



Plant Archives

Journal homepage: <http://www.plantarchives.org>

DOI Url : <https://doi.org/10.51470/PLANTARCHIVES.2024.v24.specialissue.001>

MECHANIZATION OF PRE-COCOON ACTIVITIES OF TASAR SERICULTURE: SCOPE AND PROSPECTS OF CUSTOM HIRING SERVICES

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ABSTRACT

Tasar sericulture is wild sericulture which is an agriculture allied activity which produces tasar silk. The industry can be divided into pre and post cocoon production stages. The post cocoon industry is dependent on the cocoon production and thus pre-cocoon phase is considered as the determinant of tasar market. In India most of the tasar sericultural activities related to cocoon production are still being performed manually or with tools and equipment which are not only inefficient but also obsolete since the communities involved are rural and tribal communities native to the areas. The cost of tasar silk production is quite high. Hence, efforts are required to reduce the cost of production of Indian silk, besides improvement in the quality to face global competition with imported silk in addition to meeting the domestic demand. The worker's efficiency is very low as most of the works are carried out manually or with help of hand tools. Therefore, efforts should be made on reducing labour dependency and at the same time increase the precision so as to reduce cost of cocoon production and increase the productivity and quality of the cocoons produced. The solution to this labour dependency is to incorporate mechanization to perform tasks with minimal human intervention. Since the tasar farmers are small and marginal farmers, they cannot afford to buy the machinery required to perform the tasar sericultural activities. Custom hiring centre is a facility that offers agricultural machineries and equipments to farmers on rental basis. It serves as a platform where farmers can access various tools needed for pre-cocoon stage of tasar sericulture. The current study aims to study the sustainability of custom hiring as an entrepreneurial opportunity in tasar sericulture. The study shows that the cost of performing the sericultural activities through mechanization ranged from Rs. 48,984 under fully mechanized condition to Rs. 72800 under mechanization with manually operated tools. The custom hiring center can generate about 73% profit per hectare on operational cost with a benefit cost ratio of 1.72 and 12% profit on total annual recurring cost when 30 hectares are hired per year. When two crop cycles are hired per year at this rate, the investment cost can be recovered over a period of 5 years.

Keywords: Pre-cocoon, crop cycles, sericulture, mechanization

Introduction

Tasar silk is one of the five types of silk found in India and is a native silk of the subcontinent. It is produced by the larvae of the insect *Antheraea mylitta*, spun into cocoons on suitable host plants. The process of commercially producing the tasar silk by rearing the insects, is called "Tasar sericulture" or "Tasar culture". Tasar sericulture is a wild sericulture performed in forest areas or systematic plantations of host trees. The tasar sericulture can be divided into pre and post cocoon activities, the post cocoon industry is dependent on the cocoon production and thus pre-cocoon phase is considered as the major determinant of tasar market. Unlike mulberry sericulture, the larvae of the tasar silkworm are reared directly on the trees where they feed on the leaves and thus the host tree

plantation or the forest is also a place of silkworm rearing. The management practices required for maintenance of the host plants and those required for silkworm rearing all should be carried out at one place. Hence in tasar sericulture, the plantation maintenance is optimized in such a way to obtain maximum productivity of both plant and silkworm making the whole production very labour intensive. The tasar sericulture is carried out by the rural and tribal population living in the fringe areas of the forests majorly in the states of Jharkhand, Chhattisgarh and Odisha. Since the literacy and economic status of these communities is very low, the activities are carried out manually and in age old ways by the members of their own families. This limits the productivity due to absolute dependency on manpower and at the same

time the further generations involved in the tasar sericulture are deprived of development in other spheres of life which slowly led to decline in their inclination towards tasar sericulture. The only possible solution is mechanization of the tasar sericultural activities. Mechanization in sericulture has many advantages which include reduction in time taken to perform the activities, reduction in manpower requirement and improvement in precision and quality of the activities performed. In other terms, mechanization can effectively reduce the cost of production and drudgery (Satyasai and Balanarayana, 2018; Nadaf *et al.*, 2022). The need for mechanization in mulberry sericulture has also been recognized and emphasized. Yet, some constraints hinder the intervention of mechanization. The tasar sericulture farmers are very poor and cannot afford to own the implements required for mechanization and illiteracy is another major hurdle which limits the skill required for use and maintenance of the implements. Custom hiring service is a viable means which will make the implements affordable for the tasar farmers and thereby promote mechanization in tasar sericulture. Custom hiring services may be established under public-private partnerships through the support of local governments as well as by private entrepreneurs and can be profitable if planned appropriately based on the area-based requirements (Chinnappa *et al.*, 2018). The current report is an attempt to estimate the expenditure which may incur for mechanization of all the activities of tasar sericulture and the prospects for custom hiring as an entrepreneurial opportunity.

