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# Constraints Analysis of Drip Irrigation Technology Adoption in Cotton Cultivation-An Explorative Study in Three States of India

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## ABSTRACT

Drip irrigation is widely recognized as a sustainable and efficient technology in modern agriculture, particularly for enhancing water-use efficiency across a range of crops. Even though the efficiency of the technology has been proven by several researchers and despite promotion by the government, the dissemination of the technology remains restricted within a boundary. In India, Maharashtra leads in the adoption of drip irrigation technology, followed by Andhra Pradesh, Karnataka, and Tamil Nadu. Although numerous studies have highlighted the advantages and efficiency of drip irrigation across different crops, limited research has been conducted specifically on cotton to assess the constraints in the adoption of drip irrigation technology. In this context, it is essential to explore the different constraints faced by drip-irrigated cotton farmers. The present study was undertaken to systematically examine the different constraints involved in cotton cultivation. A structured survey research design was employed, covering three major cotton-growing states of India-Maharashtra, Gujarat and Tamil Nadu. From each state, 120 drip-irrigating cotton farmers were selected using stratified random sampling, constituting a total sample size of 360 respondents. The results revealed that while some constraints such as emitter clogging and high initial costs are common across states, others like electricity charges, spare parts availability, and wildlife damage vary significantly by region. The study concludes that although drip irrigation enhances water-use efficiency in cotton cultivation, its widespread adoption is hindered by region-specific technical, economic, and infrastructural constraints. Addressing these localized challenges is crucial for maximizing the benefits of drip irrigation technology.

**Keywords:** Adoption, Constraints, Cotton, Irrrigation, Sprinkler, Technology.

## INTRODUCTION

In India, agricultural irrigation largely relies on traditional methods, whereas in many other countries, modern techniques such as drip and sprinkler irrigation have been adopted extensively. To promote the adoption of drip irrigation, several initiatives have been undertaken by the Government of India. The current government's manifesto includes the objective of *"Har Khet Ko Paani"* aligned with the Honourable Prime Minister's vision of "Per Drop More Crop." In line with this, the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) was launched in 2015, incorporating micro-irrigation as a key component of the flagship scheme. However, the area under drip irrigation in India remains less than one percent of the total irrigated area. This indicates significant potential to expand the adoption of drip irrigation across the country (Kumar and Jitarwal, 2012; Yadav *et al,* 2017). While studying the constraints in drip irrigation under sugarcane cultivation; Karpagam *et al* (2011) found that the high initial investment cost, despite the availability of subsidies, was the primary barrier faced by drip irrigation users followed by inadequate subsidies. Cotton is one of the world's most important fiber crop and the second most important oil seed crop (Gill and Bhatt, 2015; Sathya *et al,* 2022). India leads in the cultivation of cotton in the world (Vikram Simha *et al,* 2022). Although numerous studies have highlighted the advantages and efficiency of drip irrigation across different crops, limited research has been conducted specifically on cotton to assess the constraints in adoption of the technology. In this context, it is essential to examine the constraints in adoption of drip irrigation technology for cotton cultivation. Hence, the present study was undertaken to systematically examine the different constraints involved in cotton cultivation under drip irrigation technology.

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**Table 1. Constraints faced by the Tamil Nadu, Maharashtra and Gujarat farmers.**

| Sr. No. | Constraint faced by farmers | Tamil Nadu | Maharashtra | Gujarat |
|---|---|---|---|---|
| 1 | Electricity Charges by Government | 0 | 100.00 | 100.00 |
| 2 | Rat and Wild Pig biting | 72.5 | 100.00 | 67.50 |
| 3 | High investment cost despite subsidy | 68.75 | 98.33 | 78.33 |
| 4 | Clogging of emitters | 91.25 | 95.00 | 80.83 |
| 5 | Labour problem | 62.50 | 52.50 | 50.00 |
| 6 | Unavailability of spare parts locally | 13.75 | 30.83 | 62.50 |
| 7 | Poor after sale service | 41.25 | 27.50 | 27.50 |
| 8 | Trouble in taking up inter cultural operations | 33.75 | 25.83 | 67.50 |



## MATERIALS AND METHODS

The present study was conducted in three states: Maharashtra, Gujarat, and Tamil Nadu. From each state, two districts were selected based on the predominance of area under drip irrigation for cotton cultivation. Within each selected district, two villages were chosen using the extent of drip-irrigated cotton area as the selection criterion. From each village, 30 cotton farmers were randomly selected, resulting in a sample size of 120 farmers per state. Thus, the total number of respondents for the study was 360. To assess the constraints encountered by the cotton farmers in drip irrigation, a well-structured interview schedule was prepared and the survey was undertaken in the selected villages in the three states and the results were compiled and subjected for statistical analysis for systematic conclusion. For the constraint analysis, respondents were asked to enumerate the problems they encountered while using drip irrigation. For each identified constraint, the percentage of respondents reporting that particular issue was calculated. This helped in quantifying the prevalence of specific challenges faced by drip irrigation users and provided insight into the most critical areas requiring attention or intervention.

