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### Evaluating the effectiveness of training on sericulture cultivation among farmers in the Bholahat Region

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#### Abstract

Silk, a highly valuable asset of the textile industry, intertwines tradition and contemporary demands in Bangladesh. This study delves into the effectiveness of sericulture training programs for Bangladeshi farmers within the Bholahat upazila, a region pulsating with historical significance and contributing 75% of the nation's silk production. Employing Kirkpatrick's four-level model and a mixed-methods approach, thoroughly examine the impact of training on farmers' reactions, learning, behavior, and ultimately, results. The investigation, encompassing 192 trained farmers, reveals promising yet intricate results.

A substantial majority (88.02%) express positive impressions of the training, with 80.21% reporting significant improvements in knowledge, skills, and attitudes. However, a closer look reveals a spectrum of effectiveness. Those with medium gains might benefit from more targeted resources or struggle with skill application, while the high-effectiveness group (7.81%) may require advanced training tailored to their existing expertise.

The analysis further showcases the multifaceted benefits of training. At the forefront of this improvement is the cocoon yield, which serves as a clear indicator of trained farmers' superior performance. Following closely are positive effects on income, mulberry leaf yield, silk quality, and market prices. The study also highlights gains in efficiency, pest management, and socioeconomic status, suggesting a holistic advancement for farming communities.

While increased interest in commercial sericulture ranks less essential, it underscores a positive shift in attitude. Overall, the investigation unravels the intricate tapestry of training's influence, revealing its crucial role in empowering Bangladeshi farmers and strengthening the nation's position in the global silk market.

**Keywords:** Sericulture, cultivation, farmers, impact, training, effectiveness

#### 1. Introduction

Silk holds the regal title of "Queen of Fibers." It's a luxurious and highly prized natural fiber that has been cultivated through the intricate art of sericulture for centuries. This ancient craft of silk cultivation incorporates traditional elements in a complex and interconnected manner with innovation, bridging the past with the demands of the contemporary textile industry. In Bangladesh, sericulture holds significant cultural and economic importance, standing at the crossroads of tradition, economic prosperity, and global competitiveness. As the country aims to fortify its position in the silk industry, the effectiveness of training programs among Bangladeshi sericulture farmers emerges as a crucial determinant.

A sturdy training system equips sericulture farmers with the knowledge and skills necessary to navigate the complexities of silk farming, address challenges, and adopt innovations. While the importance of training in agriculture is widely acknowledged (Swanson & Rajalahti, 2010) <sup>[1]</sup>, there remains a need for empirical studies that specifically assess the impact of training initiatives in the context of

sericulture.

The importance of thoughtfully crafted training programs in sericulture is widely recognized, with studies revealing a positive association between training efforts and improved outcomes. Several studies highlight the positive correlation between training and agricultural productivity. Findings from studies on rice farming in Bangladesh indicate that well-designed training programs significantly improve farmers' knowledge and practices, leading to enhanced crop yields (Ali *et al.*, 2015; Hasan *et al.*, 2018) <sup>[2, 3]</sup>. The consensus within the sericulture community supports the notion that strategic training interventions contribute significantly to advancements in sericulture practices, echoing the positive correlations found in the realm of agriculture (Feder *et al.*, 2020; Sadashivappa & Biradar, 2016) <sup>[4, 5]</sup>. The works of Islam *et al.* (2017) <sup>[6]</sup> emphasize the continuous skill development required among Bangladeshi sericulture farmers. This study underscores the positive correlation between training and enhanced productivity in the broader agricultural context.

