P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating: 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 8; SP-Issue 2; February 2025; Page No. 33-35

Received: 25-11-2024
Accepted: 29-12-2024

Indexed Journal
Peer Reviewed Journal

An assessment of bottlenecks and realities of micro-irrigation: A review

[1]R Raghavi and [2]Dr. AS Archana

[1]PG Scholar, Assistant Professor, Department of Agricultural Extension Education, Institute of Agriculture &Technology, Muthuramalingapuram, Aruppukottai, Tamil Nadu, India

[2]Department of Agricultural Extension Education, N.M.V University of IART Aruppukottai, Tamil Nadu, India

DOI: https://doi.org/10.33545/26180723.2025.v8.i2Sa.1613

Corresponding Author: R Raghavi

Abstract

In the current review paper, explores both the technical and non-technical dimensions of micro irrigation systems, with a focus on drip irrigation, which is recognized for its potential in water and nutrient conservation. The primary objective of micro irrigation is to address water scarcity in the root zone and minimize evaporation losses, thereby enhancing agricultural productivity. Various institutions and agencies have actively promoted drip irrigation technology as a viable solution to combat water scarcity, particularly in regions where water resources are limited. Despite these initiatives, the adoption rate of drip irrigation among farmers remains disappointingly low, particularly in Villupuram district, where it stands at approximately 15-20%. This paper investigates the multifaceted barriers to the adoption and effective functioning of drip irrigation systems, including economic constraints, lack of technical knowledge, insufficient maintenance, and the inadequacy of supportive infrastructure. It highlights the critical role of educational outreach and the need for tailored support programs to empower farmers with the knowledge and resources necessary for successful implementation. Additionally, the review emphasizes the importance of integrating local agricultural practices with modern irrigation technologies to ensure sustainable water use. Ultimately, this paper aims to provide insights that could lead to enhanced adoption rates of drip irrigation systems, thus contributing to improved water management and agricultural sustainability in water-scarce regions.

Keywords: Water resources, drip irrigation, water scarcity, evapotranspiration

Introduction

In the changing agricultural scenario world over and shift towards precision farming, drip irrigation happens to be the technology capable of providing more efficient utilization of water.

"Drip irrigation is basically precise and slow application of water in the form of discrete continuous drops, sprayed through mechanical devices caused emitters in to the root zone of the plants" Singh (1995) reported that by the drip irrigation system water reaches the root drop by drop and hence is economic method of irrigation. It is relatively a new concept, which has developed over the last decade throughout the world. In 1964, Synch Blass an Israeli engineer developed the first potential drip irrigation system (DIS). Today India ranks 7th in terms of coverage of area under drip irrigation with an irrigated area of 2, 87,500 hectares after USA, Spain, Australia, South Africa, Israel and Italy. In this method, water is supplied directly near the roots of plants, drop by drop, with the help of drippers. Drippers are linked with main pipeline connected with water supplying source.

Drip irrigation system is very profitable as it saves 40-70% water as compared to surface irrigation method and reduces labor cost, protects the plants from diseases by minimizing humidity in atmosphere. Soluble fertilizers can be applied with irrigation water. Thus, drip irrigation has become a means of hi-tech agriculture/horticulture and precision farming. Micro- irrigation is the slow application of water as discrete or continuous drips, tiny streams or miniature spray on, above, or below the soil by surface drip, subsurface drip, bubbler and micro- sprinkler systems. It is applied through emitters connected to a water delivery line through low-pressure delivery.

Review on Advantages and Disadvantages of water issues

Irrigation plays a role in ensuring the growth and productivity of crops, traditionally irrigation methods are often inefficient and wasteful, leading to water scarcity and environmental degradation.

Oron *et al*. (2015) and Waheda *et al* to overcome these challenges, farmers and agricultural experts have turned to micro irrigation as a more sustainable and effective solution. It will deliver water directly to the roots of plants through a network of pipes, tubing, and emitters. This system ensures that water is applied precisely where it is needed, minimizing waste and maximizing the efficiency of water usage. Water infiltration in the subsurface drip takes place in the region directly around the dripper, which is small compared with the total soil volume of irrigated field.

The reason for better performance of subsurface drip could be the favorable soil moisture conditions in the active crop

root zone, while conventional surface drip probably facilitates moisture losses primarily in the upper soil layer. The broadest water pattern is obtained under subsurface drip, which was conductive for good growth of crop. There is increased flexibility in matching field shape and size as compared to sprinkler irrigation systems. The sprinkler irrigation system can be easily and economically sized to the available water supply. In widely spaced drip, lines for crops can be placed for optimum water and nutrient uptake. Pressure compensating irrigation systems have fewer slope limitations than surface irrigation.

