

Water use Efficiency Assessment through Micro Irrigation Systems

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Introduction

Micro-irrigation/precision irrigation technologies are one of the technical interventions in agriculture that are advocated to have a significant impact on water use efficiency. It has numerous advantages over traditional water application techniques because of its close proximity and targeted application. Which are: (i) Micro-irrigation technology ensures up to a 50–90% water consumption efficiency. This is made possible by the fact that micro-irrigation considerably lowers losses from conveyance, runoff, evaporation, seepage, and deep percolation. The water that is saved can be used to expand the area that is irrigated or to reclaim waste or degraded land. (ii) Since a

low flow rate is needed, tiny wells can also be used as a source, which contributes to energy savings of up to 30.5%. There are other industries that could benefit from the expected energy reductions. (iii) Direct fertiliser application to the roots can reduce fertiliser use by up to 28.5%. This has a long-term effect on achieving land productivity; (iv) crop production increases; it has been reported that crop and fruit productivity has increased by 42.4%, and vegetable productivity has improved by 52.7%. This ensures that the increased yields will yield a just financial return. Consequently, micro-irrigation has been regarded as a cutting-edge technology for the expansion of sustainable agriculture.

What is micro irrigation?

Water is irrigated using drippers, sprinklers, foggers, and other emitters on the surface or subsurface of the soil in this modern type of

irrigation. The two most widely utilised microirrigation techniques are sprinkler irrigation and drip irrigation. Micro

irrigation is the slow, continuous application of water above or below the soil

surface in the form of tiny streams, drips, or sprays.

Types of Micro Irrigation Systems

1. Drip Irrigation: Drip irrigation also called trickle irrigation is the method of localized slow application of water to the

plant root zone. Drip or trickle irrigation is the newest of all commercial methods of water application.



Water application through Drip Irrigation

2. Micro Sprinkler: Water is distributed by applying a fine mist or spray of water to the soil's surface and letting it move through the air. Two different types of equipment, namely micro-sprayers and micro-sprinklers, are used in this category. Non-

rotating micro-sprayers and static micro jets have flow rates between 20 and 150 l/h. Micro-sprinklers rotate and have flow rates between 100 and 300 l/h. The operation of a tiny sprinkler used to water a flower bed.



Micro sprinkler irrigation system

3. Sprinkler Irrigation System: A sprinkler irrigation system may have stationary irrigation sprinklers or those that are mounted on moving frames. A greater

area is covered by sprinkler heads that spin as they spray, as opposed to sprinkler heads that exclusively spray in one direction, which require careful placement. Rotating

heads are widely utilized because they make it possible to place a single sprinkler array across a vast area. Water can be obtained via wells, storage facilities, rivers,

lakes, and streams. High wind speeds interfere with the field's ability to distribute water properly.



Sprinkler irrigation system

4. Centre-Pivot Systems: The water tube is held out into the fields by a number of metal frames that are mounted on rolling wheels in the centre-pivot systems. Each frame is moved by an electric motor in a large circle around the field, squirting water (the tube is fixed to the water supply in the

centre of the circle). The depth of water applied is dependent on the system's travel speed. Single units typically have a length of 1,250 to 1,300 feet and can irrigate a 130-acre circle. There might be very large water guns along the tube in high-pressure systems.

5. Bubbler System: In this method, a little stream or fountain applies water to the soil's surface. Point source bubbler emitters have a discharge rate that is higher than drip or subsurface emitters but often lower than 225 l/h. A small basin is typically needed to retain or manage the water since the emitter discharge rate typically exceeds the soil

infiltration rate. Simple filtration systems are sufficient for bubbler systems. These work effectively when irrigating trees with large root systems and high water requirements, or when a large volume of water needs to be applied rapidly.



Bubbler irrigation system

Micro irrigation systems' advantages

1. Save water: When compared to the traditional surface method of irrigation, which has a water use efficiency of just 35–40%, micro-irrigation (MI) has been shown to be an effective way for water conservation and enhancing water use efficiency.

2. Increased irrigation efficiency: It is believed that drip irrigation systems that are correctly planned and maintained have an on-farm irrigation efficiency of roughly 90%. When irrigating their crops with pumping systems, farmers must ensure that the pipe and pump sizes are appropriate for

their needs in order to avoid wasting energy and water and experiencing leaks as a result.

3. Greater yields: In comparison to conventional flood irrigation, the yields are higher. Micro-irrigation is thought to increase productivity by anywhere between 20 and 90% for certain crops. Crop yields rise by up to 45% for wheat, 20% for gramme, and 40% for soybean.

4. Less water loss: Less water is lost due to a decrease in evaporation, runoff, and deep percolation, as well as a decrease in water lost during conveyance.

Crop	Yield (kg/ha)			Irrigation		
	Surface	Drip	Increase (%)	Surface	Drip	Increase (%)
Beet root	570	880	54	86	18	79
Bitter ground	3200	4300	34	76	33	57
Broccoli	14000	19500	39	70	60	14
Chili	17100	27400	60	27	18	33
Cucumber	4230	6090	44	109	42	61
Okra	15500	22500	45	54	24	56
Onion	28400	34200	20	52	26	50
Potato	17200	29100	69	60	28	53
Sweet potato	4240	5890	39	63	25	60
Tomato	6180	8870	44	50	11	78
Banana	57500	87500	52	176	97	45
Grapes	26400	32500	23	53	28	47
Pomegranate	3400	6700	97	21	16	24
Watermelon	8210	50400	514	72	25	65

5. Energy-efficient: Micro-irrigation uses less water, which lowers the amount of energy (electricity) needed to pump water from irrigation wells.

6. Less fertilizer consumption: Fertiliser consumption is decreased thanks to fertigation when using an effective drip irrigation system.

7. Disease prevention: By keeping weeds to a minimum, it aids in reducing weed development.

The incidence of disease is also lowered in this situation.

8. Cost saving: Savings on electricity and fertilisers are also significant, as are the costs of irrigation.

9. Precision farming: In order to match soil and plant status and needs as provided by wireless sensor networks, growers will be able to apply water and agrochemicals more precisely and site-specifically using emerging computerised GPS-based precision irrigation technologies for self-

propelled sprinklers and micro irrigation systems.

Conclusions

Micro irrigation system plays an important role in modern agriculture. By use of various micro irrigation systems 20-90% crop productivity increase, labor

requirement decrease, proper fertigation in uniform pattern maintain and water saves up to 50-90% according to type of soil, crop and topography.