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Analysis of profitability and employment generation potential of silk cocoon production: A case of Nainital District of Uttarakhand

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Abstract

The study assesses the profitability and employment potential of silk cocoon production in Nainital, Uttarakhand, where sericulture supports small and marginal farmers. Based on data from 60 producers in 2022-23, it compares costs and returns with and without government support. Assistance reduces cocoon production costs by 38.8% per DFL, mainly by lowering fixed costs. Farmers without support face net losses (-₹2,930), while supported farmers earn ₹10,755. The returns-expenditure ratio rises from 0.92 to 1.49 with support. Each farm generates 56.27 man-days of employment, with silkworm rearing accounting for over 73%. Sustaining sericulture as a rural livelihood requires continued policy support, including subsidies, infrastructure, and training.

Keywords: Silk cocoon production, profitability, employment, sericulture, government assistance Nainital, mulberry

Introduction

Silk, the product of sericulture and often called the 'Queen of Textiles,' is a natural protein filament fiber known for its remarkable properties such as natural luster, innate affinity for dyes, and excellent absorbency. It is woven into a variety of textiles. India is the second-largest producer of silk after China (ISC, 2021). The country manufactures a wide range of silk-based products such as garments, yarns, carpets, shawls, scarves, sarees, cushions, and accessories from raw silk. Due to high global demand, India exports its silk products to more than 30 countries, with the USA being the largest importer, followed by the UAE.

India is the only country that produces all four major types of silk—mulberry, eri, tasar, and muga. Among these, mulberry silk (produced by *Bombyx mori*) is the most commonly reared, as the worms feed on mulberry leaves. Karnataka is the leading silk-producing state in India. However, Uttarakhand is unique as the only state that produces all four types of silk. It is also known as the 'Bowl of Bivoltine Silk of India' for its high-quality bivoltine cocoons of international standards (Uttarakhand Sericulture Department, 2017) [47].

Sericulture is an eco-friendly, labor-intensive rural cottage industry that offers supplementary income and employment opportunities, particularly to economically weaker rural households (Tariq, 2014) [46]. It is well-suited to small and marginal farmers with surplus labor, especially women and children (Alderman, 1987) [1]. To promote sericulture, the Government of India has launched several initiatives, including the 'Silk Samagra' program (2017-2020), implemented through the Central Silk Board. The program aimed to boost domestic silk production, reduce import dependency, and support activities such as nurseries, chawki rearing, and the development of improved mulberry varieties.

Sericulture comprises three components: mulberry cultivation (moriculture), silkworm rearing, and post-cocoon processes. Cocoon production is a technical process that requires skilled labor. Due to variations in skill levels and resource usage, farmers experience different levels of output and profitability, leading to diverse cost structures. As a labor-intensive industry, sericulture holds substantial potential for generating income and employment for both skilled and unskilled workers. It can contribute to reducing rural labor outmigration and alleviating poverty.

However, to effectively promote sericulture, it is essential to systematically estimate the associated costs and returns. The absence of such data hinders effective policy formulation and support. In Uttarakhand, despite the significant potential of sericulture—particularly in cocoon production—very limited data is available. Therefore, this study was undertaken to estimate the costs, returns, income, and employment generated through silk cocoon production.

Materials and Methods

This study was conducted in Nainital district, Uttarakhand. Two blocks—Kotabag and Ramnagar—were purposively selected. Silk cocoon-producing villages were identified with the help of block-level officials and research or extension centers. A pooled list of producers was prepared, and 60 producers were randomly selected using a random number table. Data for the year 2022-23 were collected through personal interviews using a pre-tested survey schedule, which covered costs and returns from mulberry cultivation, its maintenance, and cocoon rearing.

In Uttarakhand, sericulture is practiced as a secondary occupation, primarily through bund cultivation of mulberry. To promote this activity, the government enrolls farmers under Central Sector Schemes such as the SC-ST Sub-Plan and the Tribal Sub-Plan Bi-voltine Sericulture Schemes. Eligible farmers must possess at least one acre of land, an SC certificate, domicile status, a voter ID, an Aadhaar card, and a passport-sized photograph. Many participants submitted ancestral land records during enrollment. Farmers with one to two acres of land can cultivate mulberry efficiently with relatively low investment and enjoy year-round family employment (Pathare *et al*., 2021) [19]. Enrolled farmers received free items including a rearing house, pruning kit, trays, mountages, nets, and cash support for FYM, fertilizers, insecticides, and disinfectants. The S146 mulberry variety was supplied at ₹6 per plant, and Disease-Free Layings (DFLs) at ₹1 each by the Sericulture Department.

