Profitability of Mulberry cocoon production in West Bengal

G R Manjunatha¹*, Kiran Kumar R Patil², Shafi Afroz¹, Dipesh Pandit¹, V Sivaprasad¹

¹ Central Sericultural Research and Training Institute, Berhampore, 742 101, West Bengal, India
² Department of Agricultural Economics, UAHS, Shivamogga, 577225, Karnataka, India

Abstract

Objectives: To examine the profitability of mulberry cocoon production and to identify the reasons for marginalization of mulberry sericulture in West Bengal, India. Methods/Statistical analysis: The primary data pertaining to socio-economic status of farmers and costs & returns of mulberry cocoon production was collected from 240 respondents (Malda, Murshidabad & Birbhum) using pre-tested structured interview schedule following multi-stage purposive random sampling. The economics of mulberry cocoon production was worked out using budgeting technique. Findings: Mulberry cultivation in West Bengal was pronounced on marginal/small farms with average mulberry holding of 0.66 acre. Cost of production per kg of mulberry cocoon on marginal farms worked out to ₹283 and the profitability expressed in terms of the returns per rupee of expenditure was 1.47. Inadequate land holding and labour-intensive nature of mulberry cultivation are identified as major causes for marginalization of mulberry sericulture in West Bengal. Application/Improvements: The cost estimates will serve as the basis for policy-makers to intervene for the announcement of minimum support price in the event of price crash. Labour cost formed major chunk in the total cost of production of mulberry cocoon on marginal/small farms reelecting the scope for development of suitable implements & equipments for economizing mulberry sericulture.

JEL classification: Q1

Keywords: Profitability; marginal farm; small farm; Mulberry sericulture; cocoon; budgeting technique

1 Introduction

Sericulture a profitable alternative for agricultural crops in terms of income and employment generation played an important role in poverty alleviation. Sericulture has got employment potential round the year for about 8.5 million rural farm families in India¹. The same is evident from micro level studies indicating that mulberry sericulture practiced on an acre could generate on & off farm employment of 11 mandays per kg of mulberry silk production².
Mulberry sericulture is practiced mainly in five traditional states of India viz., Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal and Jammu & Kashmir (3). Among the traditional states, West Bengal occupied third position in terms of mulberry silk production. It has been observed in West Bengal that area under mulberry had slightly decreased over last three decades whereas productivity levels of mulberry, cocoon & raw silk have increased significantly due to adoption of recent technologies through Central Silk Board's R&D institute & Department of State Sericulture (DoS), West Bengal (4). At present, West Bengal accounts for nearly 10 percent (2428 MT) of the nation’s mulberry silk production in the vertex of the silk map of India with total mulberry area of 15721 ha (5). The sericulture industries in India is dominated by southern states due to favorable soil-climatic conditions & other resources endowment necessary for rearing mulberry silkworm. The soil & climatic conditions in West Bengal, as compared to southern states, are not much favorable (6). But there is a scope for improvement in mulberry sericulture by updating the skills of the farmers and through adoption of latest technologies (7). Even then, the involvement of marginal farmers in Sericulture is quite high. The present study attempts to examine the profitability of mulberry cocoon production and plausible reasons for marginalization of mulberry sericulture in West Bengal.

2 Materials and methods

The primary data pertaining to socio-demographic factors of sericulture farmers, variety of mulberry grown, area under mulberry, breeds/hybrids of silkworm reared, resources use pattern, yield of mulberry & cocoon, prices accrued during the agricultural year was elicited using pre-tested structured-interview schedule; multistage purposive random technique was employed in selection of farmers (respondents). Accordingly, based on intensity of sericulture, three traditional districts (Malda, Murshidabad & Birbhum) were considered purposively with the total sample size of 240 respondents (40 from each block). Both implicit & explicit costs were considered while estimating economics of mulberry cocoon production using standard cost concepts & budgeting techniques. The definition of terms and concepts used are cited in Manjunatha (6). The details of standard cost concepts is given in Table 1.

