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A Cost and Return Analysis: Assessing the Economic Viability and Challenges of Mulberry Cocoon Production in Coimbatore District, Tamil Nadu

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Abstract:- Nowadays, the development of the sericulture industry in India is employment generative sector. In the context of a developing nation like India, sericulture provides an excellent opportunity for socioeconomic progress. First of all, sericulture is a very labor-intensive sector of the Indian economy. It is an agro-based, multifaceted industry that includes mulberry cultivation, laying production, silkworm rearing for cocoons, marketing, and reeling of cocoons for value-added products including yarn processing and weaving. The study focuses on the economic viability and challenges faced by the sericulture famers in both the silkworm rearing and cocoon production sectors. The results of the Analysis would help sericulture industry to get a holistic picture about sericulture in Coimbatore district. It leads to a creation of more employment opportunities in the rural areas and augments the foreign exchange reserves.

Keywords:- *Sericulture, Chawki Rearing, DFL's, Cocoon Production, Cost – Benefit Ratio.*

I. INTRODUCTION

India is primarily an agricultural country, with 65 percent of its people making their living from farming. Additionally, about 47% of the rural population still live below the poverty line, while almost 75% of people live in rural areas. The Indian government pledged to ensure employment for one member of every family living below the poverty line in rural areas. Additionally, the Indian government has been promoting regular income and employment-oriented farming methods to reduce the migration of rural impoverished people to urban areas; sericulture is one such promising agricultural endeavor. (D. Elumalai, 2019).

In India, sericulture is a significant industry that is essential to reducing poverty. Compared to agricultural crops, sericulture offers more jobs throughout the year, is highly labor-intensive, requires little capital, and has a shorter time to conception. It is also a highly profit-oriented, low-input indoor activity that frequently cycles high economic returns for rural farm families. In rural communities, the sericulture sector has been a reliable source of income for a variety of social classes, including the landless. (D. Elumalai, 2019).

Since the silk industry employs 7.9 million people and facilitates the steady flow of income for many rural and semi-urban populations, it significantly influences India's rural economy. This significant agro-based rural cottage economy encompasses a variety of sericulture operations, including mulberry farming, the rearing of silkworms and the manufacture of cocoons, as well as the reeling, twisting, dyeing, and other post-cocoon production stages. Because of its superior quality, silk has long been recognized as a natural textile fiber and as one of the high-value, low-volume goods traded between continents. Its shine, durability, light weight, grace, and richness are unmatched by any other fabric even now.

There are four types of silk produced in India. They are mulberry silk, tassar silk, muga silk and eri silk. The yarn made from the cocoons of some insect species is essential for the manufacturing of raw silk. (Gupta, 2013). Except mulberry silk, all the other three varieties of silks are produced by wild silkworms which are polyphagous and feed on several food plants, whereas mulberry silk is produced by silkworm bombyx mori L., which feeds totally on mulberry leaves (Morus spp.). According to the western history, mulberry sericulture came to India from China in about 140 B.C.

A. The Development of Sericulture in Coimbatore District

The Coimbatore Sericulture Center reports that even though the district's cocoon output has increased by 20% over the last five years, there is still a significant demand for the product. The city's government cocoon market auctions out an average of 1.5 tonnes of cocoon per day. "About 20 to 25 farmers sell their cocoon at the market. Production can reach 3.5 tonnes per day at times. However, an official from the district sericulture center stated that the demand for cocoon has not been satisfied. In Coimbatore, cocoon is produced at Annur, Narasipuram and Thondamuthur.

Although the state often sets new goals each year, this year's output objective was raised to 400 tons, and the center had achieved 75% of the goal, according to the official. The silkworm rearing cycle takes 28 days, and farmers can make money each month. (The Times of India 2020).

B. Research Objective

- To determine how the demographic variables influences the cocoon production among sericulture farmers in Coimbatore district.
- To estimate the economics of cocoon production in Coimbatore district of Tamil Nadu
- To analyse cost and return structure of mulberry cocoon production in Coimbatore district.
- To find out the problems and challenges faced by the sericulture industry.

C. Research Gap

The literature review highlighted the various issues such as employment and income generation through sericulture and how sericulture has contributed to the society to maintain a good standard of living, sustainable development and role of women in sericulture industry. There are few studies conducted on the silkworm rearing and cocoon production in Coimbatore. However, the purpose of this study was to assess the state of cocoon production in the Coimbatore region.