Bangladesh's conducive climate for sericulture has

positioned it as a significant player in the global silk market (Islam *et al.*, 2019) <sup>[7]</sup>. However, challenges such as market fluctuations, climate variability, and technological advancements necessitate a comprehensive examination of the current state of sericulture in the country. Rahman *et al.* (2021) <sup>[8]</sup> highlight the importance of understanding the unique challenges faced by Bangladeshi sericulture farmers, as these insights are integral to designing training programs tailored to the specific needs of this sector. Reports indicate that sericulture farmers in Bangladesh did not meet their production targets for various factors (BSDB, 2009; Morton & Sinha, 1995; Choudhury, 2021) <sup>[9, 10, 11]</sup>, while research institutes in Bangladesh achieve higher sericulture production rates under controlled conditions, farmer yields lag due to challenges like limited resources, infrastructure, and knowledge gaps. (Das & Halder, 2019; BSDB, 2020) <sup>[12, 13]</sup>.

Despite the acknowledged importance of training in bridging the production gap, research assessing the direct impact of sericulture training programs on farmer yields and income remains scarce. This lack of empirical data impedes effective program design and hinders efforts to tailor interventions to maximize their benefits for the specific needs of sericulture farmers (BSDB, 2020; Sarkar, 2018) <sup>[13, 14]</sup>.

The complexities of sericulture pose unique challenges compared to other agricultural sectors. Fluctuations in mulberry leaf quality, the disease susceptibility of silkworms, and the labor-intensive nature of cocoon rearing all necessitate training programs that go beyond generic agricultural practices. Effective interventions must delve deeper, addressing these specific hurdles and equipping farmers with practical skills and knowledge tailored to their unique circumstances. (Roy & Mondal, 2022; CSB, 2021) <sup>[15, 16]</sup>.

Evaluating training programs in sericulture is paramount, as it not only ensures the efficacy of interventions but also provides essential data-driven insights for continuous improvement, addressing the unique challenges of sericulture and promoting sustainable practices (Rahmathulla *et al.*, 2012; Das & Halder, 2019) <sup>[17, 12]</sup>. The findings of Rahman *et al.* (2021) <sup>[18]</sup> and Islam *et al.* (2017) <sup>[6]</sup> collectively lay the groundwork for this investigation into the effectiveness of training initiatives within the intricate landscape of Bangladesh sericulture.

The objective of the study was to assess how sericulture farmers perceive the effectiveness of the training they receive. The outcomes resulting from the training interventions were diverse and manifested in various forms. These changes included improvements in productivity, increased satisfaction among customers, enhanced profitability, more efficient operational processes, and a boost in morale among employees. The study recognized these diverse forms of results as key indicators of the overall impact and effectiveness of the training programs on sericulture farmers.

The output result will provide insights for policymakers, sericultural extension services, and development practitioners to enhance the sustainability and profitability of silk farming. This exploration contributes to sericultural

as well as agricultural training and sustainable rural livelihoods while preserving cultural heritage through informed sericultural practices.

## Materials and Methods

The study focuses on a significant area in Bangladesh, specifically the traditional sericultural districts within the Bholahat upazila under Chapainawabganj district. This region holds historical significance, contributing 75% of the country's silk production (Wikipedia, 2021) <sup>[19]</sup>. A group of 192 respondents who received sericulture cultivation training were sampled. The evaluation of training effectiveness in this study was based on Kirkpatrick's well-established four-level model of indicators (Kirkpatrick, 1998) <sup>[20]</sup>, encompassing participants' reactions, the extent of learning, observed changes in behavior, and the ultimate results achieved. Employing a mixed-methods approach that includes surveys, interviews, and on-site observations, this study aims to comprehensively explore the intricate impact of training on sericulture farming practices. Furthermore, appropriate statistical analysis tools and methods are employed for the purpose of data analysis and presentation.

## Data analysis

The data collected from household surveys underwent thorough processing and analysis using relevant software tools, including IBM SPSS Statistics 20 and Microsoft Excel 2021. The study included manual calculations and analysis of economic parameters for each household as a crucial aspect of the research.

