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Constraints Faced by Beneficiaries of the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) in Adopting Drip Irrigation Systems in Kamrup District, Assam

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ABSTRACT

Irrigation is a crucial component of agriculture, particularly in regions with limited water resources. It significantly contributes to food production and agricultural development. The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) has been instrumental in addressing the challenges of water scarcity in India's agriculture sector. The research aimed to identify the constraints in the adoption of drip irrigation systems among the beneficiaries of the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) in Kamrup District of Assam. 50 respondents from two blocks, named Hajo and Rampur, were collected for the study. The data were gathered via personal interviews. The constraints were categorised as technical, infrastructural, and educational. The constraints were ranked using the Garrett ranking method. The finding revealed that the major technical constraints experienced by the PMKSY beneficiary while using the drip irrigation system were 'Challenging to maintain the ideal pressure for water outflow' (74.12), 'Insufficient technological expertise' (65.68), and 'Micro-tubes being damaged by squirrels and rats' (57.74). Major infrastructural constraints faced by the PMKSY beneficiary were 'Inadequate post-purchase service of the companies' (67.90), 'Lack of technical personnel at the operational level' (59.96), 'Insufficient distribution network in rural areas' (58.78). Major educational constraints faced by the PMKSY beneficiary were 'Limited direct contact with drip irrigation professionals for effective adoption.' (55.42), 'A sufficient number of demonstrations were not organised to encourage skill development for adopting the technology' (55.32), 'Absence of structured efforts to promote drip irrigation technology.' (53.30). The key stakeholders must take appropriate actions to eliminate the highlighted constraints.

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1. Introduction:

Agriculture plays a crucial part in the Indian economy, making a substantial contribution to the GDP and employing a major amount of the country's workforce (Pathak, 2009; Arun, 2017). It is particularly important in a country like India, where per capita real income is low, and plays a key role in economic development, containing inflation, and generating employment (Pathak,2009). Water is a critical resource in agriculture, with its efficient use being a key factor in increasing food production and achieving global food security (Countries, 2006). India, where agriculture is a prominent sector, emphasises the necessity of water for sustainable production and socioeconomic growth (Sachan, 2014).

Irrigation has been a key strategy in reducing water scarcity in agriculture (Pawar, 2018; Nikolaou, 2020; Richter, 2017; Ahmad, 2017). It has been shown to increase water use efficiency and productivity, particularly when combined with modern irrigation methods such as sprinkler and drip systems (Pawar, 2018; Ahmad, 2017). These methods can also help in the sustainable use of water resources, especially in water-scarce regions (Nikolaou, 2020).

Drip irrigation is a very efficient and cost-effective technique for watering, especially in dry regions with limited water supplies (Dasberg, 1999). It entails slowly supplying water straight to the root zone of the plant to minimise evaporation and run off (Karishma, 2021). This method is commonly used in commercial nurseries and agricultural operations, and is increasingly being adopted by homeowners for their gardens (Dasberg, 1999). Drip irrigation plays a crucial role in plant health management, particularly in less chemically dependent agriculture, by providing the right amount of water to the root zone (Manda, 2021). It has been shown that it has a substantial effect on conserving resources, reducing cultivation expenses, increasing crop productivity, and enhancing farm profitability. This makes it especially crucial in areas where there is limited availability of water and labour (Kumar, 2010).

The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) is a central government initiative focused on agricultural irrigation. The objective is to promote micro-irrigation to reach the goal of "Per Drop More Crop". Implementing micro-irrigation methods, such as drip and sprinkler systems, is anticipated to save water and enhance agricultural productivity. The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) has been instrumental in addressing the challenges of water scarcity in India's agriculture sector. However, modern technologies have always had limits, and numerous authors (Rajaguru *et al*., n.d.; Tripathy *et al*., 2023) have examined them in diverse contexts. Therefore, this study seeks to explore and analyse the constraints faced by PMKSY beneficiaries in adopting drip irrigation systems in the Kamrup District of Assam.