The art of silkworm rearing involves three primary activities: establishing mulberry plantations, maintaining them, and rearing silkworms for cocoon production. Costs were estimated under each of these three components. Returns were calculated from the sale of silk cocoons and by-products, along with employment generated at each stage. Since mulberry leaves suitable for silkworm feeding become available only one year after planting, one year's maintenance cost was included in the establishment costs. Once established, plantations yield continuously for 15-20 years with minimal maintenance (Savithri *et al*., 2013) [36, 37].

Cost of Production and net returns

As a significant portion of the costs is borne by the government, the costs and returns of the enterprise were assessed by estimating all associated expenses at various stages, both with and without government assistance.

Fixed Costs: These included the cost of saplings, land rent, and depreciation on the rearing building and various equipment used in sericulture.

Variable Costs: These comprised wages for human labour, expenditure on farmyard manure (FYM), chemical fertilizers, insecticides, the cost of mulberry leaves, disinfectants, transportation, the cost of disease-free layings (DFLs), miscellaneous expenses, and interest on working capital.

Returns: Gross and net returns were estimated by considering income from both main and by-products as follows:

- **Gross Returns =** Returns from main product + Returns from by-products
- **Net Returns =** Gross Returns - Gross Cost

Profitability: Farm profitability was estimated using two measures:

- **Family Labour Income** = Gross Income - Total Expenditure + Imputed Wages of Family Labour
- **Farm Business Income** = Gross Income - Total Expenditure + (Imputed Wages of Family Labour + Interest on Working Capital)

Employment Generation

Employment generated through sericulture was assessed by accounting for all types of labour—men, women, and children—engaged in various activities such as moriculture, maintenance of mulberry plants, and silkworm rearing. Female and child labour were converted into male labour equivalents using appropriate conversion ratios.

The cost of cocoon production was estimated under different components, namely: establishment of mulberry plantations, maintenance of mulberry plants, and silkworm rearing (i.e., cocoon production).

Results and Discussion

The cost cocoon production was estimated under different heads, *viz.* establishment of mulberry plants, maintenance of mulberry plants, and rearing of silk worms i.e. cocoon production.

Establishment Cost of Mulberry Plantation

The cost of establishing a mulberry plantation was assessed under two distinct scenarios: without assistance and with assistance from the sericulture department. The major cost components included human labour, planting material, farmyard manure (FYM), insecticides, fertilizers, and interest on working capital.

As shown in Table 1, the total establishment cost without assistance was ₹8,143, whereas it decreased to ₹5,866 with assistance, indicating a cost reduction of ₹2,277 (27.97%) due to government support. These findings clearly suggest that such assistance significantly reduces the cost burden on mulberry farmers. The provision of subsidized or free inputs like farmyard manure (FYM), fertilizers, and insecticides plays a vital role in lowering overall establishment costs.

These results are consistent with the findings of Sannappa and Madegowda (2013) [34, 35], who, in their evaluation of the economics of sericulture, reported that input subsidies and institutional support reduced the cost of cultivation by 25-30% in Karnataka—comparable to the 27.97% reduction observed in the present study. Similarly, Raghuraman and Venkatesh (2016) [20] noted that government-assisted farms demonstrated improved input efficiency and reduced reliance on credit, owing to lower working capital requirements.

A breakdown of costs reveals that human labour accounted for the largest share of establishment costs in both scenarios. Labour costs remained constant at ₹3,114 for 9.58 man-days in both cases. However, its share in total cost increased from

38.24% to 53.09% under the assisted scenario due to a reduction in the costs of other inputs. This high labour cost is understandable, as the establishment process involves intensive manual work, including pit digging, sapling plantation, pruning, and input application. These findings are corroborated by the study of Architha and Murthy (2022) [2], which similarly found that labour constituted the highest share of establishment costs in mulberry gardens. Their study highlighted the labour-intensive nature of mulberry cultivation and confirmed that a major portion of establishment expenses arises from manual operations essential for preparing plantations and maintaining plant health during the early stages.