## Results and Discussion

The main aim of this investigation was to evaluate the effectiveness of the training provided to farmers involved in sericulture cultivation. To establish a comprehensive evaluation framework, we chose to employ Kirkpatrick's four-level model of training assessment. Moreover, the researcher focused on evaluating the extent to which each farmer became integrated into the training initiative. To accomplish these goals, 12 statements were formulated for each of the four evaluation levels, resulting in a total of 48 statements. These levels were designed to encapsulate the dimensions of reaction, learning, behavior, and results. A scoring system, spanning from 12 to 60 for each level, was applied, leading to an aggregate score that ranged from 48 to 240. The results of Kirkpatrick's four-level model are described below:

### 1. Effectiveness of Training on Reaction Level

The data shown in Table 1 presents the findings of the study based on the farmer's reaction level scores during training sessions. The farmer's scores varied from 12 to 58, with an average of 45.63 percent and a standard deviation of 10.43. The study categorized the farmers into three groups based on their mean and standard deviation, which were "low," "medium," and "high" reaction levels. This categorization provided a wise comprehension of the varied responses among the farmers and shed light on the wide range of reactions to the training program.

**Table 1:** Farmers' Distribution to Reaction Level of Training Effectiveness

Category	Farmers		Mean	Standard Deviation	Max/Min
	Number	Percent			
Low	23	11.98	45.63	10.43	Max = 58, Min= 12
Medium	153	79.69			
High	16	8.33			
Total	192	100			

The majority (79.69%) of sericulture farmers perceive the training's effectiveness at a medium level, with 8.33% exhibiting a high level of reaction and 11.98% displaying a low level of reaction. Survey results suggest that the group with the lowest score (11.98%) may perceive the training as less effective, potentially due to language barriers or resource limitations. Conversely, the group with the highest score (79.69%) indicates a more favorable perception of training effectiveness, potentially leading to improved farming practices. The 8.33% group, despite having the highest score, shows a lower perception of training effectiveness, suggesting that they may find it too basic or not tailored to their specific needs. Overall, the survey found that 88.02% of respondents belonged to the middle to high-level reaction group, indicating active participation and a positive view of the training's efficacy in sericulture cultivation."

**2. Effectiveness of Training on the Learning Level**

The study assessed participants' learning levels, which ranged from 16 to 59, resulting in a mean score of 45.62 percent and a standard deviation of 9.40. Categorizing farmers' responses into "low," "medium," and "high" groups based on training effectiveness and learning level, Table 2 illustrates the distribution of farmers across these categories.

**Table 2:** Farmers' Distribution to Learning Level of Training Effectiveness

Categories	Farmers		Mean	Standard deviation	Max/Min
	Number	Percent			
Low	23	11.98	45.62	9.40	Max = 59, Min= 16
Medium	155	80.73			
High	14	7.29			
Total	192	100			

Upon analyzing the aforementioned table, it is evident that a significant majority of farmers (80.73%) exhibit an average level of learning from sericulture cultivation training. A minority, approximately 11.98%, appears to have a low level of learning, while only 7.29% of farmers demonstrate a high level of learning. Consequently, the majority of farmers (88.02%) fall within the medium- to high-level learning category.

**3. Effectiveness of Training on the Behavioral Level**

The scores for farmers' displayed behavior levels varied from 16 to 60, having a mean of 45.29 and a standard deviation of 9.51. Categorizing farmers into "low," "medium," and "high" levels of behavior change based on the mean and standard deviation, Table 3 illustrates the distribution of farmers across these behavior-changing training effectiveness levels.

**Table 3:** Farmers' Distribution to Behavioral Level of Training Effectiveness

Categories	Farmers		Mean	Standard Deviation	Max/Min
	Numbers	Percentage			
Low	24	12.50	45.29	9.51	Max= 60, Min= 16
Medium	152	79.17			
High	16	8.33			
Total	192	100			

The table data reveals that post-training, the majority of farmers (79.17%) experienced a moderate level of behavior change. A 12.50% minority falls into the low group, suggesting varied reasons for this outcome. The medium group appears to have achieved substantial success with the training program, indicating its average effectiveness in altering their behavior. Lastly, the high-level group (8.33%) witnessed less change, possibly attributed to their pre-existing knowledge, advanced skills, or a potential mismatch between the training and their specific needs.