![Diagram of WEST BENGLA, MALDA, MURSHIDABAD, BIRBHUM with Kaliachak-I, V-1, V-10, Nabagram, Khargram, Naihat-I, Naihat-II]

Table 1. Details of Standard Cost Concepts

| Cost A1 | The actual expenses incurred in production by owner operator. The items included are wages of hired human labour, charges for bullock and machine labour, market rates of manures, seeds (cuttings/saplings), fertilizer, plant protection chemicals and other necessary inputs, depreciation of implements, machinery and farm buildings, irrigation charges, cess and other taxes, land revenue, amortized establishment cost for perennials, interest on working capital and fixed cost, processing and marketing costs |
| Cost A2 (Cost A) | Cost A1 + rent paid for leased in land |
| Cost B1 | Cost A1 + interest on owned fixed capital (other than land). Building is one of the key requirements for the prosperous sericulture. In order to encourage capital formation in sericulture, this tendency needs to be strengthened. Hence, it is essential to consider the interest on the fixed assets while estimating the cost of mulberry cultivation /silkworm rearing/ reeling |

Continued on next page
Cost B2 (Cost B) Cost B1 + rental value of owned land (net of land revenue) + rent paid for leased land. The Commission of Agricultural Costs and Prices consider 1/6th of the gross value of produce minus land revenue, taxes and cesses as the imputed value of the rent for the owned land. However, in the present study, the opportunity cost of land was considered for estimating the rental value. The rainfed paddy was the ‘next best alternative’ crop for the land devoted for mulberry in the traditional region.

Cost C1 Cost B1 + imputed value of family labour at the rate of attached farm labour wherever available or else the wage rate of the casual labour. If the family labour does the skilled jobs like tractor driving, harvesting of mulberry leaves, feeding, bed cleaning, and reeling of cocoon, the ruling wage rate was considered.

Cost C2 Cost B2 + imputed value of family labour

Cost C3 (Cost C) Cost C2 + 10 per cent of Cost C2 towards the managerial functions performed by stakeholders

3 Results and Discussion

The general characteristics of sericulture farmers of West Bengal are presented in Table 2. The perusal of table indicated that 44.44 percent of the respondents lie in the age group of 30-40 years. Another 33 percent of sample farmers fall in the age group of below 30 years. This result clearly indicates that majority of farmers involved in sericulture activity belonged to young & middle age group. The age factor is considered as pivotal in technology spread and adoption. Since, majority of farmers belonged to young-middle age group, adoption of technology should not be a major constraint in the study area. With regard to occupation, 84.45 percent of farmers engaged in both sericulture & agricultural activities and hardly 15.55 percent engaged in sericulture activity alone. Agricultural crops are grown for food purpose and sericulture for income generation. In terms of literacy, 71 percent of farmers possessed education above higher primary indicating the existence of good literacy level among respondents. This factor will give a further fillip for technology spread and adoption. Average size of the family in the study area was found to be five. Greater the size of family, larger will be the supply of family labour towards sericulture and agricultural operations as both of them are labour-intensive. The average area under mulberry was found to be 0.78 acre. The major factor limiting the size of holding under mulberry in the study area is the availability of labour force. The mulberry varieties like Local, S1 and S1635 are ruling in the study area on an average 17 years age-old garden. Farmers rear all the three types of silkworm breeds/hybrids such as Multi × Multi (N × M12W), Multi × Bi (N × (SK6 × SK7); locally known as hybrid) and Bi × Bi (SK6 × SK7; locally called as F1). The distribution of land holding for mulberry cultivation in the study area is given in the Table 3. It indicated that majority of the farmers practicing mulberry cultivation belonged to marginal category (85%) and rest to small category (15%). This clearly revealed that mulberry is largely practiced by marginal farmers in West Bengal.

