

# Sericulture as a Sustainable Rural Enterprise: Quantitative Assessment of Production, Employment and Economic Benefits

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**Abstract** — Sericulture is an agro-based rural enterprise that integrates mulberry cultivation, silkworm rearing, cocoon production, silk reeling and value-added silk processing. Its importance extends beyond silk production because the sector provides employment, income diversification and livelihood opportunities for small and marginal farmers. India is the world's second-largest producer of raw silk and produced 38,913 MT in 2023–24, of which mulberry silk contributed 29,892 MT, while Tasar, Eri and Muga contributed 1,586, 7,183 and 252 MT, respectively. Estimated cumulative employment associated with the Indian silk sector reached 9.5 million persons in 2023–24. This review quantitatively examines sericulture as a rural enterprise by comparing production, employment, labour utilization, production costs, gross and net returns, benefit–cost ratios and technological interventions. Published farm-level studies demonstrate substantial economic potential. In Dharmapuri district of Tamil Nadu, the reported total cost of sericulture was ₹279,585.80 ha<sup>-1</sup>, gross income was ₹332,168.80 ha<sup>-1</sup> and net income was ₹52,583 ha<sup>-1</sup>, with a benefit–cost ratio of 1.37. Labour requirements were also substantial, particularly for women during mulberry maintenance and silkworm rearing. Recent evidence further demonstrates that structured training can significantly improve adoption of sustainable sericulture practices. Among 222 farmers in West Bengal, trained farmers recorded a knowledge score of  $94.12 \pm 6.35$  compared with  $74.33 \pm 8.21$  among untrained farmers, while adoption scores were  $71.31 \pm 9.42$  and  $53.00 \pm 10.18$ , respectively. The evidence indicates that sericulture can function as a sustainable rural enterprise when productivity-enhancing technologies, skill development, market access, labour availability and environmental management are integrated into production systems.

**Keywords**— Sericulture; silk production; rural livelihood; employment; income; economic benefits; mulberry; silkworm; sustainable agriculture; rural entrepreneurship

## I. INTRODUCTION

Rural livelihoods in developing economies frequently depend on agriculture and allied activities. However, small and marginal farmers face limitations related to land availability, rising input costs, climatic variability, labour shortages and fluctuating agricultural prices. Diversification into high-value, labour-intensive enterprises can therefore contribute to livelihood security.

Sericulture—the cultivation of host plants and rearing of silkworms for silk production—is one such enterprise. The activity encompasses a complete production chain beginning with mulberry or other host-plant cultivation and extending through silkworm rearing, cocoon harvesting, reeling, weaving and marketing.

The sector has particular importance in India because of its extensive rural employment base. According to the Ministry of Textiles, India produced 38,913 MT of raw silk during 2023–24, representing an increase from 36,582 MT in 2022–23. The area under mulberry plantation increased from 2.53 lakh ha in 2022–23 to 2.63 lakh ha in 2023–24. Estimated cumulative employment increased from 9.2 million to 9.5 million persons during the same period.

### Objectives of the Review

The review was undertaken to:

- Quantitatively examine trends in silk and cocoon production.
- Assess employment generation through sericulture.
- Compare the costs and returns associated with sericulture.
- Examine the role of labour, particularly women's labour, in the enterprise.

- Evaluate the contribution of technology and training to productivity and sustainability.
- Identify major constraints affecting the economic sustainability of rural sericulture.

## II. METHODOLOGICAL APPROACH

This review synthesizes quantitative information from peer-reviewed research, agricultural databases, institutional publications and Government of India reports.

The major quantitative indicators considered were:

- raw silk production,
- mulberry plantation area,
- employment,
- cost of production,
- gross income,
- net income,
- benefit–cost ratio,
- internal rate of return,
- labour utilization,
- knowledge scores,
- technology-adoption scores, and
- productivity-related indicators.

Particular emphasis was placed on studies from India, especially Tamil Nadu, Karnataka, Andhra Pradesh and West Bengal, because these regions represent important sericulture production systems.