**4. Effectiveness of Training on Result Level**

The farmers' result-level scores varied from 21 to 60, with a mean of 46.68 and a standard deviation of 8.96. By categorizing farmers into "low," "medium," and "high" result groups using the mean and standard deviation, you can find a detailed breakdown in Table 4 for an overview of their training effectiveness.

**Table 4:** Farmers' Distribution to Result Level of Training Effectiveness

Categories	Farmers		Mean	Standard Deviation	Max/Min
	Number	Percent			
Low	22	11.46	46.68	8.96	Max= 60, Min= 21
Medium	151	78.64			
High	19	9.90			
Total	192	100			

According to Table 4, the majority of farmers (78.64%) achieved medium results, while 9.90% attained excellent outcomes, and 11.46% experienced low results. The training program appeared effective in enhancing productivity and income for the medium group but may not have been as impactful for the low and high groups. The low group might have faced resource shortages or challenges in applying their skills, while the high group may have already possessed a high level of necessary training. Overall, the majority (88.54%) of farmers observed medium to high

level outcomes.

The data unequivocally demonstrates that sericulture training boosts farmers' confidence in making informed decisions. This implies that the more farmers gain from the training, such as knowledge, improved skills, or positive attitudes toward farming techniques, the more they perceive it as effective. In essence, the more they learn, the more they appreciate the training.

**5. Overall Effectiveness of Training on Four Levels**

The effectiveness of the four levels of the Kirkpatrick training evaluation model was analyzed using data collected from farmers. The overall effectiveness score extended across 65 to 237, including a mean of 183.21, accompanied by a standard deviation of 38.12. To enhance understanding, farmers' responses were categorized into "low," "medium," and "high" overall training effectiveness groups. Refer to Table 5 for a detailed breakdown of farmers based on their overall training effectiveness levels.

**Table 5:** Overall Effectiveness of Training Distribution of Farmers

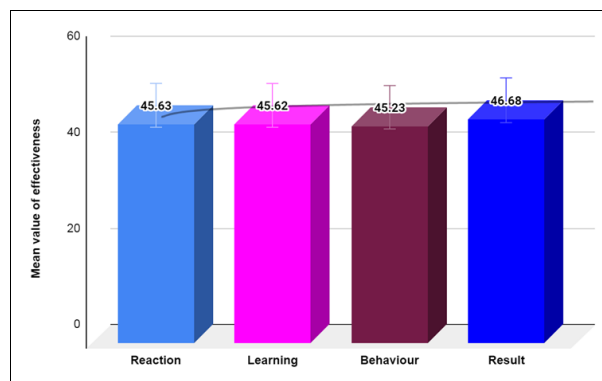
Categories	Farmers		Mean	Standard deviation	Max/Min
	Numbers	Percentage			
Low	23	11.80	183.21	38.12	Max= 237 Min= 65
Medium	154	80.21			
High	15	7.81			
Total	192	100			

Based on the data in Table 5, a substantial majority of farmers (80.21%) rated the training effectiveness at a medium level. In contrast, 11.80% found it ineffective, while only 7.81% deemed it very effective. This indicates that a significant proportion of farmers (88.02%) had a medium to high opinion of the sericulture cultivation training.

The majority of farmers in the medium group (80.21%) felt that the training significantly improved their knowledge, skills, and attitudes, possibly due to better access to resources or effective application of learned skills. Conversely, the low-effectiveness group (11.80%) suggests limited improvement in knowledge, abilities, or attitudes, potentially due to poor training techniques, a lack of

motivation, or difficulties in applying acquired skills. The high-effectiveness group (7.81%) experienced a lower impact, suggesting the training may not have been as effective, possibly due to their existing high knowledge level or a mismatch with their specific needs.

Participants' perception of the mean values was one of striking similarity across all four levels. Training effectiveness was measured across four levels: reaction, learning, behavior, and results. Scores were consistent at around 45.5, except for results at 46.7. Figure 1 details the program's overall effectiveness.