The cost and quantity of mulberry saplings remained constant at ₹1,800 for 300 plants, as they were uniformly supplied by the state sericulture department. However, their proportion in the total cost increased from 22.10% to 30.69%, again reflecting the overall decline in other input costs.

Expenditure on FYM showed a significant decrease—from ₹980 to ₹80 per farm—primarily due to subsidies or direct government supply. This led to a decline in its cost share from 12.03% to just 1.36%. Insecticide costs, which stood at ₹700 (8.60%) in the unassisted case, were fully subsidized (₹0) under the assisted scenario. Fertilizer costs also declined, from ₹1,274 to ₹674, with a corresponding drop in their share from 15.65% to 11.49%. Thus, a notable difference was observed in the expenditure on key inputs such as FYM, insecticides, and fertilizers. Nataraju (2011) [17] emphasized the role of input support schemes in encouraging mulberry cultivation, highlighting that reduced initial costs enhanced adoption among small and marginal farmers. Likewise, a recent study by Kumar and Devi (2020) [10, 11] found that government schemes under sericulture missions improved economic viability by reducing non-labour costs, further validating our findings related to FYM and fertilizer expenditure.

In conclusion, government assistance played a crucial role in reducing the establishment costs of mulberry plantations by subsidizing key inputs like FYM, fertilizers, and insecticides. Nevertheless, labour remains the dominant cost component. These findings, in line with earlier research, underscore the importance of targeted policy interventions in promoting cost-effective and sustainable sericulture practices among smallholder farmers.

Maintenance of mulberry garden

Mulberry cultivation forms the foundation of sericulture, directly influencing cocoon yield and profitability. Proper maintenance of mulberry plantations ensures a consistent supply of high-quality leaves, which in turn supports silkworm health and cocoon production. Analyzing the cost structure of maintenance provides valuable insights into the financial requirements and input efficiency at the farm level.

Table 2 presents the annual per-farm maintenance cost for mulberry plantations. A glance at the table reveals that the total cost incurred for maintaining the plantation was ₹6,404 per year. Among the components, the rental value of land accounted for the highest share at ₹3,714 (58.00%), indicating that land remains a major resource cost for farmers. The dominance of rental value in the total cost aligns with the findings of Rao *et al*. (2013) [24] and Krishnaswami (1994) [9], who emphasized that land cost is a significant determinant of sericulture viability, particularly in regions with high land values.

Human labour, involving 5.29 man-days per year, ranked second in cost components, contributing ₹1,719 (26.84%) to the total cost. This underscores the importance of labour in carrying out essential cultural and maintenance operations such as weeding, pruning, irrigation, and manure application. The labour cost, accounting for over one-fourth of the total expenditure, aligns with the findings of Hogade *et al*. (2017) [8], who reported that labour—particularly for intercultural operations and irrigation—is a critical component in sericulture.

The cost of fertilizers was ₹674 (10.52%), representing a moderate but vital input for plant nutrition and growth. Farmyard manure (FYM), though important for maintaining soil fertility, contributed only ₹80 (1.25%) to the overall cost. This combination of moderate expenditure on fertilizers and minimal cost for FYM suggests an economically efficient nutrient management strategy. This trend supports the observations made by Reddy and Reddy (2003) [29, 32], who recommended an integrated use of organic and inorganic inputs to minimize recurring costs.

The survival rate of mulberry saplings was 85% (255 out of 300), indicating a strong establishment of plantations under existing conditions. This high survival rate reflects effective plantation care and the adaptability of mulberry to the local agro-climatic environment, consistent with the success rates reported by Dandin *et al*. (2007) [7] for rainfed mulberry farming under standard packages of practices.

Overall, the analysis highlights that the rental value of land and labour are major cost drivers in mulberry maintenance. Effective labour management and judicious input use can enhance cost-efficiency. The observed cost structure and high sapling survival rate align with previous studies, reinforcing the economic and biological feasibility of mulberry cultivation in sericulture systems.

Cost of mulberry leaf cultivation

The total cost of mulberry leaf cultivation in any given year comprises two components: the annual share of the establishment cost of the mulberry plantation and the maintenance cost of the mulberry plants. The entire cost of leaf cultivation was assumed to represent the cost of the leaves harvested for feeding silkworm larvae, and this was considered common to both scenarios— with and without government assistance. This section examines and compares the costs involved in mulberry leaf cultivation on per farm, per year basis under both conditions.

