically
4.	Intercultural equipment (implements used for weeding and ensuring soil aeration)
	Conoweeder: a rotary movement harrow that uproots and buries weeds into the soil
5.	Plant protection equipment
	Knapsack sprayer: a shoulder and back mounted tank with manual pump spray mechanism
	Power knapsack sprayer: a shoulder mounted tank with a mechanised sprayer
6.	Harvesting equipment
	Riding type self-propelled vertical conveyer reaper: a machine that cuts stalks and places them aside
	Self-propelled reaper binder: a machine that makes bundles of paddy crop cut with stalks and keeps them aside
	Combined harvester: a big machine to reap, thresh, winnow and pack paddy seeds



7.

Threshing equipment

Multi-crop thresher: a mechanical device to remove grain from reaped or harvested crop

Axial-flow paddy thresher: a machine that threshes paddy and also converts stalks into fine chopped straw

SESSION 1: IMPLEMENTS USED FOR LAND PREPARATION AND PLANTING

Types of plough

Mouldboard plough

Mouldboard plough helps in cutting furrow slices into pulverised form of soil. This farm implement helps to turn and plough various types of plant and vegetation present in the field into the soil. Both single and double bottom mouldboard ploughs are used but double bottom ploughs are more common.

Parts of mouldboard plough

- Beam
- Three-point hitch (hake)
- Height regulator
- Coulter
- Chisel
- Share
- Mouldboard

Disc plough

It is in the shape of a disc (concave shape). It helps reduce friction. This plough cannot be used at higher speed as the cutting process needs to be carried out at low speed. Compared to mouldboard plough, the maintenance cost is lesser. It can be used in sticky soils, dry and hard conditions, and for deep ploughing.

Rotary plough

It is an implement with steel tynes or blades mounted on a power-driven shaft. It is used to

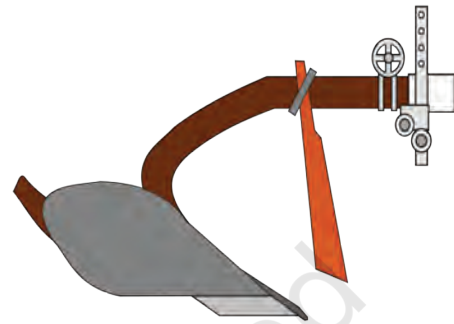


Fig. 2.1: Mouldboard plough



Fig. 2.2: Disc plough



Fig. 2.3: Rotary plough



break clods and weeds, and thus, helps in preparing the seedbed. It can cut up to a depth of 9". However, it is better to make a cut up to a depth of 5" at the beginning in order to avoid overloading of the machine.

Sub-surface or chisel plough

It helps loosen hard pan of dry soil to allow deep penetration of roots and conservation of moisture. Besides, it aids upward movement of nutrients available in the soil beyond the root zone layer. This implement is mostly used for reclamation of land, which has not been under use for some time or for initiating cultivation on barren soil.



Fig. 2.4: Sub-soiler

Sub-soiler

Sub-soilers are somewhat similar to chisel plough and require heavy power to operate. The shear part of sub-soiler can penetrate deeper than chisel plough. Sub-soiler is an important implement that helps in land reclamation, water conservation and improves drainage.



Fig. 2.5: Disc harrow

Harrow

It is a secondary tillage implement, which breaks large clods into fine tilth. The four types of harrow available on the basis of soil type and requirement of a farmer are disc, chain, chain disc and tyne harrows.

Implements used for seed sowing and transplanting

Direct paddy seeder (drum seeder)

It is a device used for uniform seed distribution and increasing plant population. It is manually operated and consists of a main shaft, seed drum, ground wheel, floats, furrow openers and a handle. It is used for sowing seeds in prepared puddled fields.

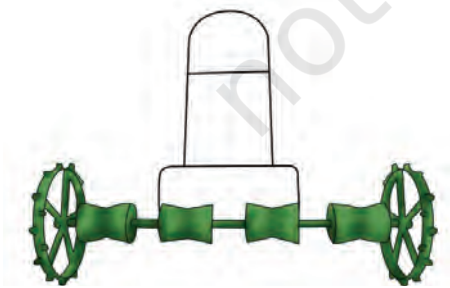


Fig. 2.6: Direct paddy seeder



Seed-cum-fertiliser drill

It is a line sowing equipment used for direct sowing of paddy seeds and application of fertilisers simultaneously. It requires 35–45 hp tractors to operate. The seed-cum-fertiliser drill helps in:

- the adjustment of seed rate and fertiliser dose.
- the placement of fertiliser at the appropriate soil depth.
- better germination of crop.
- saving time.

