

IRRIGATION MANAGEMENT IN  
HORTICULTURAL CROPS

# Introduction

- Irrigation is the artificial application of water to the land or soil.
- It is used to assist in the growing of agricultural crops, maintenance of landscapes, and revegetation of disturbed soils in dry areas and during periods of inadequate rainfall.

# Necessity Of Irrigation

- Insufficient rainfall
- Uneven distribution of rainfall
- Improvement of perennial crop
- Development of agriculture in desert area

# Benefits Of Irrigation

- Increase in crop yield
- Protection from famine
- Cultivation of superior crops
- Elimination of mixed cropping
- Economic development
- Hydro power generation
- Domestic and industrial water supply

# III Effects Of Irrigation

- Rising of water table
- Formation of marshy land
- Dampness in weather
- Loss of valuable lands

# Methods Of Irrigation

- Surface irrigation

- (a) Uncontrolled (or wild or free) flooding method
- (b) Border strip method
- (c) Check method
- (d) Basin method and
- (e) Furrow method.

- Sub-surface irrigation

- Sprinkler irrigation

- Trickle(Drip) irrigation

# Surface Irrigation

- In all the surface methods of irrigation, water is either ponded on the soil or allowed to flow continuously over the soil surface for the duration of irrigation.
- It does not result in high levels of performance.
- This is mainly because of uncertain infiltration rates which are affected by year-to-year changes in the cropping pattern, cultivation practices, climatic factors, and many other factors

# Uncontrolled Flooding

- When water is applied to the cropland without any preparation of land and without any levees to guide or restrict the flow of water on the field, the method is called 'uncontrolled', wild or 'free' flooding.
- Uncontrolled flooding generally results in excess irrigation at the inlet region of the field and insufficient irrigation at the outlet end.
- Efficiency is reduced because of either deep percolation or flowing away of water from the field.
- The advantage of this method is the low initial cost of land preparation.

# Border Strip Method

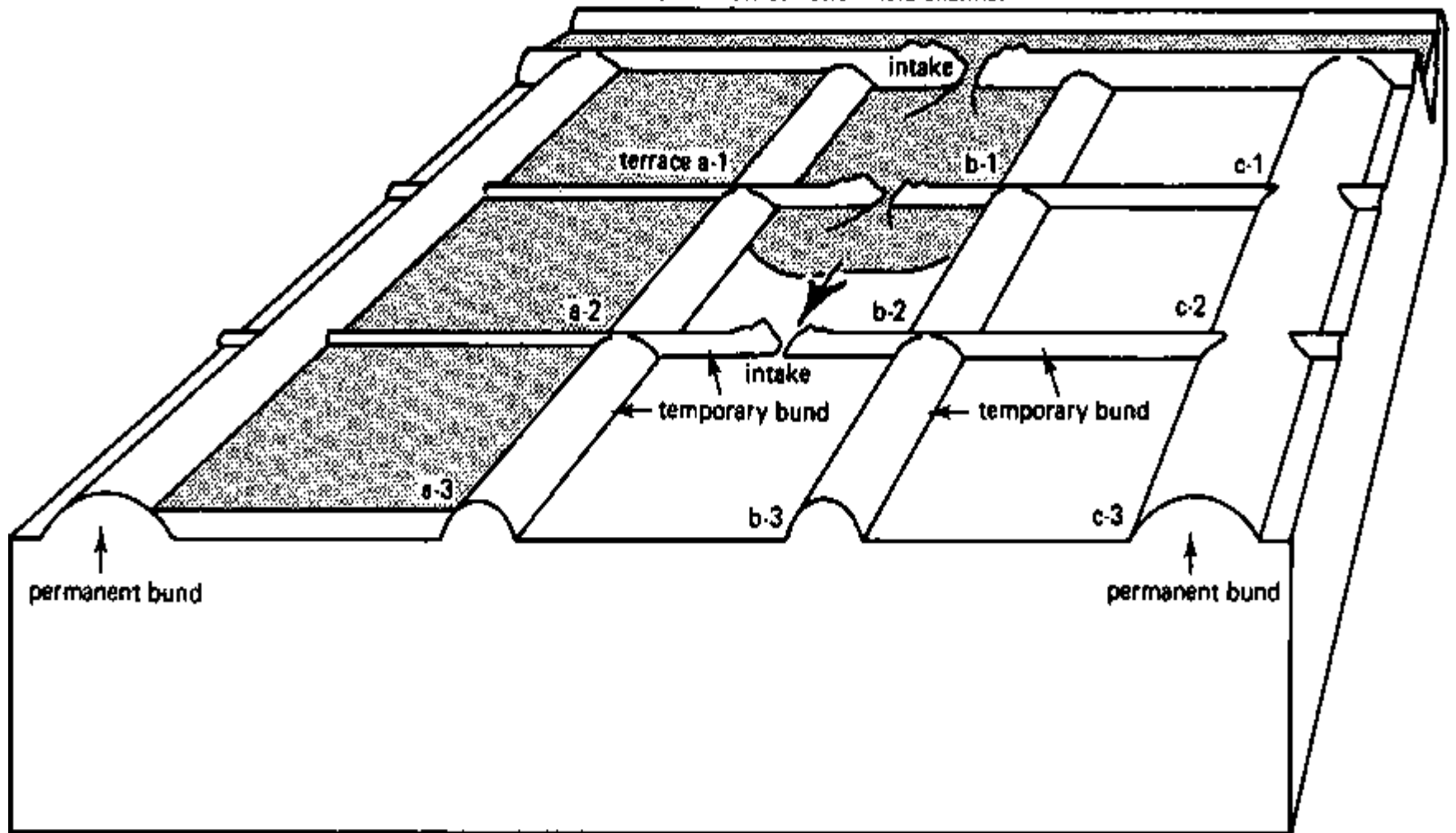
- Border strip irrigation (or simply ‘border irrigation’) is a controlled surface flooding method of applying irrigation water. In this method, the farm is divided into a number of strips. These strips are separated by low levees (or borders).
- The border strip method is suited to soils of moderately low to moderately high intake rates and low erodibility.
- This method, however, requires preparation of land involving high initial cost.



