

## Drip Irrigation - An Efficient Water Management Technique in Rainfed Agriculture for More Farm Income

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### Abstract

In the climate changing scenario with continuous depletion of natural resources, it is a big task to meet the food demand of growing population. Water scarcity is the major challenge worldwide for the farming community. The need of the hour is to conserve the water and ensure its judicious utilization through highly efficient irrigation techniques. Drip irrigation system may be a promising option for this which can help farmers to have higher production with better-quality crops using limited resources. Here, briefly different aspects of drip irrigation system has been elucidated covering its applicability, types, components, functions, schematic layout, advantages, disadvantages, saving of water and more crop yields using drip system, efficiency, *etc.* The information given here will be helpful for farmers, researchers and policy makers for more acceptance of drip irrigation system for higher farm income.

**Keywords:** Agriculture, Climate change, Drip irrigation, Water use efficiency

### Introduction

Water is a vital input and one of the important scarce natural resources for agricultural production. When we think about food security and sustainable agriculture, without water it is not at all possible. Worldwide 20% of the cultivated land is under irrigation and it supports 40% of the total food production (Anonymous, 2023). There is a wide mismatch between demand and supply of water due to burgeoning population, urbanization, industrialization and climate change and it has a major impact on agriculture. The increasing population of world is expected to cross 10 billion by 2050 and it will require expansion of agricultural production to the extent of 70% by 2050. The need of the hour is to conserve the water and ensure its judicious utilization. Drip irrigation may be a promising option towards this to have more crops per drop of water and higher agricultural production.

In drip irrigation, water is frequently applied to plants with very low quantity of water directly to root zone. It minimizes deep percolation, runoff and evaporation. In this technique, water is applied through pipes under pressure and is distributed by the emitters directly into the soil near

the roots slowly. Since small amount of water is applied to plants in this method, there is less weed growth and leaching of plant nutrients from the soil. Application of chemical fertilizers can be done efficiently to the plants by the drip system. This facilitates good soil health with adequate moisture content to support plants growth. It is also called trickle irrigation.

### Applicability of Drip Irrigation

Drip irrigation method is well accepted in water scarce situation for irrigating the crops and is suitable for arid and semi-arid areas. This is suitable for orchards, row crops and vines. Crops like grapes, banana, pomegranate, orange, lemon, papaya, guava and other fruit trees, sugarcane, cotton, tea, coffee, rubber, coconut, flowers, oil seeds and vegetables like tomato, chilly, capsicum, cabbage, *etc.* perform well under drip irrigation system. It can work well in all types of soil. In case of clay soils, application of water should be done slowly for avoiding the ponding and runoff. In sandy soils it needs sufficient lateral wetting of the soil and so high emitter discharge is needed. Drip irrigation system can also be used where water quality is poor or saline.

### Article History

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### Types of Drip Irrigation

There are mainly two types of drip irrigation methods which include both surface and subsurface drip irrigation. In case of surface drip irrigation method, application of water is done directly on soil surface and in sub-surface drip irrigation; application of water is done below the ground. Water loss through evaporation is high in surface drip system whereas it is reduced by 20-25% in sub-surface drip irrigation systems including less pesticides and fertilizers uses and less chances of pipe damage.