As shown in Table 3, notable differences were observed in the cost structure between the two scenarios. The total establishment cost of a mulberry plantation without government assistance was ₹8,143 per farm, whereas with assistance, it significantly reduced to ₹5,866—resulting in a cost saving of ₹2,277 (27.97%) due to subsidies or input support. When annualized, the amortized share of the establishment cost declined from ₹956 to ₹689 under the assisted scenario, indicating a 27.91% reduction in the yearly financial burden on farmers. Reddy *et al*. (2016) observed that financial assistance led to a 25-30% reduction in the establishment costs of sericulture-related activities, thereby facilitating quicker adoption among smallholders.

Similarly, Basavaraja *et al*. (2005) [3] reported that amortization of the initial investment significantly influenced annual profitability in sericulture, and any support to reduce this component improved the viability of the enterprise.
Interestingly, the cost of maintenance remained constant at ₹6,404 per year per farm, regardless of government assistance. This indicates that maintenance inputs—such as labour, irrigation, and manure—were not covered under the assistance component.
When amortization and maintenance costs are combined, the total annual cost amounted to ₹7,360 without assistance and ₹7,093 with assistance, reflecting a modest annual saving of ₹267 (3.63%) per farm due to a reduced establishment burden.
These findings highlight that government assistance has a tangible effect in lowering the capital burden associated with establishing a mulberry plantation. However, since maintenance costs remain unchanged, the overall reduction in annual expenditure is relatively limited. This suggests that while financial support facilitates the initial setup of plantations, long-term sustainability hinges on efficient management practices. Singh and Subrahmanian (2018) [38] also observed that although input subsidies reduce entry barriers, maintenance efficiency and plant survivability are critical for realizing long-term benefits—supporting the present study's observation that fixed maintenance costs constrain total cost reduction.
The analysis clearly emphasizes the beneficial role of government support in decreasing the establishment cost of mulberry plantations. Nevertheless, to enhance its overall impact, policies should consider extending partial support to maintenance inputs and promoting capacity building for improved plant care and survivability. Such a dual approach could result in greater economic returns and encourage the sustained adoption of sericulture practices.

Cost of silk cocoon production

Sericulture, particularly silkworm rearing, is a labor-intensive and profitable agro-based industry that provides supplementary income and employment to rural households. The enterprise involves substantial expenditure on fixed assets. To support its development, the Government of India and state authorities have actively promoted sericulture by providing subsidies for rearing infrastructure, inputs, and training. In this context, the present analysis estimates and compares the cost structure of silkworm rearing enterprises under two scenarios—with and without government assistance. For estimating the cost of cocoon production, the standard classification of fixed and variable costs was used; however, under the assisted scenario, fixed costs were not considered.
The comparative analysis of the silkworm rearing cost structure (Table 4) reveals a significant difference in both fixed and variable costs. Fixed costs were completely eliminated under the government assistance scenario, as beneficiaries received subsidies or full support for permanent investments such as rearing buildings and equipment. In the absence of assistance, the fixed cost amounted to ₹13,243 per farm per year, comprising 37.53% of the total cost. Among the fixed components, interest formed the highest share at ₹11,145 (31.59%), while depreciation on rearing buildings and equipment contributed ₹2,098 (5.94%).
Under the 'with assistance' scenario, the entire cost of ₹21,600 comprised only variable components, although the absolute variable cost was slightly lower compared to the 'without assistance' scenario (₹21,600 vs ₹22,042). Notably, expenditure on human labor remained constant at ₹13,455; however, its share in the total cost increased significantly from 38.13% to 62.29%, owing to the absence of fixed costs. The cost of mulberry leaves slightly declined with assistance (from ₹7,360 to ₹7,093). Expenses on disinfectants were recorded only in the 'without assistance' group, possibly indicating that disinfectants were supplied under the government support scheme.
The cost of cocoon production per DFL significantly reduced from ₹371.42 (without assistance) to ₹227.37 (with assistance), indicating a substantial cost saving of 38.8% due to public intervention. These findings are consistent with earlier studies highlighting the positive economic impact of governmental support on sericulture. Ramesh *et al*. (2014) [21, 22] observed that assistance in the form of building subsidies and input support reduced the burden of fixed investments, thereby increasing net income and profitability in silkworm farming. Similarly, Sivaprasad and Venugopalan (2016) [39, 40] reported a reduction in unit production costs under government-aided farms in Karnataka, attributing the outcome to subsidized inputs and improved training. According to the Central Silk Board (2020) [4], beneficiaries of the Catalytic Development Programme (CDP) demonstrated improved returns due to lower costs of DFLs, equipment, and disinfectants. The present results also align with the findings of Kumaresan and Amudha (2012) [12], who reported that the removal of fixed capital burdens significantly enhanced the economic viability of sericulture among smallholder farmers.
Overall, the analysis indicates that government assistance plays a vital role in improving the economic feasibility of silkworm rearing. By eliminating fixed costs and reducing per-unit production costs, such support enhances profitability and promotes the wider adoption of sericulture among rural farmers. Continued investment in infrastructure support, input subsidies, and training programs is essential to sustain and expand sericulture-based livelihoods.

