

IRRIGATION

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Concept of Irrigation:

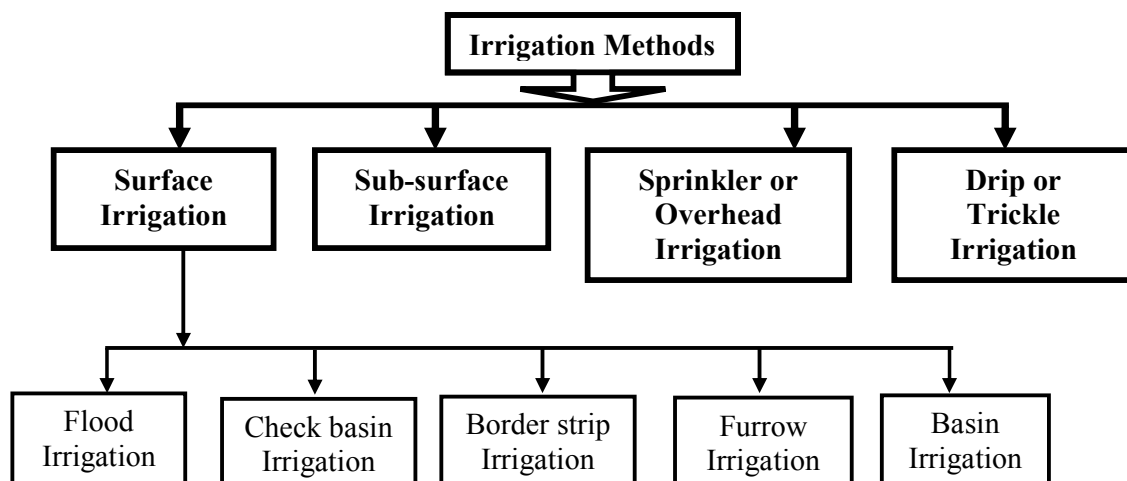
Irrigation may be defined as “**the artificial application of water to plant for its proper growth and development**”. It is supplied to supplement the water available from rainfall, residual soil moisture and ground water contribution. In areas of irregular rainfall, irrigation is used during dry spells to ensure harvests and to increase crop yields. Irrigation has greatly expanded the amount of arable land and the production of food throughout the world.

Objectives of Irrigation:

1. To ensure the proper growth and development of plants by supplying adequate water.
2. To make the plant nutrient soluble so that they can be easily uptaken by plants.
3. To accelerate the decomposition of organic substances. Adequate moisture supports the microorganisms to become more active to help in decomposition.
4. To control soil temperature.
5. To soften tillage pans and clods.
6. To washout or dilute salts in soils.
7. To control some destructive pests and diseases.
8. To avoid short duration drought.

Methods of Irrigation:

There are a number of irrigation methods according to the soil physiography, sources and amount of water, types of crop, labor cost, capital etc. The important methods of irrigation are shown in the flow chart below:



A. Surface irrigation

This method of irrigation is widely used in Bangladesh. Surface irrigation is the application of water by gravity flow to the surface of the field. Either the entire field is flooded or the water is fed into small channels or strips of land. Surface irrigation includes the following:

1. Flood irrigation
2. Check basin irrigation
3. Border stripe irrigation
4. Furrow irrigation
5. Basin irrigation

1. Flood irrigation

In this method, water is allowed from the irrigation channel into the entire field and it slowly spread all over depending upon the existing slope of the land. This method is practiced where water is in abundance and inexpensive. It is followed in smooth and even land.



Fig.1 Flood irrigation

Advantages of Flood irrigation

- ☑ Less time consuming.
- ☑ Cost of irrigation is minimum. There is no extra cost except land leveling.
- ☑ Labor requirement is minimum.
- ☑ Waste of land is minimum.

Limitations of Flood irrigation

- It is very inefficient method.
- Only 20-25% of the supplied water is used by plant and rest amount is lost by different processes.
- It is not suitable in unlevelled land.
- There is no control of water.
- Waterlogging may occur in lower end of field.
- Possibility of soil erosion is high.

Suitable crops: Rice, jute, mustard, pulses, linseed, wheat, chilli, onion etc.

