Original Research Article

Assessing the adoption and utilization of drip irrigation technology among tapioca farmers in thuraiyur taluk, tiruchirappalli district, Tamil Nadu, India

ABSTRACT

Aims: The study examines the adoption and utilization of drip irrigation technology among tapioca farmers in Thuraiyur taluk, Tiruchirappalli district, Tamil Nadu.
Study design: An ex-post-facto research design is used to collect data from 90 farmers across four villages.
Place and Duration of Study: Thuraiyur taluk, Tiruchirappalli district, Tamil Nadu. The study has been conducted for a period of six months (April – September, 2024)
Methodology: Out of the district's eleven taluks, Thuraiyur had the highest number of tapioca farmers, making it ideal for this study. Four villages—Naganallur, Settikadu, Sobanapuram and Koppampatti—were chosen from Thuraiyur taluk for their significant tapioca cultivation and large farmer populations. A stratified random sampling method is used to select participants. The primary data are collected through structured questionnaires and personal interviews with farmers. Secondary data are obtained from relevant literature, reports and government records. The dependent variables are the adoption level of drip irrigation and the extent to which the farmers use the drip irrigation technology. Descriptive statistics mean, percentage and frequency distribution are used in the study.
Results: Findings reveal that the majority of farmers (82.22%) demonstrated medium to high adoption of drip irrigation technology. Key practices like checking the workability of the foot valve and maintaining pipeline fittings are widely adopted, while more advanced techniques such as fertigation showed lower adoption levels. Drip irrigation was used universally for water management, with 87.80% of farmers acknowledging its role in reducing water usage and 83.30% citing reduced labor needs.
Conclusion: However, only 46.70% of respondents reported increased yields, indicating potential gaps in system optimization. The study suggests the need for greater technical training, financial assistance and improved extension services to enhance the adoption of advanced drip irrigation practices. Policy measures, such as increased awareness of government schemes like PMKSY and accessible training programs, are recommended to maximize the benefits of drip irrigation in improving water efficiency, crop yield and sustainable farming practices

Keywords: Drip Irrigation Technology, Adoption, Utilization and Tapioca Farmers.

1. INTRODUCTION

Agriculture is India's main source of income, especially in rural areas and significantly contributes to the GDP. Sustainable agriculture is essential for food security, rural employment and environmental conservation. Modern technology in farming has improved crop productivity, reduced costs and simplified farming operations. Techniques like plant breeding, hybrid seeds, gene editing and micro-irrigation have been widely adopted. Irrigation in India is critical for agriculture, with groundwater being the dominant source. Around 65% of irrigation relies on groundwater and nearly 51% of the agricultural area for food grains is irrigated. However, over-reliance on groundwater has led to water depletion in many regions. Micro-irrigation, such as drip and sprinkler systems, offers efficient water use

and the Indian government promotes these technologies through the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) (Pandey, 2018) (Alaamer et al., 2024). Drip irrigation is an efficient method of water and nutrient delivery, especially beneficial for crops like tapioca which is a long duration crop. Drip irrigation delivers water directly to the root zone, ensuring optimal crop growth and yield (Ray & Majumder, 2024). Tapioca, a staple in tropical regions, is extensively grown in Tamil Nadu, with Salem being the largest producer due to its favorable soil and climate conditions followed by Tiruchirappalli. Tamil Nadu ranks first in the world in cassava productivity and tapioca is widely used in starch extraction industries. The study focuses on the adoption of drip irrigation among tapioca farmers in Thuraiyur taluk, Tiruchirappalli district. It aims to understand farmers' profiles, their adoption levels and the utilization patterns in using drip irrigation.