**Fig 1:** Distribution Effectiveness of Training of Sericulture Farmers at Different Levels

**Training Effectiveness Ranked by Indicator**

The Training Effectiveness Index (TEI) is crucial for measuring the success and impact of training programs within an organization. Without an effective TEI, organizations may struggle to evaluate their training programs' success and identify areas for improvement. This study found that the TEI values for Kirkpatrick's four levels, 'Reaction,' 'Learning,' 'Behavior,' and 'Result' ranged from 693 to 807, 653 to 796, 518 to 808, and 686 to 838, respectively. The potential data range for each case was 192 to 960 (refer to Tables 6 to 9). The legends utilized in Tables 6 to 9 are as follows: SA represents Strongly Agree, A represents Agree, UD represents Undecided, DA represents Disagree and SD represents Strongly Disagree.

**Table 6:** Rank Order of the Effectiveness Indicators of Training on Reaction Level

Sl. No.	Statements	Extent of opinion					TEI Total	Rank Order
		SA* 5	A* 4	UD.* 3	D* 2	SD* 1		
1	I am satisfied with reception and registration process	51	135	3	0	3	807	1
2	I am satisfied with the course content	78	82	11	13	8	785	2
3	I am satisfied with the course time.	38	121	10	11	12	738	3
4	I am satisfied with the educational equipment.	41	113	9	18	11	731	4
5	I am satisfied with the instructors' teaching and confident in their expertise	49	96	14	21	12	725	5
6	I am satisfied with the trainer's responsiveness to trainee questions and issues	43	101	17	19	12	720	9
7	I am satisfied with the trainer's delivery and elucidation of the training materials	38	110	17	14	13	722	7
8	I am satisfied with the instructors' discipline in educational activities, like timing	42	103	21	12	14	723	6
9	I am satisfied with the trainer's ability to build positive relationships with participants	34	119	11	14	14	721	8
10	I am content with the training service quality for trainees	35	103	25	12	16	707	10
11	I am satisfied with the performance of the training center staff	19	129	10	18	16	693	12
12	I am satisfied with fairness of the course exam (pre & post-test)	22	120	18	18	14	694	11

**Table 7:** Rank order of The Indicators of Effectiveness of Training on Learning Level

Sl. No.	Statements	Extent of opinion						Rank Order
		SA* 5	A* 4	UD.* 3	D* 2	SD* 1	TEI Total	
1	I have learned newly released mulberry and silkworm variety	45	138	1	8	0	796	1
2	I learned updated information about silkworm rearing technology	69	79	4	37	3	750	3
3	I have learned about modern mulberry cultivation system	48	116	2	19	7	755	2
4	I learned the importance of temperature and environment in silkworm rearing.	48	107	3	26	8	737	7
5	I learned the appropriate timing and amount for fertilizing and irrigating mulberry fields.	51	106	4	24	7	746	4
6	I learned about the prevention and treatment of various diseases and pests of mulberry and silkworm.	49	108	3	24	8	742	5
7	Learned about the many beneficial uses of surplus and waste produced during silkworm rearing	42	111	5	24	10	727	8
8	Learned the method and importance of cleanliness in silkworm rearing	43	114	9	14	12	738	6
9	Learned about mulberry fruit nutrition and mulberry intercropping to meet family nutritional needs	33	114	7	29	9	709	11
10	I am satisfied with theoretical and practical sessions of the training	41	106	6	29	10	715	10
11	The concept became more apparent to me after receiving the training	38	113	8	23	10	722	9
12	Capable of comparing traditional and modern sericulture technologies	13	122	5	33	19	653	12

