



## Extent of adoption of technologies in mulberry (*Morus Alba*) cultivation and silkworm (*Bombyx mori*) rearing among sericulture farmers in Tenkasi District of Tamil Nadu

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### Abstract

Sericulture involves cultivating mulberry plants and rearing silkworms to produce silk cocoons and silk yarn. Adoption of integrated management technologies is essential to address challenges in sericulture. A study on the adoption of 30 important bivoltine sericulture technologies was conducted in five districts of the Tenkasi sericulture cluster in southern Tamil Nadu. In Tenkasi district, 56.67% of technologies showed high adoption, while 23.3% and 20.0% fell under medium and low adoption categories, respectively. Tuticorin recorded the highest level of adoption, with 66.67% of technologies under high adoption and only 10.0% under low adoption. Tirunelveli showed 40.0% high adoption, 33.33% medium adoption, and 26.67% low adoption. In Virudhunagar, 30.0% of technologies had high adoption, 40.0% medium adoption, and 30.0% low adoption. Kanyakumari reported 33.33% high adoption, 56.67% medium adoption, and 10.0% low adoption. Adoption gaps in mulberry cultivation and sericulture practices varied considerably across districts. Mean adoption gaps ranged from 15.0% in Tuticorin to 30.71% in Tirunelveli. Overall, farmers moderately adopted technologies related to rearing silk worms and cocoon harvesting, while pre-rearing and disinfection practices received greater attention. The findings highlight to initiate appropriate measures to raise awareness and bridge the adoption gap and the need to motivate farmers to adopt these technologies in order to increase the cocoon production and profitability.

**Keywords:** Mulberry cultivation, silkworm rearing technology, adoption of technologies, adoption gap

### Introduction

Sericulture is the cultivation of mulberry plants and the rearing of silkworms for the production of silk cocoons, which yield raw silk. Sericulture includes several disciplines, such as mulberry cultivation, silkworm rearing, silk reeling, and weaving (Dandin *et al.*, 2001) [2]. Tamil Nadu is one of the leading producers of bivoltine silk in India, contributing significantly to the nation's silk industry. Tenkasi region, located in the southern part of Tamil Nadu near the Western Ghats, experiences a tropical climate characterized by hot summers, moderate monsoons, and mild winters. Mulberry cultivation and silkworm rearing are successfully practiced by farmers in this region and are among the most beneficial income-generating activities. Despite this potential, sericulture faces several challenges in the area. The adoption of integrated management technologies is required to overcome these challenges. Technologies for high silk cocoon production have been developed through intensive and location-specific research efforts to mitigate these problems. However, only a few technologies are adopted by farmers. Farmers' knowledge plays a very important role in the adoption of technologies. At present, scientific and technological resources are available to increase silk cocoon production, but they are fully, partially, or not used by farmers.

A review of past research indicates that these problems need to be managed properly and that farmers should be adequately educated. Studies on the adoption of technologies for mitigating sericulture problems in Tenkasi cluster area are scarcely reported in the literature. Hence, the

extent of adoption of 30 selected important technologies of bivoltine sericulture was studied in the Tenkasi sericulture cluster of southern Tamil Nadu.

### Review of Literature

The technology plays an important role in production of good quality cocoons and increased silk production. Adoption of the technologies is essential for increased production and sustainable sericulture (Jadhav *et al.*, 2020) [4]. Lakshmanan, *et al.*, (1998) [8] reported that the farmers who do not adopt improved technologies consistently earn lower incomes in sericulture. The study conducted by Ahmad *et al.*, (2017) ascertains that the adoption of technology is of utmost importance for improvement of this sector. Researchers typically design a questionnaire or interview schedule containing objective questions such as multiple choice, true or false, or short-answer formats that reflect both awareness and practical understanding (Lakshmanan and Geethadevi, 2007) [7]. Each response is scored, with correct answers assigned full points and incorrect or incomplete answers receiving zero or partial points. The total score is then converted into a percentage by dividing the farmer's obtained score by the maximum possible score, which allows for clear comparison. This method is widely recommended in agricultural extension research for identifying knowledge gaps and designing effective training interventions. Adoption of technologies merely based on the individual farmer's decision according to availability, socio economic condition, age, education and knowledge (Rathore *et al.*, 2019) [12]. Technology adoption