### Different Components, Functions and Layout of Drip Irrigation System

Drip irrigation system has various components which include water source, pump unit, control valve, main lines, sub main lines, laterals and emitters or drippers. The pump lifts water from the source and supplies water into the pipes. The control valves are used to regulate the discharge and pressure. Screen filters/ graded sand filters are used to separate suspended material from the irrigation water. It has also fertilizer/ nutrient tank for application of fertilizer during irrigation. From the control head/ valve, the water is carried by main lines to sub-mains and from sub-mains to laterals and then laterals to drippers and directly applied to the root zone of plants. The mains, sub-mains and lateral lines are made from PVC and are buried below the soil surface to avoid degradation by direct sun light. The emitters/ drippers are used with laterals to regulate the discharge of water to the plants and are normally kept more than 1 m away. In row crops, emitters are more closely spaced. For the mains, PVC pipes with 65 mm diameter or more having 4 to 6 kg cm<sup>-2</sup> pressure rating are used. For sub-mains, hard PVC, HDPE or LDPE of diameter 32 mm to 75 mm with 2.5 kg cm<sup>-2</sup> pressure ratings are used. Laterals are made from LDPE with 10, 12 and 16 mm internal diameter and 1 to 3 mm wall thickness. For drippers, poly-propylene micro-pipes/ tubes of diameter 1 to 4 mm are used.

A schematic typical drip irrigation system layout is given below (Figure 1) and the percentage of water saved and crop yields increased of different crops using drip system is mentioned in table 1.

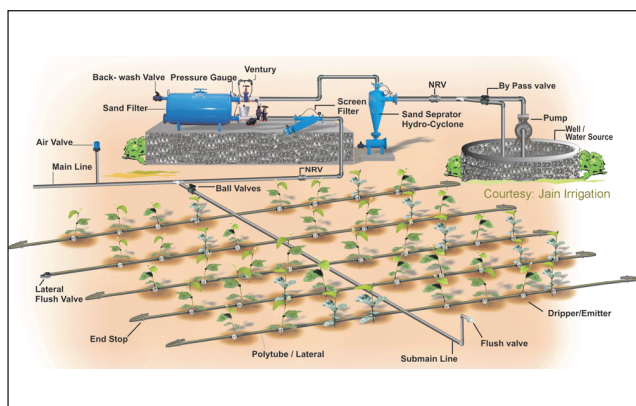


Figure 1: Layout of a drip irrigation system (Anonymous, 2023a)

Table 1: Water saving and yield increase in crops using drip irrigation

Name of the crop	Saving in water (%)	Yield increase (%)
Grapes	48	23
Sweet lime	61	50
Banana	45	52
Pomegranate	45	45
Cauliflower	68	70
Chilli	68	28
Cucumber	56	48
Tomato	42	60
Ground nut	40	152
Watermelon	66	19
Sugarcane	50	99

(Source: Anonymous, 2023b)

### Advantages of Drip Irrigation System

- Root zone application of water and there is no need to wet the entire area around the crops.
- Uniform distribution of water and high application efficiency in comparison to other irrigation methods.
- Operates on low pressure (0.15-1.75 kg cm<sup>-2</sup>) and reduces energy consumption.
- Poor quality water or saline water can be used safely to irrigate.
- Reduced salt deposition in the root zone.
- Minimum fertilizer/ nutrient loss.
- It can be used for leveled, sloppy and undulating field conditions.
- Availability of adequate soil moisture within the root zone.
- It can be used in any types of soil.
- Minimized weed growth.

### Disadvantages of Drip Irrigation System

- Initial cost is more.
- Frequent clogging of emitters due to deposition of salts or dirt.
- Water used is to be properly filtered and the equipment to be properly maintained.
- Degradation of pipes due to excess exposure to sun light.
- Salt accumulation in the root zone of crops.
- Not suitable for cover crops due to the localized nature of the water applications.

### Conclusion

Drip irrigation method is most suitable for semi-arid, arid and areas where water is scarce and of poor quality, undulating land with steep slopes and labour is expensive. Under this system of irrigation, 90% or more application efficiency can be achieved in comparison to surface irrigation and other

methods of irrigation (Anonymous, 2023c). It can increase crop yield by 30-90%, water use efficiency by 60-70% with saving of fertilizer application up to 40%. By adopting drip irrigation system, more dependency on rainfall and excessive ground water extraction for agriculture can be avoided. In addition, this may be a promising and viable option to mitigate the problem of water scarcity in arid, semi-arid and desert areas for better agricultural production and sustainability in climate changing scenario.

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