Original Research Article

Rooting for Change: Unveiling Farmers' Bio-Input Awareness and Knowledge Across Tamil Nadu's Agro-Climatic Zones

ABSTRACT:

Aim: The purpose of this research is to analyse farmers' awareness and knowledge towards bio-inputacross six agro-climatic zones in Tamil Nadu, India.
Study design: The study used an ex post facto research strategy with multistage random sampling.
Place and duration of study: The research was done in eight districts spanning six agro-climatic zones of Tamil Nadu. The data was extensively collected with well- structured interview schedule. The data was collected between December 2023 to April 2024
Methodology: A total of 240 farmers were surveyed, with 30 drawn from each of the eight districts. Participants were selected via snowball sampling. Data was gathered via structured interviews and evaluated using percentage analysis.
Results: The survey found that 55.56 per cent of farmers across all districts were highly aware of bio-inputs, 26.64 per cent were somewhat knowledgeable, and 17.79 per cent were unaware. Thoothukudi district has the highest awareness rate (68.00%), followed by Thanjavur (66.66%) and Villupuram (64.00%). Kodaikanal was the outlier, with the lowest high awareness (24.50%) and the greatest low awareness (39.50%). The research discovered various variables that impact these variances, including the efficacy of extension services, access to knowledge and resources, demonstration programs, peer influence, and Socio-economic status.
Conclusion: The data show a large gap between farmers' awareness and in-depth understanding of bio-inputs, with noticeable regional differences. While overall awareness is good, the preponderance of medium knowledge levels suggests the need for additional practical, hands-on training and continuing education programs. The research emphasizes the need of specialized, region-specific measures to increase awareness and practical understanding of bio-inputs. Addressing these difficulties has the potential to encourage more sustainable farming methods, assuring food security and environmental health across Tamil Nadu's different agro-climatic zones. These data may help policymakers and agricultural stakeholders build tailored initiatives to encourage the use of bio-inputs and sustainable farming practices.

Keywords: Bio-inputs, Sustainable agriculture, Organic farming, Soil health, Food security, Environmental sustainability, Rural development.

1.INTRODUCTION:

Agriculture is critical to India's economic growth and global food security. However, the industry confronts various problems that have an influence on its long-term viability and productivity. Singh and Kumari (2023) discuss numerous concerns that farmers face, including dependency on the monsoons, issues with MSP, irrigation, working capital, and fertilizer and pesticide use. Among these concerns, the misuse of chemical fertilizers and pesticides has arisen as a major worry owing to its negative impact on soil health and long-term agricultural sustainability.

In accordance to these issues, there is a greater focus on bio-inputs in agriculture. The Indian biofertilizer market has expanded significantly, with output more than doubling between FY09 and FY15. This trend is likely to continue, fuelled by strong government efforts encouraging bio-agriculture. Tamil Nadu, in particular, has emerged as a pioneer in this sector, recognizing the advantages of biofertilizers in boosting soil health and production.

The Tamil Nadu government has established a number of projects to encourage the usage of biofertilizers. According to the Tamil Nadu Department of Agriculture, these programs include the Chief Minister's Dryland Development Mission, the Sustainable Cotton Cultivation Mission, and the

UNDER PEER REVIEW

National Food Security Mission. These initiatives attempt to disperse enormous amounts of biofertilizers across vast regions of agricultural land used to produce a variety of crops.

While these studies seem promising, their success is ultimately dependent on farmers' adoption. However, there is meagre documents on farmers' existing awareness and knowledge of bio-inputs. Understanding these factors is critical for a various reasons, including evaluating the effectiveness of existing outreach and education programs, identifying knowledge gaps that must be addressed in future initiatives, providing insights into potential barriers to bio-input adoption, and informing policy decisions to tailor future programs to farmers' needs.

This work seeks to meet two key objectives:

1. To assess farmers' Awareness of bio-inputs in agricultural and horticultural crops.
2. To evaluate farmers' knowledge of bio-inputs in agricultural and horticultural crops.

2.METHODOLOGY:

Biofertilizers increase soil fertility in agricultural regions, hence it is important to assess farmers' attitudes regarding bio inputs. The investigation was done utilizing an ex post facto research method. Given the novelty of biofertilizers, a multistage random sampling procedure was used to get a representative sample of farmers who use them.

