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Economic analysis of silk cocoon production in Maharashtra

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Abstract

Sericulture is a rural agro-based industry. Sericulture included various activities as like mulberry cultivation, silkworm rearing and post silk cocoon activities. Random sampling design was adopted in the selection of district, tehsils and farmers. Kolhapur district was selected on the basis of cocoon production. Three tehsils were selected from Kolhapur district according to highest mulberry area under cultivation viz., Hatkanagale, Karveer and Gadhinglaj. The primary data was taken from 90 silk cocoon producers from the study area.

Thus, the total sample consisted of 30 farmers each of Group I, Group II and Group III size groups, the per ha cost of cocoon production was worked out to Rs. 311063.93. The share of feed (mulberry leaves) in total cost was found to be the highest (48.71 per cent) followed by human labour (14.73 per cent). The per ha gross returns and net returns were Rs. 480022.96 and Rs. 168959.03, respectively. The financial feasibility of sericulture showed that the investment made in sericulture was financially viable with pay back period 1.81 years, Benefit-Cost Ratio 1.54, NPV Rs. 239842.59 and IRR 30.42 per cent. As sericulture is a profitable subsidiary occupation, the efforts should be made by state agriculture department to initiate activity of sericulture on large scale to maximize farmers' income.

Keywords: cost and returns, mulberry, silkworm, sericulture

Introduction

The diversification of rural economy in general and agriculture sector in particular has become essential to boost income and employment opportunities of rural masses. Sericulture is an agro-based industry, the end product of which is silk. Silk is fibrous protein of animal organ produced by the silkworm for spinning a cocoon. India is the only country in the world to produce all the four commercial silks, viz. 1) Mulberry silk 2) Tasar silk 3) Eri silk 4) Muga silk. India is the second largest producer of raw silk in the globe next to China. The raw silk production of India was 35820 MT in 2019-20. The raw silk production of Maharashtra was 529 MT in 2019-20 and in Kolhapur it was 84.34 MT in 2019-20. India was the largest consumer and importer in the world.

Sericulture is divided into two sectors such as industry and farm, with diversified nature of skills, involving a heterogeneous group of people, bringing people of varied walks of life together to work for the silk production. In sericulture, farm activity includes mulberry cultivation and silk cocoon production. Reeling, twisting, drying, finishing and knitting comes under industrial sector (Srivastava and Thangavelu, 2005). Sericulture provides employment and frequent income throughout the year. Sericulture comprises 5 to 6 rearing per annum. Sericulture provides a low investment with regular income. Once the mulberry plantation is established, it will provide a continuous yield for 15 to 20 years with a minimum expenditure for their maintenance (Savithri *et al.*, 2013) [18].

In western Maharashtra and Vidarbha, the mulberry cultivation is increasing day by day. For successful silk farming, mulberry cultivation and silkworm rearing should be done scientifically and technically. Silk farming is famous in Maharashtra and silk is used for making silk cloth and also for threading. Maharashtra has 9th rank in state wise raw silk production (Anonymous, 2019) [2-4]. Silk clothes has high demand in Maharashtra and other states. Maharashtra is a non-traditional sericulture producer state that produces both mulberry silk and tasar silk. Present production is 2280.00 MT cocoons and 350.00 MT mulberry raw silk. Mulberry plantation has spread in about 4327.00 hectares with 9955.00 farmers. Sericulture is an agro-based industry, comprising of land-based activities like raising silkworm food plantation along with post-cocoon activities as the rearing of silkworms, reeling, twisting, weaving and processing for fabrics (Jadhav *et al.*, 2020) [9].

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Kolhapur is known for sugarcane, rice and chili crops but some farmers are adopting the sericulture activity in recent years. The farmers with one or two acres of land holding can easily cultivate mulberry effectively as well as efficiently, such small holding demands lesser initial investment and also helps for family employment throughout the year. Sericulture activity provides income and employment throughout year. The three silk production centers of Kolhapur district are Karveer, Hatkanagale, Gadhinglaj. New silk cocoon markets are developed near Kolhapur as like in Gadhinglaj cocoon market, Jaysingpur cocoon market and other private markets. Also in Kolhapur, Ichalkaranji is home to one of the oldest textile industries in India. Ichalkaranji is a "Manchester of Maharashtra". The present area under the mulberry plantation in Kolhapur district is 124.80 ha and silkworm egg rearing area are 88.00 ha. Present total cocoon production and egg distribution in the Kolhapur is 84340.50 kg per ha and 19960.00 per ha respectively (Source: District Sericulture Office, Kolhapur). The present study has been undertaken with following objectives.