2. METHODOLOGY

The research adopts an ex-post-facto research design to investigate the adoption of drip irrigation technology among tapioca farmers in Thuraiyur taluk, Tiruchirapalli district, Tamil Nadu. This design is appropriate for analyzing phenomena after they had occurred, providing insights into factors influencing the adoption of drip irrigation. The study is conducted in Tiruchirapalli due to its high potential for tapioca cultivation and the promotion of drip irrigation under the Tamil Nadu Irrigated Agriculture Modernization and Water-Bodies Restoration and Management (TN-IAMWARM) scheme. Tiruchirapalli ranks tenth in tapioca cultivation in Tamil Nadu and its dry climate made it well-suited for irrigated farming practices over rain-fed methods. The selection of Thuraiyur taluk is based on its large population of tapioca farmers, with 1,500 hectares under tapioca cultivation. Out of the district's eleven taluks, Thuraiyur had the highest number of tapioca farmers, making it ideal for this study. Four villages—Naganallur, Settikadu, Sobanapuram and Koppampatti—were chosen from Thuraiyur taluk for their significant tapioca cultivation and large farmer population. A stratified random sampling method is used to select participants, ensuring representation across various socio-economic groups of tapioca farmers. The primary data were collected through personal interviews with farmers with the help of well-structured questionnaires, focusing on their socio-economic profile, farming practices, adoption and utilization of drip irrigation and challenges faced. Secondary data were obtained from relevant literature, reports and government records. The dependent variables are the adoption level of drip irrigation and the extent to which the farmers use the drip irrigation technology. Descriptive statistics such as mean, percentage and frequency distribution are used to describe the farmers' socio-economic characteristics and the adoption level is measured using the scale followed by Singh and Dangi (2022). The study has been conducted for a period of 6 months from April to September, 2024, covering data collection, analysis and report preparation.

3. RESULTS AND DISCUSSION

3.1. Profile of the Respondents

Table 1: Profile Characteristics of the respondents

(n=90)

Sl. No.	Characters	Categories	Frequency	Percentage
1.	**Age**	Young	7	7.78
		Middle	31	34.44
		Old	52	57.78
2.	**Gender**	Male	57	63.33
		Female	33	36.67
3.	**Education**	Illiterate	5	5.56

		Primary school	27	30.00
		Middle school	26	28.89
		Secondary school	16	17.77
		Higher secondary school	11	12.22
		College	5	5.56
4.	**Land holdings**	Marginal (<2.5)	20	22.22
		Small (2.5-5)	46	51.11
		Large (>5)	24	26.67
5.	**Family Type**	Joint Family	61	67.78
		Nuclear Family	29	32.22
6.	**Occupation**	Agriculture as Primary Occupation	66	73.33
		Agriculture as Secondary Occupation	24	26.67
7.	**Annual income**	Low	3	3.33
		Medium	78	86.67
		High	9	10.00
8.	**Livestock possession**	Low (<30)	54	60.00
		Medium (30-50)	30	33.33
		High (>50)	6	6.67
9.	**Extension contact**	Low (<30)	26	28.89
		Medium (30-50)	45	50.00
		High (>50)	19	21.11
10.	**Tapioca cultivation**	Full area	35	38.89
		Half of their land area	48	53.33
		Less than half of their land area	7	7.78
11.	**Variety**	Taiwan	42	46.67
		Burma	25	27.78
		Palvadi	23	25.55
12.	**Awareness on Govt. Schemes**	PMKSY	76	84.44
		PMFBY	58	64.44
		PMK	36	40.00
		PKVY	11	12.22

The study results reveal key characteristics of tapioca farmers in Thuraiyur taluk. The majority of farmers (57.78%) are older adults, with a notable presence of middle-aged individuals (34.44%). Male farmers dominated (63.33%), while 33.33% are female. In terms of education, most farmers have completed primary school (30.00%) or middle school (28.89%) education, with only 5.56% being illiterate and completed college-educated. A significant portion (51.11%) held smaller sized landholdings (2.5-5 acres), while 67.78% lived in joint families. Nearly one-fourth (73.33%) of the respondents practices Agriculture as their primary occupation, with only 26.67% engaged in agriculture as a secondary source of income. Medium-income farmers dominated the sample (86.67%), while 60.00% had low livestock holdings (<30 animals). Majority (53.33%) of the farmers cultivated tapioca on half of their land and the popular variety grown is Taiwan (46.67%). There is high awareness of government schemes, particularly PMKSY (84.44%) and PMFBY (64.44%). In terms of irrigation practices, a large majority had adopted the drip irrigation system, benefiting from its efficiency in water use and productivity enhancement. These findings highlight the demographic and socio-economic profile of farmers, along with their adoption of modern farming practices, specifically irrigation technology. Similar findings were reported by Sandberg (2016), Patel *et al.* (2017), Ranganathan (2015), Rajaguru and Kalidasan (2023) and Vinothkumari (2022).