2. Objective

To analyse the constraints encountered by PMKSY beneficiaries in the adoption of the drip Irrigation system in the Kamrup district of Assam.

3. Research Methodology

The present study was carried out in the Kamrup District of Assam among PMKSY beneficiaries while using a drip irrigation system. Kamrup district is selected due to its diverse cropping patterns and low adoption of drip irrigation despite being a target area under PMKSY (NABARD, District Potential Linked Credit Plan, Kamrup, 2023). Two blocks are selected purposively, Rampur and Hajo. A total of 50 samples were selected for the study. 25 samples from each block were taken into consideration using simple random sampling for the study. The recipients were asked to specify the constraints that they encountered in adopting the drip irrigation method. The data were gathered using a method of personal interviews. The constraints for the schedule were taken from (Rajaguru *et al.*, n.d.) for the study. The constraints were assessed, ranked using the Garrett ranking system, and discussed.

The Pradhan Mantri Krishi Sinchayee Yojana beneficiaries' constraints were analysed by the application of the Garrett ranking technique. To determine their choice in the selection of constraints, respondents were asked to rank the factors that were discovered for this study as 1, 2, 3, 4, 5, 6, 7, and 8. The calculated percentage positions for the Garrett tables that correlate to ranks 1, 2, 3,..., and 8. Each item's total score is calculated by multiplying the Garrett table's corresponding figures by the number of respondents who gave that factor a rating between 1 and 8. (Garrett & Woodworth, 1969).

To convert ranks into percentages using Garrett's method, the formula is as follows:

Percent position = $100 * (R_{ij} – 0.5)/Nj$

Where, R_{ij}= rank give for i^{th} constraint by j^{th} individual;

N_j= number of constraints ranked by j^{th} individual.

4. Results and discussion

The constraints are classified into three categories: technical constraints, infrastructural constraints, and educational constraints

Table 1 Technical Constraints

Sl. No	Constraints	Garret Mean Score	Rank
1	Inappropriate for field crops	30.48	VIII
2	Obstruction of drippers due to the Presence of suspended materials	42.46	VI
3	Needs regular maintenance	52.14	IV
4	Challenging to maintain the ideal Pressure for water outflow.	74.12	I
5	Need of clean water	38.26	VII
6	Blockage of water pipeline	43.12	V
7	Insufficient technological expertise	65.68	II
8	Micro-tubes are being damaged by Squirrels and rats	57.74	III

Source: Primary

The study reveals that Challenging to maintain the ideal pressure for water outflow (74.12), Insufficient technological expertise (65.68), Micro-tubes being damaged by squirrels and rats (57.74), and Needs regular maintenance (52.14) are the significant constraints encountered by the farmers. Whereas Obstruction of drippers due to the presence of suspended materials (42.46), Need for clean water (38.26), and Inappropriate for field crops (30.48), are the less significant constraints.

With an average score of 74.12, ‘Challenging to maintain the ideal pressure for water outflow’ was the most significant technical problem that farmer shad to deal with. Maintaining an ideal pressure level is essential to a drip irrigation system's seam less operation; it shouldn't be too high or too low to ensure a consistent supply of water to the plants. However, maintaining this ideal pressure proved to be an important challenge for the majority of respondents.

Farmers' "Insufficient technological expertise" (65.68) may be attributed to inadequate technical guidance on adopting drip irrigation technology from government personnel such as Village Extension Workers, Agricultural Officers, and Assistant Agricultural Officers. Farmers noted that most technical advice was provided by dealers solely at the time of installation, with limited follow-up visits or ongoing technical assistance from officials thereafter.

The respondents identified ‘Micro-tubes being damaged by squirrels and rats’ (57.74) as their third constraint. This could be because the pipelines and micro-tubes are made primarily of low-quality plastic, which makes them vulnerable to damage from squirrels and rats. Rats and squirrels must be properly cared for and controlled.