## III. PRODUCTION STRUCTURE OF SERICULTURE

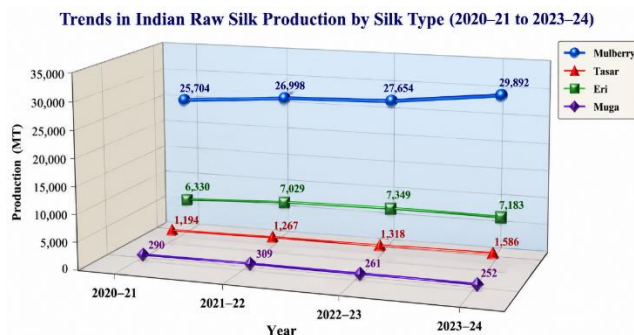
### 1. Mulberry and vanya silk

Indian silk production consists primarily of **mulberry, Tasar, Eri and Muga silk**. Mulberry remains the dominant category. In 2023–24, mulberry silk contributed approximately **76.82%** of India's raw silk production, while Tasar contributed 4.08%, Eri 18.46% and Muga 0.65%.

Table 2. Composition of Indian raw silk production in 2023–24

| Silk type | Production (MT) | Approx. share |
|-----------|-----------------|---------------|
| Mulberry  | 29,892          | 76.82%        |
| Tasar     | 1,586           | 4.08%         |
| Eri       | 7,183           | 18.46%        |
| Muga      | 252             | 0.65%         |
| Total     | 38,913          | 100%          |

The growth in bivoltine silk is particularly relevant because bivoltine silk is generally associated with higher-quality raw silk. Production increased from 8,904 MT in 2022–23 to 9,675 MT in 2023–24, representing an increase of 8.66%.



This indicates that technological improvement and quality-oriented production are becoming increasingly important components of the Indian sericulture economy.

## IV. ECONOMIC BENEFITS OF SERICULTURE

### 1. Cost, income and profitability

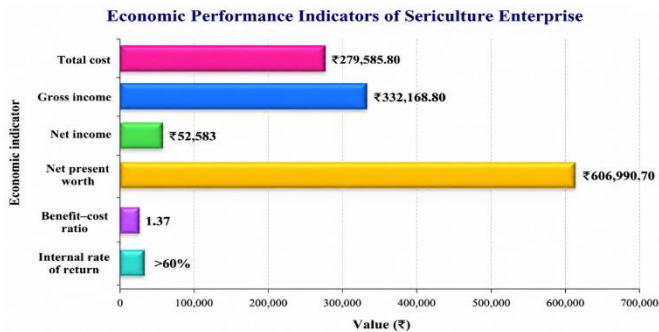
Sericulture is frequently characterized as a labour-intensive enterprise requiring comparatively limited land and offering periodic returns. However, profitability varies considerably according to location, technology, irrigation, labour costs, cocoon prices and productivity.

A farm-level study in Dharmapuri district, Tamil Nadu, reported a total cost of ₹279,585.80 ha<sup>-1</sup>, gross income of ₹332,168.80 ha<sup>-1</sup> and net income of ₹52,583 ha<sup>-1</sup>. The estimated benefit–cost ratio was **1.37**, while the internal rate of return was reported to exceed 60%.

Table 3. Economic indicators from a sericulture enterprise in Dharmapuri, Tamil Nadu

| Economic indicator      | Value                        |
|-------------------------|------------------------------|
| Total cost              | ₹279,585.80 ha <sup>-1</sup> |
| Gross income            | ₹332,168.80 ha <sup>-1</sup> |
| Net income              | ₹52,583 ha <sup>-1</sup>     |
| Benefit–cost ratio      | 1.37                         |
| Net present worth       | ₹606,990.70                  |
| Internal rate of return | >60%                         |

The difference between gross income and total cost demonstrates that the enterprise generated a positive economic return under the conditions studied.



However, these values should not be interpreted as a current national profitability estimate, because the study represents a particular location and period. Current profitability would depend on present labour costs, input prices, cocoon prices, productivity and market conditions.

### Employment Generation

#### Labour-intensive nature of sericulture

Employment generation is one of the strongest socioeconomic features of sericulture. Unlike some mechanized agricultural activities, sericulture involves repeated manual operations throughout the production cycle.

These include:

- land preparation,
- mulberry planting,
- irrigation,
- weeding,
- pruning,
- leaf harvesting,
- silkworm bed preparation,
- feeding,
- cleaning,
- disease management,
- cocoon harvesting,
- sorting,
- reeling and
- post-cocoon processing.

The Government of India estimated cumulative employment associated with sericulture at 9.5 million persons in 2023–24. A farm-level study from Dharmapuri provides further evidence of labour intensity. During establishment of the mulberry garden, the enterprise required 73.70 male labour-days and 78.91 female labour-days per hectare. During maintenance and silkworm rearing, labour requirements increased to 676.11 male labour-days and 923.83 female labour-days.