| Table 2. General Characteristics of Sample Respondents |
|------------------------------------------------------|
| # | Particulars                  | Frequency/Average |
|---|------------------------------|-------------------|
| 1 | Age of the respondent        |                   |
| A | <30                          | 80 (33.33)        |
| B | 30-40                        | 107 (44.44)       |
| C | 40-50                        | 21 (8.88)         |
| D | 50-60                        | 21 (8.88)         |
| E | >60                          | 11 (4.44)         |
| 2 | Occupation                   |                   |
| A | Sericulture                  | 37 (15.55)        |
| B | Sericulture & Agriculture    | 203 (84.45)       |
| 3 | Education                    |                   |
| A | Illiterates                  | 43 (17.77)        |
| B | Primary school               | 27 (11.11)        |
| C | Higher Primary               | 91 (37.77)        |
| D | High school                  | 48 (20.00)        |
| E | College                      | 31 (13.33)        |
| 4. | House type                   |                   |
| A | Kuccha (Paat kadi)           | 48 (20.00)        |
| B | Mixed                        | 126 (52.50)       |
| C | Pucca                        | 66 (27.50)        |
| 5. | Average family size          | 5.30 [2-13]       |
| 6. | Type of family               |                   |

Continued on next page
Table 2 continued

|   |   |   |
|---|---|---|
| A | Joint family | 69 (28.88) |
| B | Nucleus family | 171 (71.11) |
| 7. | Average area under mulberry (Acre) | 0.78 [0.25-2.5] |
| 8. | Avg. age of the mulberry gardens | 17 [7-50] |
| 9. | A. Mulberry varieties | Local, S1 & S1635 |
|   | B. Spacing | Layering/ 2’×2’ |
| 10. | Silkworm breeds/hybrids | Hybrid: N x M12W & N x (SK6 x SK7 F1: SK6 x SK7) |

Values in ( ) indicates the % contribution to the total and [ ] indicates the range of the particular item

Table 3. Distribution of Farms based on Mulberry Area

|   | Farms | Avg. Mulberry Area (acres) | Respondents | % to the total respondents |
|---|---|---|---|---|
| 1 | Marginal (<2.5 acre) | 0.66 (0.25-1.00) | 204 | 85 |
| 2 | Small (2.5-5 acre) | 1.50 (1.01-2.50) | 36 | 15 |
| Total | 240 | 100% |

Economics of Mulberry Cultivation:

The farm size was post-stratified into marginal (0.66 acres or 2 bigha) & small (1.5 acres or 4 bigha) farms. The details of labour use, cost incurred towards establishment & maintenance of mulberry garden, cost incurred on rearing silkworm were worked out on per farm basis.

a) Labour use pattern: Establishment and maintenance of mulberry garden for optimum leaf production is crucial for the profitability of sericulture enterprise. Sericulture being a labour intensive enterprise, its profitability depends on efficiency of labour use. The information on operation-wise labour requirement to establish and maintain mulberry garden is detailed in Table 4. On an average, establishment of mulberry garden required human labour of 50 (marginal farms) and 90 mandays (small farms). Machine labour of 2 hours & 3 pair-days of bullock labour were essential to perform tillage and intercultural operations, respectively. Human labour was essential to perform operations such as weeding, irrigation, land digging (land scooping/loosening by pickaxes usually done from second year onwards), planting, gap-filling, application of FYM and fertilizers, application of plant protection chemicals etc. Weeding and irrigation activities were considered as labour intensive operations in mulberry cultivation demanding 20 and 36 mandays of labour on marginal (marginal farm; 0.66 acre) and small farms (small farm; 1.5 acre), respectively. The flood method of irrigation is the usual practice demanding more labour compared to micro irrigation systems. The soil type (alluvial) having moderate retention adds to labour requirement for frequent irrigation. Robust weed growth is observed due to frequent irrigation provided on fertile alluvial soils. Since the closer spacing (layering) is practiced, scope for intercultural operations is minimum, demanding huge human labour to keep garden weed free. Similarly, towards maintenance of mulberry garden from second year onwards, the human labour of 74 and 122 mandays was required on marginal & small farms, respectively.