The pipelines may experience frequent blockages due to the accumulation of salts, resulting in reduced water flow velocity and uneven water distribution. Furthermore, the tiny tubes frequently sustain damage from squirrels and rats. All of these factors would result in the need for regular maintenance of the entire drip system. Therefore, this constraint was given a ranking of fourth place, with a score of 52.14. "Blockage of water pipelines" ranked as the fifth constraint, with a mean score of 43.12. This issue likely results from the buildup of salt and mud in the drippers and pipelines.

The issue of 'Obstruction of drippers due to the presence of suspended materials ' was identified as the sixth most significant limitation, with an average score of 42.46. Clogging can occur due to the presence of slime, algae, sand, and various organic and inorganic substances in the water.

'Need for clean water' (38.26) was listed as the seventh constraint because muddy water clogs pipelines and drippers, causing blockages in emitters, drippers, and other components. As a result, even at high pressure, the water output is still quite low. As a result, pure water was necessary for drip sets to operate properly.

The farmers encountered 'Inappropriate for field crops' as their technical constraint, ranking eighth with a mean score of 30.48. This could be the result of field crops having a high plant density and hence requiring more water. Furthermore, with such dense crops, individual drippers for every plant cannot be installed.

Table 2 Educational Constraints

Sl No.	Constraints	Garret Mean Score	Rank
1	Limited awareness of the benefits of Drip irrigation technology.	34.84	VII
2	Limited direct contact with the drip Irrigation professionals for effective adoption.	55.42	I
3	Insufficient understanding of drip Irrigation technology operation	49.82	VI
4	Older farmers face challenges in Implementing drip irrigation Technology	51.98	V
5	Insufficient instructions for installing a drip system	52.32	IV
6	A sufficient number of Demonstrations were not organised to encourage kill development for adopting the technology	55.32	II
7	Absence of structured efforts to promote drip irrigation technology.	53.30	III

Source: Primary

The above table reveals that the educational constraints, viz., 'Limited direct contact with drip irrigation professionals for effective adoption.' (55.42), 'A sufficient number of demonstrations were not organised to encourage skill development for adopting the technology' (55.32), 'Absence of structured efforts to promote drip irrigation technology.' (53.30), 'Insufficient instruction for installing a drip system' (52.32), 'Older farmers face challenges in implementing drip irrigation technology.' (51.98) were ranked as the first five important constraints by the respondents. The mean scores of these constraints were found to be above 50.00. Whereas, the constraints viz 'Insufficient understanding of drip irrigation technology operation' (49.82), 'Limited awareness of the benefits of drip irrigation technology' (34.84) were found to have the mean scores of below 50.00.

'Limited direct contact with drip irrigation professionals for effective adoption' was ranked as the first constraint with a mean score of 55.42. This might be attributed to the fact that there were no specialised Government professionals to provide technical instruction to the farmers at regular intervals. Hence, these challenges were encountered by the responders.

'A sufficient number of demonstrations were not organised to encourage skill development for adopting the technology' (55.32) was the second-ranked constraint encountered by the respondents. This might be a government official or the concerned department that does not provide adequate demonstrations about drip irrigation to the farmers.

The farmers also faced the constraints of 'Absence of structured efforts to promote drip irrigation technology.' (53.30). This could be because most people didn't take part in drip irrigation technology promotion programmes. After all, they thought of them as government initiatives. Additionally, there wasn't enough one-on-one interaction between extension agents and other government employees to effectively spread irrigation technology.

Fourth on the list of restrictions was 'Insufficient instruction for installing a drip system ', with a mean score 52.32. Due to financial constraints, the State Department of Agriculture only offers a limited number of farmers' programmes on drip irrigation technology, and each training course only covers a small number of beneficiaries.

"Older farmers face challenges in implementing drip irrigation technology" ranked fifth, with a mean score of 51.98. This difficulty may stem from their struggle to understand the technical terms and operational procedures involved.