Eight districts will be chosen from the five agroclimatic zones of Tamil Nadu. This research will include 30 samples from each district picked using snowball sampling approaches. As a result, 240 samples would be taken from the selected eight districts of Tamil Nadu. (Table 1) The gathered data was analysed using basic percentages. Percentage analysis was utilized in the descriptive analysis procedure to get basic and calculated percentages. To get percentages, multiply a category's frequency by 100 and divide by the total number of respondents. To guarantee accuracy, all percentages were rounded to two decimal points.

$$\text{Percentage} = \frac{\text{Frequency}}{\text{Total no.of respondents}} \times 100$$

Table1: Sample area distribution

Sl .no	Zones	District	Crops	Sample size
1	Western Zone	Erode	Pulses	30
2	Cauvery Delta Zone	Tanjavur	Paddy	30
3	North Eastern Zone	Villupuram	Oilseed	30
4	North Eastern Zone	Thiruvannamalai	Millets	30
5	Western Zone	Theni	Vegetables	30
6	Southern Zone	Tuticorin	Millets	30

UNDER PEER REVIEW

7.	Hilly zone	Kodaikanal Hilly region (Dindigul)	Hilly banana	30
8.	Cauvery Delta Zone	Pudukottai	Maize and flower crops	30
		Total		**240**

3.RESULTS AND DISCUSSION

3.1 AWARENESS OF FARMERS REGARDING BIO FERTILIZERS AND PESTICIDES:

In Thanjavur, the majority of farmers (66.66%) have a high degree of understanding of bio-inputs, while a minor number (6.66%) have poor awareness and 26.66 per cent have medium awareness. In Tiruvannamalai, a similar pattern emerges, with 63.33 per cent of farmers having high awareness, 10.00% having poor awareness, and 26.66 per cent having medium awareness. Theni has a more even distribution of awareness, with the biggest proportion of farmers having high awareness (47.34%), a significant number (20.00%) having low awareness, and 32.66 per cent having medium awareness. In Villupuram, the distribution is largely in the high awareness group (64.00%), comparable to Thanjavur and Thiruvannamalai, with 10.00 per cent of farmers having low awareness and 26.00 per cent having moderate awareness. Erode has a rather uniform distribution, with half of farmers having high awareness (50.00%) and the remainder falling between low (16.66%) and medium (33.33%) awareness levels. In Pudukkottai, the majority of farmers are in the high awareness group (60.66%), but the low and medium awareness categories are closer in proportion (16.00% and 23.33%, respectively). Thoothukudi has the greatest proportion of farmers with high awareness (68.00%) of all districts, with a substantial number (23.50%) having low awareness and 8.50% having medium awareness. Kodaikanal is an exception, with the largest proportion of farmers with low awareness (39.50%), the lowest with high awareness (24.50%), and 36.00% with medium awareness. (Table 2) Thomas et al. (2023) provided evidence that the majority of farmers had a high degree of awareness but only a medium level of understanding. Shashidhara's investigation provided more evidence for this claim. Parmar *et al.*, (2016) observed that the majority has a high degree of awareness.

Based on the findings, it was determined that 17.79% of farmers in all districts of Tamil Nadu have poor knowledge of bio-inputs, while the medium awareness group has an average of 26.64%, and the majority of farmers have high awareness, averaging 55.56%. This indicates that most districts have a larger proportion of farmers with high knowledge of bio-inputs, with the exception of Kodaikanal, which has a higher low awareness rate. The medium awareness group is very constant throughout all districts.

According to the statistics on farmer awareness of bio-inputs in Tamil Nadu, Thoothukudi has the greatest degree of awareness, with 68.00% of farmers classified as having high awareness. This is closely followed by Thanjavur (66.66%) and Villupuram (64.00%). These districts' farmers have a strong awareness of bio-inputs, suggesting that information or resources on agricultural methods are well disseminated in these places.(Table 2)

Table 2: Awareness level of farmers towards bio fertilizers and bio pesticide:

SL.NO	DISTRICT	LOW %	MEDIUM%	HIGH%
1.	Thanjavur	6.66	26.66	66.66

UNDER PEER REVIEW

2.	Thiruvannamalai	10.00	26.66	63.33
3.	Theni	20.00	32.66	47.34
4.	Villupuram	10.00	26.00	64.00
5.	Erode	16.66	33.33	50.00
6.	Pudukkottai	16.00	23.33	60.66
7.	Thoothukudi	23.50	8.50	68.00
8.	Kodaikanal	39.50	36.00	24.50
	TOTAL	**17.79**	**26.6425**	**55.561**

