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Micro-irrigation: A Key to Increase Water Use Efficiency in Agriculture

Manoj Kushwah[1]
ICAR-National Dairy Research Institute, Karnal, Haryana-132001 India.

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Introduction

India is an agriculture-based country, and agriculture requires water to produce the commodity. The current and future agricultural demands may be fulfilled by increasing water use efficiency in agriculture and which can be possible by introducing innovative technologies like micro irrigation. Different micro-irrigation systems are already being used in agriculture but economics of these systems are becoming an obstacle in adoption of it. In developing countries, small farmer wants relevance of economic on any innovative technology. Hence economics of micro-irrigation technology matters a lot in India. Increasing population of country is raising the demand of food which will become a serious problem in future. So micro-irrigation is a way for making better production in agriculture by efficient use of water.

What is Micro-irrigation?

Micro irrigation system refers to low pressure irrigation system which consist spray, mist, sprinkler, and drip. It is the precise, slow and frequent application of water to the plants in the form of continuous drops, through the devices called the emitters located at selected points along the water delivery lines called as laterals. It permits frequent water application around the root zone.

Why Micro-irrigation have to be adopted?

Continuously water demand for irrigation and non-agricultural purposes is increasing and groundwater level is decreasing due to over exploitation of water that leads to high

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shortage of irrigation water in many areas. Surface method of irrigation is widely used in India but water use efficiency in surface irrigation methods is only 40-50%. Plants feel water stress in surface irrigation because water is applied once in every 7-20 days depending on the soil, crop and climate which ultimately affect the growth and yield of crops. So there is a need to increase the water use efficiency by adopting the micro irrigation technologies. Micro irrigation ensures 80-90% water use efficiency because water is applied efficiently according to the crop need and surface runoff and deep percolation is totally avoided. It is very difficult task to irrigate crops frequently by using surface irrigation methods but under micro irrigation crops get water daily and moisture is maintained at field capacity in the root zone of crop which results in higher crop yield.

Suitability of Micro-irrigation

- Wide spaced high value crops like coconut, citrus, cotton.
- Highly sensitive crops like tobacco, banana.
- Nurseries, glass house grown plants which needs careful nurturing.
- Crops in which vegetative parts are harvested like sugarcane, tea, tobacco, etc.
- Acute water scarce areas.
- Areas where labour and energy scarcity is a major problem.
- Efficient irrigation in highly undulated lands without levelling.
- Very efficient for the areas where irrigation water quality is low (saline water).

Fig 1: Drip Irrigation

Different systems of Micro-irrigation technology

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1. **Surface drip irrigation system** – This is a widely used drip irrigation system and mainly used under the wider spaced crops. In this system, the lateral pipes and water discharging emitters are laid on soil surface and it is proved advantageous for farmers by efficient dealing with clogging problem because it ensures ease of installation, inspection and cleaning. For single source emitters its discharge rate is 12 l h^{-1}.

2. **Sub-surface drip irrigation system** - In this system, drippers and lateral lines are laid below the soil surface and water discharge rates are similar to surface drip irrigation system. Water is applied slowly to the root zone and provides additional benefits to the plants. It is very efficient method for the arid, semi-arid and dry windy regions. It eliminates surface water evaporation and confers the extra water saving in dry areas.

3. **Bubbler** - It is a method that applied water in a small stream or fountain from a tiny point opening having a rate of discharge much greater than surface or subsurface drip irrigation system. Generally, this system is used for small tree basins and places where deep localized water application is preferable. It requires less maintenance and has low energy cost than other drip irrigation systems.

4. **Micro jet irrigation** - It is a system in which water is applied to the soil surface in the form of dispersed drops from small heights through the air around the plant. Despite not having moving parts it has greater discharge rates and a good coverage area as compared to drippers and bubblers. This system is very efficient for fruit trees and seedlings in orchard.

5. **Micro or Mini sprinkler irrigation** - In this system water is sprayed into air and allow it to fall on the ground surface, it resembles like rain on the crop. The micro-sprinkler system has greater discharge rates and more coverage area than drippers, bubblers, and micro jet irrigation system.

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6. **Misting or Fogging system** - This system applies the water in the form of fine spray for maintaining the humidity in the air. This system is generally used in poly houses and greenhouses to control the temperature and humidity. It has a very low flow rate (10-30 l ha^{-1}) and high pressure (3.5-10 kg cm^{-2}) is required to maintain the foggy condition in greenhouses.

7. **Pulse irrigation** - This system applied water in cycles like 5, 10, 15 minute in 1 hour. It has emitters which have higher discharge rates therefore; this system takes less water application time. Reduction in clogging problem is the major advantage of this system.

8. **Pop-up sprinkler** - This system is similar to sprinkler irrigation system but sprinklers are installed below the surface and covered with soil, and when the system is activated the sprinklers pop-up from the ground and water application is done and when the system is shut off sprinklers are returned to their original positions. This system is mostly used in lawns and gardens.

9. **Set move irrigation** - This system is moved from one position to another by mechanically or manually. At the time of water application set move irrigation system remains stable at any point and when the water has sufficiently applied then the system is shut off and able to move to the next set position.

Conclusion

The purpose of this article was to review the systems of micro irrigation technology that can be implemented to improve the use of scarce water resources with a focus on irrigation in India. The micro irrigation technology gives higher benefits which are as follows:

- Irrigation efficiency improved by 50 to 90%
- Fertilizer efficiency increases up to 28.5%
- Energy utilization increases up to 30.5%.

Micro-irrigation addresses numerous issues of agricultural growth and hence it acts as supporting technology for sustainable agriculture. The government has an important role in

taking the technology to the farmer field, so to adopt micro-irrigation technologies by farmers, the government will have to launch new and effective subsidy schemes and have to execute those schemes in an effective manner.

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