The sixth constraint on the list was 'Insufficient understanding of drip irrigation technology operation' (49.82). This could be because of the farmers' limited exposure to information, lack of training, and moderate interactions with extension agents, all of which contributed to their lack of scientific knowledge.

With a mean score of 34.84, the constraint 'Limited awareness of the benefits of drip irrigation technology' came in seventh place. This could be because the majority of study participants had only an elementary education, and even those who were functionally literate had limited knowledge of drip irrigation technology.

Table 3 Infrastructural Constraints

Sl No	Constraints	Garret Mean Score	Rank
1	Inadequate energy supply for irrigation field.	35.12	V
2	Inadequate post-purchase service of the Companies	67.90	I
3	Lack of technical personnel at the Operational level	59.60	II
4	Insufficient distribution network in rural areas	58.78	III
5	Delays in the availability of spare parts	46.52	IV
6	Substandard quality of pipes and micro-tubes.	33.72	VI

Source: Primary

The table above shows that the top three constraints perceived by the PMKSY beneficiaries, with mean scores above 50.00, were: 'Inadequate post-purchase service from companies' (67.90), 'Lack of technical personnel at the operational level' (59.60), and 'Insufficient distribution network in rural areas' (58.78). On the other hand, constraints such as 'Delays in the availability of spare parts.' (46.52), 'Inadequate energy supply for irrigation fields' (35.12), and 'Substandard quality of pipes and micro-tubes' (33.72) had mean scores below 50.00.

The constraint 'Inadequate post-purchase service from the companies,' with a mean score of 67.90, ranked first. This may be attributed to the lack of sufficient qualified engineers or experts in irrigation systems within the agencies.

The constraint ‘Lack of technical personnel at the operational level,’ with a mean score of 59.60, has also impeded the adoption of drip irrigation technology. The State Department of Agriculture lacks sufficient technical staff to meet the needs of farms in rural areas.

‘Insufficient distribution network in rural areas,’ with a mean score of 58.78, was ranked as the third constraint. This could be attributed to the lack of proper retail outlets, the remote location of villages, and inadequate transport facilities.

‘Delays in the availability of spare parts’ was listed as the fourth constraint. The farmers may have encountered this since the replacement components needed for drip system upkeep and repair were expensive and infrequently available, making it less common for the village shopkeepers to stock these parts for sale in their shops.

'Inadequate energy supply for irrigation field ' was placed fifth among the infrastructure constraints. This could be because there was a very inconsistent and low supply of energy in the research area, which prevented the farmers from irrigating their fields on time.

‘Substandard quality of pipes and micro-tubes’ ranked as the sixth constraint with a mean score of 33.72. This may be due to the fact that subsidies are provided directly to companies by the government, leading these companies to supply low-quality materials in pursuit of higher profits. Additionally, the absence of a proper quality control system to ensure the standards of pipes and micro-tubes means that the companies often neglect material quality.

5. Conclusion

The significant constraints encountered by PMKSY beneficiaries were ‘Challenging to maintain the ideal pressure for water outflow’, ‘Insufficient technological expertise’, ‘Limited direct contact with drip irrigation professionals for effective adoption.’, ‘A sufficient number of demonstrations were not organised to encourage skill development for adopting the technology’, ‘Inadequate post-purchase service of the companies’, ‘Lack of technical personnel at the operational level’. Therefore, the following implications are derived to encourage the use of drip irrigation technology among farmers

a. The concerned department should engage technical staff at the ground level to provide training and necessary assistance to the farmers when they face any technical difficulties in operating the irrigation system.

b. The government and the concerned department should take the initiative to raise awareness the farmers about the importance of irrigation in agriculture by providing training, mass campaigning, and hoardings in rural areas.
c. The parts and other accessories required for the smooth functioning of irrigation systems should be readily available and affordable to farmers when they need them.

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