2. Check basin irrigation

In this method, the field is divided into a number of plots and leveled. It is also known as “Bed method”. This method is most suitable for leveled fields with low permeability and where water is not a constraint. The size of the beds may vary from 1.5 m × 1.5 m to 6.0 m × 4.5 m, depending upon the topography of the land. Water from the main channel is supplied to the field channels one after another. Each field channel supplies water to adjacent plots.

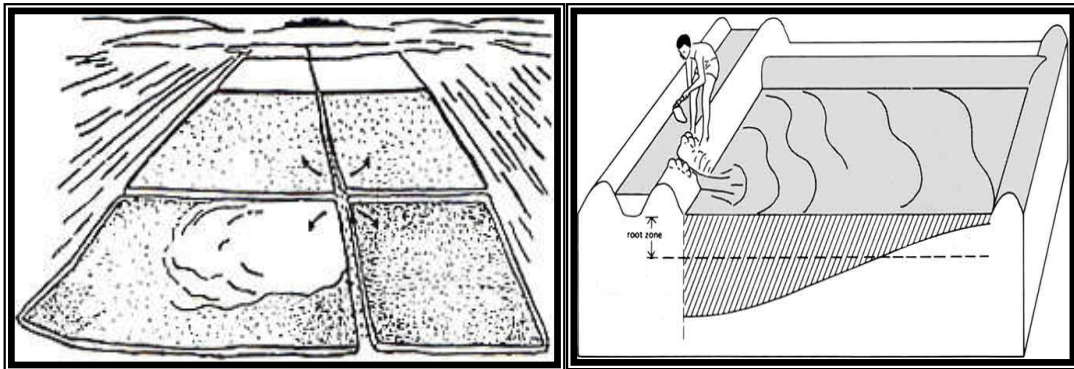


Fig. 2.1 Check basin irrigation (graphical view)

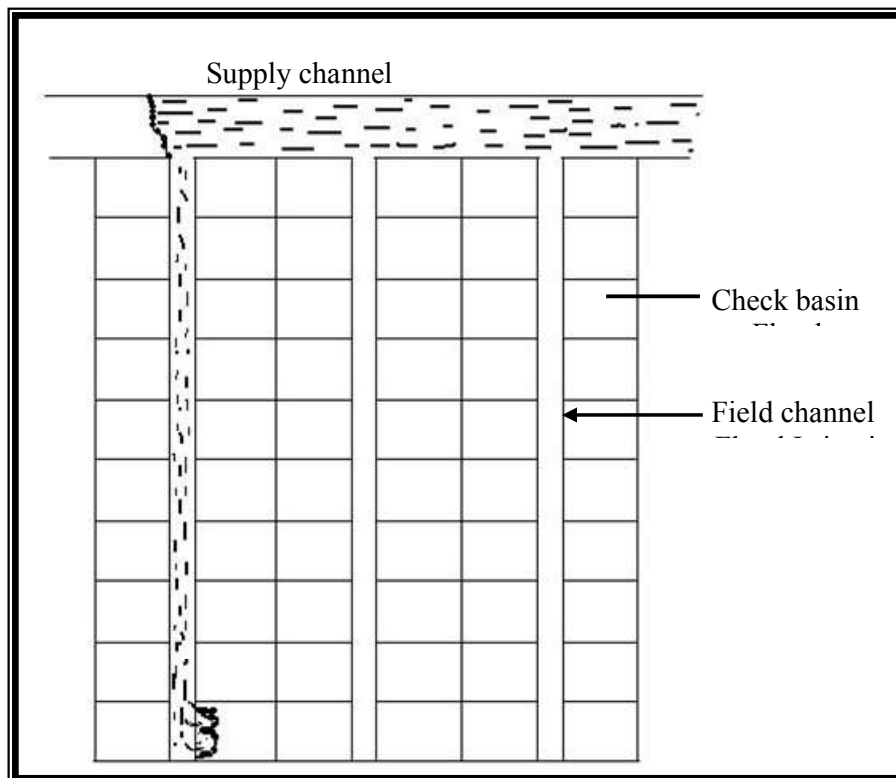


Fig. 2.2 Check basin irrigation (schematic illustration)

Advantages of Check basin irrigation

- ☑ Water can be supplied uniformly.
- ☑ Soil erosion is lower.
- ☑ Water loss is minimum.
- ☑ Water can be applied efficiently.
- ☑ Since the land is divided by borders, the land can be moistened with required depth.

