

# A Study on Diffusion Rate of Micro-Irrigation (Drip And Sprinkler) Systems In India

*Dheeraj Singh*

*Ph.D Scholar Department of Management Tilak Maharashtra Vidyapeeth Pune-37*

*Dr. Deepak J. Tilak*

## Abstract

Agriculture consumes over 80% of the present water supply. Irrigated land makes up roughly 48.8% of India's 140 million hectares (mha) of agricultural land. Rainwater is used to irrigate the remaining 51.2 percent. Mizoram is India's only state that is not watered.

In India, canal irrigation is the most common type of irrigation. It is less expensive. During 2008-09, canals irrigated around half of the 165.97 lakh acre area in the country, with the Northern Plain accounting for half of the irrigated land.

Canal irrigation area as a percentage of overall irrigated area in the country has decreased from around 40% in 1950-51 to less than 25% today. The states of Uttar Pradesh, Punjab, Haryana, Rajasthan, and Bihar account for over 60% of the country's canal irrigated land.

In India, rice has the largest irrigation area. Rice cultivation covers around one-fourth of India's total planted land.

Drip irrigation is the most efficient of all irrigation technologies and may be used on a wide range of crops, including vegetables, orchard crops, flowers, and plantation crops.

Micro-irrigation can boost yields while lowering water, fertiliser, and labour costs. The approach lowers water loss by conveyance, run-off, deep percolation, and evaporation by providing water directly to the root zone.

The Centrally Sponsored Scheme on Micro Irrigation was started by the Ministry of Agriculture's Department of Agriculture and Cooperation in January 2006. (CSS).

Micro irrigation penetration varies by state in India. In comparison to countries like Israel, the United States, and even China, India's average penetration is only 5.5 percent. Karnataka (8.16 lakh ha) is top, followed by Andhra Pradesh (7.17 lakh ha) and Gujarat (7.17 lakh ha) (7 lakh ha). In the last five years, 43.71 lakh acres of land in India have been irrigated via micro irrigation.

**Keywords:** Micro Irrigation, Drip, Sprinkler, Diffusion Rate, India

## Introduction

Micro irrigation is a new irrigation technique that conserves water and improves water efficiency. Drippers, sprinklers, and foggers are used. Micro irrigation can boost yields while lowering water, fertiliser, and labour costs. It can also assist in the reclamation of degraded, uncultivable land.

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Water is a limited natural resource, and the agricultural sector has the highest demand for it. Water availability is influenced by a variety of hydro-meteorological conditions; therefore making optimum use of available water for irrigation is critical but difficult. As a result, technological advances and interventions are critical for water development and management in order to ensure the long-term viability of agriculture. Because water is such a valuable resource in agriculture, every drop of water available at the delivery system, as well as its efficient use, is critical to total farm efficiency [12].

As a result, efficient use of available water is sensible and vital, and micro-irrigation is one such revolutionary method. The most prevalent micro-irrigation methods are sprinkler irrigation and drip irrigation. Economic return is a key factor in deciding whether or not to embrace a new technology, and land and water productivity are equally essential. As a result, new engineering ideas are needed to make water productivity more economically relevant [10]. In arid and semi-arid regions of developing countries, efficient irrigation technology enables considerable water savings in agricultural production.

## Micro-Irrigation: An Advance Technology

Due to water scarcity in many sections of the country, people are becoming more aware of micro-irrigation systems, and their installation has resulted in major economic and social benefits for the country. Crop yields, less energy use, and reduced use of chemical fertilisers and pesticides are all noticeable advantages. It also provides other benefits such as avoiding the exploitation of groundwater, lowering the cost of weeding, and alleviating the effects of water scarcity-induced labour migration [11].

The irrigation efficiency at the field level can be used to calculate real water savings. Initiatives can be taken at the field level to improve water productivity for agriculture, and the saved water can be used for irrigation of more land or for environmental and social requirements. Kumar et al. (2008) noted that true water savings through the use of micro-irrigation technologies depend on a variety of factors including crop type and spacing, kind of micro irrigation technology, soil type, climate, and geo-hydrology.

## Present Status and Growth of Micro-Irrigation in India

We may learn from Israel, a desert country that has turned into a water surplus by implementing micro irrigation techniques, particularly drip irrigation. It has the potential to save up to 3/4 of the water required for irrigation. Micro irrigation penetration in India is 19 percent (as of February 3, 2021), which is substantially lower than in many other countries [7].

If drip irrigation is used for cultivation, up to 60% of the water required for sugarcane, banana, okra, papaya, bitter-gourd, and a few other crops could be saved. Only Sikkim, Andhra Pradesh, Karnataka, and Maharashtra have micro irrigation covering more than half of their net cultivable area, while 27 states in India have less than 30% micro irrigation, with 23 having less than 15%.

Although Uttar Pradesh produces the most sugarcane, which is a water-intensive crop, it only has 1.5 percent of its land under micro irrigation, while Punjab has only 1.2 percent.

Mr. Narendra Singh Tomar, the Agriculture Minister, stated in September 2020 that the government has set a goal of covering 100 lakh hectares of land with micro irrigation in the next five years.