Methods

1. Collection of the primary data:

The following primary data was taken from suitable sources

- Selection of agricultural implements needed for tasar sericulture during the pre – cocoon stage is done based on the activities involved and the range of implements available in the market (Pandey *et al.*, 2023).
- After the selection of the agricultural implements, information on their market cost was gathered and capital fixed cost has been calculated.
- Mileage of agricultural implements required for tasar sericulture was obtained from the manufacturers and vendors (i.e. cost / hour/ hectare) and expressed as an average cost.
- An activity schedule of tasar production was prepared along with the information on usage

metrics for the agriculture implements that are going to be used activity wise.

2. Estimation of expenditure (recurring cost/ year) calculated under the following heads:

- Establishment of custom hiring center
 - Activity wise cost estimation was done based on activities taking place during the pre –cocoon stage of tasar sericulture.
3. Estimation of rental cost of each machine based on the mileage @ 10% margin on fuel expenses and the income generated from such a venture
4. Estimation of cost benefit ratio and profit margin to know the sustainability of the project. Benefit: cost ratio was calculated as a ratio of net positive cash flow to net negative cashflow. Profit margin was calculated as gain percentage over annual investment or expenditure incurred.

Results and Discussion

(a) Investment on farm machinery for mechanizing tasar production:

The farm implements of different kinds are required to mechanize various activities of tasar cocoon production. They include a wide range of implements from simple mechanical tools to larger tractor operated tools. Both manually operated and power operated implements have been included for each activity in order to bring customization according to the needs of the farmers of various economic categories. Although there is a wide variation in the price of implements have been observed, an average estimated cost has been included for the study. The list of the implements along with their cost is given below.

Table 1: Purchase cost of various agro-machinery for tasar sericulture

S. No.	Implements	Unit Price (Rs.)
1	Tractor (55-60 HP)	693000
2	Rotavator (6 ft)	92500
3	Leveler (6 ft)	16500
4	Power tiller	17270
5	Weed cutter	9500
6	Secateur	326
7	Long reach pruner	2500
8	Manual sprayer	750
9	Dusting machine	4500
10	Power sprayer	13970
11	Trailer	85000
12	Wheel hoe	4000
13	Shed	120000
	Total	10,59,771

(b) Estimation of expenditure towards running costs of tasar mechanization:

Mechanization in tasar sericulture may bring about many socio-economic transformations in the communities associated with it and the tasar production itself (Nadaf *et al.*, 2022). In order to mechanize the tasar sericulture activities, the fuel costs and manpower requirement was calculated as per the activities involved in the sericulture (Table 2). Since Jharkhand is the major producer, the manpower wages were considered as per the norms of Government of Jharkhand. Since handling of machinery and socio-economic status of the farmers play a major role in adoption of mechanization in sericulture (Kumaresan *et al.*, 2013), from farmer's perspective, mechanization was estimated at three different levels *viz.*, mechanization at full extent, partial mechanization with power operated tools and partial mechanization using manual tools (Tables 3, 4 and 5).

As per the calculated activity-wise expenditure, the number of mandays required for one crop cycle of tasar sericulture was 66 days in case of complete mechanization, whereas the mandays requirement was 152 and 208 days in case of partial mechanization with power tools and manual tools respectively. As opposed to the misconception of the farmers that mechanization may increase the cost of sericultural activities, the total calculated running expenditure in the three scenarios was Rs. 50,000, Rs. 71,000 and Rs. 72,000 per hectare plantation respectively when the mandays were considered for expenditure excluding the actual purchase cost of the machinery. Although an argument be considered for the farmers along with their family members carrying out the tasar sericulture activities (Mishra, 2021) cannot be counted under actual manpower expenditure, the higher mandays requirement when manual tools are used deprives them from exploring other additional income possibilities leading to the hindrance of the economic growth of their families.