Limitations of Check basin irrigation

- It is more costly than flood irrigation.
- More labor is required for field layout and irrigation.
- More land is wasted due to channel preparation.
- Movement of farm animals and implements is difficult.
- Inter-cultivation is difficult due to obstruction by bunds.

Suitable crops: Wheat, T. Aman rice, mustard, fodder crops, vegetables etc.

3. Border strip irrigation

Border strip method involves irrigating a field by dividing it into long strips separated by low parallel borders (bunds). The size of the strip ranges from 30 to 300 m in length and 3 m to 15 m in breadth. Border strips are laid along the general slope of the field. The size of the border strip also depends on stream size and soil texture. For larger sized streams and heavy soils, longer strips are made. This method is suitable for medium to heavy textured soils, but not for sandy soil.



Fig. 3.1 Border strip irrigation (graphical view)

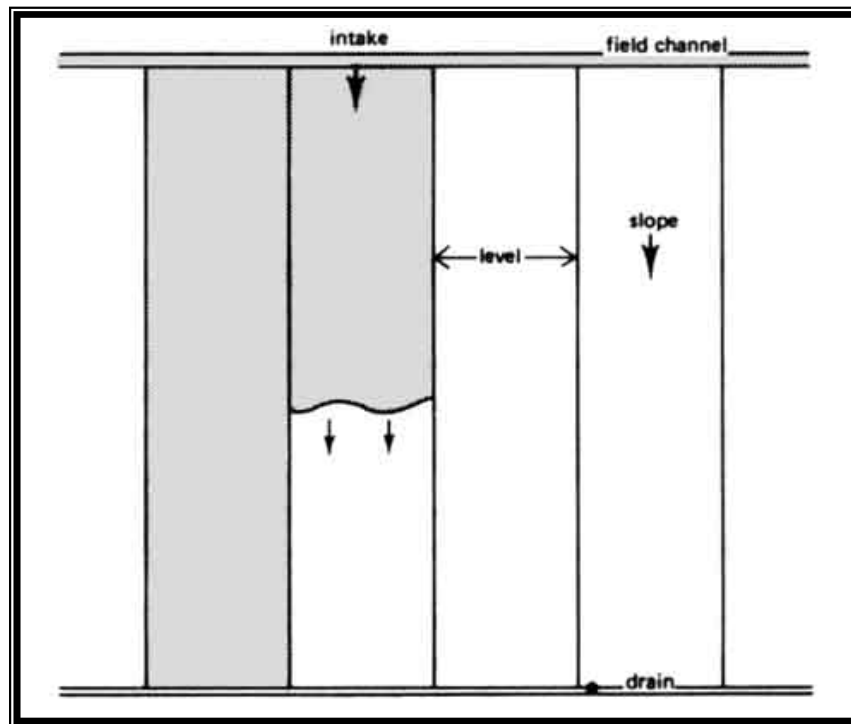


Fig. 3.2 Border strip irrigation (schematic illustration)

Advantages of Border strip irrigation

- ☑ No land is wasted for making channels excepting the supply channel.
- ☑ Border can be used for growing crops.
- ☑ Efficiency of water application is high.
- ☑ Variable stream size can be efficiently used.
- ☑ Construction of borders is easy and does not involve much cost.
- ☑ Labor requirement for irrigation is lower than check basin irrigation.

Limitations of Border strip irrigation

- Precise land leveling is essential.
- Initial cost for land preparation and land grading is high.
- There are chances of excess water intake by upper reach of the stream.
- Excess water may accumulate at the tail end of the strip.
- It cannot be used in light textured soils.

Suitable crops: Wheat, oat, jowar, barley, mungbean, upland rice, mustard, fruit sapling etc.

4. Furrow irrigation

In furrow irrigation, water is applied in small stream between the rows of crops, grown on ridges or furrow sides. The size and shape of the furrows depend upon the soil, crop, spacing and the equipment used for furrow forming. Water is applied in small stream into the furrow. It infiltrate into the soil and spreads laterally to wet the area between the furrows. This method of irrigation is generally used to irrigated row crops and vegetables.