and employment generation in Tamil Nadu, focusing on employment from sericulture, family labour contribution, and women's participation in sericulture activities was studied by Meenal and Rajan (2008) [9]. Dayananda and Kamble (2008) [3] reported that the adoption level varies with each practice and is not up to the knowledge level. Jadhav *et al.* (2020) [4], in their study, reported that only 12.5% of the farmers have adopted the model rearing houses equipped with the modern facilities. Dayananda and Kamble (2008) [3] examined the challenges faced by sericulturists in adopting improved technologies, identifying key constraints such as lack of knowledge about specific practices (83.75%), limited access to technical guidance (81.25%), difficulty in obtaining finance (61.25%), and uncertainties in irrigation and electricity supply (30%). Additionally, Srinivasa *et al.*, (2008) [13] found that sericulturists were particularly influenced by the Catalytic Development Programme (CDP) of the Central Silk Board, which effectively promoted awareness and support for sericulture practices.

### Materials and Methods

Extent of adoption of bivoltine sericulture technologies by the farmers were studied in the Tenkasi district of southern Tamil Nadu, India. An interview schedule was designed based on the objectives of the study for data collection. Socioeconomic characteristics and 30 bivoltine sericulture technologies recommended by the Central Sericultural Research and Training Institute, Mysore were included in the schedule. The schedule was pre-tested and necessary modifications were made. Data were collected through personal interviews of the sericulture farmers. Data for knowledge and adoption of thirty identified technologies was collected from 50 randomly selected farmers in each district accounting to 250. Selection was done using simple random sampling technique to avoid biasness. The selection of the farmers was done in coordination with the officials of department of sericulture of particular district.

### Extent of adoption of bivoltine technologies of the farmers of study area

The procedure to study the extent of adoption on technologies involves following systematic steps. The adoption of thirty selected identified technologies was evaluated with the respondents in the selected study area by random sampling methods. Data collection was done using structured interview schedule and observation checklists, developed to gather information on farmers' adoption of the technologies. Field surveys, interviews, and focus group discussions were conducted to collect both qualitative and quantitative data. The extent of adoption is measured by examining the actual use of the technologies. Finally, the collected data were analyzed using descriptive and inferential statistical methods to identify extent of adoption and gaps.

### Measurement of extent of adoption

The farmers were found to adopt the technologies at different levels, which were delineated as, nil adoption; a situation where the farmer never adopted the technology,

partial adoption; where the adoption of technology was found to be partial or on a limited basis and in another situation, where the farmers were found to adopt the technology in full, as recommended. The adoption behaviour of the selected farmers was computed using the adoption score. The scores were assigned as per the level of adoption. For complete adoption of a technological practice a score of 2 was given and for partial adoption of the same a score of 1 was given, while for non-adoption a score of 0 was given. In all, 30 technologies were considered for the study and given equal weightage. Each technology was given score and summed up for calculating farmer's wise adoption index. Further the farmers were classified into low, medium and high groups based on their adoption score. The adoption index was computed for each farmer as below:

$$\text{Adoption index} = \frac{\text{Total score of a technology}}{\text{Total possible score}} \times 100$$

### Measurement of Adoption gap

The technology wise adoption gap (TAG) was the proportion of respondents, who had not adopted the particular technology to the total number of respondents expressed in percentage.

$$\text{Technologywise AG} = (\Sigma Y_i / X_m) \times 100$$

Where,  $\Sigma Y_i$  = The total No. of respondents, who had not adopted the particular technology  $i=1$  to 100