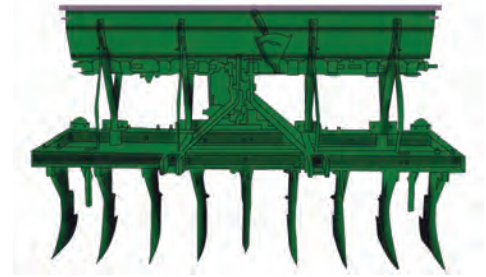


Fig. 2.7: Seed-cum-fertiliser drill

Paddy transplanter

Paddy transplanter involves a tray system for transfer of nursery seedlings. Mat type rice nursery is a pre-requisite for planting with this machine. It is important for ensuring systematic smooth flow of seedlings during transplanting. A paddy transplanter helps save time and money. It is not a labour-intensive implement. All these features make it popular among farmers.



Fig. 2.8: Paddy transplanter

Importance of weeding

Weeds are common in a paddy field. They reduce the yield considerably. Therefore, their eradication is a major challenge that farmers face. Weeds can be removed manually, by the use of chemicals or herbicides, or mechanically. Hand weeding is the most common method used for the removal of weeds. But it is not suited as it is a time-consuming and labour-intensive process. The use of chemicals reduces the weed population considerably. But they are not preferred much by farmers due to their harmful effects on human beings and environment. Mechanical weeding promotes plant growth as it leads to increased soil aeration, root length and better tiller production. It may be done by using manual and power weeders.



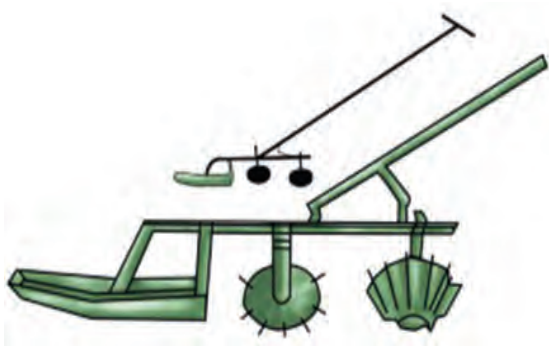


Fig. 2.9: Conoweeder



Fig. 2.10: Weeding by conoweeder

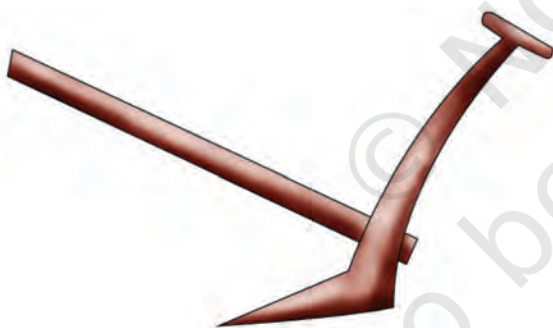


Fig.2.11: Desi (indigenous) plough



Fig. 2.12: Trifal cultivator

Implements used for intercultural operations in paddy cultivation

Conoweeder

The use of a conoweeder facilitates weeding between rows. It is operated manually by a single operator. It uproots and buries weeds in the soil. The weeder does not sink in puddled soil.

Paddy rotary weeder

It is operated manually and helps carry out weeding in paddy row crops. During operation, it can be adjusted up to 20–25 cm, according to row spacing of the plants. One person can easily operate the unit by continuous push and pull action. The use of a rotary weeder helps bury the weeds and improves soil aeration.

Implements used in *biasi* operation

Biasi or 'bueshening' is a method of broadcasting paddy seeds in dry or wet soils after regular field preparation. Paddy plants and weeds grow at same time in the field for up to 30–40 days. *Biasi* operation is done mainly to destroy the weeds, manipulate the root zone of the plants, create semi-puddled conditions, reduce percolation of water and maintain plant population. It is mainly practised in Chhattisgarh and Odisha.

Desi plough

It is single furrow opener animal drawn indigenous plough that is, usually, used in *biasi* operation. *Biasi* operation is a time and labour consuming process.

