

Sericulture as a Sustainable Tool for Economic Development of Small and Marginal Farmers

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ABSTRACT: The experiment was carried at Sericulture Production and Marketing Unit at Agricultural College, Jagtial, PJTSAU. The final year B.Sc. (Ag.) students from 2012-13 to 2017-18 as a part of their Agricultural Experiential Learning Programme (AELP) have been trained in sericulture. As a part of their AELP they undergone rigorous training in rearing techniques and handling skills of sericulture at Department of Entomology, Agricultural College, Jagtial. The rearing skills of silkworms are essential for the success of the sericulture. The results clearly showed that sericulture will be a dependable industry especially for small and marginal farmers with minimum investment, low gestation period and high net returns. The production of cocoons and net profits increased as we progressed from 2012-13 to 2017-18 and few students who are passionate and impressed by the results turned out to be entrepreneurs in sericulture after their graduation.

Keywords: Sericulture, Mulberry, Silkworm, Chawki rearing, Late age larval rearing, Cocoon production and Agricultural Experiential Learning Programme (AELP).

INTRODUCTION

India occupies the second position next to china in raw silk production and consumer of pure silk. In India, silk production has improved manifold in recent years. India produces all the four varieties of silk (Mulberry, Eri, Tasar and Muga) in the world. Tasar, Eri and Muga silks are cultivated from *Antheraea mylitta*, *Philosamia ricini* and *Antheraea assama*, respectively.

Silk contains a very little amount of sulphur and having outstanding mechanical strength, comfortability and elegant luster (Bandana, 2013; Sarma, 2013) and ecofriendly nature, hence, silk is considered as “Queen of fibers.”

In India, Karnataka, Andhra Pradesh, Tamil Nadu, Jammu & Kashmir and West Bengal, are the leading states in mulberry silk production, while Jharkhand, Chhattisgarh, Orissa and north-eastern states are leading in non-mulberry silks production (www.csb.gov.in).

In India, rural economy is very much influenced by the agriculture and agro based industries. Furthermore, the limited land, poor returns and agriculture being confined to one or two seasons in the year have made villages to look for other supporting rural industries such as sericulture (Rai, 2006).

Sericulture is an important labour-intensive and agro-based cottage rural industry. It is providing an occupation to around 7.9 million persons in rural and semi-urban areas in India. The people were engaged in various sectors of sericulture industry like pre-cocoon

and post-cocoon operations. Out of these, a good number of workers belong to the economically weaker sections of society. Mulberry silk production is the largest practiced sericulture industry in India which contributes almost 75 percent for entire silk production in the country. Sericulture industry provides livelihood to large section of the rural and semi-urban population through different activities like mulberry cultivator, cooperative rearers, silkworm seed producer, farmer-cum rearer, reeler, twistor, weaver, hand spinners of silk waste, traders etc. (Upadhyay and Barman 2013) Sericulture comprises mainly three inter-linked activities: 1. Cultivation of Host Plant. 2. Silk worm rearing for cocoon production 3. Silk extraction from cocoons *i.e.* Silk Reeling and other Post Cocoon activities like spinning, twisting, weaving, processing, printing etc. (Ahmed and Rajan 2011).

Sericulture plays very effective role in the utilization of the natural resources in a most effective manner for socio-economic upliftment with livelihood, employment and income generation (Malik, 2008). Sericulture is an integral part of modern rural life, practiced by about 1.5 lakh rural farmers in the states of Jharkhand, Chhattisgarh, Orissa, Madhya Pradesh, Utter Pradesh, West Bengal, Bihar, Maharashtra and Andhra Pradesh (Shetty, 2007).

Sericulture in India is a rural based organized activity and is labor intensive. Mulberry cultivation is spread over 22 States, covering 172000 ha, in 54000 villages operating 258000 handlooms and 29340 power looms

(Dewangan *et al.*, 2011; Sarkar *et al.*, 2017; Singh *et al.*, 2021). The four different types of silk produced in India such as Mulberry 74.03% (25,853 MT), highest volume, Tasar 4.17% (1,456 MT), Eri 21.07% (7,359 MT) and Muga 0.73% (255 MT) of the total raw silk production of 34,923 MT in 2021–22. Karnataka is the leading state in raw silk production with over 9,322, 11,592, 11,143, 11,292 and 11,191 metric tons of raw silk produced, and followed by Andhra Pradesh with almost 6,778, 7,481, 7,962, 8,422 and 8,835 metric tons of raw silk (www.csb.gov.in-Central Silk Board, Ministry of Textiles, Govt. of India 2022).

