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An economic study of Chawki rearing centers in Tamil Nadu

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Abstract
Sericulture, as an agro-based industry, presents significant opportunities for farming communities. The rearing of young silkworms, known as Chawki rearing, is essential for a successful sericulture crop harvest. Chawki Rearing Centres (CRCs), which distribute young silkworms, have become increasingly popular. This study aimed to assess the cost of production and profitability of CRCs in Krishnagiri, Dharmapuri, Salem, Tiruvannamalai, Tiruppur, Erode, Coimbatore, Dindigul, Theni, and Tirunelveli districts of Tamil Nadu through a structured survey conducted during 2021-22. The study included a total sample of 45 CRCs. The cost of production (including fixed and variable costs) was found to be Rs.4,70,330 in small CRCs, Rs.4,15,660 in medium CRCs, and Rs.3,96,125 in large CRCs. The total net return of CRCs was Rs.3,69,670 in small CRCs, Rs.6,24,340 in medium CRCs, and Rs.7,23,875 in large CRCs. The highest benefit-cost ratio was observed in large CRCs at 2.83, followed by 2.51 in medium CRCs and 1.79 in small CRCs.

Keywords: Sericulture, Chawki, fixed cost, variable cost, economics

Introduction
Sericulture plays a significant role in the agricultural economy of India, particularly in states like Tamil Nadu, where it provides livelihood opportunities to a large number of farming communities. Chawki rearing, which involves the rearing of young silkworms to ensure a healthy and productive silk crop, is a crucial aspect of sericulture. Chawki Rearing Centres (CRCs) are key establishments that distribute young silkworms to farmers, thus playing a vital role in the sericulture value chain.

Despite the importance of CRCs in sericulture, there is a lack of comprehensive economic analysis focusing on these centers in Tamil Nadu. Understanding the economics of CRCs is essential for assessing their financial viability, identifying potential areas for improvement, and formulating policies to support the sericulture sector. Therefore, this study aims to conduct an economic analysis of CRCs in Tamil Nadu. Specifically, it will assess the cost of production, profitability, and benefit-cost ratio of CRCs in selected districts of Tamil Nadu. By analyzing the economic aspects of CRCs, this study seeks to provide valuable insights for policymakers, researchers, and stakeholders in the sericulture sector. The findings of this study are expected to contribute to the understanding of the economic dynamics of CRCs in Tamil Nadu and inform strategies for enhancing the efficiency and sustainability of CRC operations.

Materials and Methods
The present study was conducted in Tamil Nadu during the year 2021-22. The survey was taken up in 45 CRC's from the list of chawki rearing centers collected from Directorate of Sericulture, Salem. For the study, CRC's were selected from the district of Krishnagiri, Dharmapuri, Salem, Tiruvannamalai, Tiruppur, Erode, Coimbatore, Dindigul, Theni and Tirunelveli. The selected respondents were contacted in person and enquired with the help of pre-tested comprehensive interview schedule. Information collected from sample farmers size of CRC, details on production of chawki larvae, number of crops (Chawki larvae production) raised and constraints faced by farmers in chawki mulberry cultivation and chawki rearing.

The collected data were analyzed by simple tabular method, averages and percentages along with the frequencies computed for work out the cost and returns of chawki mulberry leaf

production (Lakshmanan *et al*. 2000, Lakshmanan and Geetha Devi, 2005, Srinivasa *et al*. 2008; Balasaraswathi *et al*. 2010; Manjunatha *et al*. 2017) [5, 4, 1, 6, 2].