## RESULTS AND DISCUSSION

The constraint analysis revealed notable differences in the challenges faced by drip irrigation farmers across Tamil Nadu, Maharashtra, and Gujarat, indicating that regional factors significantly influence the effectiveness and adoption of the technology. Table 1 and Fig. 1 highlight tthe major constraints reported by drip irrigation farmers in Tamil Nadu, Maharashtra and Gujarat. One of the most critical constraints, reported exclusively by farmers in Maharashtra and Gujarat (100%), was the high electricity charges imposed by the government, at a flat rate of Rs. 5,000 per year. This issue was not reported by any farmers in Tamil Nadu, due to differences in state-level electricity policies or subsidies.

Rat and wild pig damage emerged as another major concern, particularly in Maharashtra (100%), followed by Tamil Nadu (72.5%) and Gujarat (67.5%). Rodent damage is a frequent issue in drip irrigation systems, as rats and other rodents often chew through the tubing, leading to leaks. This damage can severely reduce the efficiency of the irrigation system, resulting in water loss and lower crop yields. To address this problem, various preventive measures can be employed, such as using thicker tubing, burying the irrigation lines, applying rodent repellents, and adopting integrated pest management practices. Sorensen *et al* (2007) reported that drip tubing that was slightly buried had the best rodent control (5 holes/ha) compared with all other treatments (1771 holes/ha).

The high investment cost despite subsidies was perceived as a significant constraint by farmers across all three states of Maharashtra (98.33%), Gujarat (78.33%), and Tamil Nadu (68.75%). While state governments approve subsidies for drip systems based on a standard 100 x 100-meter (1 hectare) layout with 1 x 1 meter emitter spacing and a 50-meter distance for PVC pipelines, this setup rarely reflects the real field conditions. In practice, few farmers have a perfect 100 x 100-meter layout, and the commonly adopted crop spacing is 90 x 60 cm. Additionally, for most farmers, the water source is located more than 50 meters away. As a result, the actual cost of installing a drip system significantly exceeds government estimates. Even after receiving a full subsidy, farmers typically incur an additional expense of approximately ₹30,000 per hectare.