Trifal

This bullock drawn three-tined cultivator is modified to carry out effective *biasi* operation



in order to ensure minimum draft, soil inversion, clogging and low plant mortality. The curved tines and adequate ground clearance minimise clogging. Due to more working width covered by the three tines, the number of passes required for *biasi* ploughing is also minimised.

Practical Exercise

Activity 1

Prepare a chart on the different type of ploughs used for paddy cultivation.

Material required: chart paper, photographs of different type of ploughs, glue stick, sketch pens, pen, pencil, etc.

Procedure

- Collect pictures of different type of ploughs used in paddy cultivation. You can also use a computer and access the Internet.
- Paste the pictures on the chart paper and write the names of the ploughs.
- Present it before the class.

Activity 2

Visit a shop selling agricultural implements and identify the different type of implements used in paddy cultivation.

Material required: pen, pencil, notebook, etc.

Procedure

- Visit a shop selling agricultural implements in your area.
- Identify the farm implements used for paddy cultivation being sold there.
- Note down the names of the implements in your notebook.

Check Your Progress

A. Fill in the Blanks

1. Crop residues and vegetation are buried in the soil by _____ plough .
2. A _____ plough is used for the reclamation of degraded lands.
3. A _____ is used to break clods in order to provide fine tilth.
4. A process that modifies undulated land and provides adequate slope is known as _____.



NOTES

B. Multiple Choice Questions

- Which of the following is not type of plough?
(a) Mouldboard (b) Chisel
(c) Rotary (d) Spike
- _____ is considered as a secondary tillage implement.
(a) Chisel (b) Disc harrow
(c) Disc plough (d) Rotary
- Which of the following helps improve surface drainage and minimise soil erosion?
(a) Mouldboard plough (b) Harrow
(c) Land leveller (d) Disc plough
- Which of the following helps modify the existing land contours for carrying out efficient agricultural production?
(a) Plough (b) Harrow
(c) Chisel (d) Land leveller
- A conoweeder is used to control _____ in a paddy field.
(a) insects (b) diseases
(c) weeds (d) Water

C. Match the Columns

A	B
1. Laser leveller	(a) Weed removal
2. Rice transplanter	(b) Uniform land levelling
3. Sickle	(c) Labour saving
4. Harvester	(d) Harvesting manually
5. Weeder	(e) Harvesting machine

D. Subjective questions

- Differentiate between the following.
(a) Ploughing and harrowing
(b) Mouldboard and disc plough
- Define tillage. List the different type of ploughs used in paddy cultivation and describe any one plough.
- Define harrowing. List the type of harrows suitable for paddy cultivation.
- Define land leveling and explain its significance in paddy cultivation.
- Differentiate between the following.
(a) Conoweeder and two-row finger rotary weeder
(b) Seed-cum-fertiliser drill and rice transplanter



SESSION 2: METHODS OF PLANTING IN PADDY CULTIVATION

Paddy fields are ploughed and harrowed during summer to ensure optimum soil condition and tilth. Addition of Farm Yard Manure (FYM) helps achieve a friable seedbed, which facilitates easy uprooting of seedlings from a nursery for transplanting in a field. Seed sowing in rain-fed rice conditions and transplanting in irrigated systems is done as soon as monsoon arrives. Planting in rows is preferred to ensure crop stand, and carry out easy weeding and intercultural operations. The three common methods practised in paddy cultivation are as follows.

- Direct seeding in dry soil
- Direct seeding in puddled soil
- Transplanting in puddled soil

A method is adopted depending on rice ecology.

- Upland rice: mostly direct seeding in dry soil
- Transplanted rice: generally, done in irrigated and rain-fed rice under low land situation (water stagnated in field)
- Deep water rice: direct seeding and transplanting

Methods of sowing or planting

Broadcasting

It is a primitive method of paddy planting. About 60–80 kg/ha of seeds are scattered randomly across a field to obtain uniform plant stand. Broadcasting can also be done in straight lines at an estimated spacing of 20 cm. Shallow furrows are made in the prepared field, and then, the seeds are broadcast, followed by planking.

Line sowing (drilling)

Seeds are sown either with a seed drill, machine or plough in dry soil, loose enough for holding the seedlings and also moist enough for germination. A levelled field is necessary to ensure seed placement at optimum depth. Besides, adequate water supply is necessary for the growth of the



Fig. 2.13: Line sowing (drilling)



crop. The seeds can be sown and fertilisers be applied at the same time by using ferti-seed drill. In this method, a conoweeder can be used to check weed population in the paddy field.