3.2. Level of Adoption of Drip Irrigation Technology Among the Tapioca Farmers

Table 2: Level of Adoption of Drip Irrigation Technology among the tapioca farmers

(n=90)

Sl. No.	Adoption Statements	MPS	Rank
1.	Check carefully the workability of foot valve	67.50	1
2.	Check carefully the pipeline fitting of the pump set	62.50	3
3.	Use by pass assembly to drain out the excess water for maintaining the required pressure in DIS	65.83	2
4.	Use of media filter to the biological impurities	57.91	4
5.	Use of liquid fertilizer through DIS	54.16	6
6.	Use of fertigation unit with drip irrigation system	55.83	5
7.	Use of strainer filter to control physical impurities	52.33	7

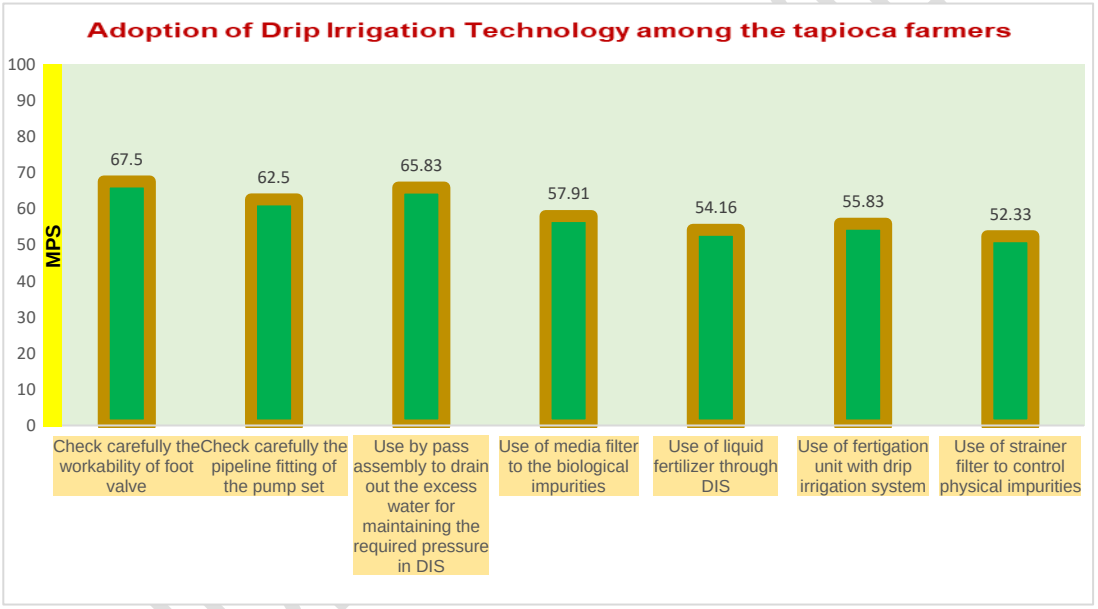

Fig .1 : Adoption of Drip Irrigation Technology among the tapioca farmers

The analysis of adoption practices among tapioca farmers using drip irrigation systems (DIS) revealed important trends in Table 1. The highest adoption, with a Mean Percent Score (MPS) of 67.50, is observed in farmers carefully checking the workability of the foot valve. The the use of a bypass assembly to maintain required pressure ranked second at 65.83 MPS, while the pipeline fitting of the pump set is another key practice, ranked third with an MPS of 62.50. Farmers are also attentive to managing impurities, with media filters used to control biological impurities ranking fourth (57.91 MPS). The adoption of modern techniques like liquid fertilizer uses through DIS and fertigation units ranked sixth (54.16 MPS) and fifth (55.83 MPS), respectively. Strainer filters for physical impurities placed seventh (52.33 MPS). Similar finding was reported by Singh and Dangi (2022), Kavya (2018), Mistry *et al*. (2018), Balamurugan and Dhivya (2018) and Sadhana *et al.* (2022).