D. Hypothesis

Hypothesis is framed based on the objectives of the study. The following hypothesis is framed totest the study:
H0 - Mulberry cultivation, Silkworm rearing, Cocoon yield and income levels of Sericulturists are directly associated with their personal characters.
H1 - There is a higher yield and income per hectares in the Coimbatore district.

E. Need for the Study

This study focuses on the economics of silkworm rearing and cocoon production. The studwould help sericulture industry to get a holistic picture about sericulture in Coimbatore. There is a need to update information on knowledge level of farmers on the technologies associated with mulberry production silkworm rearing. The Government has adopted different measures to improve sericulture and to give employment opportunities to the rural people. Under this background, it is appropriate to undertake a study on sericulture which would help the planners, policy makers and officials of the sericulture department to take further steps to improve sericulture sector.This would lead to a creation of more employment opportunities in the rural areas and augments the foreign exchange reserves.

F. Limitation of the Study

The present study covers the Coimbatore district of Tamil Nadu. The data have been collected from the farmers through personal interview method. Since there are no records maintained by thefarmers, the data are subject to the twist and turns of the retention and reservation of the memory power of the respondents. The survey however posed several cross-check questions to as accurate get information as possible.

II. LITERATURE REVIEW

Rijul Bathla, et al. (2019) -Evaluating Sericulture Feasibility in Himachal Pradesh. In this study, the authors tried to examine the feasibility study to evaluate if silk production in Mandi, HP India. They collected the primary data through interview and archival research. They suggested that the government improve its communication with silk producers and processors and make investments to address some of the problems that hinder the success of silk producers, like infections that kill the silkworms.

Taufique, M. and Areful, H. (2021) found that sericulture is a labor-intensive, household-job-generating agro-based sector in West Bengal. The report also identifies a number of issues, including price fluctuations for cocoons, a lack of storage facilities, an unsuitable market, etc. Additionally, the researchers noted that West Bengal had excellent prospects for sericulture.

Dewangan Santosh Kumar (2017) examined that among the country's tropical states, sericulture is the only cash crop that yields consistent and alluring returns all year round. In order to support the growth of sericulture in Chhattisgarh state, the author recommended that the government provide compensation for the losses suffered in this field as a result of illnesses and the adverse effects of natural elements.

B.S Angadi (2017) opined that sericulture is one of the most potential agricultural vocations with low capital investment and high returns. The author viewed that sericulture in India has proved to be an ideal location for inclusive development of rural people. The study revealed that the labour participation rate in sericulture is highest in comparison to other similar rural occupations. The activity provides job opportunities to all family members especially women andelderly persons.

Lakshmanan (2009) studied on “Economic issues of Production of Mulberry Cocoon in Tamil Nadu–A Micro Economic study". He selected Dharmapuri and Salem districts with 50 respondents from each district. HE observed and found that an average of 18.40, 24.64 and 21.22 MT of mulberry leaf per hectare was produced from Salem, Dharmapuri and pooled farms respectively. The study suggests the farmers to minimize the cost of production allocation of resources on rational basis and committee should be appointed to monitor the frequent fluctuations of cocoon price.

III. RESEARCH METHODOLOGY

A good design of the study is essential to evaluate systematically the difficulty situation and to find solutions to the problem constraints identified. This paper represents exclusively the choice of the study area, selection of sample respondents, methods of collection and analysis of data with the help of models appropriate to the objectives. The

methodology adopted has been presented under for the following major objectives:

- Determining how the demographic variables influence the cocoon production among sericulture farmers in Coimbatore district.
- Economics of mulberry sapling production, chawki rearing, cocoon production.
- Analyzing the cost and return structure of mulberry cocoon production in Coimbatore district.
- Problems and challenges faced by the sericulture industry.

A. Materials and Methods

Coimbatore district of Tamil Nadu was intensively selected for the study. A random sampling design was employed for the selection of sample villages. 58 villages were randomly chosen for the first stage of sampling. In the selected villages, the list of sericulture farmers was prepared along with silkworm seed rearer. From these villages, random samples of 70 silkworm rearers were selected. Cross sectional data were collected with the help of a well-structured, pretested schedule by personal interview method. The research was conducted in December 2023. Analytical techniques were used to achieve this through the application of frequency distribution, cost-benefit ratio and the percentage method.