$$X_m = \text{Total selected respondents} = 100$$

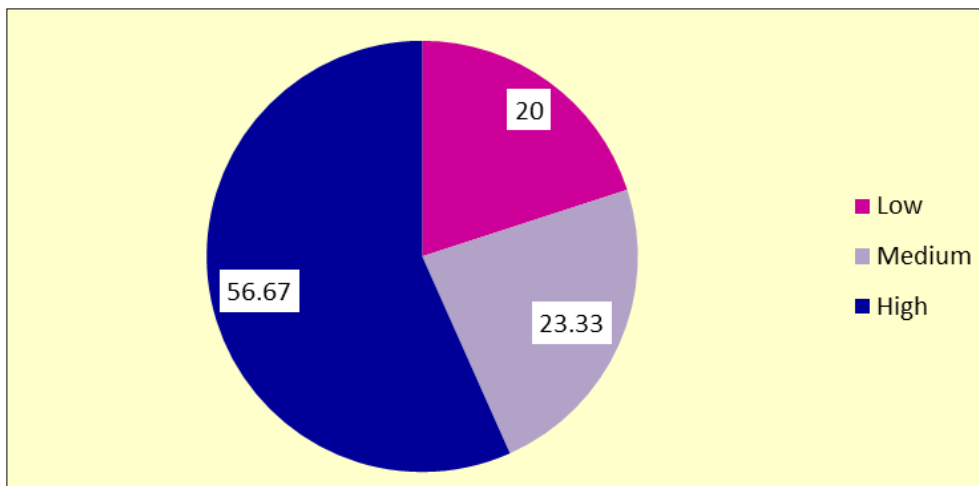
### Results

#### Extent of Adoption of technologies on mulberry cultivation and silkworm rearing

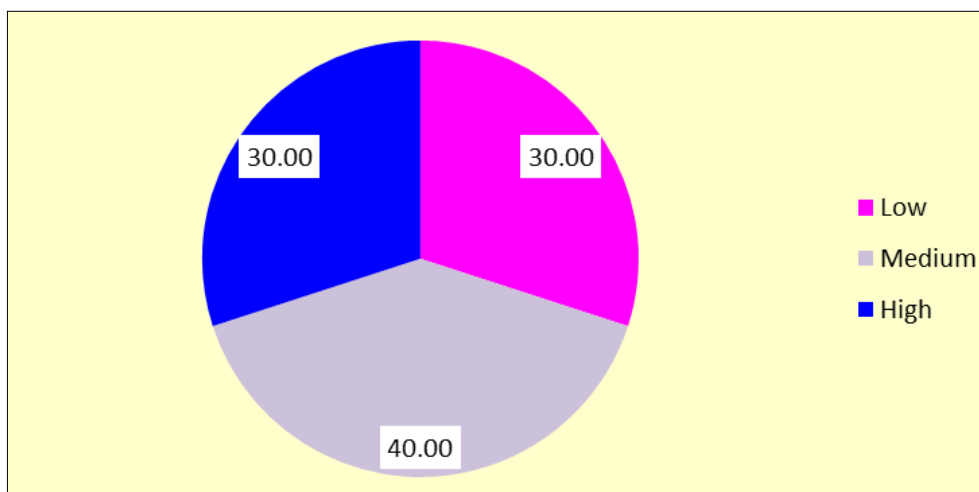
The frequency of adoption in Tenkasi district reveals that 56.67 per cent of technologies were shown high adoption, 23.3 per cent of farmers have accounted medium adoption and 20.0 per cent of technologies have shown low category of adoption of technologies (Fig 1). In Virudhunagar district 30.00 per cent of technologies have accounted high adoption, 40.00 per cent of farmers have medium adoption and 30.0 per cent of technologies have low category of adoption of technologies (Fig 2). In Tirunelveli district, 40.00 per cent of technologies have reported high adoption, 33.33 per cent of farmers have medium adoption and 26.67 per cent of technologies have low category of adoption of technologies (Fig 3). In Tuticorin district, 66.67 per cent of technologies have high adoption, 23.33 per cent of farmers have medium adoption and 10.00 per cent of technologies have low category of adoption of technologies (Fig 4). In Kanyakumari district, 33.33 per cent of technologies have high adoption, 56.67 per cent of farmers have medium adoption and 10.00 per cent of technologies have low category of adoption of technologies (Fig 5). Same pattern of adoption was reported by Vijayakumar and Rajan, 2006 [15]. Very good adoption of technologies about harvesting of leaves during cooler hours of the day and preservation, about silkworm bivoltine single / double hybrid, Usage of bed disinfectant, Shoot feeding method and frequency, cocoon harvesting, maintenance of hygiene during rearing and construction of recommended model shed were

recorded. Higher adoption of these technologies was in conformity with the reports of Meenal and Rajan (2011)<sup>[10]</sup>. In mulberry cultivation the farmers have very good adoption of technologies about weed management, spraying multi-nutrient formulation on mulberry leaves, and Ploughing with Power weeder which was in compliance with the report of Krishnamurthy and Radhakrishnan (2012). Technologies like Soil testing and Soil reclamation, Deep ploughing and