Table 3: Overall adoption of Drip Irrigation Technology among the tapioca farmers

(n=90)

Sl. No.	Categories	No. of Respondents	Percentage
1.	Low	16	17.78
2.	Medium	33	36.67
3.	High	41	45.55

From the Table 3, it is evident that majority of the respondents (82.22%) belonged to high to medium level of adoption while, 17.78 per cent of the respondents reported low level of adoption. The findings suggest that tapioca farmers in Thuraiyur prioritized basic system functionality and pressure management in drip irrigation systems (DIS) over more advanced practices like fertigation. This might be due to the farmers' practical focus on ensuring system efficiency and minimizing breakdowns, as highlighted by the high adoption of practices like checking foot valve workability (67.50 MPS) and pipeline fittings (62.50 MPS). Their moderate adoption of fertigation methods (54.16 MPS) might be stems from limited technical knowledge or access to advanced irrigation technology, as noted earlier in the study's socio-economic profile, where education levels are low and most of the farmers relied on institutional support like PMKSY and TN-IAMWARM. This reveals that basic system maintenance is well-adopted, technical know-how and familiarity with advanced fertigation methods might be lacking, leading to lower adoption of those practices.

3. Extend of Utilization of Drip Irrigation Technology among the tapioca farmers

Table 4: Extend of Utilization of Drip Irrigation Technology among the tapioca farmers

(n=90)

Sl. No.	Utilisation particulars	No. of respondents	Percentage	Rank
1	Irrigation	90	100.00	1
2	Fertigation	56	62.20	5
3	Less Usage of Water	79	87.80	2
4	Precised irrigation	43	47.80	6
5	Weed Control	68	75.60	4
6	Less Need of Labour	75	83.30	3
7	Increased Yield	42	46.70	7

The utilization of drip irrigation technology among tapioca farmers in Thuraiyur taluk reveals varying utilization pattern across different practices. Irrigation is universally adopted by all farmers (100%), which highlights their reliance on drip irrigation for water management, a key focus due to the region's dry conditions, as mentioned earlier. The high percentage of respondents recognizing less water usage (87.80%) and less need for labor (83.30%) reflects the benefits of drip irrigation in reducing water consumption and labor dependency, both significant factors in this predominantly agricultural area.

However, the adoption of more advanced practices like fertigation (62.20%) and precise irrigation (47.80%) is relatively lower, indicating that while farmers are utilizing the basic

functions of drip systems, they might face challenges in accessing or fully understanding the more technical aspects of the system, consistent with earlier findings about moderate adoption of fertigation units. Interestingly, weed control (75.60%) is well-recognized, likely due to the direct irrigation method minimizing weed growth. However, only 46.70% observed increased yield, suggesting that full potential benefits of the technology may not yet be realized, might be due to gaps in knowledge or system optimization. The findings are in-line with the findings of Sureshkumar and Palanisami (2010) and Arya *et al.* (2017).

4. CONCLUSION

The study revealed a high level of basic system use, particularly for water management and labor reduction. However, advanced practices like fertigation and precision irrigation showed lower adoption rates, might be due to limited technical knowledge and accessibility. While drip irrigation reduced water usage and controlled weeds effectively, the expected yield improvements were not fully realized. These findings suggest the need for enhanced training and support to maximize the benefits of Drip Irrigation Technology for farmers in the region. The findings have important implications for improving the adoption of drip irrigation technology. While basic practices like water management are widely adopted, there is a clear need for targeted interventions to enhance farmers' technical knowledge, particularly in advanced practices like fertigation and precision irrigation. Policymakers should focus on providing accessible training programs, increasing awareness of government schemes like PMKSY and offering financial support for the purchase of advanced equipment. Additionally, ensuring proper subsidies for maintenance services and extension support will be crucial in optimizing the benefits of drip irrigation for increased crop yield and sustainable farming practices in the region.

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