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Micro-Irrigation: A Modern Method of Irrigation

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Agriculture consumes the largest share of groundwater in country like India – the biggest user of groundwater in the world. Groundwater resources in the country have been rapidly depleted during the last few decades. While irrigation is used to cultivate over half of India's agricultural land for food grains, as much as 65 percent of these irrigated land holdings rely on groundwater to meet their water needs. Global water use in agriculture is approximately 70% in not only India but also in the world. The irrigation sector is under pressure to improve its efficiency since it is the world's largest user of fresh water (Ramteke *et al.*, 2019). This is accentuated as water resources become scarcer due to climate change, increased population, and unsuitable irrigation applications. Improved efficiency in the use of water for food production will become even more crucial in the future. Considering irrigation efficiency and environmental issues Micro-irrigation, which is the precise application of water at low pressure on or below the soil surface using small devices such as spray, mist, shower, or drip water, is becoming more popular. Micro-irrigation has been more popular across the world in recent decades due to rising sales and technological advancements. It is a modern method of irrigation in which water is irrigated on the surface or subsurface of the ground using drippers, sprinklers, foggers, and other emitters. In this article, the types of micro-irrigation, its advantages and disadvantages and effect of micro-irrigation to improve soil and water resources sustainability and are discussed.

Types of Micro Irrigation Systems

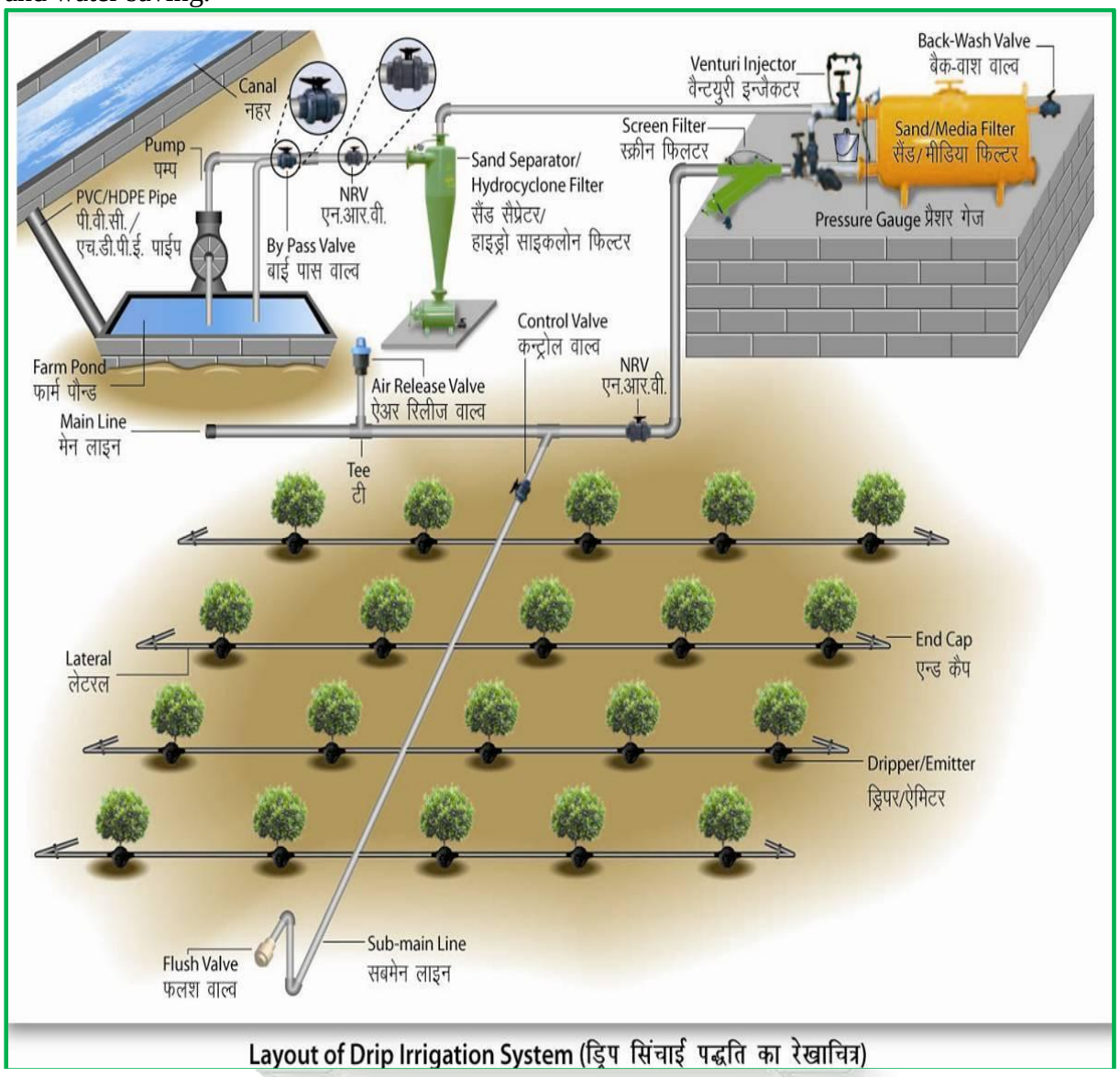
Drip Irrigation

Drip Irrigation also known as Trickle Irrigation, is a most common type of micro irrigation system (Mafuta *et al.*, 2013). It includes dripping water directly to the root zone of the plants using a small plastic pipe system. It can be properly equipped with water emission outlets known as pipes, valves, emitters, or drippers. Drip irrigation has the potential of precisely applying nutrients and water both in location at a rate which matches the plant requirement. This type of irrigation system saves 40-70% water compared to conventional method of irrigation but also depend on crop, soil and environmental conditions.