Table 4. Labour requirement reported in Dharmapuri sericulture

| Production stage                        | Male labour-days | Female labour-days |
|-----------------------------------------|------------------|--------------------|
| Mulberry garden establishment           | 73.70            | 78.91              |
| Garden maintenance and silkworm rearing | 676.11           | 923.83             |

The data indicate that women contributed substantially to labour requirements, particularly during maintenance and silkworm-rearing activities.

This feature gives sericulture potential as a household-based enterprise, although women's participation does not necessarily mean equal ownership, income control or decision-making power.

#### Sericulture and Rural Livelihood Diversification

Sericulture can contribute to rural livelihood diversification because it can be combined with other farming activities. Mulberry cultivation may be integrated into existing agricultural holdings, while silkworm rearing can be conducted in dedicated or modified household structures.

An ICAR study describes mulberry sericulture as a rural enterprise capable of generating family employment and providing periodic returns, particularly for marginal and small landholdings under irrigated conditions.

The relatively intensive use of land can be important for smallholders who cannot depend entirely on extensive crop cultivation.

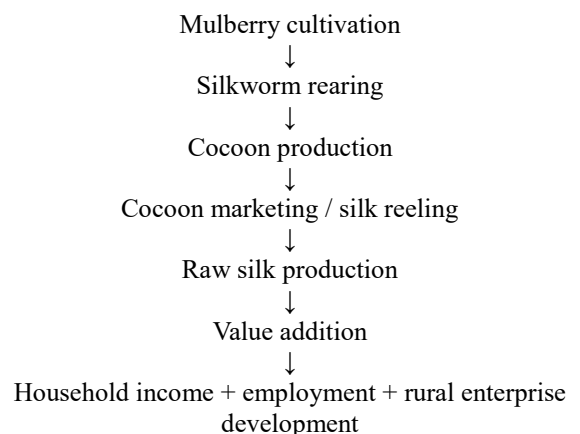


Figure 1. Livelihood pathway of sericulture

## Technology and Training as Drivers of Economic Sustainability

### Training and adoption

Technology adoption is an important determinant of productivity and economic sustainability. Scientific practices can improve mulberry production, silkworm survival, cocoon quality and silk recovery.

A recent study from Murshidabad district, West Bengal, evaluated **222 seri-farmers**, including 131 trained and 91 untrained farmers. The trained group recorded a knowledge score of **94.12 ± 6.35**, compared with **74.33 ± 8.21** among untrained farmers. The difference was statistically significant ( $t = 6.84, p < 0.001$ ).

Adoption scores were also substantially different:

| Indicator       | Trained farmers | Untrained farmers     |
|-----------------|-----------------|-----------------------|
| Knowledge score | 94.12 ± 6.35    | 74.33 ± 8.21          |
| Adoption score  | 71.31 ± 9.42    | 53.00 ± 10.18         |
| Knowledge test  | —               | $t = 6.84, p < 0.001$ |
| Adoption test   | —               | $t = 5.27, p < 0.001$ |

The study reported an **impact index of 19.05%**, indicating measurable training effectiveness.

These findings support the argument that human capital is an important component of sustainable sericulture.

### Quantitative Comparison of Production and Economic Indicators

Table 5. Selected quantitative evidence supporting sericulture as a rural enterprise

| Indicator                           | Quantitative evidence        | Interpretation                    |
|-------------------------------------|------------------------------|-----------------------------------|
| Indian raw silk production, 2023–24 | 38,913 MT                    | Large national production base    |
| Mulberry silk, 2023–24              | 29,892 MT                    | Dominant silk category            |
| Vanya silk, 2023–24                 | 9,021 MT                     | Important non-mulberry sector     |
| Estimated employment, 2023–24       | 9.5 million persons          | Major employment contribution     |
| Mulberry area, 2023–24              | 2.63 lakh ha                 | Extensive production base         |
| Dharmapuri total cost               | ₹279,585.80 ha <sup>-1</sup> | Significant production investment |

|                                      |                              |                                           |
|--------------------------------------|------------------------------|-------------------------------------------|
| Dharmapuri gross income              | ₹332,168.80 ha <sup>-1</sup> | Positive revenue generation               |
| Dharmapuri net income                | ₹52,583 ha <sup>-1</sup>     | Positive farm-level return                |
| Dharmapuri B:C ratio                 | 1.37                         | Economic viability under study conditions |
| Female labour in maintenance/rearing | 923.83 labour-days           | Strong labour contribution                |
| Trained farmer knowledge             | 94.12 ± 6.35                 | High knowledge following training         |
| Untrained farmer knowledge           | 74.33 ± 8.21                 | Training-associated difference            |
| Trained adoption score               | 71.31 ± 9.42                 | Improved practice adoption                |
| Untrained adoption score             | 53.00 ± 10.18                | Lower adoption                            |

## V. RESULTS AND DISCUSSION

The quantitative evidence indicates that sericulture operates through three interconnected dimensions: production, employment and income generation.