3.1.1 Discussion:

3.1.1.1. Low awareness:

Farmers in specific districts of Tamil Nadu have limited understanding of bio-inputs, which may be caused by several circumstances. Geographic remoteness often restricts access to agricultural information and services, and language issues may impede farmers from comprehending available resources. Farmers' capacity to obtain and grasp bio-input information may be hampered by a lack of knowledge and literacy. Strong loyalty to conventional agricultural techniques may lead to resistance to new approaches. The lack of local success stories and obvious instances of bio-input advantages may inhibit adoption. Poor infrastructure and restricted access to technologies further impede information transmission. Economic constraints may lead farmers to prioritize immediate returns over long-term sustainable methods. Inadequate communication efforts by agricultural departments or non-governmental organizations (NGOs) in certain regions, along with the possible spread of disinformation, lead to low awareness levels. (Figure 1)

3.1.1.2. Medium Awareness:

Farmers with a medium level of knowledge of bio-inputs are generally in a transitional phase. They may have some exposure to material but lack a thorough comprehension. Mixed messages on the effectiveness of bio-inputs from various sources might cause misunderstanding. These farmers often have academic knowledge but little practical experience utilizing bio-inputs. Skepticism regarding the advantages of bio-inputs over traditional approaches may remain. Time and budgetary restrictions might impede the thorough examination of bio-input methods. Generational disparities in knowledge and adoption rates may also contribute to this ambiguity of awareness. This category comprises farmers who are aware of bio-inputs but have not completely committed to or comprehended its use.(Figure 1)

3.1.1.3. High Awareness:

Farmers' high knowledge of bio-inputs is often the consequence of competent extension programs that provide ongoing training and assistance. Strong instructional initiatives, such as farmer field schools, workshops, and seminars, are essential. Extensive media outreach via local agriculture

UNDER PEER REVIEW

programs on many platforms' aids in the widespread dissemination of information. Successful demonstration plots in communities provide visual proof of bio-input advantages. Government actions, such as supporting policies and subsidies, boost interest and adoption. The growing market demand for organic products encourages farmers to learn about bio-inputs. Peer influence, in which innovative farmers share information with their communities, raises awareness. The easy availability of bio-inputs in local markets also helps to raise awareness. This combination of elements provides an atmosphere in which farmers may easily get knowledge on bio-inputs and fully understand and appreciate their benefits. (Figure 1)