IV. RESULTS AND DISCUSSIONS

The major mulberry cocoon producing areas in Coimbatore were Kondampatty, Kumarapalayam, Othakalmandabam, Orattukuppai, Vetuvampalayam, Kanur, Chettipudur, Anantagiri, Pichanur, Narasipuram, etc,. Sericulture is a significant industry in these areas that can support marginal and small farmers, as well as other weaker segments of society, financially. Unlike other agricultural crops, it takes little investment and yields a large profit, giving farmers a consistent income all year round. It has a steady and growing demand that will only increase as the middle class and liberalization continue. For those who are socially and economically marginalized, all of these characteristics make it easily adaptable. It can be a useful instrument for quickening the expansion of the rural economy if given the proper weight.

A. Demographic Influences in the Production of Cocoon

Table -1 The Sample of Farmers Exhibited a Diverse Range of Agricultural Practices and Levels ofExperience

S. NO	PARTICULARS FOR THE GENERAL CHARACTERISTICS OF SERICULTURE FARMERS				
1	AGE	> 25	26 - 35	36 - 45	< 46
	Total no of %	3	19	30	48
2	Gender	Male	Female		
	Total no of %	89	11		
3	Literacy level	Secondary	SSLC	HSC	UG
	Total no of %	36	24	26	14
4	Experience	> 2	3 to 6	7 to 10	<11
	Total no of %	12	31	36	21
5	Occupation	Sericulture	Sericulture +Agriculture	Sericulture + Other	Sericulture + Agriculture + Other
	Total no of %	35	30	21	14
6	Land Size	>1 acre	2 - 3 acres	4 - 5 acres	< 5 acres
	Total no of %	43	50	7	Nil
7	Annual Income	>1 LPA	1 LPA to 2 LPA	2 LPA to 3 LPA	< 3 LPA
	Total no of %	Nil	7	42	51
8	Mulberry Varieties	MR2	V1	V1 + MR2	
	Total no of %	49	34	17	

From table- 1, it was clear that the middle-aged group, ranging from 36 to 45, was actively engaged in sericulture cultivation. It is also proved that the Men's involvement in sericulture cultivation is essential for its success, from the cultivation of mulberry trees to the production of high-quality silk. Based on their level of literacy and experience, most of the sericulture farmers finished secondary school with 7-10 years of experience. It plays a vital role in preparing individuals for successful careers and entrepreneurship in the sericulture industry while enhancing the quality and sustainability of sericulture practices. The data showed that 2-3 acres were used for sericulture, and that 35% of farmers thought it was a necessary profession. It is also proved that 51% of farmers were earning more than 3 lakhs per annum. Increasing annual income from sericulture cultivation motivates others to raise awareness aboutthe importance of sericulture.

B. Economics of Mulberry Sapling Production, Chawki Rearing,Cocoon Production

➢ *Economics of Mulberry Sapling Production*

The sample respondents for mulberry sapling production were selected based on the area under mulberry cultivation where there was a suitable agro-climatic condition prevails both under irrigated and rain fed. For mulberry sapling production, data on the cost of land preparation, sand, farm yard manure, preparation of nursery beds, cost of planting material, irrigation, weeding, plant protection chemicals and uprooting of sapling were collected.

Fig - 1 Mulberry Sapling Production

Table 2 - Cost of Mulberry Cultivation

S. No	Particulars	Amount in Rs /acre
1	Fixed cost	2451
2	Tractor	2033
3	Farmyard manure	8702
4	Fertilizer cost	7198
5	Irrigation cost	2086
6	Pesticides and other growth promoters	1951
7	Pruning and clearing of plants	1871
8	Other expenditure	1332
	Sub Total (a)	**RS.27,624**

➢ *Economize of Young Age Chawki Rearing:*

The process of raising newborn silkworms until their second moult, known as "chawki rearing," typically lasted ten days and was a crucial part of the sericulture sector. They appear to be small ants to the naked eye. They are significantly more likely to be damaged while handling because they are little and sensitive. They also need food that is easy to digest and very nutrient-dense. Compared to their later stages, they need a little higher temperature (around 28°C) and relative humidity (about 80%) at this point. They are also growing at a slightly faster pace.