Objectives

1. To study the costs and returns of silk cocoon production.
2. To study the financial feasibility of sericulture.

Materials and Methods

The research was conducted in Kolhapur district during 2019-20. Random sampling design was adopted in selection of district, tehsils and farmers. The silk cocoon producers from Hatkanagale tehsil, Karveer tehsil and Gadhinglaj tehsil were selected randomly for study based on area under silk cocoon production. The list of silk cocoon producers along with their operational area under mulberry cultivation and silk cocoon production for each of the selected size group prepared on the basis of information obtained from tehsil revenue office. The silk cocoon producers were categorized into three predetermined size classes viz., Group I (up to 0.20 ha), Group II (0.21 to 0.40 ha) and Group III (above 0.41 ha) thereby making a total of 30 cocoon producers for each tehsil selected randomly. Thus, the total sample size for the study consisted of 90 silk cocoon producers comprising 30 each size group.

Cost of production and net returns

To examine the economic viability, the cost of production and net returns of cocoon production were computed as under.

Fixed cost

These costs refer to those which remain unchanged over a short period of time. Fixed costs considered in present study included depreciation on implements and buildings @ 10 per cent per annum, respectively and interest on fixed capital @ 12 per cent per annum.

Variable cost

Variable costs are those costs which vary with the level of production. In making production decisions in the short run, only variable costs were needed to be considered which include cost of silkworms, cost of mulberry leaves, cost of DFLs, charges of labour utilization, cost of disinfectant, electricity charges and other charges such as newspaper, uzi fly trap etc.

Financial Feasibility of sericulture

In order to test the financial feasibility of investment in sericulture series of cash outflows was developed for seven years by undertaking 12 per cent inflation in input costs. The cash inflows were taken at a constant level. The Payback period, BCR, NPV and IRR methods were used for testing the financial feasibility of the sericulture project.

Payback Period

The payback period is an undiscounted measure of project appraisal. A number of years required to recover the initial investment was considered as the payback period. The preference of project is based on the shorter payback period. The payback period of the project is calculated by the formula-

$$\text{Payback Period} = \frac{\text{Initial investment of the project}}{\text{Annual net cash revenue}}$$

Net Present Value (NPV)

Net present value is the difference between the present value of cash inflows and the present value of cash outflows over some time. It is the present worth of the cash flow stream. It is discounted of net cash flow of investment. The project with positive NPV is given weightage in the selection compared to those with negative NPV. It was computed as.

$$\text{NPV} = \sum \frac{\text{NCF}}{(1+i)^t} - C_0$$

Where,

NCF = net cash flows for the given year

t = time period

C₀ = cost of initial investment

i = discount rate (10 per cent per annum)

Benefit-Cost Ratio

The benefit-cost ratio is a discounted measure of project appraisal. The benefit-cost ratio determines the profitability of the Agribusiness. The benefit-cost ratio is defined as financial ratio that determines whether the costs incurred during the execution of the business will be less or more than the amount made from the business. The benefit-cost ratio was calculated by dividing the gross return by the total costs. It will compute as follows,

$$\text{BCR} = \frac{\text{Gross Returns}}{\text{Total costs}}$$

Internal Rate of Return

The internal rate of return of sericulture activity is the discount measure, which makes the net present value equal to zero. This represents average earning capacity of an investment from the projects.

In the computation of IRR, the time value of money is accounted. The methods of working IRR provided the knowledge of actual rate of return from the different projects. It was estimated by using the formula

$$\left(\text{Internal rate of return} \right) = \left(\text{Lower discount rate} \right) + \left(\text{Difference between two discount rates} \right) \times \left(\frac{\text{NPW at lower discount rate}}{\text{Absolute difference between the NPW at two discount rates}} \right)$$

Results and Discussion

Operation-wise labour utilization for Silkworm rearing

The per hectare operation-wise labour utilization for the silkworm rearing is estimated and presented in given Table 1. It could be seen that, at an overall level, total human labour needed for cocoon production was 184.53 man-days, out of those 91.88 man-days of male labour and 92.65 man-days of female labour were utilized for completing various operations of silkworm rearing. The results showed that female labour were major participants in silkworm rearing activities. The operation-wise labour utilization, the maximum male labour (39.46 per cent) was required for harvesting of leaves, followed by feeding of mulberry leaves (13.19 per cent) and chopping of mulberry leaves (10.65 per cent). The maximum female labour (29.42 per cent) was required for harvesting of leaves, followed by cocoon harvesting (18.13 per cent) and bed cocoon harvesting and daily watch (17.25 per cent). About group sizes, the maximum human labour utilized for