Advantages

- Seeds are sown at uniform depths.
- Intercultural operations can be carried out in the field conveniently.
- Uniform row-to-row spacing is maintained in line sowing.
- Seed requirement is less in line sowing as compared to broadcasting.
- Sowing is done when the soil has adequate moisture level.
- Line sowing leads to higher yield and improves water use efficiency.

Limitations

- Machine is required for seeds sowing.
- In line sowing, it is important to maintain sufficient moisture in the soil, which may be a challenge.
- It is not possible to maintain exact plant-to-plant (inter row) spacing.
- For sowing, skilled labourers are required.



Fig. 2.14: Dibbling

Dibbling

Dibbling or hill planting method is, generally, practised in sloped land, where ploughing and harrowing are difficult. In this method, farmers use a bamboo pole or a long wood attached to a metal scoop. The seeds are dropped into the prepared holes carefully and covered with soil.

Biasi operation

Biasi or 'beushening' is a method of broadcasting paddy seeds in dry or wet soils after regular field preparation. Paddy plants and weeds grow simultaneously in the field for up to 30–40 days. Then, ploughing (single or cross with a *desi* plough) is carried out in the standing



crop in 5–10 cm of water. After ploughing, the seedlings are planted erect and gap filling is done (in the field) by transplanting manually. During the process, most weeds are buried in the soil. This process is traditionally known as *chalai*. This practice is followed in some parts of Odisha, West Bengal, Assam and Chhattisgarh.

Direct Seeded Rice (DSR)

This method is, usually, practised in rain-fed and deepwater paddy fields. DSR requires less labour inputs and the crop tends to mature faster than in transplanting. The primary rationale behind DSR is the economical use of groundwater, which is depleting fast in major rice producing Indo-Gangetic plains. Most DSR is planted like wheat behind the plough or with the help of normal seed-cum-fertiliser drill. In some cases, it is done with a drill that ought to be fit for no-tillage condition. According to land preparation methods, DSR can be sown in the following ways.

- Direct dry seeding
- Direct wet seeding



Fig. 2.15: Direct Seeded Rice

Transplanting

Transplanting of rice is common in Asian countries. In this method, seedlings are grown in a nursery and seedlings that are 20–25 days' old are transplanted in a levelled and puddled field. Puddling helps in controlling the weed population, producing higher yield and saving water. There are two methods of transplanting — manual and mechanical.

Manual transplanting

It is most suited for labour surplus areas and does not require costly machines. Manual transplanting can be done in fields that are undulated and have varying water levels. For such a transplanting,



Fig. 2.16: Manual method of transplanting



the seedlings are raised in dry or wet nursery. To get healthy and vigorous seedlings for transplanting, adequate nursery management practices must be followed. Manual transplanting is either done randomly or in straight rows.



Fig. 2.17: Random transplanting

Random transplanting

In this method, the seedlings are transplanted without a definite distance or space between plants.

Straight row transplanting

In this method, the seedlings are planted in a straight row at an optimum plant-to-plant and row-to-row distance. Wire or ropes are tied with bamboo poles at both the ends and placed along the baseline. Usually, a row-to-row distance of 20–25 cm and plant-

to-plant distance of 10–15 cm is considered optimum. Normally, two to three seedlings per hill are transplanted at a depth of 4–5 cm.

Advantages of manual transplanting

- It ensures adequate plant spacing
- Cultural operations are more effectively carried out by implements in this method.
- Other field management activities like fertigation and spraying of chemicals are also easier.

Limitations of manual transplanting

- It is a time-consuming method.
- This method requires a large number of labourers (one hectare of paddy transplanting requires approximately 25–30 people per day). Therefore, the labour costs are high.
- Initially, the plants grow slowly than in direct seeding method, mainly due to transplanting shock.

Mechanical transplanting

Machines are used for transplanting young paddy seedlings in puddled soil. Transplanting by machines



is less time-consuming and requires lesser number of labourers than manual transplanting. Normally, 14–15 days' old paddy seedlings are used for transplanting. It must be ensured that the fields are levelled and puddled. Adequate water level must be maintained in the fields at the time of transplanting. The seedlings are, generally, grown in seedling trays or special mat-type nurseries. The machine is set and the seedlings are loaded on the trays for transplanting.