**Table 8:** Rank Order of the Indicators of Effectiveness of Training on Behavior Level

Sl. No.	Statements	Extent of opinion						Rank Order
		SA* 5	A* 4	UD.* 3	D* 2	SD* 1	TEI Total	
1	Changed old or traditional concepts on mulberry cultivation and silkworm rearing	54	131	0	7	0	808	1
2	I Dig the soil in the mulberry at the right time	71	87	0	30	4	767	2
3	I Apply proper amount of fertilizer and irrigation to mulberry land	59	104	0	23	6	763	3
4	I prune the mulberry tree with the correct method and time.	52	101	0	30	9	733	4
5	During silkworm rearing a certain amount of silkworm is reared in each tray	53	97	0	32	10	727	6
6	I control the temperature and environment of the room depending on the age of the silkworm	44	110	0	30	8	728	5
7	I follow the hygiene of the entrance to silkworm rearing room	40	104	0	38	10	702	10
8	My confident and farming skill has been improved	37	107	2	33	13	698	11
9	Quality and quantity of my work has improved	42	113	1	25	11	726	7
10	I am capable to identify lacks & problems and to overcome farming problems of sericulture cultivation	38	110	1	33	10	709	9
11	My sericulture technology proficiency has improved, and I now offer guidance to others for better farming practices	38	117	0	25	12	720	8
12	My leadership and technology dissemination skills have improved, and I encourage others to adopt modern sericultural practices	12	112	0	42	26	518	12

**Table 9:** Rank Order of the Indicators of Effectiveness of Training on Result Level

Sl. No.	Statements	Extent of opinion						Rank Order
		SA* 5	A* 4	UD.* 3	D* 2	SD* 1	TEI Total	
1	I got the best yield of mulberry leaves.	63	101	2	20	6	771	3
2	I got the best cocoon yield.	72	119	0	1	0	838	1
3	I got the best market price of cocoons	55	101	3	26	7	747	5
4	The mortality rate of silkworm during rearing is decreasing	59	101	2	24	6	759	4
5	I harvested the best size and shape of cocoon	45	109	2	26	10	729	8
6	As a result of receiving the training, my income from sericulture has increased	70	94	5	22	1	786	2
7	I think as per training, the unnecessary production cost has been minimized	46	112	3	22	9	740	7
8	My socio-economic status has been improved	42	112	2	25	11	725	10
9	After received training my efficiency improvements have significantly reduced the time it takes to complete silkworm rearing tasks	47	111	2	24	8	741	6
10	Mulberry and silkworm diseases & pests have been reduced as a result of training	40	117	1	24	10	729	8
11	My health and nutritional status has been improved	36	117	3	26	10	719	11
12	Mentally I became interested in more commercial sericulture in the future.	27	110	14	28	13	686	12

Evaluating the effectiveness of employee training programs is crucial for any organization. To measure the efficacy of such programs, multiple indicators are used, such as business impact, behavior change, and learning transfer. Business impact measures how the training has positively affected business outcomes, while behavior change assesses

whether employees are applying their newfound knowledge and skills in their work. Learning transfers gauge how well employees can transfer their training to their jobs. Although participant satisfaction and attendance rates are also used as indicators, they may not always correlate with business impact. Therefore, organizations must use various indicators

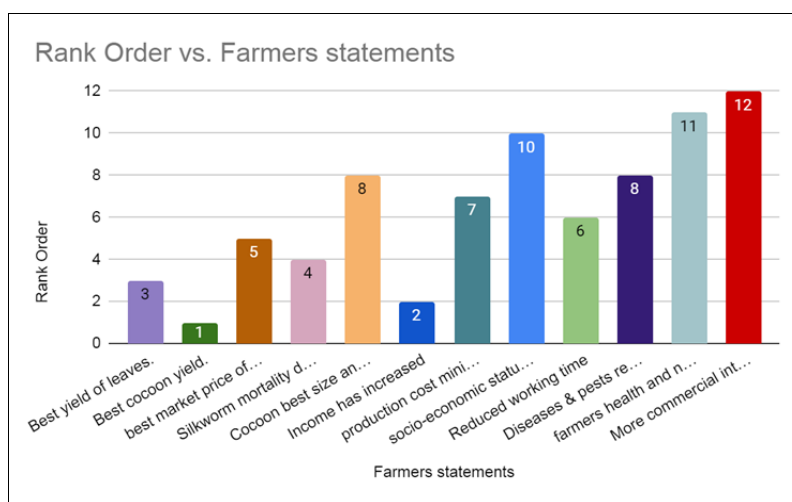
to ensure that their training programs are effective and make the necessary adjustments to achieve the desired results.