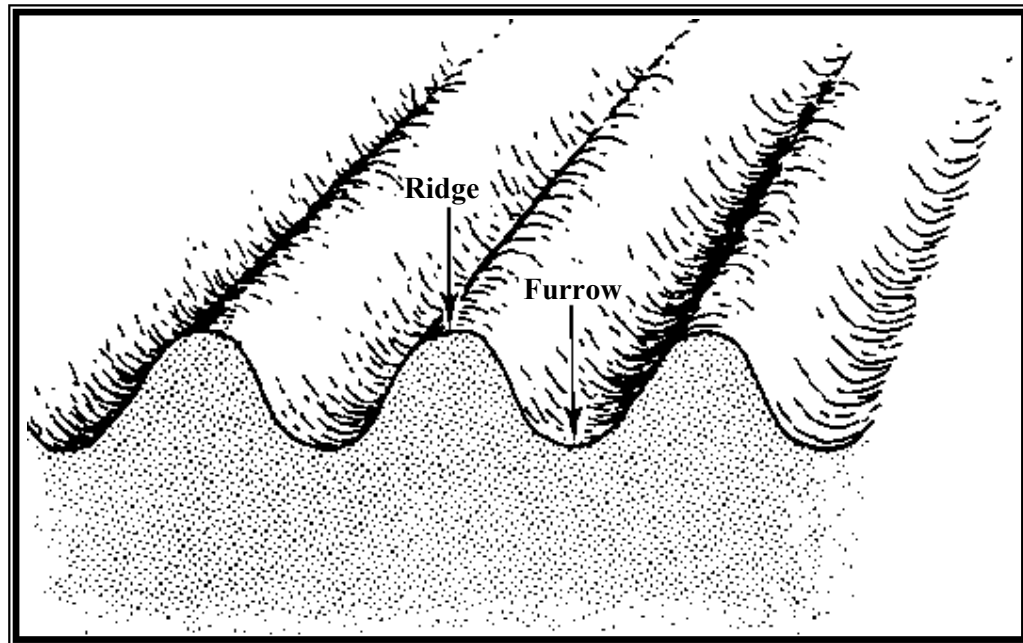


Fig. 4 Furrow irrigation (schematic illustration)

Advantages of Furrow irrigation

- ☑ Great saving of water over other flooding methods.
- ☑ Variable size of steam can be used.
- ☑ Irrigation water can be used efficiently.
- ☑ Flow of water can be controlled.
- ☑ Soil erosion is low.
- ☑ Furrow acts as drainage channel.
- ☑ Low cost for crops which are cultivated in ridge.

Limitations of Furrow irrigation

- It is not suitable for the crops which do not require ridge and furrow.
- More cost for furrow making.
- It is unsuitable for light irrigation.
- Excessive water flow in the furrows can break the ridges.
- Weeds may grow in furrows.

Suitable crops: Potato, groundnut, sugarcane, cotton, cauliflower, cabbage, brinjal, tomato, maize etc.

5. Basin irrigation

Basin method is almost similar to check basin method except that in the check basin method, entire field is irrigated while in basin method only the basins around the plants are irrigated. Basins are generally round in shape and occasionally square or rectangular. The basins are small when plants are young and their size increased with the age of plants. Basins are connected by an irrigation channel. This method is suitable for fruit crops.