# Check Method

- The check method of irrigation is based on rapid application of irrigation water to a level or nearly level area completely enclosed by dikes.
- In this method, the entire field is divided into a number of almost levelled plots (compartments or 'Kiaries') surrounded by levees.
- This method is suitable for a wide range of soils ranging from very permeable to heavy soils.
- Loss of water through deep percolation (near the supply ditch) and surface runoff can be minimised and adequate irrigation of the entire farm can be achieved. Thus, application efficiency is higher for this method.
- There is some loss of cultivable area which is occupied by the levees.

→ flow direction field channel





# Basin Method



# Furrow Method

- An alternative to flooding the entire land surface is to construct small channels along the primary direction of the movement of water and letting the water flow through these channels which are termed 'furrows', 'creases' or 'corrugation'.
- Furrows necessitate the wetting of only about half to one-fifth of the field surface. This reduces the evaporation loss considerably.
- Furrows provide better on-farm water management capabilities for most of the surface irrigation conditions, and variable and severe topographical conditions.
- Possibility of increased erosion
- Furrow irrigation requires more labour than any other surface irrigation method.



# Subsurface Irrigation

Subsurface irrigation (or simply sub irrigation) is the practice of applying water to soils directly under the surface. Moisture reaches the plant roots through capillary action. The conditions which favor sub irrigation are as follows:

- Impervious subsoil at a depth of 2 meters or more,
- A very permeable subsoil
- A permeable loam or sandy loam surface soil,
- Uniform topographic conditions, and
- Moderate ground slopes

# Sprinkler Irrigation

Sprinkling is the method of applying water to the soil surface in the form of a spray which is somewhat similar to rain.

Rotating sprinkler-head systems are commonly used for sprinkler irrigation.

Each rotating sprinkler head applies water to a given area, size of which is governed by the nozzle size and the water pressure. Alternatively, perforated pipe can be used to deliver water through very small holes which are drilled at close intervals along a segment of the circumference of a pipe