Table 9 displays the rank-order results of farmers' responses regarding the changes they have experienced after receiving training in sericulture. The table presents a list of indicators reflecting the benefits of the training, which are ranked in order of perceived importance or impact on the farmers' level of sericulture.

The data shown in Table 9 summarizes that the rankings of sericulture training indicators suggest that farmers who undergo such training experience significant benefits. The top indicator emphasizes improved cocoon yield, indicating that trained farmers outperform their non-trained counterparts. Subsequent rankings highlight positive effects on farmers' income, mulberry leaf yield, reduced silkworm

mortality, better market prices for cocoons, increased efficiency, and minimized production costs. Additionally, training contributes to disease and pest management, the production of high-quality cocoons, improved socioeconomic status, and enhanced health and nutritional well-being. While the least essential indicator pertains to increased interest in commercial sericulture among trained farmers, it suggests a positive shift in attitudes without a substantial impact on production or economic outcomes (Figure 2). Overall, the rankings underscore the multifaceted advantages of sericulture training for farmers.

Similar findings are reported in studies by Asfaw *et al.* (2012) [21], Bhullar *et al.* (2016) [22], Ali *et al.* (2018) [23], Mvena *et al.* (2014) [24], Karugia *et al.* (2017) [25], Kumar *et al.* (2017) [26], IFAD (2015) [27], and CGIAR (n.d.) [28].



**Fig 2:** Rank Order of the Indicators of Effectiveness of Training on Result Level

## Conclusion

The training program for sericulture has helped farmers improve their production processes and economic status. The top-ranked indicators include obtaining better market prices for cocoons and becoming more efficient in rearing silkworms. The training has also helped reduce production costs, manage pests and diseases, produce high-quality cocoons, and improve overall well-being and nutritional status. The program has positively impacted farmers' attitudes and interest in commercial sericulture. The training effectively improved the farmers' performance and provided them with the necessary knowledge and skills to enhance their practices in sericulture.

## Limitations and potential areas for future research

The study was limited to one upazila in order to evaluate the impact of training on their sericulture cultivation. Consequently, the findings may not reflect the picture of the entire country. In the future, this sort of research may be expanded to cover additional regions across the entire country, enabling the acquisition of comprehensive information on this subject.

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## References

- Swanson BE, Rajalahti R. Strengthening agricultural extension and advisory systems: Procedures for assessing, transforming, and evaluating extension systems. World Bank; c2010.
- Ali MY, Hossain MA, Rashid MA, Sattar MA, Matin MA. Impact of training on agricultural productivity: An empirical analysis of rice farmers in Bangladesh. *J Agric Rural Dev Trop Subtropics*. 2015;116(1):1–10.
- Hasan SMZ, Miah MM, Rahman MM, Hossain MM. Impact of training program on knowledge level of paddy farmers regarding organic farming practices. *Agric Food Secur*. 2018;7(1):1–9.
- Feder G, Nigatu A, Asfaw S. Agricultural extension services and technology adoption in Ethiopia. *Am J Agric Econ*. 2020;102(2):579–603.
- Sadashivappa P, Biradar S. Impact of agricultural extension services on farming practices and crop productivity in Karnataka, India. *Int J Agric Ext Rural Dev Stud*. 2016;3(2):61–68.
- Islam, Rahman MS, Akhtar F. Continuous skill development among Bangladeshi sericulture farmers: A comprehensive study. *J Seric Res*. 2017;7(3):215–230.
- Islam, Alam MS, Asaduzzaman M. Sericulture: An emerging industry in Bangladesh. *J Seric Res*. 2019;9(2):123–137.
- Rahman A, Akter F, Ali MA. Challenges and opportunities in Bangladeshi sericulture: A