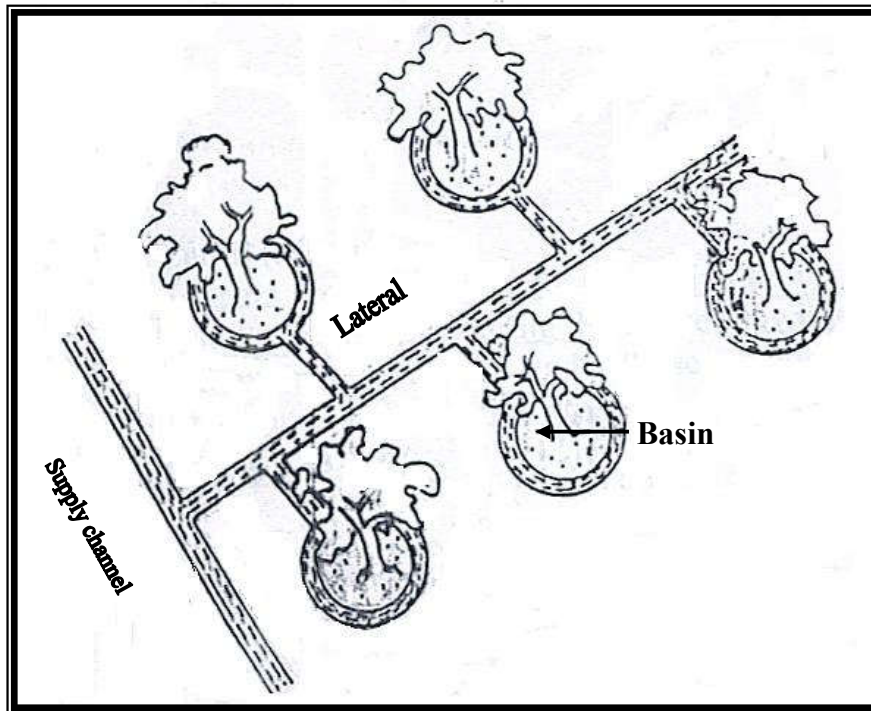


Fig. 5 Basin irrigation

Advantages of Basin irrigation

- A considerable amount of water is saved.
- Variable size of streams can be easily controlled.
- Water application efficiency is very high.
- Entire area does not require leveling except basin area.
- Does not hamper the fruit crops.
- The labor requirement and cost of making basin are low.
- No land is wasted.

Limitations of Basin irrigation

- This method is only suitable for trees and shrubs.
- Primary cost of irrigation is high.
- Channels and basins restrict the movement of animals and farm machineries.

Suitable crops: Mango, apple, orange, berry, olive, grapefruit etc.

B. Sub-surface irrigation

In this method of irrigation, water is applied below the ground surface by constructing trench or installing underground perforated pipe lines or tile lines. Water moves laterally and upward to moist the root zone of soil under capillary tension.



Fig. 6.1 Sub-surface irrigation (graphical view)

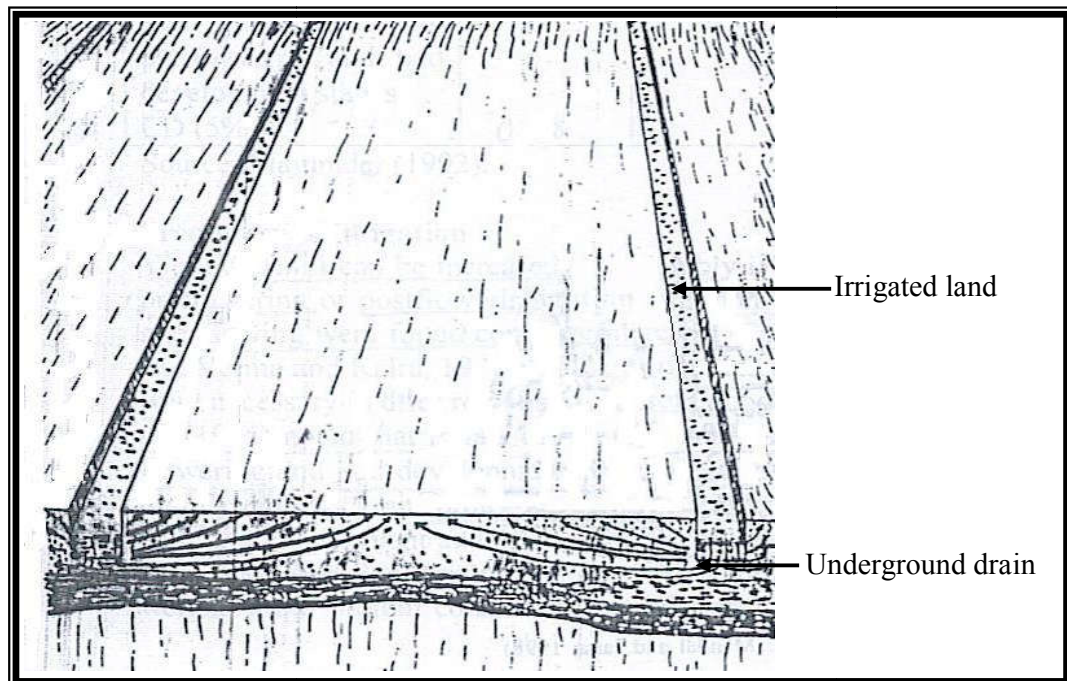


Fig. 6.2 Sub-surface irrigation (schematic illustration)