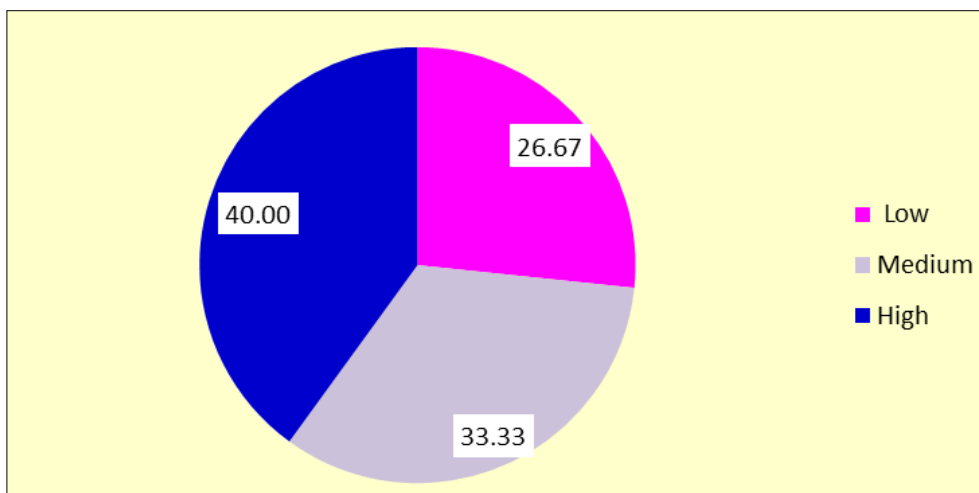
Land leveling, Green manuring / Mulching, Bio fertilizer application, Following Integrated pest and disease management, and technologies to use Shoot harvesting/pruning machine have very low extent of adoption. Krishnamoorthy and Radhakrishnan (2012)<sup>[5]</sup> reported the low adoption of these technologies in mulberry cultivation and affirmed the requirement of special attention to increase the adoption of technologies