- comprehensive review. *Int J Seric*. 2021;10(1):45–62.
9. Bangladesh Sericulture Development Board (BSDB). *Sericulture development in Bangladesh [Annual report]*. Dhaka: Bangladesh Sericulture Development Board; c2009.
  10. Morton A, Sinha S. An appraisal of the sericulture sector of BRAC Project proposal for rural development program. [Cited in Halder, S. R. 1999. Viability of sericulture programme of BRAC: Results of a cost–benefit analysis. *Bangladesh J Agric Econ*. 1995;XXII(2):99–116.]
  11. Chowdhury MA, Haq S, Islam MN. Impact of COVID-19 on the silk industry in Bangladesh. *Int J Textile Leather Ind*. 2021;12(4):202–210.
  12. Das J, Halder S. *Advancement of GI-science and sustainable agriculture: A multidimensional approach*. Academic Press Publishers; c2019. pp. 124–129.
  13. Bangladesh Sericulture Development Board (BSDB) *Annual Report 2019-2020*. Dhaka, Bangladesh: Author; c2020.
  14. Sarkar DP. Sericulture development in Bangladesh: Opportunities and challenges. *Int J Recent Sci Res*. 2018;9(8):30659–30662.
  15. Roy S, Mondal SK. Impact of improved management practices on cocoon production and quality in mulberry sericulture. *J Entomol Zool Stud*. 2022;10(2):372–375.
  16. Central Silk Board (CSB). *Training Manual for Sericulture Development Officers*. Bangalore, India: Author; c2021.
  17. Rahmathulla VK, Srinivasa G, Vindhya GS. Impact assessment of need-based training programmes in sericulture. *J Seric Technol*. 2012;3(1&2):73–76.
  18. Rahman A, Akhtar F, Ali MA. Training initiatives and productivity in Bangladeshi sericulture: A contemporary analysis. *Int J Agric Stud*. 2021;11(2):145–162.
  19. Bholahat Sericulture Nursery. In Wikipedia. Retrieved July, 2021, from <https://bn.wikipedia.org/s/9aco>
  20. Kirkpatrick DL. *Evaluating training programs*. 2nd ed. Berrett-Koehler Publishers; 1998.
  21. Asfaw S, Shiferaw B, Simtowe F, Lipper L, Abate T. Impact of modern agricultural technologies on smallholder welfare: Evidence from Tanzania and Ethiopia. *Food Policy*. 2012;37(3):283–295. <https://doi.org/10.1016/j.foodpol.2012.02.013>
  22. Bhullar GS, Bajwa HK, Saini SS. Impact of organic farming training on the profitability of small farmers in Punjab. *Indian Journal of Agricultural Economics*. 2016;71(1):109–119.
  23. Ali MA, Seyoum T, Mengistu MG. Yield and economic benefits of seed potato production under smallholder farmers' conditions in Ethiopia. *Afr J Agric Res*. 2018;13(48):2692–2702.
  24. Mvena ZSK, Msaki MM, Makungu MT. Improved postharvest management practices of vegetable crops in Tanzania: A case of smallholder farmers. *Journal of Agricultural Extension and Rural Development*. 2014;6(3):85–94.
  25. Karugia JT, Mureithi JG, Kamau MW. Enhancing the marketing and entrepreneurship skills of smallholder farmers: A case study of the dairy industry in Kenya. *Journal of Development and Agricultural Economics*. 2017;9(8):212–219.
  26. Kumar P, Ram J, Saravanakumar R. Impact of mobile-based farm management tools on productivity and efficiency of farmers: Evidence from Bangladesh. *Agricultural Economics Research Review*. 2017;30(1):1.
  27. International Fund for Agricultural Development (IFAD). *Enhancing the Competitiveness of Smallholder Agriculture: A Guide to Competitive Smallholder Agriculture in the 21st Century*. <https://www.ifad.org/documents/10180/7c9b38d5-7cbf-4b34-a4eb-97b73540fc4a>.
  28. CGIAR. *Education and Training*. <https://www.cgiar.org/research/education-and-training/>