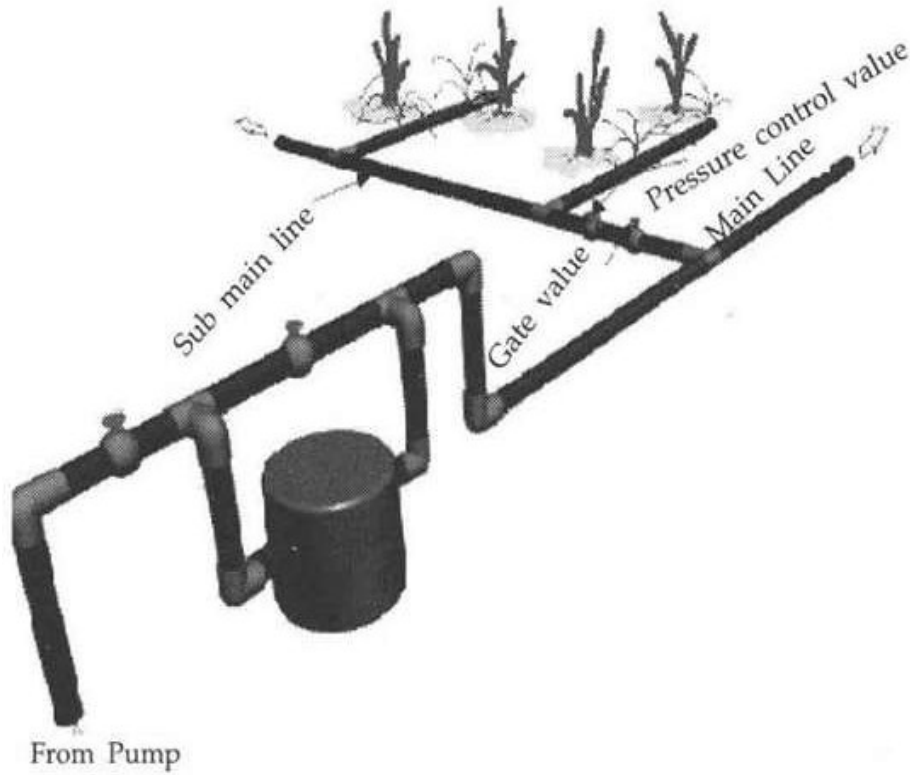


Figure 2. Sprinkler irrigation system

# Advantages

- Can be done in soils which do not permit good distribution of water by surface methods,
- Lands which have steep slopes and easily erodible soils
- Lands with shallow soils and undulating lands which prevent proper leveling required for surface methods of irrigation
- Low water loss (efficiency up to 80%)
- Saving in fertilizer
- Suitable for any topography
- No soil erosion
- Better seed germination, free aeration of root zone
- Uniform application of water

# Disadvantages

- High initial cost, cannot adopt by ordinary farmers
- Poor application efficiency in windy weather and high temperature
- High evaporation losses
- Water should be free of debris
- Physical damage to crops by application of high intensity spray
- Infection of fungal diseases
- Increase of leaf surface temperature

# Trickle (Drip) Irrigation

- Trickle irrigation system comprises main line, sub mains, laterals, valves (to control the flow), drippers or emitters , pressure gauges, water meters, filters , pumps, fertilizer tanks, vacuum breakers, and pressure regulators.
- The drippers are designed to supply water at the desired rate (1 to 10 liters per hour) directly to the soil. Low pressure heads at the emitters are considered adequate as the soil capillary forces causes the emitted water to spread laterally and vertically.

# Components of Drip Irrigation system

- Pumping set
- Filters
- Mainlines
- Sub-main
- Laterals
- Drippers/emitters

- Pumping set:

To create a pressure about 2.5 Kg/sq cm to regulate the amount of water to be supplied.



- Filter :

To filter the water in Order to remove the suspended impurities from water.

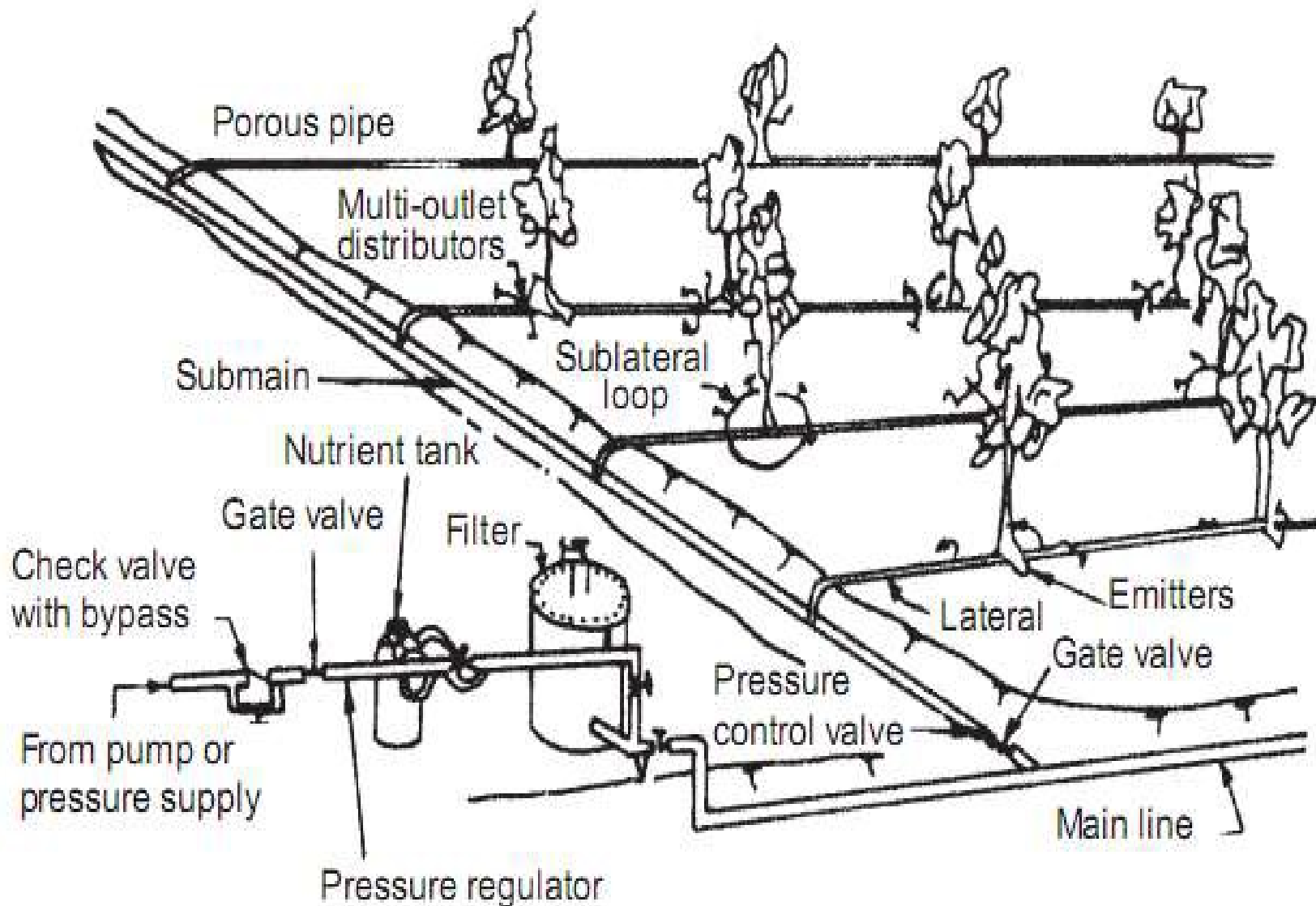
## ● Main lines:

- It is a Distribution system in drip irrigation. Rigid PVC and high density polyethylene pipes are used as main pipes to minimized corrosion and clogging.
- Pipes of 65 mm diameter and with pressure rating of 4 to 10 kg/sq. cm
- Sub Main:
  - It is usually connected to the main lines through a control valve assembly.
  - The function of its to distributes water uniformly to a number laterals.



- Drippers/emitters:
  - It is fitted to a drip irrigation lateral and intended to emit water in the form of drops or continuous flow at emitter rates not exceeding 15 liters/hr.
  - Drippers function as energy dissipaters, reducing the inlet pressure head in the lateral, which generally range from 0.3 to 1.5 atmosphere .






**Fig. 3.6** Line sketch of a typical drip irrigation system

# Advantages of Drip

## Irrigation

- Less requirement of irrigation water
- Water supply at optimum level.
- Water logging is avoided
- High yield
- Over irrigation is avoided
- Variation in application rate
- Reduced labour cost
- Weed control

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- Increase in net irrigable area
  - Highly uniform distribution of water i.e., Controlled by output of each nozzle No soil erosion
  - Suitable for any topography
  - Maintenance of high surface temperature
  - Improved disease and pest control
  - Tolerance to windy atmospheric condition

# COMPARISON

	<b>Drip method</b>	<b>Flood method</b>
Water saving	High, between 40 and 100 %	Less. High rates of evaporation, surface run off and percolation
Irrigation efficiency	80 – 90 %	30 - 50 %
Weed problem	Almost nil	High
Suitable water	Even saline water can be used	Only normal water can be used
Diseases and pests	Relatively less	High
Efficiency of fertilizer use	Very high since supply is regulated	Heavy losses due to leaching

	<b>Drip method</b>	<b><u>Flood method</u></b>
Water logging	Nil	High
Water control	Can be regulated easily	Not much control
Cost benefit ratio	Excluding water savings: 1.3 - 13.3, Including water savings: 2.8 - 30.0	Between 1.8 and 3.9
Capital cost/ha	Rs 15,000 to 40, 000	depending — on crop spacing
Yield increase	20 - 100 % higher than flood method	Less compared to drip

# Disadvantages:

- High skill in design, installation, and subsequent operation
- Clogging of small conduits and openings in emitters due to sand, clay particles, debris, chemical precipitates and organic growth
- Not suitable for closely planted crops such as wheat and other cereal grains

# Quality of irrigation water

- Irrigation water must not have direct or indirect undesirable effects on the health of human beings, animals, and plants.
- The irrigation water must not damage the soil and not endanger the quality of surface and ground waters with which it comes into contact.
- The presence of toxic substances in irrigation water may threaten the vegetation besides degrading the suitability of soil for future cultivation.
- Surface water, ground water, and suitably treated waste waters are generally used for irrigation purposes

The various types of impurities, which make the water unfit for irrigation, are classified as:

- Sediment concentration in water
- Total concentration of soluble salts in water
- Proportion of sodium ions to other ions
- Concentration of potentially toxic elements present in water
- Bacterial contamination