**Fig 1:** Frequency of Adoption of technologies in Tenkasi district



**Fig 2:** Frequency of Adoption of technologies in Virudhunagar district



**Fig 3:** Frequency of Adoption of technologies in Tirunelveli district

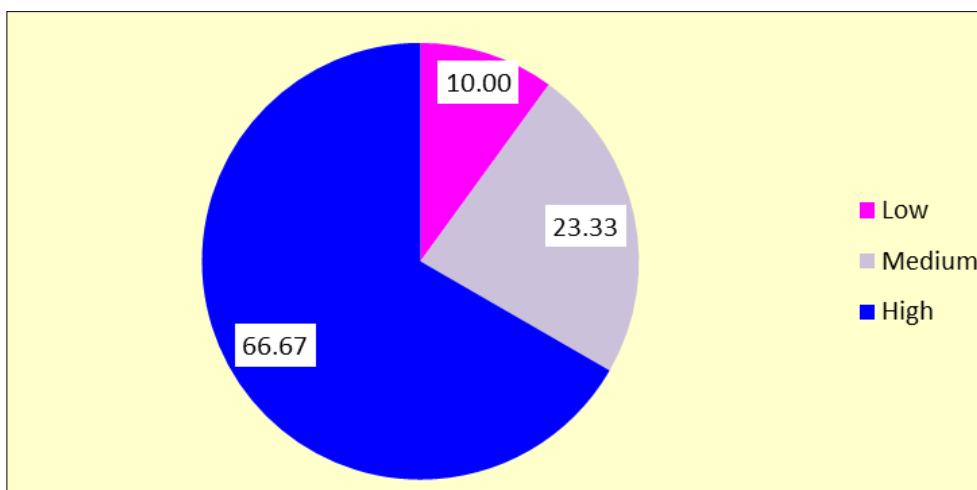


Fig 4: Frequency of adoption of technologies in Tuticorin district

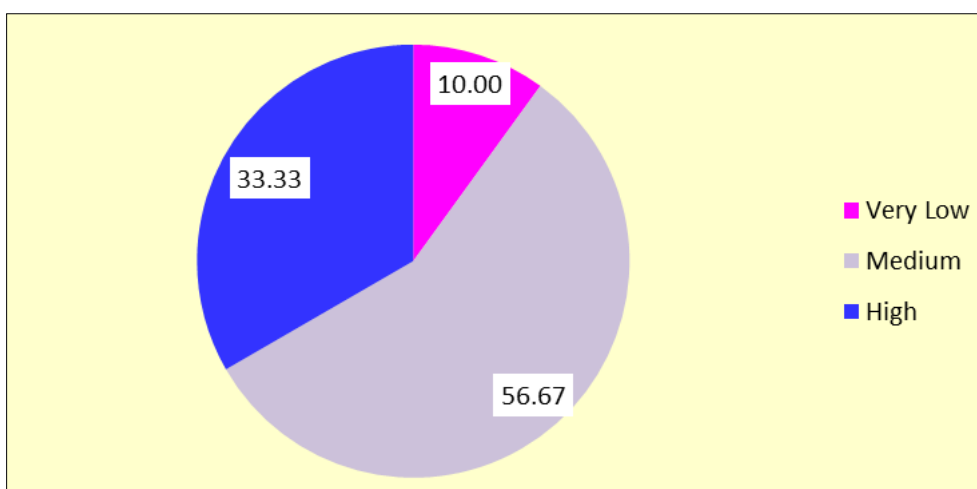


Fig 5: Frequency of Adoption of technologies in Kanyakumari district

#### Adoption Gap of technologies on Mulberry cultivation and Silk worm rearing

The adoption gap of various sericulture technologies among silkworm rearers in the Tenkasi district revealed that the discrepancy between recommended technological practices and their actual implementation by sericulture farmers. The adoption gaps of various technologies related to mulberry cultivation among sericulture farmers across the southern districts revealed considerable variation in the adoption of specific practices (Table.1). Technologies such as soil testing and soil reclamation, green manuring, mulching, biofertilizers application and integrated pest & disease management showed relatively high adoption gaps across most districts, indicating lesser acceptance among farmers. Conversely, practices like planting improved mulberry varieties, spacing, drip irrigation, weed management, and pruning methods exhibited lower gap, reflecting acceptance and implementation. The mean adoption gaps across districts ranged from 27.25 in Tuticorin to 34.63 in Tenkasi, with standard deviations between 27.09 and 26.19, suggesting substantial variability in technology adoption within and across districts. Overall, while certain key technologies were widely adopted, several critical practices still face significant adoption gaps, highlighting the need for targeted extension efforts and capacity-building programs for farmers.

The adoption gap in sericulture technologies in the southern districts showed considerable variation across locations and practices (Table.2). Among the districts, Tirunelveli and Virudhunagar recorded the highest overall mean adoption gap (30.71% & 26.14%), Kanyakumari (29.00%), and Tenkasi (16.57%), while Tuticorin with the lowest mean of 15.00%. The technology related to cocoon sorting, packaging, and transporting exhibited the highest adoption gap, mean was  $52.0 \pm 13.49\%$ , indicating that post-harvest handling practices were not more commonly followed across the districts, especially in Virudhunagar and Tirunelveli. Similarly, the giving spacing during silkworm rearing was  $37.2 \pm 19.47\%$ , temperature, humidity, and airflow maintenance was  $34.8 \pm 7.56$  and usage of mountages and maintenance of environmental conditions during mounting was  $28.00 \pm 9.59$  were also less adopted technologies, reflecting an awareness of proper rearing conditions among farmers. On the other hand, technologies such as usage of bed disinfectant, planning of silkworm rearing schedule and usage of room disinfectant and disinfection schedule recorded low adoption gap, suggesting more emphasis on preventive and preparatory measures. The maintenance of hygiene during rearing and moulting care showed moderate gap in adoption, indicating that some farmers practiced basic hygienic and care techniques during rearing. The adoption gap in construction of recommended model sheds had a mean of 17.6% showing that

infrastructural improvements were adopted by majority. Overall, the findings suggested that farmers in the southern districts had moderately adopted technologies that were directly related to the rearing and harvesting phases of sericulture, while pre-rearing and disinfection practices received relatively more attention.

The results clearly showed that the technology ‘Cocoon sorting and transporting records the highest adoption gap across all districts, particularly in Tuticorin and Kanyakumari. This indicates limited awareness for post-harvest management, which could directly affect cocoon quality and market returns. According to Subramanian *et al.* (2019) <sup>[14]</sup>, inefficiencies in cocoon handling and transportation significantly reduce the commercial value of silk due to mechanical damage and poor preservation practices.

Thus, the high adoption gap in this area underscores the necessity for training programs focused on post-rearing management and value-chain improvement. High adoption gaps were also evident in technologies such as Moulting care, Microclimate maintenance, and Silkworm spacing. These technologies are vital for maintaining optimal environmental conditions and silkworm health, directly influencing cocoon yield and quality (Kumar & Chandrasekaran, 2020) <sup>[6]</sup>. On the other hand, technologies such as Disinfectant and Disinfection schedule and Construction of model rearing shed exhibited comparatively lower adoption gaps, suggesting that these basic hygiene and infrastructural measures are more familiar to farmers, possibly due to earlier extension campaigns or accessibility of inputs. This result was in conformity of studies of Kumaresan & Geetha Devi, 2009.