Sericulture is a dependable cash crop with a gestation period of thirty days. Hence, this helps the rural people for their socio-economic development, women empowerment, children's education status. Sericulture includes the practical aspects such as increasing productivity of land as well as labor, stabilization of cocoon production, improvement of silk yarn, fabric and generating profitable income for rural poor, Scheduled Castes (SC), Scheduled Tribes (ST) and Other Backward Classes (OBC) people. At present, with government support, tribals and few non-tribals under the Below Poverty Line (BPL) category are practicing sericulture and producing silk cocoons.

By considering all the facts, sericulture is opted by many farmers as a cash crop and it is a boon to the farmers to change their economic status. Hence, the present study was taken to show case the profits of sericulture to the rural farmers of Karimnagar district, especially the villages in and around of Jagtial. The final year B.Sc. (Ag.) Students have got an opportunity to work in sericulture. After completing the training few students got confidence and started their career in sericulture by establishing their own sheds in their own villages.

MATERIALS AND METHODS

Study site and crop establishment: The experiment was carried out for six consecutive years of 2012-13, 2013-14, 2014-15, 2015-16, 2016-17 and 2017-18 at Agricultural College, Jagtial, Telangana, India, which is located at 18.84°N latitude and 78.95°E longitude. This area falls under Northern Agro-Climatic Zone of Telangana and it falls under semi-arid tropical climate. Soils are black soil with assisted irrigation and an average temperature of 22°C. A bulk area of 4000 m²(1acre) was prepared and transplanted during first year using mulberry variety V1 with a spacing of 60 × 60 cm between the rows and plants. The crop was raised following all the recommended package of practices. The operations like pruning, fertilization, irrigations and other management practices were followed as per the schedule after every harvest.

Silkworm Rearing Shed: Rearing shed constructed with dimensions of 20' × 50' × 12' (lbh) with the financial assistance of ICAR under Agricultural Experiential Learning

Silk worm rearing: In the First year 100 dfls were brushed and following subsequent years 600dfls bivoltine (Diseased free Layings) were brushed per year. The DFL's were procured from grainages from

Mysore and supplied by Sericulture Officer, Department of Horticulture, Telangana.

Black boxing: After receiving the dfl's they are subjected to black boxing. Allowing the eggs to develop in a totally dark environment to synchronize the circadian rhythm of the silkworms, thus ensuring uniform hatching of eggs. Black boxing should be done on the 8th or 9th day i.e. on the onset of eye-spot or black head stage.

Chawki Rearing: The Silkworm life cycle comprises 5 larval instars, and 4 moults. Rearing of young age silkworms up to 2nd moult is called as chawki rearing. Approximately first five to six days rearing is known as chawki rearing. This stage of larvae requires ideal environmental conditions like 26-27°C temperature and 85-90% RH and tender mulberry leaves. These conditions were maintained in the rearing shed. Robust growth and development of chawki larvae make them resistant to diseases and they become more stress tolerant during later stages of development.

Late age larva rearing: The rearing of 3rd, 4th and 5th instar larvae up to spinning is known as late larval rearing. This late larval rearing will take approximately 16-18 days including moulting period and total larval duration ranges from 24-28 days.

Mounting of Cocoons: Netrikas are used for the mounting. Approximately 50 matured worms placed in a 1 sq. ft. area in the montage for smooth spinning and maintained a temperature of 24°C and 60-65% RH besides providing good aeration at the time of spinning. Spinning of cocoons completed within 2-3 days and harvesting of the cocoons was done on the 6th day and collected cocoons were sorted into good, double, flimsy and stained cocoons separately from the mountage. The cocoons were cleaned by removing floss and they were loosely packed in jute bags for transporting to the market. The cocoons were marketed at Govt. Cocoon market at Tirumalagiri, Hyderabad

RESULTS

The brushing of silkworms were started from 2012-13 soon after establishment of sericulture shed and mulberry garden. Here we are presenting the results of sericulture production from 2012-13 to 2017-18 (Table 1).