Return from sericulture

Sericulture has emerged as a sustainable livelihood option for small and marginal farmers, particularly in rural and hilly regions of India. As a labour-intensive, agro-based industry, it offers periodic income through cocoon production and valuable by-products. Silkworm rearing primarily yields cocoons, while also generating various types of cocoons (reeling, double, damaged) and secondary products like leftover mulberry leaves, twigs, and litter—used as fodder, firewood, or compost. This section evaluates per-farm economic returns from both direct (cocoon) and indirect (by-product) incomes, along with a cost-return comparison under two scenarios—with and without government assistance.
Table 5 shows that nearly two-thirds (65.07%) of gross returns came from cocoon sales (₹21,052 per farm), while by-products contributed ₹11,303 (34.93%). Leaves were retained for cocoon production and other by-products were

fully utilized by farm families (Architha and Murthy, 2022) [2]. By-product returns were nominally estimated.

The analysis indicates a clear benefit from government support. While gross income was unchanged across scenarios, notable differences emerged in cost and net returns. Without assistance, net returns were negative (-₹2,930), indicating unviability. In contrast, assisted farms earned a net return of ₹10,755, proving economic feasibility. Profitability improved significantly, with the return per rupee of expenditure rising from 0.92 to 1.49—a 62% increase. Estimates of Family Labour Income and Farm Business Income also nearly doubled with support, showing greater income potential for farm households.

The gross income per farm was ₹32,355—₹21,052 (65.07%) from cocoons and ₹11,303 (34.93%) from by-products. Net returns varied widely: in the absence of assistance, farmers lost ₹2,930; with support, they gained ₹10,755. Family Labour Income increased from ₹12,610 (without support) to ₹26,295 (with support). Farm Business Income also rose, from ₹13,604 to ₹27,265. The benefit-cost ratio improved from 0.92 to 1.49, meaning each ₹1 spent generated ₹1.49 with support.

This aligns with earlier studies. Subramanya (2006) [41, 42] and Mahendra Dev (2012) [13, 14] observed that government interventions significantly boost rural livelihoods through sericulture. Vijaykumar *et al*. (2014) [48, 49] found that improved practices and institutional support raised incomes by over 40%. Similarly, Reddy and Reddy (2005) [30, 33] noted that access to credit, training, and subsidies enhanced returns and cost-efficiency. Reddy *et al*. (2013) [27, 28] and Suresh & Kiran (2017) [43, 44] also reported that subsidies reduced input costs and improved incomes. Ravindra and Devi (2020) [25] highlighted that training, credit, and infrastructure positively affect profitability and sustainability.

In short, silk cocoon production in Nainital district was unprofitable without assistance but marginally profitable with it. Returns based on family labour and farm business income suggest subsistence-level viability. However, at the current scale (95 DFLs per farm), commercial viability remains elusive. Achieving it requires higher investment and further research on optimal operational scale.

Government support in silkworm rearing not only lowers costs but also enhances income and efficiency. Without support, it is unsustainable; with subsidies, infrastructure, and training, it becomes a profitable rural livelihood option. This underscores the need for sustained public investment to promote sericulture as a viable livelihood for rural communities.

Employment generation

Sericulture, particularly mulberry-based silkworm rearing, is a highly labour-intensive agro-based activity that offers substantial employment opportunities in rural areas. The process encompasses multiple stages—namely, the cultivation and maintenance of mulberry trees and silkworm rearing—each requiring considerable manual effort. Recognizing its potential, sericulture has been extensively promoted in India not only as a source of income but also as a means of generating rural employment, particularly among small and marginal farmers and women. The following analysis presents the extent of employment generated through various operations involved in sericulture, measured in man-days per farm per year.