Table 2: The fuel and manpower requirement for various sericulture activities per hectare plantation

Sl. No.	Sericulture Activity	Implements (fuel consumed per ha where ever implied)	Mandays required	Running cost/ year/ hectare (Rs.)		
				Fuel Cost	Manpower cost 350/ day	Total
	Plantation Establishment					
1	Land preparation	Rotavator (21 L/ha)	1	1995	350	2345
		Leveler (7 L/ha)	1	665	350	1015
	Plantation Maintenance					
2	Cultural operations Frequency: 2X/year	Rotavator (30 L/ha)	2	5700	700	6400
3	Basin making	Power tiller (36 L/ha)	5	3564	1750	5314
4	Weeding Frequency: 21 times/ year	Weed cutter (4.8 L/ha)	32	10000	11200	21200
		Wheel hoe	84	-----	29400	29400
5	Pruning	Secatures	4	-----	1400	1400
		Long reach pruner	5	-----	1750	1750
		Looper	6	-----	2100	2100
	Silkworm rearing					
6	Field disinfection Frequency: 2x/year	Dusting machine (2 L/hr)	2	1584	700	2284
7	Jeevan Sudha spray Frequency: 3x/year	Manual sprayer	14	-----	4900	4900
		Power sprayer	6	1782	2100	3882
8	LSM spray	Manual sprayer	5	-----	1750	1750
		Power sprayer	2	594	700	1294

(A) FULLY MECHANIZED TASAR PRODUCTION**Table 3:** Cost of complete mechanization (tractor operated and power operated implements) of various sericulture activities per hectare plantation

Sl. No.	Sericulture Activity	Implements	Mandays required	Running cost/ year/ hectare (Rs.)		
				Fuel Cost	Manpower cost 350/ day	Total
	Plantation Establishment					
1	Land preparation	Rotavator (21 L/ha)	1	1995	350	2345
		Leveler (7L/ha)	1	665	350	1015
	Plantation Maintenance					
2	Cultural operations Frequency: 2X/year	Rotavator (30L/ha)	2	5700	700	6400
3	Basin making	Power tiller (36L/ha)	5	3564	1750	5314
4	Weeding Frequency: 21 times/ year	Weed cutter (4.8L/ha)	32	10000	11200	21200
5	Pruning	Secatures	4	-----	1400	1400
		Long reach pruner	5	-----	1750	1750
		Looper	6	-----	2100	2100
	Silkworm rearing					
6	Field disinfection Frequency: 2x/year	Dusting machine (2L/hr)	2	1584	700	2284
7	Jeevan Sudha spray Frequency: 3x/year	Power sprayer	6	1782	2100	3882
8	LSM spray	Power sprayer	2	594	700	1294
	TOTAL		66			48,984

(B) PARTIALLY MECHANIZED**Table 4:** Cost of partial mechanization (only power operated implements) of various sericulture activities per hectare plantation

Sl. No.	Sericulture Activity	Implements	Mandays required	Running cost/ year/ hectare (Rs.)		
				Fuel Cost	Manpower cost	Total
	Plantation Establishment					
1	Land preparation	Wheel hoe	6	-----	2100	2100
	Plantation Maintenance					
2	Cultural operations					
		Wheel hoe	84	-----	29400	29400
3	Basin making	Power tiller(36l/ha)	5	3564	1750	5314
4	Weeding Frequency:	Weed cutter	32	10000	11200	21200
5	Pruning	Secatures	4	----	1400	1400
		Long reach pruner	5	-----	1750	1750
		Looper	6	-----	2100	2100
	Silkworm rearing					
6	Field disinfection	Dusting machine	2	1584	700	2284
7	Jeevan Sudha spray	Power sprayer	6	1782	2100	3882
8	LSM spray	Power sprayer	2	594	700	1294
	TOTAL					70,724

(C) MECHANIZED USING MANUAL TOOLS**Table 5:** Cost of partial mechanization (manually operated implements only) of various sericulture activities per hectare plantation

Sl. No.	Sericulture Activity	Implements	Mandays required	Running cost/ year/ hectare (Rs.)		
				Fuel Cost	Manpower cost	Total
	Plantation Establishment					
1	Land preparation	Wheel hoe	6	----	2100	2100
	Plantation Maintenance					
2	Cultural operations	Wheel hoe	84	----	29400	29400
3	Basin making	No manual machine				
4	Weeding Frequency:	Wheel hoe	84	-----	29400	29400
5	Pruning	Secatures	4	----	1400	1400
		Long reach pruner	5	----	1750	1750
		Looper	6	-----	2100	2100
	Silkworm rearing					
6	Field disinfection	No manual machine				
7	Jeevan Sudha spray	Manual sprayer	14	-----	4900	4900
8	LSM spray	Manual sprayer	5	-----	1750	1750
	TOTAL					72800

(c) Estimation of Cost of establishment of CHC for tasar sericulture

Custom hiring centers (CHC) lend agro-machinery or tools to farmers on charge basis with or without manpower for operating the implements. In order to establish a custom hiring center for serving the tasar farmers, investment will be required for establishment and running of the CHC. The

establishment costs include machinery cost and land cost whereas the running costs (recurring costs) include manpower recruitment cost and repairs and maintenance costs. In case of a small-scale start-up, the provision of salary for manager included in cost estimation ensures the income for the entrepreneur performing the role of the manager.