(Hills and Brenes, 2016) [2] farmer's experience ascension water costs as an extra penalty. Rather than higher water costs, administrative water allocation or reallocation lowering the supply often has led farmers to adopt water-efficiency practices. The method of water is employed in a drip irrigation system, traditional surface applications of timed –release fertilizers are sometimes not effective, so drip irrigation systems usually mixed liquid fertilizer with the irrigation water. This method is called as fertigation; fertigation and chemigation (application of chemicals and other pesticides to sporadically clean out the system, like as sulfuric or chlorine) due to use of chemical injectors like as piston pumps, diaphragm pumps, or aspirators.

The chemicals may be added inelastic, then policies which encourage changes in cropping patterns can be more effective than higher prices. (Edstrom and Schwanki, 2002) [4] Fertilizers consuming of up to ninety five percent are being described from recent university field tests using drip fertigation and slow water delivery as compared to two-timed release and irrigation by micro spray heads.

According to Oron *et al* (2015), Micro irrigation requires a reliable and sufficient water supply to function effectively. In regions with limited access to water sources or facing water scarcity, implementing micro irrigation systems may not be feasible. The initial setup cost of micro irrigation systems can be high, making it unaffordable for small-scale farmers or low-income individuals. Additionally, regular maintenance and operational costs, including energy for pumping water, filtration, and repairs, can further add to the financial burden.

Technical skills and Knowledge proper design, installation, and operation of micro irrigation systems require specific technical expertise. (Bucks and Ayars 2020: Bella and Wilcox, 2022) Farmers need to have knowledge about soil types, crop water requirement, system layout, and maintenance practices. Lack of technical skills can lead to inefficient water use. Certain regions, particularly those with water scarcity or limited access to traditional irrigation methods, can greatly benefit from the adoption of micro irrigation technologies Camp (2015); (Howell, *et al*., 2022; Lamm *et al*., 2015a) [6, 3, 1].

These systems provide a controlled and precise application of water, allowing for better infiltration and reducing the risk of water stress on crops. As it is with any water source in any micro-irrigation system, clogging is a potential concern when wastewater is utilized; the problem can be exacerbated, by the particle rich, biologically active wastewater. Camp (2015) [6] concludes that these technologies allow farmers to efficiently use water resources by delivering water directly to the crop root zone, reducing water wastage through evaporation and runoff. The regions with sandy or light-textured soils, which are prone to rapid water drainage and low water holding capacity, can benefit from micro-irrigation systems.

Conclusion

The study clearly suggests the advantage and disadvantage issue of water issues offers numerous benefits for farmers, including improved water use efficiency, increased crop yields, and reduced labor and energy requirements. However, several challenges need to be addressed, such as the need for proper system design and management. Micro-irrigation in India is fraught with risks. This is because there is no guarantee in the near future that India's energy crisis could be overcome or there could be consolidation of landholdings with concomitant elevation of farmer's income to afford expensive micro-irrigation. Though micro-irrigation in India is being promoted by vested interests with sporadic success stories, it is not backed by conclusive research showing any reduction in ET of crops- the point ignored by policies and schemes. Hence, governments should initiate basin-wide studies, which take a holistic approach to verifyi whether micro- irrigation reduces crop ET before promoting micro-irrigation as a savior of water.

In fact, alternatives such as the cultivation of low ET crops in place of water trades, and water markets cause water savings with little cost. In comparison, micro-irrigation is no substitute for these alternatives in terms of freshwater saved. Hence, government has to prioritize planned cropping patterns backed by stringet laws and administrative capacity to monitor cultivation of less water intensive crops. In India have to review the current micro-irrigation strategy to avoid chaos in India's water management. Instead, if the status is persisted with, then India's micro- irrigation strategy will falter with service consequences not only to the exchequer but also exacerbate the worsening water crisis across Tamil Nadu.

References

1. Lamm FR, Ayars JE, Bucks DA. Irrigation capacity and plant population effects on crop production using subsurface irrigation method technique; c2015. p. 73-80.
2. Ravina I, Schischa A, Sagi G, Hali Z, Brenes Y. Control of clogging in drip irrigation with stored reclaimed municipal effluent. Agric Water Manag. 2016;33:127-137.
3. Howell TA, Ravina I. Subsurface and surface micro irrigation of crops, Southern high plains. Trans ASAE. 2022;40(3):635-641.
4. Edstrom J, Schwanki LJ. Water conservation in irrigation can increase water use. Proc Natl Acad Sci USA. 2002;105(47):18215-18220.
5. FAO. AQUASTAT - India: Water Use. Available from: http://www.fao.org/nr/water/aquastat/countries_regions/Profile_segments/IND-WU_eng.stm. Accessed on: 08/01/2024.
6. Camp CR. Subsurface drip irrigation: A review. Trans ASAE. 2015;41(5):1353-1367.
7. WWF India. About us. Available from: http://www.wwfindia.org/about. Accessed on: 08/01/2024.
8. ICAR. Available from:

http://www.icar.org.in/en/node/5718. Accessed on: 04/11/2024.
9. National Mission for Sustainable Agriculture. Available from: http://nmsa.dac.gov.in/. Accessed on: 10/01/2024.