Group III was 198.49 man-days, out of those 99.82 man-days of male labour and 98.67 man-days of female labour, followed by group II (185.96 man-days) and Group I (169.15 man-days). According to operations of silkworm rearing, the maximum male labour utilized for harvesting of leaves was 42.56 man-days in Group III followed by Group II (36.06 man-days) and Group I (30.63 man-days). The maximum female labour utilized for harvesting of leaves was 28.12 man-days in Group I followed by Group III (27.77 man-days) and Group II (25.55 man-days). The maximum male labour utilized for feeding of leaves was 13.93 man-days in Group III followed by Group II (13.11 man-days) and Group I (11.11 man-days). Among the groups, the proportionate share of different labours observed more or less the same trend as noticed for different operations. This study revealed that the harvesting of mulberry leaves and cocoon harvesting were labour-intensive operations.

Table 1: Operation-wise labour utilization for silkworms rearing (man-days/ha)

Sr. No.	Items	Group I		Group II		Group III		Overall	
		Male	Female	Male	Female	Male	Female	Male	Female
1	Harvesting of leaves	30.63 (36.66)	28.12 (32.85)	36.06 (39.08)	25.55 (27.27)	42.56 (42.64)	27.77 (28.14)	36.42 (39.46)	27.15 (29.42)
2	Chopping of mulberry leaves	9.55 (11.43)	8.08 (9.44)	11.34 (12.29)	9.90 (10.57)	8.21 (8.23)	16.02 (16.24)	9.70 (10.65)	11.33 (12.08)
3	Feeding of leaves	10.11 (12.10)	11.11 (12.98)	12.21 (13.23)	13.11 (13.99)	14.21 (14.23)	13.93 (14.12)	12.17 (13.19)	12.72 (13.69)
4	Bed cleaning and daily watch	18.23 (21.82)	16.66 (19.46)	17.01 (18.43)	16.55 (17.66)	18.76 (18.79)	14.45 (14.64)	18.00 (19.68)	15.88 (17.25)
5	Cocoon harvesting	9.33 (11.17)	12.83 (14.98)	10.11 (10.96)	20.02 (21.37)	8.89 (8.90)	17.78 (18.02)	9.44 (10.34)	16.87 (18.13)
6	Sale of cocoons	5.70 (6.82)	8.80 (10.28)	5.54 (6.00)	8.56 (9.13)	7.19 (7.20)	8.72 (8.83)	6.14 (6.67)	8.69 (9.42)
	Total	83.55 (100)	85.60 (100)	92.27 (100)	93.69 (100)	99.82 (100)	98.67 (100)	91.88 (100)	92.65 (100)

(Figures in parentheses indicates the percentage to the total)

Input utilization for silkworm rearing

The per hectare input utilization for the silkworm rearing of selected cocoon producers was furnished in Table 2. The values estimated have been indicated in the table which is in monetary terms. It has been observed that at an overall level total input cost for the silkworm rearing process was Rs. 248929.62. The maximum input costs were incurred on mulberry leaves (Rs. 151641.87) followed by human labour (Rs. 45802.51) and disease-free laying (Rs. 19524.86). The

highest cost was incurred on mulberry leaves because silkworms required a continuous fresh supply of mulberry leaves for their proper growth and silk quality. According to groups, the input costs incurred on silkworm rearing process was highest in Group III (Rs. 273745.54) followed by Group II (Rs. 248839.13) and Group I (Rs. 224204.18). Among the groups, the investment of different input costs incurred more or less same trend as noticed in a Table 2.

