

1. **Sowing** or seeding is an art of placing seeds in the soil to have good germination in the field. A perfect seeding gives correct amount of seed per unit area, correct depth at which seed is placed in the soil and correct spacing between row-to-row and plant to plant.

Methods of sowing

There are different methods of sowing such as Broadcasting, Dibbling, Drilling, Seed dropping behind the plough, Transplanting, Hill dropping and Check row planting.

i) Broadcasting

Broadcasting is the process of random scattering of seed on the surface of seedbeds. It can be done manually or mechanically both. When broadcasting is done manually, uniformity of seed depends upon skill of the man. Soon after broadcasting the seeds are covered by planking or some other devices. Usually higher seed rate is obtained in this system.

Mechanical broadcasters are used for large-scale work. This machine scatters the seeds on the surface of the seedbed at controlled rates.

ii) Dibbling

Dibbling is the process of placing seeds in holes made in seedbed and covering them. In this method, seeds are placed in holes made at definite depth at fixed spacing. The equipment used for dibbling is called dibbler. It is a conical instrument used to make proper holes in the field. Small hand dibblers are made with several conical projections made in a frame. This is very time consuming process, so it is not suitable for small seeds. Mostly vegetables are sown in this way.

iii) Drilling

Drilling consists of dropping the seeds in furrow lines in a continuous flow and covering them with soil. Seed metering may be done either manually or mechanically. The number of rows planted may be one or more. This method is very helpful in achieving proper depth, proper spacing and proper amount of seed to be sown in the field. Drilling can be done by (1) Sowing behind the plough (2) Bullock drawn seed drills (3) Tractor drawn seed drills.

iv) Seed dropping behind the plough

It is very common method used in villages. It is used for seed like maize, gram, peas, wheat and barley. A man drops seeds in the furrow behind the plough. Sowing behind the plough can be done by a device known as malobansa. It consists of a bamboo tube provided with a funnel shaped mouth. One man drops the seeds through the funnel and other man handles the plough and the bullocks. This is a slow and laborious method.

v) Transplanting

Transplanting consists of preparing seedlings in nursery and then planting these seedlings in the prepared field. It is commonly done for vegetable and flowers. It is very time consuming operation. Equipment for placing plants in the soil is called transplanter.

vi) Hill dropping

In this method, seeds are dropped at fixed spacing and not in a continuous stream. Thus the spacing between plant to plant in a row is constant. In case of drills, the seeds are dropped in continuous stream and the spacing between plant to plant in a row is not constant.

vii) 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.

2. Land Preparation -

Once a suitable area for establishing the plantation is selected and the planning operation is finalised, the actual preparation can be activated. These activities are divided to structure and pace the implementation process in order to be ready for planting at the most suitable time, according to the specific regional climatic conditions.

2.1 Mechanical field preparation

The mechanical or initial soil preparation concerns mainly the preparation of a field for further detailed preparation such as irrigation system installation, hole preparation, etc. Actions, if applicable to the area, include:

- (i) debushing/bush clearing;
- (ii) removal of stones and rocks;
- (iii) ripping; and
- (iv) levelling of the soil.

2.2 Irrigation system installation

The type of irrigation system to be used will be determined by the availability of water, topographical and soil conditions. When the initial soil preparation is completed, the installation of the required irrigation system will be implemented according to the prescribed design (Figure 55).

In saline soils (soluble salts present as chlorides, sulphates and/or carbonates of calcium, sodium or magnesium), only leaching will be necessary to drain the excess salts. In the case of alkaline and/or saline-alkaline soils, sodium can be replaced through the application of gypsum or acidifying agents like sulphur. Once the sodium has been replaced, a programme should be followed to leach it out.

When the irrigation water is of poor quality, proper drainage and over irrigation, without the development of a water table, is very important.

Hole preparation

The actual digging of the hole is one of the last actions before planting takes place, but it must be emphasised that this is not the final preparation for the planting operation itself. This is the point where the required inputs such as gypsum and organic materials are worked into the soil and a start is made with the leaching programme. The reason why the leaching is only applied at

this stage is because of the relatively small area that is occupied by the date palm. If the total area had to be leached, it would become very costly with little or no benefit in the long run.

It is recommended that a hole of 1 m³ be prepared and that the soil from the hole be mixed with the organic material and gypsum (Figures 56 and 57). The soil mix is then put back into the hole, whereafter the site is clearly marked for positioning of the small date palm plants.