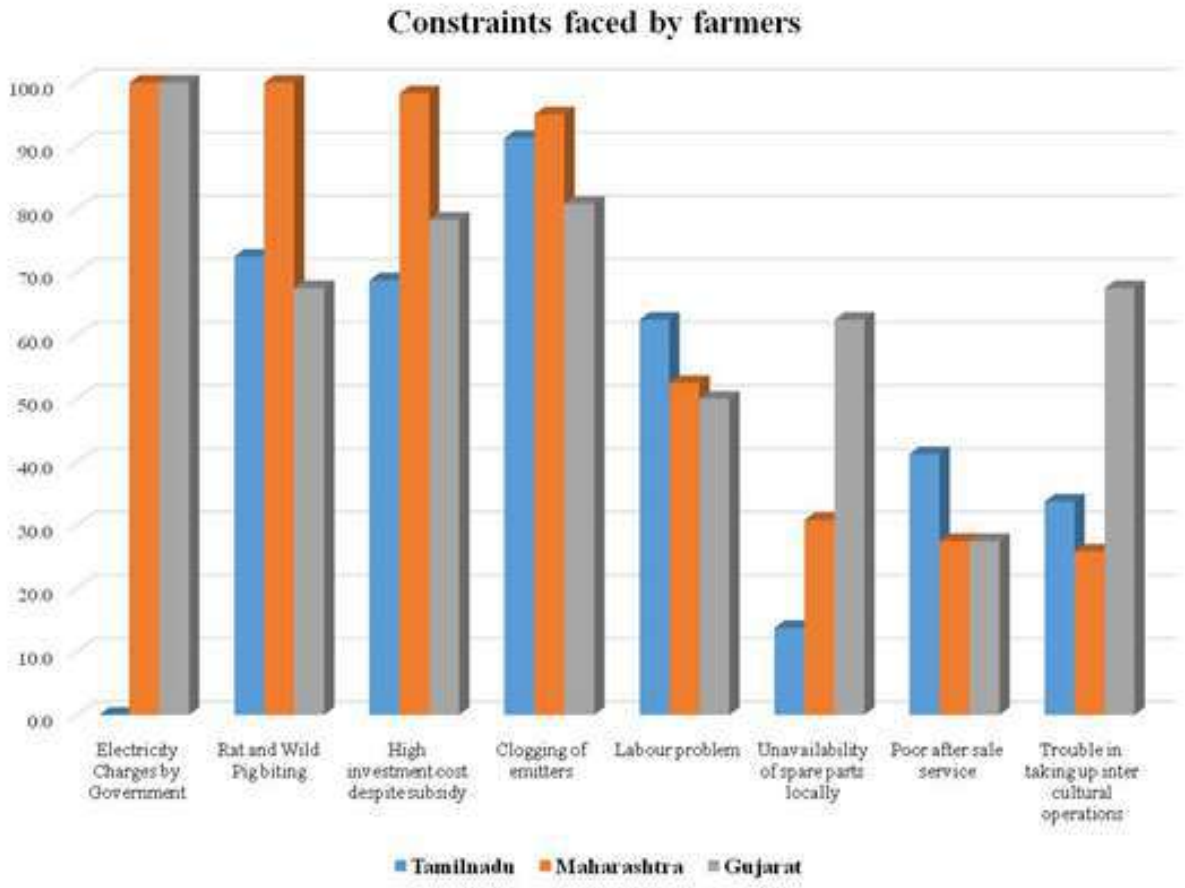


**Fig. 1: Constraints faced by the Tamil Nadu, Maharashtra and Gujarat farmers**

Clogging of emitters, a technical problem, was reported by a large proportion of farmers in Tamil Nadu (91.25%), Maharashtra (95%), and Gujarat (80.83%), suggesting that maintenance issues persist irrespective of location and may affect system efficiency and uniformity of irrigation. Clogging of emitters in drip irrigation systems is a frequent issue that decreases flow rate and water distribution uniformity. This problem arises from the accumulation of particles, chemical residues, microorganisms inside the emitters. The physical, chemical, or biological particles can result in inconsistent watering and hinder healthy plant development. Petit *et al* (2023) reported that clogging is one of the main factors in drip irrigation. Labour shortages were more commonly reported in Tamil Nadu (62.5%), compared to Maharashtra (52.5%) and Gujarat (50%), possibly reflecting state-level differences in labor availability or wage structures.

## CONCLUSION

This study is among the first of its kind to comprehensively examine the multifaceted aspects of drip irrigation technology in cotton cultivation. It provides valuable insights into the constraints faced by drip-irrigated cotton farmers across three states in India. The identified constraints are not only hindering the adoption process for drip technology but also limiting the cotton cultivation widely. In a nutshell, the results emphasize that while some constraints such as emitter clogging and high initial costs are common across states, others like electricity charges, spare parts availability, and wildlife damage vary significantly by region. These findings underscore the importance of region-specific policy and technical interventions to improve the adoption and sustainability of drip irrigation systems in cotton cultivation. Cotton remains a major cash crop in Gujarat, Maharashtra and also holds significant importance in Tamil Nadu. The

constraints identified in the present study have important policy implications. They offer a strong empirical foundation for policymakers to understand the problems of cotton farmers and redefine the micro irrigation policies which will surely contribute for wider adoption of drip irrigation and at the same time, accelerate the growth of sustainable cotton production across different states in India.

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## REFERENCES

Gill K K and Bhatt K (2015). Development of agrometeorological models for estimation of cotton yield. *J Krishi Vigyan* **3**(2): 27-34.

Karpagam C (2012). Identifying the factors of social dynamics among drip users-A socio-technological enquiry. *Indian Res J Ext Edu* **12**(3): 112-115.

Karpagam C, Ravichandran V and Theodore R (2011). Social dynamics among sugarcane, onion, and leaf banana drip and non-drip users-A sociological enquiry. *J Sugar Res* **1**(1): 75-79.

Karpagam C, Ravichandran V, Murali P and Prathap D P and Shanthy T R (2013). Influence of profile characteristics on social dynamics among sugarcane drip users and non-drip users-A farm level enquiry. *Sugar Tech* **15**(4): 349–353.

Karpagam C, Theodore R, Ravichandran V and Murali P (2010). Impact of drip irrigation in sugarcane-A field level enquiry. *Coop Sugar* **42**(4): 51-53.

Kumar M and Jitarwal R C (2012). Review of factors affecting the adoption of drip irrigation technology. *J Krishi Vigyan* **1**(1): 69-71.

Narayanamoorthy A (1997). Drip irrigation: A viable option for future irrigation development. *Produc* **38**(3): 504-511.

Narayanamoorthy A, Madhusudan Bhattarai and Jothi P (2018). An assessment of the economic impact of drip irrigation in vegetable production in India. *Agri Econ Res Rev* **30**(1): 105-112.

Petit J, Kappel N, Cheviron B, Buisson A and Cadiou T (2023). Detection and monitoring of drip irrigation clogging using absorbance spectroscopy coupled with multivariate analysis. *Biosystems Engineering* **235**(1): 1–14.

Sathya S, Akila N, Thirunavukkarasu M and Kalaiselvi B (2022). Yield and available nutrient status as influenced by nutrient management practices in cotton. *J Krishi Vigyan* **11**(1): 406-409.

Sorensen R B, Nuti R C and Lamb M C (2007). Rodent management for surface drip irrigation tubing in corn, cotton, and peanut. *Peanut Sci* **34**(1): 32–37.

Vikram Simha H V, Basavaraj K, Manjunath N, Shruti N and Bellad S B (2022). Utility of Tractor Operated Mobile Shredder for Cotton Residue Management. *J Krishi Vigyan* **11**(1): 381-385.

Yadav K, Yadav J P and Kumari A (2017). Constraints encountered by the farmers in adoption of drip irrigation system in district Jaipur. *J Krishi Vigyan* **6**(1): 32-36.

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