Advantages of sub-surface irrigation

- ☑ No loss of land area.
- ☑ Control of water flow is easier.
- ☑ There is no chance of water logging.
- ☑ There is no loss of water by evaporation.
- ☑ No crust develops on the soil surface after drying of irrigation water.
- ☑ Leveling of surface land is not necessary.
- ☑ There is no possibility of nutrient loss by leaching.
- ☑ There is no soil erosion.
- ☑ It does not hamper the use of farm implements.

Limitations of Sub-surface irrigation

- Initial cost of irrigation is high.
- Good quality water must be available.
- Flow of water can be hampered by clay.
- Pipes may be replaced after several years.
- It is not suitable for deep rooted crops like coffee, rubber, mango etc.

Suitable crops: Wheat, bajra, jowar, beet, peas, potato, fodder crops, etc.

C. Sprinkler or Overhead irrigation

Sprinkler irrigation refers to application of water to crops in forms of spray from above the crop like rain. It is also called overhead irrigation as water is allowed to fall as spray from above the crop. Water under pressure is carried and sprayed into the air above the crops through a system of pumping unit, overhead perforated pipes and nozzle lines.

Sprinkler irrigation may be used for many crops and all types of soil on lands of widely different topography and slopes. However, it finds its best use to irrigate:

- i. Sandy soils and soils with high infiltration rates,
- ii. Shallow soils that do not allow proper land leveling required for surface irrigation methods
- iii. Areas with steep slopes having erosion hazards,
- iv. For growing high priced crops and
- v. Where water is scarce and costly.



Fig. 7.1 Sprinkler irrigation (graphical view)

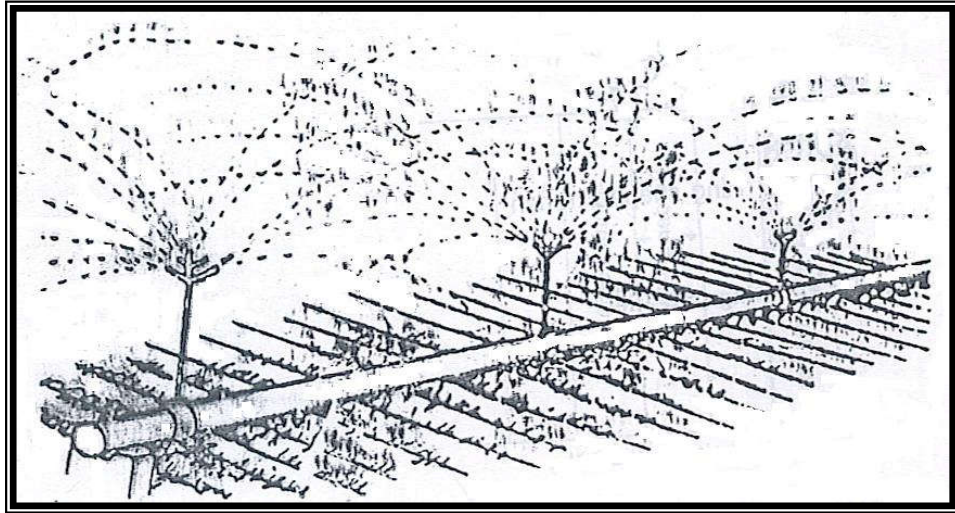


Fig. 7.2 Sprinkler irrigation (schematic illustration)

Advantages of Sprinkler irrigation

- ☑ Water application efficiency is very high.
- ☑ There is little waste of land.
- ☑ It can be applied in all kind of lands including hilly area.
- ☑ Land leveling is not necessary.
- ☑ Soil erosion is very low.
- ☑ There is no problem of water logging.
- ☑ Application of fertilizer, pesticides and herbicides can be applied with irrigation water.
- ☑ High yields or fresh quality fruit are obtained.