At this stage, once the hole has been prepared and closed, it is irrigated and a leaching programme implemented. The water supply will then enhance the leaching of excessive salts and contribute to the fermentation process of the organic material. Subsequent irrigation, several times (2 to 3) before planting, will also allow the mixed soil to settle in the hole.

In most soils, the early and rapid growth of the date plant is better when the holes are prepared one to two months before planting. Well-rotted manure can also be used in holes prepared and irrigated shortly before planting, but extreme care must be taken to put the manure (and fertilisers) deep enough to allow a layer of soil at least 15 to 20 cm thick to be placed between the manure and the roots of the date plant.

3. Irrigation

In general, the goal of irrigation is to supply the entire field homogeneously with water, so that each plant has the amount of water it needs, neither too much nor too little. Irrigation in India is done through wells, tanks, canals, perennial canal, and multi-purpose river valley projects.

Surface Irrigation:

In this technique water flows and spreads over the surface of the land. Varied quantities of water are allowed on the fields at different times. Therefore, flow of water under surface irrigation comes under wobbly flow.

Basin irrigation: Basin irrigation is common practice of surface irrigation. This method is employed for watering orchards (Basak, 1999). It is useful especially in regions with layouts of small fields (Shah et al. 2002). If a field is level in all directions, is encompassed by a dyke to prevent runoff, and provides an undirected flow of water onto the field, it is herein called a basin. A basin is typically square in shape but exists in all sorts of irregular and rectangular configurations. It may be furrowed or ridged, have raised beds for the benefit of certain crops, but as long as the inflow is undirected and uncontrolled into these field modifications, it remains a basin.

Free Flooding:

This flooding system of irrigation is used from ancient times. Flooding method consists in applying the water by flooding the land of rather smooth and flat topography. In current irrigation practice, several flooding methods have been developed. In free flooding method, water is applied to the land from field ditches without any check or guidance to the flow. The land is

divided into plots or kiaries of suitable size depending on porosity of soil. Water is spread over the field from watercourse. The irrigation operation begins at the higher area and proceeds towards the lower levels. The flow is stopped when the lower end of the field has received the desired depth of water. The field watercourse is properly spaced, the spacing depends on the topography, soil texture, depth of soil and size of stream.

Well and Tube Well Irrigation:

A well is a hole dug in the ground to get the subsoil water. Normal well is about 3-5 metres deep but deeper wells up-to 15 metres are also dug. This system of irrigation has been used in India from ancient time. Various methods are used to lift the ground water from the well for irrigation, drinking, bathing and for other purposes. Well irrigation is more popular in those regions where ground water is in ample and where there are few canals.

Canal Irrigation Most of the canals provide perennial irrigation and supply water as and when required. This saves the crops from drought conditions and helps in increasing the farm production. Canals carry a lot of residue brought down by the rivers. This sediment is deposited in the agricultural fields which make soil more fertile. Some of the canals are parts of multipurpose projects and, therefore, provide inexpensive source of irrigation. Although the initial cost involved in canal irrigation is more, it is quite cheap in the long run.

4. Harvesting

Harvesting is the process of collecting the mature rice crop from the field. Paddy harvesting activities include reaping, stacking, handling, threshing, cleaning, and hauling. These can be done individually or a combine harvester can be used to perform the operations simultaneously.

It is important to apply good harvesting methods to be able to maximize grain yield, and minimize grain damage and quality deterioration.

Harvesting rice consists of the basic operations which can be done in individual steps or in combination using a combine harvester. These include:

- **Reaping** - cutting the mature panicles and straw above ground
- **Threshing** - separating the paddy grain from the rest of cut crop
- **Cleaning** - removing immature, unfilled, non-grain materials
- **Hauling** - moving the cut crop to the threshing location
- **Field drying** - leaving the cut crop in the field and exposing it to the sun for drying (optional)
- **Stacking/piling** - temporarily storing the harvested crop in stacks or piles (optional)
- **Bagging** - putting the threshed grain in bags for transport and storage

Traditional harvesting activities such as field drying and stacking/piling are not recommended because they can lead to rapid quality deterioration and increased harvest losses.

Besides these, a variety of other activities can be included in harvesting such as gathering, reaping (gathering standing grain by cutting), bundling, and various forms of transporting the crop and grain.