Sub-surface Drip Irrigation

Application of the small amount of water to the soil through drippers placed below the soil surface. This type of micro irrigation is beneficial and highly efficient and it needs low level of water pressure to perform effectively. Different type of subsurface irrigation are being developed mainly with different type of laterals (on-line and in-line lateral system, drip tape, porous pipe system). PVC tubes with a length of 6m, an outer diameter of 20.4 mm is used

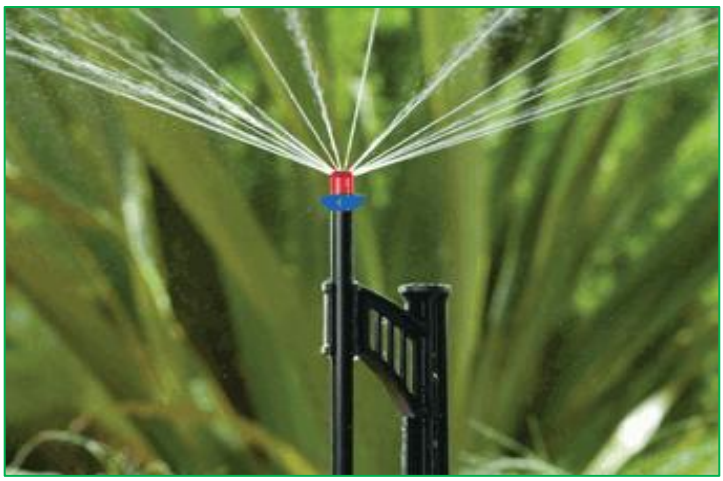
for sub surface irrigation. These tubes are drilled with 4 holes with a diameter of 1 mm. The tube is buried at 30cm below the soil surface. Compared with the common drip irrigation subsurface drip irrigation with PVC tube is easy to embed, irrigates rapidly and increase yield and water saving.



Layout of Drip Irrigation System (ड्रिप सिंचाई पद्धति का रेखाचित्र)

Micro-jet Irrigation

In microjet irrigation, water leaves the jets at a pressure of nearly one bar. This gives throw distances of 1 to 4 m with a correspondingly larger wetted area. The water discharge of jet is 5 to 160 l per hour i.e. much higher than drip irrigation system. Depending on the design and operating pressure, the microjet produce coarse or fine spray i.e. varying degree of atomization of water and varying droplet size.



Micro-sprinkler Irrigation

This system of irrigation is a method of watering farm or land that works similarly to rain. Jet have no moving parts while micro sprinkler have moving parts which enables them to discharge water over a larger area than jets. The discharge of micro sprinklers varies from 28 to 223 l/h, operating at a pressure of 0.8 to 4.0 bar and throw distance 0.9 to 4 m. These are generally suitable for forest trees.

Bubbler Irrigation

It is a relatively new irrigation system that is designed to minimise energy requirements using inexpensive, thin-walled, corrugated plastic pipes. Drip irrigation's disadvantages, such as high energy consumption to pump water, clogging of drip emitters, and damage to sensitive screen filters, are all avoided by using a bubbler irrigation system. Open vertical tubes with diameters ranging from 1 to 3 cm rise from the lateral buried irrigation tubes. The vertical risers are anchored to stakes or post and their height are so adjusted that they deliver water at the rate desired. Water bubbles out of open vertical tubes. This system can cater to irrigation of widely spaced crops such as mangoes, sapotas, oranges, coconut, grapes.

Advantages of Micro Irrigation

- It saves water and produces higher yield.
- Ideal for all type of soils.
- Farm operational cost saving.
- Use of recycled, waste and saline water.
- Potential improved distribution uniformity of water and chemicals.
- An easy way to take fertigation which is a method of delivering fertilizer and water to plants and crops via an irrigation system.

Disadvantages

- The installation process is time consuming.
- Higher initial investment.
- Clogging of emitters.
- Plastic tubes affects soil fertility.
- Sun heat affects tubes, they might break as a result of excessive heat production.

Environmental Effects of Micro Irrigation on Soil and Water Resources

The ability to use water with a high salt content is a significant advantage of micro-irrigation systems. Also, both treated and untreated wastewater can be applied in a way that targets only suitable crops (Madramootoo and Morrison 2013). During the dry season in humid areas, or in arid climates, micro-irrigation can have a substantial effect on soil salinization (Üzen *et al.*, 2013). Also there are no drainage issues. In addition to these immediate, private benefits to adopters, there are a number of indirect, social benefits of drip irrigation. Because water percolates only to a shallow depth in the soil, it decreases soil erosion and non-point pollution; fertilizers and pesticide residues do not mix with the water table; it encourages more efficient use of nutrients; and it assures better and longer moisture retention in the root zone.

Conclusion

Micro-irrigation has proven to be particularly effective in horticultural, ornamental, and landscape applications, and it has been used in a variety of climatic conditions ranging from humid to dry and semi-arid regions. Microirrigation have several advantages with respect to

water and energy savings, increased yields, improved fertilizer application, reduced the rate of salinization, eliminated wood and diseases, and reduced labour. The use of drip irrigation technology to the production of cereal crops, particularly in developing countries, is a significant challenge. Several social, technological, and institutional challenges must be addressed in certain regions of the world and accelerating education and knowledge transmission is essential. As a result, using the micro-irrigation systems will be vital important in terms of conservation or sustainability management of soil and water resources.

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