Table 4. Operation-wise Labour-use Pattern in Mulberry Cultivation

|   | Particulars | Establishment | Maintenance (II Year onwards) |   |
|---|---|---|---|---|
|   | Marginal farms | Small farms | % to total | Marginal farms | Small farms | % to total |
| 1. | Land digging | 10 | 16 | 13.11 |
| 2. | Ploughing (Hr) | 2 | 3 | 3.33 | 5 | 8 | 6.56 |
| 3. | Manure application | 5 | 9 | 10.00 | 5 | 8 | 6.56 |
| 4. | Transplanting/ gap filling | 5 | 9 | 10.00 | 2 | 2 | 1.64 |
| 5. | Weeding | 20 | 36 | 40.00 | 33 | 54 | 44.26 |
| 6. | Fertilizer Application | 3 | 6 | 6.67 | 6 | 9 | 7.38 |
| 7. | Irrigation | 12 | 21 | 23.33 | 12 | 19 | 15.57 |
| 8. | Spraying | 5 | 9 | 10.00 | 8 | 14 | 11.48 |
| 9. | Bullock pairs (leveling/ploughing) | 2 | 3 | 3.33 | As & when required |
| Total | 50 | 90 | 100% | 74 | 122 | 100% |
b) Establishment cost: The details of cost incurred by farmers in establishing mulberry garden is presented in Table 5. It was found that farmer incurred ₹37,244 (marginal farm; 0.66 acres) and ₹71,916 (small farm; 1.5 acres) towards establishment of mulberry garden. In estimation of establishment cost, both variable and fixed expenses were considered. Among the variable expenses, the expenditure on human labour was found highest i.e., ₹12,500 (33%; marginal farms) and 22,500 (31%; small farms). During establishment period, the human labour was essential to perform operations viz., planting, application of fertilizers, manuring, gap filling, weeding, irrigation and application of plant protection chemicals. The other major item of expenditure was on plant nutrition which amounted to ₹4,430 (12%; marginal) and ₹9,860 (13%; small farms). The plant nutrition involves supplementation of both organic manures and inorganic fertilizers. Fully decomposed FYM was applied at the time of planting while chemical fertilizers like Urea, DAP, SSP, MOP in two splits. The expenditure of ₹3,200 (9%; marginal) and ₹8,000 (11%; small) was incurred on irrigation as it is imperative in deciding leaf production during off seasons. The opportunity cost of capital at 12 percent rate of interest was ₹2,709 (7%; marginal farms) and ₹5,320 (7%; small farms) which reflected the extent of working capital incurred in mulberry cultivation (moriculture). The net establishment cost mainly depends on cocoon yield (2 crops) and to some extent on sales of mulberry leaves during initial period. Net establishment cost worked out to ₹19,044 (marginal farms) & ₹33,566 (small farms).