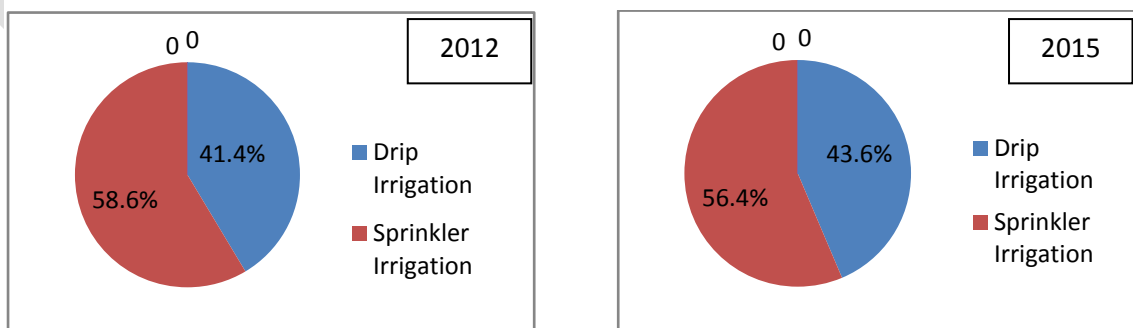


Figure 1: Diffusion rate of drip and sprinkler irrigation systems in 2012 and 2015

Source: Strategy paper - Future prospects of micro irrigation in India-Grant Thornton

Micro irrigation has been steadily increasing in popularity over the years. Since 2005, the area covered by micro irrigation systems has increased at a 9.6% compound annual growth rate (CAGR).

Rajasthan (1.68 mh), Maharashtra (1.27 mh), Andhra Pradesh (1.16 mh), Karnataka (0.85 mh), Gujarat (0.83 mh), and Haryana (1.68 mh) are the states with the most micro-irrigated land (0.57 mh). Sprinkler irrigation accounts for 56.4 percent of the area covered by micro irrigation systems, while drip irrigation accounts for 43.6 percent. In recent years, drip irrigation has risen at a faster rate than sprinkler irrigation, with a CAGR of 9.85 percent from 2012 to 2015, compared to 6.60 percent for sprinkler irrigation. In this time period, the area under micro-irrigation has expanded at a CAGR of 7.97 percent [8].

## Satewise Current Status of Micro Irrigation in India

Micro-irrigation is used to water less than 30% of farmland in 27 states. If a drip irrigation system is used for agriculture, up to 60% of the water needed for sugarcane, banana, okra, papaya, bittergourd, and a few other crops could be saved. However, just four states — Sikkim, Andhra Pradesh, Karnataka, and Maharashtra — have micro-irrigated more than 50% of their net cultivated farmland. In India, 27 states (including UTs) have less than 30% micro-irrigation, with 23 states having less than 15% micro-irrigation.

## Net Irrigated Area under Micro-Irrigation

According to data supplied to the Lok Sabha by the Ministry of Agriculture and Farmers Welfare last month, the country's net irrigated area is 68,649 thousand acres. Micro-irrigation covers 12,908.44 thousand ha of agricultural land, with drip irrigation covering 6,112.05 thousand ha and spray irrigation covering 6,796.39 thousand ha. This means that just 19% of the country's total irrigated area is under micro-irrigation. These statistics cover the years 2005-06 to 2020-21. (as on February 3, 2021). Surprisingly, Uttar Pradesh, the world's top sugarcane producer, has only 1.5 percent of its land under micro-irrigation, while Punjab, the world's largest wheat producer, has 1.2 percent. The states of Bihar and West Bengal are among those with less than 5% microirrigated land.

## Water Situation in Future

The findings are concerning, especially in light of a study by a committee set up to investigate the restructure of the Central Water Commission and the Central Ground Water Board, which paints a bleak image of India's water situation.

According to the research, numerous peninsular rivers are experiencing severe post-monsoon flow problems. "By 2030, almost half of the water demand will be unfulfilled if current demand patterns continue. In most places of India, water tables are lowering, and our groundwater contains fluoride, arsenic, mercury, and even uranium. We have concentrated solely on the massive sums of money spent on the construction of dams and major canal systems, rather than on long-term results. The average cost overrun in major irrigation projects is 1382 percent, and 325 percent in medium projects, according to the research.

State	Net irrigated area *	Area covered under micro irrigation <sup>#</sup>		%
		Drip irrigation	Sprinkler irrigation	
Sikkim	16	6.35	5.26	73
Andhra Pradesh	2,719	1,388.13	519.17	70
Karnataka	3,104	752.82	1,148.70	61
Maharashtra	3,163	1,314.78	561.65	59
Mizoram	16	5.09	2.45	47
Tamil Nadu	2,385	735.81	311.06	44
Gujarat	4,233	852.02	747.75	38

Figure 2: Sate wise irrigated area under micro irrigation

Source: <https://krishijagran.com>

## Impact Evaluation

The Department of Agriculture, Cooperation, and Farmers Welfare conducted an effect evaluation research of the micro-irrigation plan, which indicated that irrigation costs are decreased by 20-50 percent, with an average of 32.3 percent in micro-irrigation schemes. Electricity consumption is lowered by around 31%, and fertiliser consumption is reduced by roughly 7% to 42%. Most notably, farmers' overall income enhancement ranges from 20% to 68%, with an average of 48.5 percent. However, according to official data, only a few states have expressed interest in implementing micro irrigation systems to save water and increase farmer revenue.

## Conclusion

The importance of micro-irrigation to achieve sustainability in Indian agriculture is quite evident and cannot be neglected. But it's a long way ahead and requires extensive demonstrations, training and awareness programmes to bring Indian farming community abreast with micro-irrigation practices.

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