Limitations of Sprinkler irrigation

- Initial cost as well as operating cost is high.
- Irrigation may be hampered if wind flow is high.
- Evaporation loss is high.
- Clean water is needed.
- It can not be applied if the height of plant is very high.
- There is chance to spread diseases.

Suitable crops: Wheat, pulses, oilseeds, vegetables, pineapple, mango, litchi etc.

D. Drip or Trickle irrigation

Drip or trickle irrigation is also called 'micro-irrigation'. It refers to the application of water at a slow rate drop by drop through perforated in pipes or through nozzles attached to tubes spread over the soil to irrigate a limited area around the plant. It achieves wetting of even smaller surface area. This method is profitably used in arid region where water is scarce and often of poor quality in respect of salt concentration. It enables the application of fertilizer along with irrigation water. It is well adapted to a variety of row crops from widely spaced fruit crops to closely spaced vegetable crops.



Fig. 8.1 Drip irrigation (graphical view)

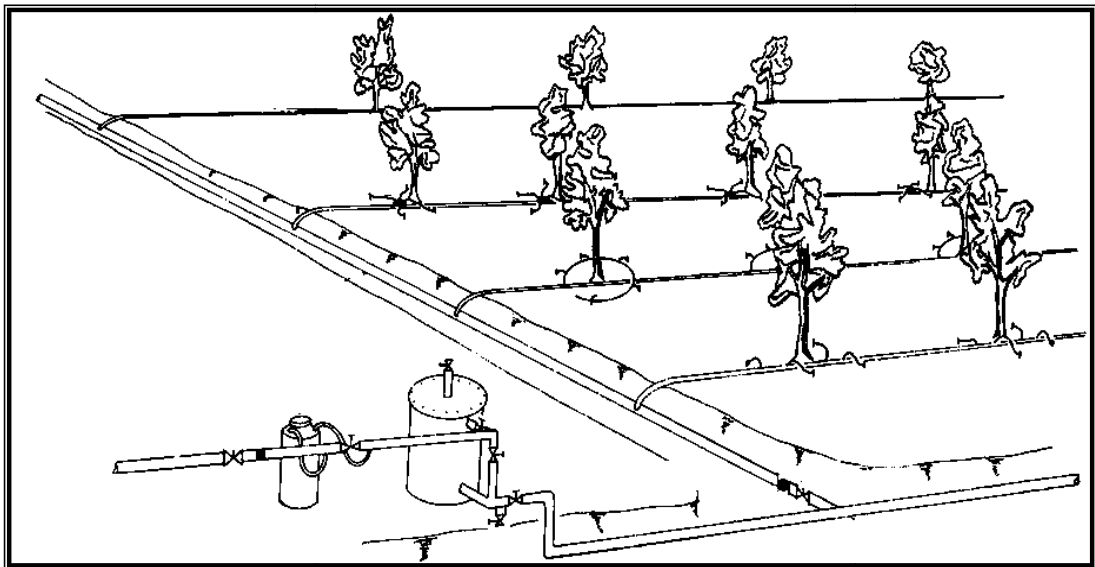


Fig. 8.2 Drip irrigation (schematic illustration)

Advantages of Drip irrigation

- ☒ Considerable saving of water.
- ☒ High water application efficiency.
- ☒ Loss water through evaporation and seepage is reduced.
- ☒ Labor cost is low.
- ☒ No soil erosion.
- ☒ Reduced weed growth.
- ☒ Free from waterlogging.
- ☒ Improve the quality of production.
- ☒ It can be used in slopping land.
- ☒ Fertilizer can also be used with irrigation water.

Limitations of Drip irrigation

- ☐ Initial cost is high.
- ☐ Maintenance of the system is complex.
- ☐ It is not suitable for narrow spaced field crops.
- ☐ Water cannot enter at a deeper region.

Suitable crops: This method is suitable for tree crops like mango, berry, litchi, jackfruit, date etc. It is also suitable for nursery plant, graft, cutting etc.