Table 5. Establishment cost of Mulberry

| Particulars | Marginal Farms | Small Farms |
|-------------|----------------|-------------|
|             | Qty. | Value (₹) | % to total cost | Qty. | Value (₹) | % to total cost |
| I. Labour Cost |      |           |               |      |           |               |
| i Human Labour (mandays) | 50  | 12500.00  | 33.56         | 90  | 22500.00  | 31.29         |
| a) Hired Labour (mandays) | 20  | 5000.00   | 13.42         | 36  | 9000.00   | 12.51         |
| b) Family Labour (mandays) | 30  | 7500.00   | 20.14         | 54  | 13500.00  | 18.77         |
| ii Bullock Labour (pair-days) | 3   | 1500.00   | 4.03          | 4   | 2000.00   | 2.78          |
| a) Hired Bullock Labour | 1   | 500.00    | 1.34          | 2   | 1000.00   | 1.39          |
| b) Own Bullock Labour | 2   | 1000.00   | 2.68          | 2   | 1000.00   | 1.39          |
| II. Material/Input Cost |      |           |               |      |           |               |
| FYM (ton) | 3   | 3000.00   | 8.05          | 7   | 7000.00   | 9.73          |
| Fertilizers (kg) | 190 | 1430.00   | 3.84          | 380 | 2860.00   | 3.98          |
| Planting material (no.) | 7200 | 720.00    | 1.93          | 15990 | 1599.00  | 2.22         |
| Plant Protection Chemicals (PPC, lit) | 1.5 | 225.00    | 0.60          | 2.5 | 375.00    | 0.52          |
| Irrigation Charges (hrs.) | 10  | 3200.00   | 8.59          | 25  | 8000.00   | 11.12         |
| Interest on working capital@12% per annum | 2709.00 | 7.27    |               | 5320.08 | 7.40 |
| Total Variable Cost (TVC) [I + II] | 25284.00 | 67.89 |               | 49654.08 | 69.04 |
| Y. Fixed Cost (FC) |      |           |               |      |           |               |
| land revenue | 140.00 | 0.38  |               | 245.00 | 0.34 |
| Depreciation | 1110.00 | 2.98  |               | 1230.00 | 1.71 |
| Interest on fixed capital @ 8% per annum | 710.40 | 1.91  |               | 787.20 | 1.09 |
| Rental value of land | 10000.00 | 26.85 |               | 20000.00 | 27.81 |
| Total Fixed cost (TFC) | 11960.40 | 32.11 |               | 22262.20 | 30.96 |
| Total Establishment Cost (TVC + TFC) | 37244.40 | 100.00 |               | 71916.28 | 100.00 |
| X. Returns (sale of leaf/cocoon production) | 18200.00 | 38350.00 |               | 33566.28 |
| Net Establishment Cost (Z+Y-X) | 19044.40 | 33566.28 |               |
c) Maintenance cost: The cost incurred on mulberry cultivation from second year onwards is regarded as maintenance cost. The details of maintenance cost on marginal & small farms is presented in Table 6. During maintenance period five crops at an interval of two & half months were taken up by farmers. The total cost incurred on maintenance of mulberry was ₹47,348 (marginal farms) and ₹85,760 (small farms). The expenditure on hired labour (~20%) shared major chunk of the total cost followed by irrigation charges (10%), FYM (6-8%), Fertilizers (5%) etc. Human labours were hired to perform labour intensive operations such as application of FYM, weeding and application of plant protection chemicals. To overcome labour problem, farmers had made an arrangement of working on collective mode. Neighbouring farmers voluntarily come together and work for other farmers to meet labour requirement. To lift water from tube/open wells, the water lifting devices were hired on rental basis during late autumn & summer months to facilitate irrigation. Flood irrigation was the usual practice demanding more of human labour. Application of FYM was done prior to monsoon to retain soil health. Straight and complex fertilizers such as Urea, DAP, SSP, MOP, 10:26:26 were applied in five splits @ 310 kg (marginal farms) & 620 kg (small farms) per year. The average productivity of mulberry was found to be 7.7 tons (per 0.66 acre; marginal farm) and 17.89 tons (per 1.5 acre; small farm) from five crops in a year. The Cost-A incurred per kg of mulberry leaves came to ₹3.63 (marginal farm) and ₹2.78 on small farms. The Cost-C (total cost) per kg of mulberry leaves worked out to ₹6.21 (marginal farm) and ₹4.79 (small farms). The result reflected the existence of scale economies on small farms, accordingly, small farmers could save 20% of maintenance cost.