Advantages

- It is a faster and an efficient method of transplanting than manual transplanting as it requires less number of labourers and also ensures timely planting.
- Mechanical transplanting method ensures uniform plant spacing and population density.
- The seedlings recover fast, tiller vigorously and mature uniformly.

Limitations

- The fields must be accessible for smooth entry, exit and movement of machines.
- Mechanical transplanting method is mostly suitable in an irrigated area.
- Effective management practices are required during the preparation of nursery for mechanical transplanting.
- Land preparation and water management are also required if a farmer opts for this transplanting method.
- Skilled labourers are required for operating the machine.

System of Rice Intensification

The System of Rice Intensification (SRI) originated in Madagascar in 1983. The productivity of irrigated paddy is optimised by changing the management of a plant with the intensification of operational activity. In SRI, the nursery is raised and young seedlings



Fig. 2.18: Paddy seedlings planted as per the System of Rice Intensification



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are transplanted in a puddled field. SRI works on the principles of improving the soil conditions, reducing plant population, and application of water for root and plant growth. The basic principles of SRI are as follows.

- Less than 14 days' old seedlings are used for transplanting.
- It ensures early, quick and healthy plant establishment.
- The plant density is reduced as single seedling is planted per hill.
- A spacing of 25×25 cm row-to-row and plant-to-plant in square pattern is maintained.
- Weed management is done by the help of a conoweeder.
- Alternate wetting and drying method of irrigation is practised, which reduce water wastage.
- Organic matter is added to the field improve the soil conditions.

Benefits of SRI

- It enhances productivity by 20–60 per cent.
- The seed rate gets reduced by 75–80 per cent.
- It encourages water saving by 40–50 per cent.

Gap filling in transplanted fields

Some seedlings fail to survive due to transplanting shock or improper transplanting, creating gaps in the field. To obtain optimum crop yield by maintaining adequate plant population, gap filling must be done within 7–10 days of transplanting. To check the emergence of weeds, a pre-emergence herbicide can be used after transplanting. Hand weeding must be carried out at the tillering stage itself (i.e., 20–25 days after transplanting). Maintaining 5-cm water depth continuously from the rooting stage till 15–20 days before harvesting will minimise weed population.



Practical Exercise

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Activity

Demonstrate the System of Rice Intensification (SRI).

Material required: measuring tape, rope, seedlings, etc.

Procedure

- Select a suitable land and get it prepared.
- Select healthy seedlings that are less than 14 days' old.
- Measure and mark 25×25 cm row-to-row and plant-to-plant spacing in square pattern.
- Transplant the seedlings as per the layout.
- Irrigate the field intermittently with alternate wetting and drying system.
- Manage weeds with the help of a conoweeder.

Check Your Progress

A. Fill in the Blanks

1. The SRI originated in _____ in 1983.
2. In line sowing, weeds are controlled by the use of a _____.
3. Manual transplanting is a time-consuming and _____ activity.
4. Alternate wetting and drying method is used in _____.
5. Under SRI, the seed rate gets reduced by _____ per cent.
6. In a paddy field, gap filling must be done within _____ days of transplanting.

B. Multiple Choice Questions

1. In SRI method, the age of seedlings for transplanting is _____ days.
(a) less than 14 (b) 16–20
(c) 22–24 (d) 25–28
2. Beushening is a method of _____.
(a) field preparation (b) transplanting
(c) seed broadcasting (d) nursery preparation
3. In SRI, plant-to-plant and row-to-row spacing is _____ cm.
(a) 15×10 (b) 15×15
(c) 35×35 (d) 25×25



NOTES

4. Random method of transplanting comes under _____ system.

- (a) mechanical (b) manual
(c) SRI (d) *biasi*

5. Normally, less than 14 days' old seedlings are used for transplanting in _____ system.

- (a) mechanical (b) manual
(c) SRI (d) *biasi*

C. Match the Columns

A	B
1. Dibbling	(a) Old or primitive
2. Broadcasting	(b) Weed removal
3. Square planting	(c) <i>Desi plough</i>
4. <i>Biasi</i>	(d) SRI
5. <i>Chalai</i>	(e) Sloped land

D. Subjective Questions

1. Describe transplanted rice and direct seeded rice.
2. Explain in brief the System of Rice Intensification.
3. Describe line sowing, and its advantages and limitations.
4. Explain the various methods of paddy transplanting.