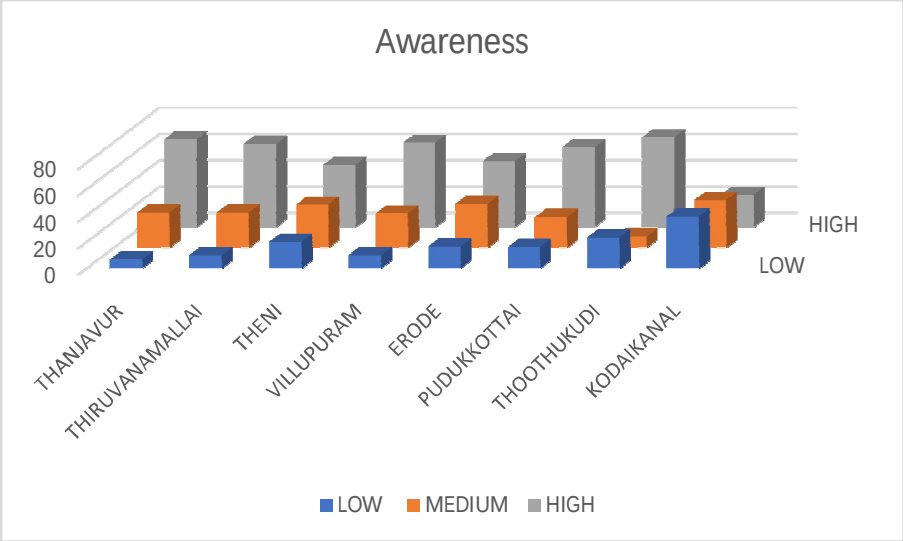

Figure 1: Awareness output

3.2. FARMERS KNOWLEDGE REGARDING THE BIO INPUTS:

In Thanjavur, 31.67% of farmers have extensive understanding of bio-inputs, 56.00% have intermediate knowledge, and 12.33% have little knowledge. Thiruvannamalai reveals that 16.67% of farmers have high knowledge, a vast majority of 73.33% have medium knowledge, and 10% have little understanding. In Theni, 20.00% of farmers have advanced knowledge, 66.66% have intermediate knowledge, and 13.34% have little knowledge. In Villupuram, 30.00% of farmers have advanced knowledge, 50.00% have intermediate knowledge, and 20.00% have little knowledge.(Table 3). Erode has 33.34% farmers with high knowledge, 56.66% with medium knowledge, and 10.0% with poor knowledge. In Pudukkottai, 40.00% of farmers have advanced knowledge, 53.33% have intermediate knowledge, and 6.66% have little knowledge. Thoothukudi data reveal that 40.00% of farmers have high knowledge, 34.00% have medium knowledge, and 26.00% have poor knowledge. Kodaikanal is an exception, with 30.00% of farmers having high knowledge, 32.00% having medium knowledge, and a staggering 48.00% having poor knowledge. Pudukkottai and Thoothukudi had the greatest levels of farmer knowledge of bio-inputs, with 40.00% of farmers in each district being classified as having good knowledge. These districts' farmers have a strong awareness of bio-inputs, suggesting that information or resources on agricultural methods are well disseminated in these places. (Table 3)

In this respect, an average of 18.00% of farmers in all districts of Tamil Nadu have little understanding of bio-inputs, while the medium knowledge group has an average of 52.03%. The above findings are consistent with the findings of Mokhale et al. (2010), who found that the majority of farmers had a medium level of knowledge about the use of biofertilizer and 30.016% had a high level of knowledge. Reddy et al. (2012) also reported that the majority of farmers had a high level of knowledge. According to the statistics, most districts have a larger proportion of farmers with medium understanding of bio-inputs. Chaudhary Diptesh (2016) indicated that the majority of farmers had a medium level of expertise, which differs from this research in that they reported a low degree of knowledge. This variation may be owing to the responder size, since this was concluded with a sample size of around 60, and it does not cover a larger region, focusing just on Gujarat. Priyadarshni

et al. (2022) found in their research that the majority of farmers had a medium degree of understanding of bio inputs, which matches our findings.

Table 3: Farmers knowledge towards bio inputs:

SL.NO	DISTRICT	LOW%	MEDIUM %	HIGH%
1.	THANJAVUR	12.33	56.00	31.67
2.	THIRUVANAMALLAI	10.00	73.33	16.67
3.	THENI	13.34	66.66	20.00
4.	VILLUPURAM	20.00	50.00	30.00
5.	ERODE	10.00	56.66	33.34
6.	PUDUKKOTTAI	6.66	53.33	40.00
7.	THOOTHUKUDI	26.00	34.00	40.00
8.	KODAIKANAL	48.00	32.00	30.00
	Total	**18.00**	**52.03**	**30.016**

UNDER PEER REVIEW

3.2.1. Discussion on Levels of Knowledge about Bio-Inputs among Farmers in Tamil Nadu

3.2.1.1. High Level of Knowledge:

Effective Extension Services: Districts such as Pudukkottai and Thoothukudi, where a large proportion of farmers are knowledgeable with bio-inputs, are likely to benefit from strong agricultural extension services. These services include training programs, seminars, and frequent visits from agricultural agents who educate farmers on the advantages and applications of bio-inputs.

Access to Information: The availability and accessibility of information via different channels, such as agricultural colleges, research organizations, and government programs, may considerably

improve farmers' understanding. Regions with greater literacy rates and internet penetration tend to have higher levels of awareness and knowledge.

Demonstration programs: Government or NGO-led demonstration programs demonstrating the efficacy of bio-inputs may also help to increase knowledge levels. When farmers witness the practical advantages of bio-inputs, they are more likely to accept and fully comprehend them. **Peer Influence and Farmer Networks:** Farmers with strong networks and associations may share information and experiences more easily. Districts with active farmer organizations often have greater levels of knowledge owing to peer-to-peer learning and collaborative problem-solving techniques. (Figure 2)

3.2.1.2. Medium level of knowledge:

Partial Exposure: Farmers in regions with medium knowledge may have had some exposure to bio-inputs but lack a thorough understanding. This might be attributed to infrequent training sessions, restricted demonstration projects, or uneven information transmission.