Activity-wise labour employment generated by sericulture is presented in Table 6. The table reveals that the establishment of a mulberry garden generated a total of 9.58 man-days per year, accounting for 17.03% of total employment. Within this category, the highest share came from digging and planting (3.52 man-days), followed by the application of FYM and other inputs (2.78), irrigation (2.06), and pruning/training (1.22 man-days). Activities related to the maintenance of mulberry trees contributed 5.29 man-days (9.40%), with key operations including pruning/training (2.26 man-days), input application (1.66), and irrigation (1.37).

Silkworm rearing, the most labour-intensive stage of the enterprise, generated 41.40 man-days (73.57%). This stage was primarily driven by tasks such as plucking of leaves (13.62 man-days), chopping (10.44), cleaning (8.36), feeding (6.88), and cocoon collection (2.10 man-days).

Overall, the sericulture enterprise generated a total of 56.27 man-days per farm per year, underscoring its significant employment potential in rural areas.

The analysis reveals that silkworm rearing alone accounted for nearly three-fourths (73.57%) of the total labour employment, underscoring its significance in generating rural work opportunities. The high man-day contribution highlights the intensive manual labour required for leaf handling and hygiene maintenance during the rearing process.

In contrast, mulberry cultivation—encompassing both establishment and maintenance—though relatively less labour-intensive, still contributed a substantial 26.43%, indicates the year-round labour demand necessary for sustainable leaf production.

These findings align with those of Reddy *et al*. (2015) [26, 31] and Nagaveni and Basavaraja (2001) [15, 16], who reported that sericulture generates over 50-60 man-days per acre annually, with the majority concentrated in the silkworm rearing phase. Similarly, Chowdhury *et al*. (2007) [5, 6] emphasized that sericulture can provide full-time employment to five persons per hectare per year, owing to its diverse activities. Studies by the Central Silk Board (2020) [4] also confirm that silkworm rearing demands meticulous care and consistent manual involvement, particularly during feeding and cleaning stages.

Overall, the study affirms that sericulture is a high-potential employment generator, particularly in labour-surplus rural areas. Its multifaceted operations—from field activities to indoor cocoon production—make it well-suited for engaging rural households, including women and the elderly, in productive economic activities.

Table 1: Establishment cost of mulberry plantation (Rs. per farm)

S. No.	Variables	Without assistance			With assistance		
		Quantity	Cost (Rs.)	Proportion (%)	Quantity	Cost (Rs.)	Proportion (%)
1	Human labour (Man days)	9.58	3114	38.24	9.58	3114	53.09
2	Mulberry Plant (No.)	300	1800	22.10	300	1800	30.69
3	FYM (Kg)	980	980	12.03	980	80	1.36
4	Insecticide (litre)	7	700	8.60	7	-	-
5	Fertilizers (Kg)	53	1274	15.65	53	674	11.49
6	Interest on working capital (Rs.)		275	3.38		198	3.38
	TOTAL		8143	100.00		5866	100.00

Note: On an average 300 mulberry saplings per farm were planted

Table 2: Maintenance of mulberry plantation (Rs. per farm per year)

S. No.	Variables	Quantity	Cost (Rs.)	Proportion (%)
1	Human labour (Man days)	5.29	1719	26.84
2	FYM (Kg)	80	80	1.25
3	Fertilizers (Kg)	33	674	10.52
4	Rental value of land (Rs.)	-	3714	58.00
5	Interest on working capital (Rs.)	-	217	3.39
	Total	-	6404	100.00

Note: Out of 300 saplings planted only 255 plants were survived per farm

Table 3: Cost of mulberry leaf cultivation (Rs. Per farm per year)

S. No.	Items	Without assistance	With assistance
1.	Total establishment cost of mulberry plantation	8143	5866
2.	Annual share of establishment cost (Amortization cost)	956	689
3.	Cost of maintenance of mulberry plantation	6404	6404
4.	Total cost	7360	7093

Note: Out of 300 saplings planted only 255 plants were survived per farm

Table 4: Cost of cocoon production (Rs. per farm per year)