Figure - 2 shows that the sericulture farmers selected a superior quality of chawki from the rearing centre (CRC) coupled with more area under mulberry cultivation and cocoon production. Farmers were buying chawki larvae from nearby CRC. In chawki rearing, the young silkworms are given soft, succulent leaves that have been trimmed to the right size. The leaves are kept fresh by retaining their moisture content, and the necessary conditions are provided for feeding, moulting, and cleanliness.

Fig – 2 Rearing of Chawki Larvae

Table - 3 Cost of Silkworm Rearing [70 Farmers]

S. No	Particulars	Amount in Rs /per year
1	Fixed cost	40000
2	Chawkie charges	19581
3	Disinfectants	5050
4	Labour cost	23050
5	Transport and marketing expenditure	2130
6	Eb charges	830
7	Other expenditure	2524
	Sub Total (b)	**RS. 93,165/-**

During young age silkworm rearing, fixed cost, chawki rearing charges, other costs like disinfectants, labour cost, transport and marketing expenditure, EB charges, etc., had been taken for evaluating the cost of production.

- *Economize of Late Age Rearing (Cocoon Production)*

Fig – 3 Late Age Cocoon Production Centers

The process of rearing silkworm larvae from the third mold to spinning was known as "shoot rearing" or "late age silkworm," and it typically took 15 to 16 days. A total of 93% of the mulberry leaf requirement was ingested by the silkworm larvae during this period, which resulted in increases in body size of 130–133 times, body weight of 124 times, and silk gland weight of 900–1000 times. Beyond sickness, late-age worms were susceptible to high temperatures and high humidity.

C. Analyzing Mulberry Cocoon Production's Cost And Return Structure

➢ *Costs of Silkworm Cocoon Production*

According to increased demand for mulberry silk in the market, mulberry silkworms require certain environmental conditions because they are entirely domesticated. It is often advised that sericulture farmers rear their silkworms at a later age since chawki worms (up to two instars) are prone to illnesses and unfavorable weather conditions. In order to produce cocoons, farmers were purchasing chawki worms from chawki raising centers. The matured worms were moved to mountages for cocoon spinning at the end of the fifth instar. Two kinds of mountages—bamboo and plastic—were utilized in the study area. Farmers harvested the cocoons when they had finished spinning, sorted them based on quality, and then loosely placed them in netted bags for sale. The expenses associated with these operations, ranging from the acquisition of DFLs (chawki) to the cocoon harvest, are shown in Table 4.

Table - 4 Total Expenses of Chawki Rearing and Mulberry Cultivation (per one hectare)

SL. NO	PARTICULARS	Amount in Rs / Acre	% of the total cost
I	Variable Cost / working capital		
A	Mulberry Cultivation		
1	Tractor Rent charges	2033	1.50
2	Fertilizer cost	7198	5.28
3	Farmyard Manure	8702	6.38
4	Irrigation cost	2086	1.53
5	Pesticides and growth products	1951	1.43
6	Pruning and clearing of plants	1871	1.37
7	Miscellaneous expenditure	1332	0.98
B	Chawki Production		
1	Chawki rearing charges	19581	14.36
2	Labour cost	24050.0	17.63
3	Disinfectants	5050	3.70
4	Transport and marketingexpenses	2130	1.56
5	Electricity Charges	830	0.60
6	Miscellaneous expenditure	2524	1.85
7	Interest on working capital @ 13% per annum	10314	7.56
	Total variable cost	89652	
II	Fixed Cost		
1	Depreciation cost for mulberry cultivation	2451	1.80
2	Depreciation cost for rearing house and equipment	40000	29.36
3	Interest on fixed capital @ 10%	4245	3.11
	Total fixed cost	46696	
	Total Cost (T.VC + T. FC)	Rs. 1,36,348/-	100

The table - 4 depicts that the cost structure in cocoon production was accounted as ₹ 1, 36,348/500 DFLs, of which ₹89,652 was incurred from variable cost and ₹46,696 from fixed cost. The expenses for the chawki rearing home and equipment (29.36%) accounted for the largest portion of the total cost of production, followed by labor costs (17.63%), of which 13.69% were imputed to family labor and 3.94% to hired labor. However, the cost of mulberry cultivation was also estimated through the associated value of tractor rental charges, farm yard manure, irrigation cost and fertilizer cost. The expenditure on disinfectants was 4.62 per cent, and a transportation charge was 1.56%. However, the cost of rearing houses and equipment was 29.36 %. Due to high maintenance costs, many farmers are hiring the equipment. So the imputed cost of depreciation on rearing house and equipment is taken under fixed costs and others as variable costs.