Table 2: Input utilization for silkworms rearing (Rs/ha)

Sr. No.	Particulars	Group I	Group II	Group III	Overall
1	Labour				
	Male	24679.23 (11.01)	27681.79 (11.12)	30144.16 (11.01)	27501.73 (11.05)
	Female	17120.95 (7.64)	18738.89 (7.53)	19042.49 (6.69)	18300.77 (7.37)
2	Mulberry leaves	135588.06 (60.48)	153130.32 (61.54)	166207.22 (60.72)	151641.87 (60.91)
3	DFLs	16373.08 (7.30)	18469.99 (7.42)	20731.50 (7.57)	19524.86 (7.43)
4	Disinfectants	9531.28 (4.25)	8145.87 (3.27)	9066.11 (3.31)	8247.75 (3.61)
5	Electricity	5682.38 (2.53)	4393.37 (1.77)	4478.58 (1.64)	4184.78 (1.98)
6	Uzi Trap	581.20 (0.26)	491.23 (0.20)	520.14 (0.18)	464.19 (0.21)
7	Newspaper	264.67 (0.12)	194.34 (0.08)	178.67 (0.07)	179.23 (0.09)
8	Transportation	14383.33 (6.42)	17593.33 (7.07)	23416.67 (8.55)	18464.44 (7.35)
	Total	224204.18 (100.00)	248839.13 (100.00)	273745.54 (100.00)	248929.62 (100.00)

(Figures in parentheses indicates the percentage to the total)

Cost of cocoon production

The per hectare of cost incurred for cocoon production was calculated and given in Table 3. It is observed that, at an overall level per hectare cost of silkworm rearing was found to be Rs. 311063.93. The cost divided into fixed and variable cost is Rs. 44709.24 (14.44 per cent) and Rs. 248929.62 (85.56 per cent). Among the variable cost, the highest contribution of mulberry leaves was 48.71 per cent (Rs. 151641.87) which were followed by human labour 14.73 per cent (Rs.45802.51), Disease-Free Layings (DFLs) 5.94 per cent (Rs. 18524.86), transportation cost 5.88 per cent (Rs.

18464.44), disinfectants 2.89 per cent (Rs. 8247.75) and electricity charges 1.58 per cent (Rs. 4184.78) respectively. Among the fixed costs, costs were incurred on depreciation on rearing sheds and equipments and interest on fixed capital. Depreciation on building and equipments were 10.92 per cent (Rs. 33823.42) and Interest on fixed capital at 12 per cent was 3.52 per cent (Rs. 10885.81). It is revealed that the highest expenditure was incurred on mulberry leaves. Quality of silk cocoon is depended on mulberry leaves quantity and quality. So, farmers are decided DFLs quantity on mulberry leaves production.

Table 3: Cost of cocoon production (Rs/ha)

Sr. No.	Particulars	Group I	Group II	Group III	Overall
1	Human labour	41800.19 (14.71)	46420.67 (14.93)	49186.66 (14.55)	45802.51 (14.73)
2	Mulberry leaves	135588.06 (47.70)	153130.32 (49.25)	166207.22 (49.17)	151641.87(48.71)
3	DFLs	16373.09 (5.76)	18469.99 (5.94)	20731.50 (6.13)	18524.86 (5.94)
4	Disinfectants	9531.28 (3.35)	8145.87 (2.62)	9066.11 (2.68)	8247.75 (2.89)
5	Electricity charges	5682.38 (2.00)	4393.37 (1.41)	4478.58 (1.32)	4184.78 (1.58)
6	Transportation charges	14383.33 (5.06)	17593.33 (5.66)	23416.67 (6.93)	18464.44 (5.88)
7	Uzi trap	581.20 (0.20)	491.23 (0.16)	520.14 (0.14)	464.19 (0.17)
8	Newspaper	264.67 (0.09)	194.34 (0.06)	178.67 (0.05)	179.23 (0.07)
9	Working capital	224204.20 (78.88)	248839.13 (80.03)	273745.55 (80.98)	248929.62 (79.96)
10	Interest on working capital @ 7% p. a.	15694.29 (5.52)	17418.74 (5.60)	19162.19 (5.67)	17425.07 (5.60)
11	Variable cost	239898.49 (84.40)	266257.86 (85.63)	292907.74 (86.65)	248929.62(85.56)
12	Depreciation cost	33429.81 (11.76)	33836.09 (10.88)	34204.37 (10.12)	33823.42 (10.92)
13	Interest on fixed capital @ 12% p. a.	10898.28 (3.83)	10832.26 (3.48)	10926.90 (3.23)	10885.81 (3.52)
14	Fixed cost	44328.09 (15.60)	44668.35 (14.37)	45131.27 (13.35)	44709.24 (14.44)
	Total cost	284226.58 (100.00)	310926.21 (100.00)	338039.01 (100.00)	311063.93 (100.00)

(Figures in parentheses indicates the percentage to the total)

Yield and returns obtained from silk cocoon production

The per hectare gross returns and yield were calculated for

different size groups and presented in Table 4.