**Table 1:** Adoption Gaps in Mulberry cultivation in Tenkasi cluster

Sl. No	Technologies	Adoption gaps in Districts					Mean	SD
		Tenk asi	Virudhu nagar	Tirunel veli	Tuti corin	Kanya kumari		
1	Soil testing and Soil reclamation	66	70	88	60	58	68.4	11.9
2	Deep ploughing and Land leveling	56	70	32	26	24	41.6	20.4
3	Planting improved mulberry varieties	20	10	30	12	18	18	7.9
4	Spacing	14	30	16	8	20	17.6	8.2
5	Drip irrigation	28	36	12	0	20	19.2	14.0
6	Organic manuring	40	52	16	8	40	31.2	18.4
7	Green manuring / Mulching	66	70	64	68	60	65.6	3.8
8	Weed management	10	10	8	0	16	8.8	5.8
9	Pruning methods and schedule	0	20	20	16	24	16	9.4
10	Ploughing	0	0	4	0	40	8.8	17.5
11	Chemical fertilizer application	28	16	10	8	10	14.4	8.2
12	Bio fertilizer application	70	70	72	64	70	69.2	3.0
13	Spraying multi-nutrient formulation on mulberry leaves	10	30	28	12	10	18	10.1
14	Following Integrated pest and disease management	70	70	80	80	80	76	5.5
15	Ploughing with tractor//Power weeder	16	34	26	34	32	28.4	7.7
16	Shoot harvesting/ pruning machine	60	70	70	40	54	58.8	12.5
	Mean	34.63	41.13	36.00	27.25	36.00	35.00	10.27
	SD	26.19	26.02	28.53	27.09	22.21	24.30	5.17

**Table 2:** Adoption Gaps in Silkworm rearing in Tenkasi cluster

Technologies	Adoption Gap in districts					Mean	SD
	Tenk asi	Virudhu nagar	Tirune lveli	Tuti corin	Kanya kumari		
Construction of model shed	0	18	22	10	38	17.6	14.17
Disinfectant and Disinfection schedule	14	14	4	10	24	13.2	7.29
Bivoltine single / double hybrid	0	40	20	0	2	12.4	17.57
Silkworm rearing schedule	10	0	62	0	28	20.0	26.12
Maintenance of Hygiene	30	20	20	10	20	20.0	7.07
Silkworm Spacing	30	34	70	18	34	37.2	19.47
Moulting care	24	40	32	20	22	27.6	8.29
Usage of bed disinfectant	8	20	6	0	14	9.6	7.67
Micro climate maintenance	30	32	34	30	48	34.8	7.56
Harvest leaves and Preservation	10	32	32	26	42	28.4	11.78
Shoot feeding method and frequency	8	10	20	8	12	11.6	4.98
Mounting	38	30	30	12	30	28.0	9.59
Cocoon Harvesting,	0	14	14	14	40	16.4	14.52
Cocoon sorting, and transporting	30	62	64	52	52	52.0	13.49
Mean	16.57	26.14	30.71	15.0	29.00	23.4	12.11
SD	13.30	15.68	20.88	14.0	14.37	11.9	5.90

## Conclusions

Adopting modern technologies is crucial for enhancing productivity at the farmer level. However, the present study reveals that farmers’ knowledge and adoption of certain bivoltine rearing technologies were good whereas few technologies such as IPM, biofertiliser usages etc., remain

limited. Technological adoption at the farmer’s level is hindered by a combination of knowledge gaps, financial constraints, environmental challenges, labor and resource limitations, and socio-cultural factors. The findings highlight the need to motivate farmers to adopt these technologies in order to increase the cocoon production and

profitability. Appropriate measures should be implemented to raise awareness and bridge the adoption gap (Mahimasanthi *et al*, 2018) [11]. To achieve higher levels of technology adoption, it is essential to conduct intensive extension communication programs such as training sessions, demonstrations, seminars, exhibitions, field days, and field visits on a regular basis. Additionally, organizing farmers into self-help groups or cooperative societies can promote collective learning and encourage the use of advanced technologies, ultimately improving the quality of silk production in these regions.

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