First, national production data demonstrate continued expansion in India's silk sector. Raw silk production increased from 36,582 MT in 2022–23 to 38,913 MT in 2023–24, representing a 6.37% increase. Mulberry production increased by approximately 8.09%, while bivoltine silk increased by 8.66%.

Second, employment data demonstrate the labour-intensive character of the industry. The estimated employment of 9.5 million persons provides evidence that the socioeconomic significance of sericulture extends well beyond farm-level cocoon production.

Third, farm-level economic data show that sericulture can produce positive returns. In Dharmapuri, gross income exceeded total cost by ₹52,583 ha<sup>-1</sup>, with a B:C ratio of 1.37. However, economic performance is sensitive to production costs and market prices. An ICAR farm-household study across Karnataka, Tamil Nadu and Andhra Pradesh emphasized the need for periodic assessment of cocoon production costs and returns because input costs and cocoon prices change over time. The evidence therefore suggests that profitability cannot be treated as a fixed characteristic of sericulture. Instead, it

depends upon productivity, labour efficiency, technology adoption, market conditions and farm-specific resources.

Training represents another measurable pathway to sustainability. The recent West Bengal study showed statistically significant differences between trained and untrained farmers in both knowledge and adoption. This indicates that extension services can influence not only technical knowledge but also practical adoption of recommended practices.

At the same time, the environmental sustainability of sericulture requires greater attention. A recent review characterizes sericulture as a potentially low-capital, high-yield agroindustry but emphasizes the importance of developing greener supply chains and expanding the applications of silk biomaterials.

Thus, the future of rural sericulture should not be evaluated only through kilograms of silk produced or rupees earned. A more comprehensive assessment should combine:

economic productivity + employment + gender participation +  
 resource efficiency + environmental sustainability +  
 technological adoption.

#### **Constraints Affecting Sustainable Sericulture**

Despite its economic potential, several constraints can reduce the profitability and sustainability of sericulture.

Table 6. Major constraints and quantitative/economic implications

| Constraint                  | Possible consequence                           |
|-----------------------------|------------------------------------------------|
| Rising labour cost          | Increased production cost                      |
| Labour shortage             | Delayed farm and rearing operations            |
| Disease incidence           | Reduced cocoon yield                           |
| Poor-quality silkworm seed  | Lower productivity                             |
| Inadequate irrigation       | Reduced mulberry leaf production               |
| Price fluctuation           | Uncertain farm income                          |
| Limited technical knowledge | Lower technology adoption                      |
| Poor rearing infrastructure | Increased mortality                            |
| Pesticide misuse            | Environmental and silkworm-health risks        |
| Weak market linkages        | Reduced producer share                         |
| Climate variability         | Changes in host-plant and silkworm performance |

In the Dharmapuri study, labour unavailability was identified as the most important production constraint, followed by the need for suitable rearing-house infrastructure.

A recent training study from West Bengal also identified improper pesticide use as a continuing issue despite improved knowledge among trained farmers.

These findings indicate that technical training alone is insufficient. Sustainable development requires simultaneous improvement in infrastructure, input supply, extension, market organization and environmental management.

## **VI. CONCLUSION**

Sericulture represents an important rural enterprise with measurable contributions to production, employment and household income. India's raw silk production reached 38,913 MT in 2023–24, while estimated employment associated with the sector reached 9.5 million persons. Farm-level evidence from Tamil Nadu demonstrates positive economic returns, with a reported B:C ratio of 1.37 and net income of ₹52,583 ha<sup>-1</sup> under the conditions studied.

The quantitative evidence further demonstrates that labour, particularly women's labour, forms a major component of the production system. Training and extension can significantly improve knowledge and adoption of sustainable practices, as demonstrated by the statistically significant differences observed between trained and untrained farmers in West Bengal.

However, the sustainability of sericulture depends on more than production volume. Rising labour costs, disease, climate variability, pesticide use, infrastructure limitations and price fluctuations can influence profitability. Consequently, future development should integrate scientific production technologies, farmer training, efficient resource use, women's participation, value addition, market support and environmentally responsible practices.

Sericulture can therefore be positioned as a multidimensional rural livelihood enterprise, linking agricultural production with employment, entrepreneurship and rural economic development.

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