Results and Discussions

The tender, soft and succulent chawki mulberry leaf produced from mulberry garden was used for rearing chawki worms. Apart from the cost of leaf, the other cost items comprised the labour cost for young age silkworm rearing, disinfectant such as Sanitech, Bleaching power, Vijitha and Lime etc., paraffin paper, depreciation cost of chawki rearing house and equipment's, interest on working capital. The cost of chawki rearing categorized into fixed cost and variable cost. The cost structure of chawki rearing (fixed cost and variable cost) are given the table 1 and 2

Table 1: Fixed cost of chawki rearing (Rupees per ha/annum)

Fixed cost						
Particulars	**Small (n=12)**		**Medium (n=23)**		**Large (n=10)**	
	Total cost	**Depreciation cost**	**Total cost**	**Depreciation cost**	**Total cost**	**Depreciation cost**
Rearing house (sq.ft)	385714	25714	458142	19844	474546	20632
Disinfect tank (sq. ft)	2056	411	8632	845	9200	920
Plastic trays (4'x3')	116071	10714	116442	11644	113750	11375
Chawki stand	25794	1821	23464	2203	24000	2182
Incubation frame	10913	2015	12250	2291	12797	2415
Feeding stand	650	163	666	182	853	198
Leaf chopping machine	-	-	15435	1029	22500	1500
Leaf chopping board	1654	301	-	-	-	-
Knives	1654	301	-	-	-	-
Room heaters	-	-	12978	1167	9100	1500
Power sprayer		850	13674	1367	26900	2069
Room cooler	-	-	2348	700	3850	529
Thermometers	788	158	1609	322	1740	348
Cleaning nets	5778	1926	7307	2436	7510	2503
Litter bags	653	653	445	445	412	412
Generator	-	-	29783	2978	31900	3190
Humidifier	-	-	7022	1736	12150	1234
Total fixed cost	561141	45440	710196	48849	751208	51347

During young age silkworm rearing, some fixed investment in construction of rearing house, purchase of tools and equipment for rearing chawki larvae had been taken for evaluating the cost of production. The non-recurring cost includes the depreciation cost of rearing house and rearing equipment such as disinfection tank, silkworm rearing tray and stands, incubation frames, leaf chopping machine, leaf chopping board and knife, thermometer, heater, humidifier, cooler, bed cleaning net, generator, etc.

The fixed costs are given in table 1. The chawki rearing centers incurred a fixed cost of Rs.45440, Rs.48849 and Rs.51347 in case of small, medium and large size farmers respectively. Total fixed cost was low in small farmers because they have not adopted new technologies and they followed traditional chawki rearing methods like thatched rearing house, used gunny cloth and planted tree around the rearing house for cooling and temperature maintenance inside the rearing house, leaf chopping board with knife etc. Cost incurred on rearing house was the major component of fixed cost for all the three size of farmers. Depreciation cost of rearing house was high in (Rs.25714.29) small size farmers than (Rs.20632.41) large and (Rs.19844.19) medium farmers because most of the small size farmers have thatched rearing house but large and medium farmers had concrete rearing shed. So the life period of rearing house was less in small farmers hence, the rearing house depreciation cost was high in small farmers.

Next major cost incurred by silkworm rearing trays (4'×3'). It was high in large size farmers (Rs.11375) and low in small size farmers (Rs.10714.29) owing to the fact that, the large farmers were well educated and experience in sericulture was minimum 25 years in large size farmers and hence, they maintain JICA recommended bed spacing i.e 9 sq. ft @ 6660 larvae/ sq. ft for beginning of the 1st instar and 36 sq.ft @ 6660 larvae/ sq. ft for ending of the 1st instar hence during 1st instar required 2 to 6 rearing tray (3' x 2') per 100 dfls and 2nd instar beginning 36 sq. ft @ 6660 larvae/ sq. ft and ending of the 2nd instar 72 sq. ft @ 830 larvae/ sq.ft so during 2nd instar required 6 to 12 rearing tray per 100 dfls. (Sivaprasad *et al*. 2015) [3].

Similarly the depreciation cost of chawki rearing stand and incubation frame was high (Rs.2182 and Rs.2415) in large size farmers and low in small farmers (Rs.1821 and Rs.2015). The depreciation cost of leaf chopping machine was Rs.1500 in large, Rs.1028.99 in medium and nil in small farmers because small farmers are using leaf chopping board and knives that cost was Rs.602. The depreciation cost incurred on power sprayer was Rs.850, Rs.1367 and Rs.2069 in small, medium and large respectively.