Table 6: Cost of establishment of CHC

Sl. No.	Particular of expenditure	Unit Price (Rs.)
1	Cost of implement	
	Tractor	693000
	Rotavator	92500
	Leveler	16500
	Power tiller	17270
	Weed cutter	9500
	Secateur	326
	Long reach pruner	2500
	Manual sprayer	750
	Dusting machine	4500
	Power sprayer	13970
	Looper	2000
	Wheel hoe	4000
2	Land for office (1000 sq ft)	100000
3	Shed for keeping the implements	120000
	TOTAL	10,76,816

Table 7: Cost towards running the CHC (recurring costs)

Sl. No.	Particular of expenditure	Unit Price (Rs.)
1	Salaries to Manpower (Annual)	
A	Manager	180000
B	Worker	126000
2	Insurance premium for implements	19536.32
3	Repair and annual maintenance	8531.9
	Total	29268.22

(d) Estimation of benefit-cost ratio and profit margin

The viability of the venture is dependent on the profit earned in the venture and the time required to recover the investment costs. From the current estimations made for establishing a custom hiring center, the benefit cost ratio was 1.72

Table 8: Custom hiring rates of different implements

Sl. No.	Implements	Fuel Cost (Rs)/hr	Machinery Hiring rate (Rs./hr)	Machinery Hiring rate @ 6hrs/day (Rs./day)	Manpower (Rs./day)	Total (Rs./day)
1.	Rotavator	665	732	4400	350	8740
2.	Leveler	333	366	2196	350	4544
3.	Power tiller	120	132	792	350	1862
4.	Weed cutter	60	66	400	350	1110
5.	Secateurs	---	---	30	350	380
6.	Long reach pruner	---	---	100	350	450
7.	Looper	---	---	100	350	450
8.	Manual sprayer	---	---	150	350	550
9.	Dusting machine	200	220	1320	350	1670
10.	Power sprayer	50	55	330	350	980
11.	Wheel hoe	---	---	100	350	450
	Total					21,186

Table 9: Income generated vs. investment per crop cycle of tasar production

Sl. No.	Implements	Running cost /hectare	Hiring charge Rs./ha/crop cycle	Profit (Rs)
1	Rotavator	1995	2200	205
2	Leveler	665	732	67
3	Power tiller	3564	3960	396
4	Weed cutter	10000	11088	1088
5	Secateurs	---	120	120
6	Long reach pruner	---	500	500
7	Looper	---	600	600
8	Manual sprayer	---	2850	2850
9	Dusting machine	1584	1760	176
10	Power sprayer	2376	2640	264
11	Wheel hoe	---	8400	8400
	TOTAL	20184	34850	14666

Table 10: Summary of profit margin

	Recurring annual expenditure (Rs)	Operational cost (Rs.)	Earnings (Rs.)	Profit (Rs.)	Profit Margin (%)
Hiring of 1 ha/crop cycle		20184	34850	14666	73
Hiring of 30 ha/crop cycle	334068	605520	1045500	105912	12

The profit margin taken for power operated tools was 10% and the total profits gained per hectare per crop cycle was 73% with respect to the fuel expenses. With respect to the total recurring cost per annum hiring for thirty hectares of tasar sericulture will yield a profit of more than 12%. The establishing cost can be recovered within a period of 5 years when two crop cycles were hired per year.

Conclusion

Mechanization is a means which can encourage the younger generations to carryout tasar sericulture without compromising with their aspirations for living a better life by exploring other opportunities for income generations along with the tasar production. Custom hiring services as an entrepreneurial opportunity is beneficial to the tasar sericulture farmers and also a viable business option for young rural entrepreneurs. The custom hiring services may be taken up through public-private partnerships or private start-ups or even by the farmer self help groups. The implements may also be lent to other agricultural operations to make the venture more profitable.

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