Mixed Results from Bio-Inputs: If the use of bio-inputs has produced mixed results in certain places, farmers may be dubious or only partly persuaded of their advantages, resulting in intermediate understanding.

Financial and resource: Restrictions may limit farmers' capacity to fully study and use bio-inputs. Medium knowledge levels might occur when farmers are aware of bio-inputs but cannot afford to utilize them widely.

Limited Extension Services: Extension services may exist, but they are insufficiently strong or ubiquitous, resulting in only partial knowledge transmission. Farmers may have fundamental knowledge but lack deeper insights on the use and advantages of bio-inputs.(Figure 2)

3.2.1.3. Low Level of Knowledge:

Lack of Awareness Programs: Districts with low knowledge levels, such as Kodaikanal, may have a lack of awareness programs and insufficient extension services. Farmers continue to be uninformed of the potential advantages of bio-inputs due to a lack of educational programs. **Geographical and socioeconomic barriers:** Remote and economically poor areas often lack access to information and resources. Geographic remoteness may limit the accessibility of extension services and agricultural education initiatives.

Traditional Practices: Farmers in certain places may be firmly entrenched in traditional agricultural methods and reluctant to change. A strong devotion to traditional procedures might lead to a lack of understanding and acceptance of emerging technology such as bio-input.

Misinformation and preconceptions: In certain circumstances, farmers are misinformed or have preconceptions regarding bio-inputs, which leads to hesitation and a lack of expertise. Negative prior experiences or anecdotal evidence against bio-inputs may also contribute to this. (Figure 2)

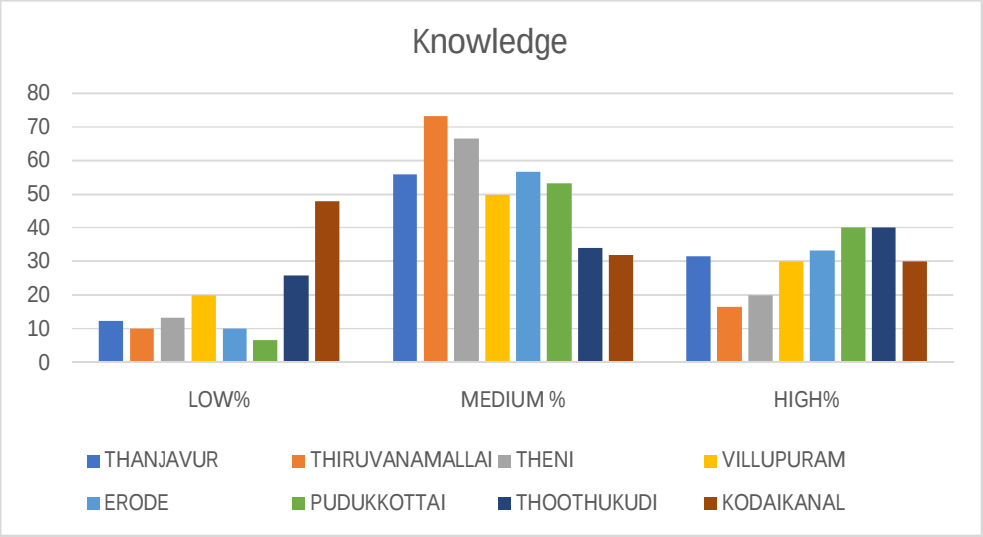

Figure 2: Farmers knowledge

4.Conclusion:

This research found that farmers in Tamil Nadu's agro-climatic zones had variable degrees of awareness and understanding regarding bio-inputs. While overall awareness is promising (55.56% high), there is a significant difference between awareness and in-depth knowledge (30.016% high). Significant geographical variances underscore the need of targeted approaches. Key suggestions include improving practical training, overcoming adoption hurdles, and incorporating successful models from high-awareness districts. These activities are critical to encouraging sustainable agriculture, guaranteeing food security, and preserving environmental health throughout Tamil Nadu's diversified agricultural terrain.

Research content: The research content of manuscript is original and has not been published elsewhere.

Ethical approval: Not applicable.

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UNDER PEER REVIEW