| Particulars                        | Marginal Farms | Small Farms | % to total cost | % to total cost |
|------------------------------------|----------------|-------------|-----------------|----------------|
|                                    | Qty. Value (%) | Qty. Value (%) |                 |                |
| Human Labour (hired mandays)       | 40 10000       | 65 16250     | 21.12           | 18.75          |
| Bullock Labour (hired Pairs)       | 1 500         | 2 1000       | 1.06            | 1.17           |
| FYM(tonnes)                        | 3 3000        | 7 7000       | 6.34            | 8.16           |
| Fertilizers (kg)                   | 310 2330      | 620 4660     | 4.92            | 5.43           |
| Gap filling planting material (nos.)| 605 60        | 805 80       | 0.13            | 0.09           |
| PPC (lit)                           | 2 300         | 2.5 375      | 0.63            | 0.44           |
| Irrigation Charges (no. of times)  | 14 4480       | 31 9920      | 9.46            | 11.57          |
| Interest on working capital @ 12%/annum | 2480.4 5.24  | 3928.5 4.58 |                 |                |
| land revenue                        | 140 0.30      | 245 0.29     |                 |                |
| Depreciation                       | 1110 2.34     | 1230 1.43    |                 |                |
| Amortised establishment cost       | 2285.33       | 3356.63      | 4.83            | 3.91           |
| Sub-Total                          | 27637.95      | 49723.44     | 58.37           | 57.98          |
| Interest on fixed asset (8% per annum) | 710.4 1.50   | 787.2 0.92   |                 |                |
| Rental Value of owned land         | 10000 21.12   | 20000 23.32  |                 |                |
| Sub-Total                          | 38348.35      | 70510.64     | 80.99           | 82.22          |
| Imputed family labour              | 34 8500       | 57 14250     | 17.95           | 16.62          |
| Imputed own Bullock labour         | 1 500        | 2 1000       | 1.06            | 1.17           |
| Sub-Total                          | 47348.35      | 85760.64     | 100.00          | 100.00         |

Economics of Mulberry Cocoon Production

a) Labour use pattern in cocoon production: The information on operation-wise labour use pattern in silkworm rearing on marginal farms (200 disease free layings or dfls) & small farms (400 dfls) per crop is detailed in Table 7. The total mandays required per crop to rear above mentioned dfls by marginal and small farms was 33 & 59, respectively. Human labour was essential to perform operations such as harvesting of leaves, its chopping, feeding, bed cleaning, mounting, harvesting & grading of cocoons. Forth and fifth instars’ of silkworm were considered as most labour intensive work demanding 20 mandays (25%) and 35 mandays (36%) for marginal and small farms, respectively. Forth and fifth instar larvae voraciously feed on mulberry, hence huge feed should be given atleast three times a day. Labour was also required to clean rearing trays (dalas) & dusting to keep worms free from infections/diseases. During 4th & 5th instars, heavy huge consumption of leaves produces more feces demanding more labours to clean beds/trays hygiene.
Table 7. Operation-wise labour-use pattern in Silkworm Rearing (per crop)

| #  | Particulars                              | DFLs reared |
|----|------------------------------------------|-------------|
|    |                                          | 200         | 400         |
| 1. | Disinfection                             | 2 (6.06)    | 4 (6.77)    |
| 2. | I Instar (4 days)                        | 2 (6.06)    | 4 (6.77)    |
| 3. | II Instar (3 days)                       | 2 (6.06)    | 4 (6.77)    |
| 4. | III Instar (4 days)                      | 3 (9.09)    | 5 (8.47)    |
| 5. | IV Instar (4-5 days)                     | 8 (24.24)   | 14 (23.72)  |
| 6. | V Instar (6-7 days)                      | 12 (36.36)  | 21 (35.59)  |
| 7. | Ripened larvae transformed to Chandrikes  | 2 (6.06)    | 4 (6.77)    |
| 8. | Harvesting & Grading Cocoon              | 2 (6.06)    | 4 (6.77)    |
|    | Total                                    | 33 (100%)   | 59 (100%)   |