S. No.	Variables	Without assistance		With assistance	
		Cost (Rs.)	Proportion (%)	Cost (Rs.)	Proportion (%)
A.	**Fixed Cost**				
1	Depreciation on rearing building	1098	3.11	-	-
2	Depreciation on rearing equipment	1000	2.83	-	-
3	Interest on fixed capital	11145	31.59	-	-
	Sub-Total Fixed Cost (A)	13243	37.53	-	-
B.	**Variable Cost**				
1	Human labour	13455	38.13	13455	62.29
2.	Cost of mulberry leaves	7360	20.86	7093	32.84
3.	Disinfectant	160	0.45	-	0.00
4.	Transportation Cost	152	0.43	152	0.70
5.	DFLs Cost	95	0.27	95	0.44
6.	Miscellaneous*	75	0.22	75	0.35
7.	Interest on working capital	745	2.11	730	3.38
	Sub-Total Variable Cost (B)	22042	62.47	21600	100.00
	Total (A+B)	35285	100.00	21600	100.00
C.	Cost of Cocoon production (Rs./DFL)	371.42	-	227.37	-

Note: On an average 95 DFLs silkworm per farm were reared

Table 5: Returns from Sericulture (Rs. per farm per year)

S. No.	Particulars	Quantity (kg/year)	Price (Rs./kg)	Value (Rs./farm)
A. Returns from Cocoons				
1.	Reeling Cocoon	40.73	512	20854 (64.45)
2.	Double Cocoon	0.90	150	135 (0.42)
3.	Damaged Cocoon	1.57	40	63 (0.19)
	Sub-total			21052 (65.07)
B. Returns from By-products				
1.	Leftover leaves (Fodder)	1798	2.77	4980 (15.39)
2.	Mulberry twigs (Fire Wood)	1753	3.48	6100 (18.85)
3.	Litter	52	4.29	223 (0.69)
	Sub-total			11303 (34.93)

C. Net Returns		Without assistance	With assistance
1.	Gross Income	32355 (100.00)	32355 (100.00)
2.	Total Cost (Rs.)	35285	21600
3.	Net Returns (Rs.)	-2930	10755
4.	Return per rupee expenditure	0.92	1.49
5.	Family Labour Income	12610	26295
6.	Farm Business Income	13604	27265

Note: On an average 95 DFLs silkworm per farm were reared

Table 6: Level of employment generated through sericulture (Man days per farm per year)

S. No.	Operations under silk rearing		Labour employment
A.	Establishment of mulberry garden	1. Labour for digging pit and planting	3.52 (6.26)
		2. Training and pruning	1.22 (2.17)
		3. FYM, insecticide and NPK application	2.78 (4.94)
		4. Irrigation	2.06 (3.66)
		Sub-Total	9.58 (17.03)
B.	Maintenance of the mulberry trees	1. Training and pruning	2.26 (4.02)
		2. FYM and NPK application	1.66 (2.95)
		3. Irrigation	1.37 (2.43)
		Sub-Total	5.29 (9.40)
C.	Rearing of silk worm	1. Plucking of leaves	13.62 (24.20)
		2. Chopping of leaves	10.44 (18.55)
		3. Feeding of leaves	6.88 (12.23)
		4. Cleaning	8.36 (14.86)
		5. Cocoon collection	2.10 (3.73)
		Sub-Total	41.40 (73.57)
	Total		56.27 (100.00)

Conclusion

The study concludes that sericulture, particularly silk cocoon production, offers significant potential for enhancing rural income and employment, especially among small and marginal farmers. However, its economic viability is highly contingent upon sustained government support. In the absence of such support, sericulture proves economically unviable, yielding negative net returns and a suboptimal benefit-cost ratio. Conversely, when accompanied by infrastructural, financial, and technical assistance, the enterprise becomes commercially viable, delivering substantial net returns and employment opportunities.

Government interventions notably reduce production costs, enhance profitability, and stimulate employment—particularly benefiting rural women through labor-intensive silkworm rearing. Additionally, income from by-products contributes meaningfully to total earnings, underlining the importance of resource utilization beyond cocoons. Despite its promise, the enterprise struggles to be profitable at scale without institutional backing, underscoring the need for expanded access to credit, training, and infrastructure.

Overall, the findings underscore the critical role of integrated, state-supported schemes in ensuring the commercial sustainability of sericulture. Continued public investment, especially in hill regions like Nainital, is essential for leveraging sericulture as a tool for rural development and livelihood enhancement.

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