➢ *Production Returns From Silkworm Cocoon*

According to Table 5 below, for every 100 DFLs, farmers produced 100 kg of cocoon. In order to attract customers, Chawki raising centers offered more DFLs, therefore it was more than the norm. Nonetheless, high-quality cocoons and second-grade jelly cocoons were the result of the output. In a rearing house, the percentage of jelly cocoons often rises because of the intensity of disease.

While these cocoons were not suitable for seed or reeling, they were often sold to local customers for a single stipulated price. On the other hand, the byproducts are litter and fodder or agricultural waste, which were typically utilized by the farm households themselves as manure and cattle feed, respectively. The net income obtained by silkworm cocoon producing farmers accounted for ₹183652/500 DFLs with a gross income of ₹320000/500 DFLs. The total benefit cost ratio is 1:1.34. So that for every rupee invested, farmers can get ₹1.34.

Table - 5 Yield and returns of silkworm cocoon production

SI.N O	PARTICULARS	Unit	Amount in Rs. (Per Unit)	Quantity(per 500 DFLs)	AMOUNT IN Rs.
1.	Sale of cocoon	Kg	620	500	310000
2.	Fodder	Quintal	250	10	2500
3.	Litter	Tonnes	1500	5	7500
4.	Gross income	Rupees	-	-	320000
5.	Total costs	-	-	-	136348
6.	Net income	-	-	-	183652
7.	Benefit Cost ratio	-	-	-	1.34

D. Problems and Challenges Faced by the Sericulture Industry

Silkworm rearing is known as sericulture. Mulberry farming is also a part of sericulture. In both rural and urban regions, raising silkworms is a lucrative endeavor. India is the world's second-largest producer and sericulture agricultural area. Even though, problems faced by farmers in sericulture are increasing. If you maintain proper care and management in silkworm rearing, the problems may decrease to some extent.

➢ *Some of the Problems Faced by the Sericulture Industry is Listed Below:*

- Unfavorable conditions cause the mulberry crop's productivity to fail.
- Diseases like leaf spots, powdery-mildew, leaf rust, marginal leaf burning in cultivation of mulberry plants are serious impediments.
- Farmers having insufficient technical expertise about rearing silkworm business.
- The Central Silk Board offers sericulture-related programs. Many farmers encounter challenges while attempting to obtain funding from this program.
- In the silkworm rearing process, there is a shortage of skilled laborers.
- Nowadays, in the Agricultural sector, many people are venturing into the Sericulture industry. Here numerous harmful chemicals were used. These chemicals are fatal to human life. A huge quantity of Carbon dioxide is evolved in rearing of silkworms. Workers in the shed experience irritations, respiratory issues, and dermatological illnesses as a result of CO2. Prior to rearing, the shed is disinfected with formalin. It causes cancer in people.
- The Market study analyzed that the absence of well-organized marketing facilities leads to a huge decrease in profit in Sericulture farming.
- Due to direct and indirect taxes paid to the transportation, farmers were facing a huge lossin their margin.

V. CONCLUSION

The present study is conducted in Coimbatore district, focused on assessing the economic viability and challenges of mulberry cocoon production. Sericulture has well prospective to generate income to the farmers. Because sericulture is more labor-intensive, it has helped small, medium, and big farms create jobs and generate revenue all year round. Periodic revenue and direct marketing in the government's commercial cocoon markets let the farmers to benefit from this enterprise. High-quality DFLs must be acquired from reliable chawki rearing facilities in order to reduce the incidence of silkworm disease. When the rearing procedure is conducted indoors, precautions can be taken by properly disinfecting the rearing house and its appliances. Maintaining hygienic conditions in the rearing house microclimate is important. Farmers should often visit the sericulture department to learn about the latest technical advancements in Sericulture industry. They can also purchase the government-provided facilities with subsidies. The present study clearly showed that both the cost and the returns of cocoon production were high among sericulture farmers. To enhance economic viability, targeted government support, improved access to affordable credit, and farmer training programs could play a crucial role. It will also help the sericulture sector to increase their economic growth.

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