Values in ( ) indicates the percentage contribution to the total

b) Cocoon production cost: Table 8 shows cost of mulberry cocoon production on marginal & small farms with five rearings per year. Total cost incurred on cocoon production was ₹1,23,053 (marginal) and ₹2,00,926 (small farms). The major expenditure was on mulberry leaves (~23%) followed by imputed family labour (22%) and hired human labour (13%) on both small and marginal farms. The total cocoon yield obtained per year was 435 kg (marginal farms) and 840 kg (small farms). The gross returns from cocoon production was ₹1,81,203 in case of marginal farms and ₹3,14,466 on small farms. Returns per rupee of expenditure from cocoon production were higher on small farms (1.58) as compared to marginal farms (1.47). The total cost per kg of cocoon (Cost-C) worked out to ₹283 on marginal farms and ₹239 on small farms, respectively. This clearly reflects the operation of scale economies. Sericulture being a labour intensive enterprise could be made profitable through reduced reliance on human labour through mechanization of possible operations. Further, majority of the farmers perceived rearing of Multi x Bi or Multi x Multi hybrids as less risky as compared to Bi x Bi hybrids during unfavourable seasons viz., Baisakhi (April), Shravani/Jaitha (June-July) & Aswina (Sept) (10). Inadequate land holding and labour intensive nature of mulberry cultivation are identified as major causes for marginalization of mulberry sericulture in West Bengal.

Table 8. Cost and Returns of Cocoon Production

| #    | Particulars                              | Marginal Farms | Small Farms |
|------|------------------------------------------|----------------|-------------|
|      |                                          | Qty. | Value (₹) | % to total cost | Qty. | Value (₹) | % to total cost |
|      | Human Labour (hired mandays)             | 60   | 15000.00 | 12.19       | 108  | 27000.00 | 13.44       |
|      | DFLs (nos.)                              | 400-850 | 4450.00 | 3.62       | 1000-1600 | 7825.00 | 3.89       |
|      | Mulberry leaves (kg)                      | 7700 | 27637.95 | 22.46       | 17890  | 49723.44 | 24.75       |
|      | Disinfectants                            | 3800.00 | 3.09     | 4700.00 | 2.34     |
|      | Electric Charges                         | 1216.00 | 0.99     | 2000.00 | 1.00     |
|      | Marketing fee                            | 750.00 | 0.61     | 1000.00 | 0.50     |
|      | Interest on working capital@12%/annum    | 7910.39 | 6.43     | 13949.84 | 6.94     |
|      | Rearing house revenue                    | 150.00 | 0.12     | 240.00 | 0.12     |
|      | Depreciation (Rearing house & its appliances) | 12604.00 | 10.24 | 14638.00 | 7.29     |
|    | Sub-total                                 | 73518.34 | 59.75     | 121076.29 | 60.26     |
|    | Cost B                                   | 18285.12 | 14.86     | 25600.00 | 12.74     |
|    | Rental Value of owned rearing house      | 5000.00 | 4.06     | 7000.00 | 3.48     |
|    | Sub-total                                 | 96803.46 | 78.67     | 153676.29 | 76.48     |
|    | Imputed family labour (mandays)          | 26250.00 | 21.33     | 47250.00 | 23.52     |
|    | Sub-total                                 | 123053.46 | 100.00   | 200926.29 | 100.00     |
|    | Cocoon or Output (kg)                     | 435.00 | 839.92   |
|    | Yield per 100 DFLs                        | 45.79 | 42.00    |

Continued on next page
Table 8 continued

| Cost per kg of cocoon (Cost A) | 169.01 | 144.15 |
| Cost per kg of cocoon (Cost B) | 222.54 | 182.97 |
| Cost per kg of cocoon (Cost C) | 282.88 | 239.22 |
| Gross returns based on Cost A | 181203.68 | 314466.67 |
| C:B Ratio | 1: 2.46 | 1: 2.64 |
| based on Cost B | 1: 1.87 | 1: 2.05 |
| based on Cost C | 1: 1.47 | 1: 1.58 |