Electric appliances like room heater, room cooler, generator and humidifier cost was high (Rs.7993) in large farmers and it was zero for small farmers because large farmers adopted new rearing technologies such as they used electric appliances for maintain desired temperature and humidity in inside the rearing shed aimed at rearing of scientific way for obtaining healthy worms. Cost incurred on cleaning net was high Rs.2503 in large farmers and low in (Rs.1926) small size farmers since the small farmers were adopting traditional method of bed cleaning (hand picking with use of feather).

Table 2: Variable cost of chawki rearing (Rs/ha/annum)

Particulars	Small (n=12)	Medium (n=23)	Large (n=10)
Batches/year	24	26	28
A. Leaf cost	66890	59418	61767
Total (A)	66890 (15.7)	59418 (16.2)	61767 (18)
B. Labour charges			
Labour @ 35 mandays/batch	158000	101130	68938
Supervisory charges	60000	61565	63000
Total (B)	218000 (51.30)	162696 (44.35)	131938 (38.27)
C. Chemical cost			
Vijetha @ 5 Kg/batch	6548	7207	7758
Bleaching powder @ 10 Kg/batch	8948	9352	10507
Sanitech @ 5 litres/batch	9325	10442	10752
Lime @ 30 Kg/batch	12083	12803	14331
Total (C)	36905 (8.69)	39804 (10.85)	43347 (12.57)
D. Materials cost			
1. Gunny cloth (meters)	893	879	870
2. Black cloth (meters)	831	816	814
3. Paraffin paper @ 230 metres/batch	54762	60041	62604
Total (D)	56486 (13.29)	61737 (16.83)	64288 (18.65)
E. Cost of Utilities and other expenditures			
1. Electricity	6933	8420	10400
2. Miscellaneous	1050	1390	1695
Total (E)	7983 (1.88)	9810 (2.67)	12095 (3.86)
Total variable cost (A+B+C+D+E)	386264	333465	313435
Interest on variable cost (@ 10% P.A)	38626.4 (9.09)	33346.5 (9.09)	31343.5 (9.09)
Total recurring cost	424890 (100.00)	366811 (100.00)	344778 (100.00)
Total Input cost	206890 (49)	204115 (56)	212840 (62)
Total Operational cost	218000 (51)	162696 (44)	131938 (38)

(Figures in parentheses indicate percentages to total)

The variable cost contributed major share in the total cost of chawki rearing presented in the Table 2 given.

Among the recurring cost, mulberry leaf cost was the major component and it was Rs.66890, Rs.59418 and Rs.61767 in small, medium and large farmers respectively. Mulberry leaf cost was high in small farmers due to lack of awareness in adoption of new mulberry cultivation technology like proper spacing, irrigation system and use of fertilizer and hence the cost of production was high in small farmers.

Next major share of contribution of the variable cost was human labour cost and it was high in small farmers (Rs.218000) and low in large farmers (Rs.131938). The small farmers were lack in adopting new technologies that requires small equipments like leaf chopping machine, bed cleaning net, power sprayer etc., so small farmers were performing these rearing activities manually using labourers.

The cost incurred on disinfectants such as (Vijetha @ 5 kg/batches, Bleaching powder @ 10 kg/batch, Sanitech @ 5 lit/batch and Lime 30 kg/batch) was Rs.36905, Rs.39804 and Rs.43347 in small, medium and large farmers respectively and it was high in large farmers because the number of batches per year was high (28 batches/year) in large farmers hence quantity and cost of disinfectant was higher in large farmers.

Similarly, the cost of rearing cloth materials like gunny cloth (45 m/ batch), black cloth (15 m/batch) and paraffin paper (230 m/ batch) cost was high in large farmers (Rs.64288) and low in small farmers (Rs.56487). The cost of utilities and other expenditure like electricity and miscellaneous charge was high in large size farmers (Rs.12095) and low in small size farmers (Rs.7983) due to use of more number of electric rearing appliances (room cooler, heater, humidifier) than small farmers.