Table 4: Returns from cocoon production (Rs/ha/annum)

Particulars	Group I		Group II		Group III		Overall	
	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
Cocoon Yield (Kg)	1786.31	417146.83	1967.35	473089.84	2443.11	545319.44	2065.59	478518.70
By Product (tonne)	2.56	1151.96	3.35	1505.80	4.12	1855.00	3.34	1504.26
Gross Return	-	418298.79	-	474595.64	-	547174.44	-	480022.96
Net Return	-	134072.21	-	163669.44	-	209135.44	-	168959.03
Per kg cost of silk cocoon	-	158.47	-	157.28	-	137.60	-	151.12

The gross returns included the value of cocoon as the main yield and value of manure or litter obtained from silkworm as the by-product. It is realized from the table that, at an overall level per hectare per annum gross returns realized by the silk cocoon producers were Rs. 480022.96. Out of the gross returns Rs. 478518.70 (99.68 per cent) were got from cocoon yield. The gross returns were highest (Rs. 547174.44) in Group III followed by Group II (Rs. 474595.64) and Group I (Rs. 418298.79). On average, the net returns from silk cocoon production were estimated to be 168959.03 at an overall level. Per kg cost of silk cocoon was found to be 151.12 at an overall level. Based on per hectare cocoon production, their by-product and price realized by silk cocoon producers, gross returns were calculated for different size groups. The price of silk cocoons differs according to their grade and different purchasing agencies or markets. During the corona situation price of the cocoon falls from last year as Rs 400-450 to Rs. 120-250 per kg. The prices of silk cocoons depend upon quality of silk cocoons i. e., which varies from Rs. 120 to Rs.450. (Silk Cocoon market price-2019).

Financial feasibility of sericulture

The Payback period, BCR, NPV and IRR methods were used

for testing the financial feasibility of the sericulture project. These values were worked out and shown in Table 5. The payback period was evaluated 2.13 years, 1.85 years, 1.46 years and 1.81 years for Group I, Group II, Group III and Overall level, respectively. The benefit-cost ratios were 1.47, 1.53, 1.62 and 1.54 for Group I, Group II, Group III and overall level, respectively. The benefit-cost ratio was more than one. This is showed that the investment in sericulture is profitable. The Net Present Values (NPV/NPW) were Rs. 219248.21, Rs. 232668.69, Rs. 267610.86 and Rs. 239842.59 for Group I, Group II, Group III and overall level, respectively. The Internal Rate of Returns (IRR) was 29.96 per cent, 30.19 per cent, 30.90 per cent and 30.42 per cent for Group I, Group II, Group III and Overall level, respectively. This analysis showed that, in all size groups, Pay Back Period (PBP) was shorter, the Benefit-Cost Ratio (BCR) was greater than one, Net Present Value (NPV) was positive value and Internal rate of Return (IRR) was more than the discount rate. All financial feasibility tests in sericulture activity were indicating the profitability of sericulture. Hence, investment in sericulture is profitable to silk cocoon producers.

Table 5: Financial feasibility of Sericulture

Particulars	Group I	Group II	Group III	Overall
Payback Period (Years)	2.13	1.85	1.46	1.81
B:C Ratio	1.47	1.53	1.62	1.54
NPV @ 12%	219248.21	232668.69	267610.86	239842.59
IRR	29.96	30.39	30.90	30.42

Conclusion

Per ha cost of cocoon production were Rs. 311063.93 per hectare. The per hectare gross returns realized were Rs. 480022.96 at an overall level. The benefit-cost ratio was observed to 1.54 (greater than unity). The average PBP of sericulture was 1.81 years (shorter period) and average NPV of sericulture was found to be Rs. 239842.59 (positive value). The IRR of sericulture was 30.42 per cent (greater than interest rate and shows NPV=0). So, this economic feasibility tools were evaluated as sericulture is profitable activity to silk cocoon producers. Hence hypothesis is proved that sericulture is profitable activity in Kolhapur district. Results revealed that silk cocoon production in Kolhapur district is profitable.

Policy Implication

The investment on sericulture activity being profitable and economically feasible, so the farmers should undertake sericulture by taking advantage of different schemes like MNREGA scheme, NABARD scheme, ATMA and RKVY schemes.

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