Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 06, Issue: 01 (JAN-FEB, 2026)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

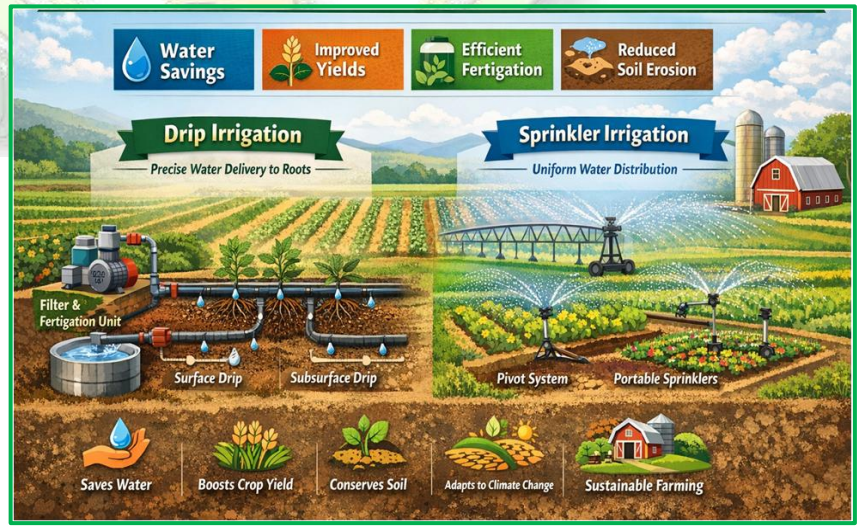
Irrigation Technologies: Drip and Sprinkler Systems

*Naveen Kumar S[1], Manjul Jain[2], Rajnish Kumar[3] and Subhash Verma[2]
[1]Ph. D. Scholar, Water Technology Centre, IARI, New Delhi
[2]Assistant Professor, School of Agriculture, Eklavya University, Madhya Pradesh
[3]Assistant Professor, School of Agriculture, Gyanveer University Sagar (M.P.)
*Corresponding Author's email: naveenkumars0208@gmail.com

It is the smart irrigation system. Scarcity of water, depleting groundwater tables, and a fluctuating environment demand more efficient irrigation technologies; and the options left are drip and sprinkler irrigation systems for increasing water efficiency, crop yields, and minimizing environmental degradation. Drip and sprinkler irrigation systems can help by providing water to plants in regulated quantities while minimizing losses due to excessive water consumption associated with traditional flooding and furrow irrigation practices. Drip and sprinkler irrigation systems may also help reduce water consumption, promote fertigation, improve nutrient uptake, reduce weeds, and improve crop products. This article aims to examine the principles and components of drip and sprinkler irrigation systems, the types found around the world, the benefits and drawbacks of these systems, where they fit in the scenario, and how they will impact the nation.

Introduction

Water ranks among the fundamental resources in farming, and its supply is becoming scarcer because of the burgeoning population, the increase in urban areas, and climate change. In India, for instance, the agricultural sector receives about 80 percent of the total freshwater resources, and a greater part of the irrigated system still depends on wasteful traditional surface irrigation systems like flood and furrow irrigation. Such surface irrigation techniques result in water wastage due to evaporation, runoff, seepage, and deep percolation, leading to low water use efficiency on arable lands. The use of micro-irrigation systems like drip irrigation and sprinkler irrigation can provide alternative approaches to traditional irrigation systems in a science-based and resourceful way. These systems apply water at low pressure in measured quantities either at the roots (drip irrigation) or like rainfall (sprinkler irrigation). The use of micro-irrigation systems results in efficient use of water while at the same time allowing for optimal development of the crop. These systems, therefore, play a critical role in sustainable and climate-resilient agriculture.



Principles of Micro-Irrigation

Micro-irrigation concepts are based on giving water to crops in small quantities that match the crop losses through evapotranspiration. The concepts of micro-irrigation are:

1. Water near the roots to cut down losses
2. Consistent water distribution for healthy growth
3. Soil moisture maintained at near optimal levels
4. Less surface evaporation, runoff, and deep percolation
5. Efficient Use of Water, Fertilizers, and Energy

Drip Irrigation System

Concept and Working Principle

Drip irrigation, also called trickle irrigation, delivers water constantly and slowly directly to the root zone of plants using small-bore tubes, laterals, and emitters. The water flows out in the form of drops or small volumes of continuous flow.

Components of Drip Irrigation

1. Water Source (well, tube well, canal, tank)
2. Pumping Unit
3. Filtration system (screen, sand, or disc filters)
4. Main pipes and sub-main pipes
5. Laterals with emitters or drippers
6. Control Valves & Pressure Regulators
7. Fertigation unit

Types of Drip Irrigation

1. Surface drip irrigation
2. Sub-surface Drip Irrigation
3. Inline and Online Emitter Systems

Sprinkler Irrigation

Concept and Working Principle

Sprinkler irrigation systems consist of water being pushed under pressure through pipes and then being sprayed into the air using sprinklers to replicate natural rains. This system allows for easy distribution of water on the field.

Table-1: Comparative Features of Drip and Sprinkler Irrigation

Feature	Drip Irrigation	Sprinkler Irrigation
Water application	Direct to root zone	Over crop canopy
Water use efficiency	Very high (90–95%)	Moderate (70–80%)
Initial cost	High	Medium
Weed growth	Minimal	Moderate
Suitable crops	Fruits, vegetables	Field crops, fodder

Components of Sprinkler Irrigation

1. Pumping unit
2. Main, sub-main, and Lateral Pipes
3. Sprinkler heads or nozzles
4. Riser pipes
5. Control valves and pressure regulators

Types of Sprinkler Irrigation

1. Portable sprinkler systems
2. Semi-portable systems
3. Solid-set systems
4. Center pivot and lateral move systems

Advantages of Drip and Sprinkler Irrigation

1. Substantial water savings, up to 30–60% compared with surface irrigation

2. Better water use efficiency and crop yield
3. Uniformity of application
4. Less weeds because of local watering
5. Can be effective even on irregular grounds
6. Supports Fertigation and Chemigation - Reduces soil erosion and nutrient leaching

Limitations and Constraints

1. High Initial Cost
2. Need for Skilled Operation and Maintenance
3. Emitter Clogging in Drip Systems
4. Reliable use of power supply
5. It is not always economical with regard to low-value crops

Applications in Indian Agriculture

Drip irrigation systems are frequently employed in fruits such as banana, citrus, grapes, pomegranate, vegetables, plantation crops, and floriculture. Sprinkler irrigation systems are frequently employed for crops like cereals, pulses, oilseeds, fodder crops, and lawns. Altogether, these systems can be employed for water-scarce regions that are dominated by arid and semi-arid zones.

Role in Sustainable and Climate Resilient Agriculture

Micro irrigation systems can help build sustainable agriculture by conserving water, maximizing the use of nutrients, minimizing the emission of green-house gases associated with overuse of water, and making farming more resistant to drought and climate change. This is in line with the concept of “more crop per drop of water."

Government Support and Promotion in India

In countries such as India, micro-irrigation is promoted through programs such as PMKSY – Per Drop More Crop, also just called Pradhan Mantri Krishi Sinchayee Yojana. Through such programs, subsidies and training are provided to farmers.

Conclusion

Drip and sprinkler irrigation show progress from traditional irrigation types to modern irrigation technologies. Accepting these two irrigation technologies is vital in dealing with problems of water scarcity, enhancing agricultural productivity, and modernizing sustainable agricultural practices in India. It would be significant in increasing awareness and training, as well as policy and technical support.