Cost and returns of chawki larvae production per year are given in Table 5.3.3. It indicated that the average number of dfls brushed per hectare per year was 120000 dfls, 130000 dfls and 140000 dfls in small, medium and large farmers respectively. The number of batches was high in large farmers since the demand was high in large farmers CRCs than small and medium CRCs.

Table 3: Cost of production of Chawki rearing (Rs/ha/annum)

S. No.	Particulars	Cost (Rs)		
		Small (n=12)	Medium (n=23)	Large (n=10)
I	Annual depreciation cost for investment	45,440	48,849	51,347
II	Variable cost	4,24,890	3,66,811	3,44,778
III	Total cost	4,70,330	4,15,660	3,96,125
IV	No. of chawki dfls reared/ annum	1,20,000	1,30,000	1,40,000
V	Return from sale of Chawki larvae (Gross income)	8,40,000	10,40,000	11,20,000
VI	Net Returns	3,69,670	6,24,340	7,23,875
VII	B:C ratio	1:1.79	1:2.51	1:2.83
	Total input cost (mulberry + chawki rearing)	3,26,701	3,28,274	3,44,411
	Total operational cost (mulberry + chawki rearing)	2,76,989	2,06,824	1,76,853

The sale of chawki larvae per year was also high in large farmers (Rs.11,20,000) and low in small farmer (Rs.8,40,000). Net returns per hectare per annum were Rs.3,69,670, Rs.6,24,340 and Rs.7,23,875 in small, medium and large farmers respectively and the net income was influenced by two factors, it was total cost of chawki production and sale of chawki production. The benefit cost ratio was high in large farmers (1:2.83) and low in small farmers (1:1:79). If the total cost of production was low and the sale of chawki larvae (gross income) was high hence the benefit cost ratio was higher.

The cost of production of chawki worms was high in small farmers and low in large farmers, it was leads to profit-loss of the respective category of the farmers. In profitability, the cost of production plays major role hence chawki centers need to try reduce the production cost by reducing different costs involved either in production by using latest technology or by utilizing the full capacity of the chawki centers. The large CRCs properly utilized full rearing capacity by rearing more number of batches per year (28 batches/ annum) i.e. rearing number of (140000) dfls was huge per hectare per year. Similarly, medium farmers also utilize but small farmers didn't utilized the full capacity of the chawki rearing centers by rearing less number of batches per hectare per annum because in most of the small CRCs are government CRCs they involvement of JICA CRCs (two batches/month) hence they rearing less number of batches or dfls per hectare per year in the study area. Private small CRC also rear less dfls per annum due to less demand because they did not provide any services to sericulture farmers like transport of chawki worms and not visiting their farmers' rearing shed periodically etc. In Tamil Nadu, government CRCs functioning very less (five) number due to inadequate human labours and inadequate infrastructure facility.

Average leaf yield was high in large farmers (31039 kg) and low in small farmers (28105 kg) due to in most of the large scale farmers followed pair row (90 cm X 90 cm) planting system hence the leaf yield was high compared to small and medium farmers. The leaf production cost was high in small farmers and low in medium farmers. By product cost was high in Rs.6784 large farmers than medium (Rs.5637.50) and small (Rs.4056.85) farmers because in large farm generate huge amount of seriwaste it was utilized for manure to the sericulture farm. Net return was high in large farmers (Rs.730659) and low in small farmers (Rs.373727) due to less cost of production and get high gross income (sale of chawki worm and byproducts cost) through the utilization of chawki rearing centers was more in large farmers like rearing huge number of dfls per hectare per annum compared to small and medium farmers. B:C ratio was 1:1.79, 1:2.52, 1:2.84 in small, medium and large size farmers respectively.

Conclusion

The present study draws the following suggestions for development of sericulture in long time run in the study regions. Sericulture has good prospective to generate income to the farmers. Sericulture is more labour concentrated and it contributed employment opportunity for small, medium and large farms and provides income throughout the year. Cost of production was reduced in farmers due to adoption of new technologies and new bivoltine sericulture techniques.

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