4 Conclusion

The majority of the farmer in West Bengal are marginal land holders practicing sericulture with mulberry varieties such as Local, S-1 & S-1635 and silkworm hybrids such as N×M12W, N×(SK6×SK7) & SK6×SK7 across five crops. Cost of production per kg of mulberry cocoon on marginal farms worked out to ₹283 and profitability was expressed in terms of the returns per rupee of expenditure ₹1.47. The returns per rupee of investment on marginal farms could be increased through collective action with the formation of multipurpose sericulture farmer’s co-operatives. Huge expenditure on labour in both marginal & small farms reflected the scope for mechanization in sericultural operations. Scale economies visible on small farms could be reaped on marginal farms through adoption of suitable mechanization on custom hiring basis. These cost estimates will also serve as basis for government intervention/policy-makers in the announcement of support price in the event of price crash (e.g. current situation of pandemic COVID-19;[10,11])

Acknowledgement

The authors are grateful to Central Silk Board (Bengaluru), Dept. of Sericulture (West Bengal) and other facilitators in conducting this study successfully.

References

1) Central Silk Board, Seri-States of India- A Profile. 2019.
2) Okhandiar RR, Kumaresan P. Indian Sericulture Industry leaps ahead. In: and others, editor. 6th Asia-Pacific Congress of sericulture & Insect Biotechnology (APSERI-2019), Mysore. 2019;p. 7–11.
3) Manjunath M, Narayanaswamy KC, Savithramma, S HB, Harishkumar HV. Scenario of mulberry and cocoon production in major silk producing States of India- Application of exponential growth function. *Indian Journal of Economic Development*. 2015;3(8):1–8. Available from: https://pdfs.semanticscholar.org/fe58/e533068a96f5fa48873239f3d1533f76e5.pdf.
4) Manjunatha GR, Afroz S, Pandit D, Biswas T, Chanda S. MTS-3599: Study on mulberry sericulture production in West Bengal: A Statistical Approach. *CSRTI-Berhampore Annual Report*. 2019;p. 48–50. Available from: http://www.csritber.res.in/annual%20report%202018-19.pdf.
5) CSRTI-BHP. Annual report of CSRTI-Berhampore for the year 2019-2020. 2020.
6) Manjunatha GR, Afroz S, Pandit D, Biswas T, Chanda S. MTS-3599: Study on mulberry sericulture production in West Bengal: A Statistical Approach. *Concluded report*. 2018;p. 1–26. Available from: http://www.csritber.res.in/MTS_3599.pdf.
7) Afroz S, Manjunatha GR, Biswas TD, Pandit D. Skill Gap Analysis in Silkworm Rearing among Farmers and Extension Workers in Eastern India. *Indian Journal of Extension Education*. 2018:54(3):85–90. Available from: https://www.researchgate.net/publication/329609737_Skill_Gap_Analysis_in_Silkworm_Rearing_among_Farmers_and_Extension_Workers_in_Eastern_India.
8) Mahesh R, Pappachan A, Vijay V, S S, BCKV, C. K. Economics of growing mulberry under lowcost drip fertigation technology. *Industry & Livelihood (ACRL 2019)*. 2019;1:57–57.
9) Lakshmnan S, Devi G, R. Studies on economics of sericulture under dry farming condition in Chamarajanagar district of Karnataka. *Indian Journal of Sericulture*. 2005;44(2):183–183.
10) Manjunatha GR, Hunmily E, Patil KKR, Afroz S, Parmeshwaraiai J, Pandit D, et al. Prognostication of mulberry silk cocoon prices in Kaliachak (West Bengal) market. *Journal of Crop and Weed*. 2019;15(3):48–53. Available from: https://dx.doi.org/10.22271/097746331.2019.v15.i3.1236.
11) P K, R MG, Patil KKR, P K, J P, Pandit D, V S, et al. An Impact Analysis of COVID-19 on Profitability of Sericulture in Karnataka. In: International E Conference of Effect of COVID Pandemic on Agriculture and Allied Sciences. Lucknow. 2020.