Year wise production results were discussed briefly here under.

2012-13: Mulberry garden establishment, rearing house establishment etc. are the different activities were taken during first year. Rearing activities initiated little late hence only one crop taken with 100dfls. We have got a yield of 80kgs with returns of Rs.23700/- and net profit of Rs.10700 in first year.

During 2nd year 2013-14 well established garden available. We have taken up 4 crops with 150 dfls each crop were taken. We have got a yield of 486kgs and got gross return of Rs.1,44,600/- with a net profit of Rs. 1,31,200/-

Similarly, 3rd year 2014-15 four crops with 150dfls were raised. We have got a yield of 450kgs and got gross return of Rs.1,34,500/- with a net profit of Rs.1,17,100/-

4th year 2015-16 four crops with 150 dfls were raised. We have got a yield of 420 kgs and got gross return of Rs.1,42,240/- with a net profit of Rs.1,26,440/-
 5th year 2016-17 four crops with 150dfls were raised. We have got a yield of 480kgs and got gross return of Rs.1,81,500/- with a net profit of Rs.1,68,100/-

6th year 2017-18 four crops with 150 dfls were raised. We have got a yield of 468 kgs and got gross return of Rs. 1,97,360/- with a net profit of Rs.1,79,960/-

Table 1: Cocoon Production details from 2012-1 to 2017-18.

Particulars	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
No. of DFLs reared/crop	100	150	150	150	150	150
No. of Crops/year	1	4	4	4	4	4
Total no. of DFLs reared	100	600	600	600	600	600
Total cost of cultivation	13000/- (10000+ 3000)	13400/- (5400+ 8000)	17400/- (5400+ 12000)	15800/- (5400+ 10400)	13400/- (5400+ 8000)	17400/- (5400+ 12000)
Total weight of cocoons produced	80 kgs	486 kgs	450 kgs	420 kgs	480 kgs	468 kgs
Weight of good cocoons	78 kgs	480 kgs	445 kgs	416 kgs	475 kgs	464 kgs
Weight of double cocoons and tenits	2 kgs	6 kgs	5 kgs	4 kgs	5 kgs	4 kgs
Cost per Kg cocoons	300/-	300/-	300/-	340/-	380/-	420/-
Total Returns from good cocoons	23,400/-	1,44,000/-	1,33,500/-	1,41,440/-	1,80,500/-	1,96,560/-
Total Returns from defective cocoons	300/-	600/-	1000/-	800/-	1000/-	800/-
Total Gross Returns	23,700/-	1,44,600/-	1,34,500/-	1,42,240/-	1,81,500/-	1,97,360/-
Total Net returns	10,700/-	1,31,200/-	1,17,100/-	1,26,440/-	1,68,100/-	1,79,960/-
1 dfl	400 to 500 eggs					
Cost of 50 DFLs	450/-					

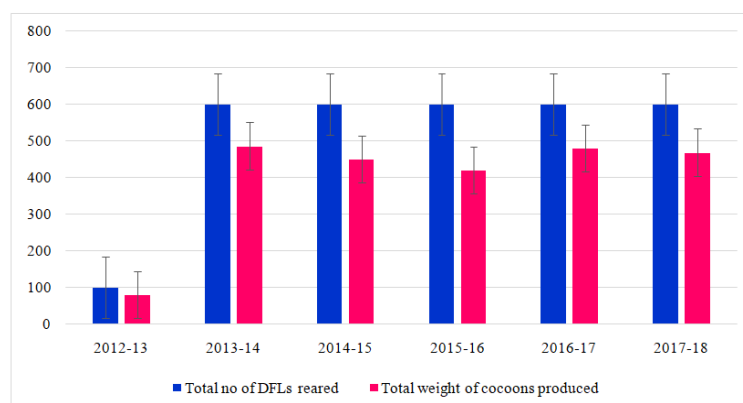


Fig. 1. The bar graph representing the number of disease free larvae (DFL) reared and weight of cocoons produced by mulberry silk worm *Bombyx mori*.

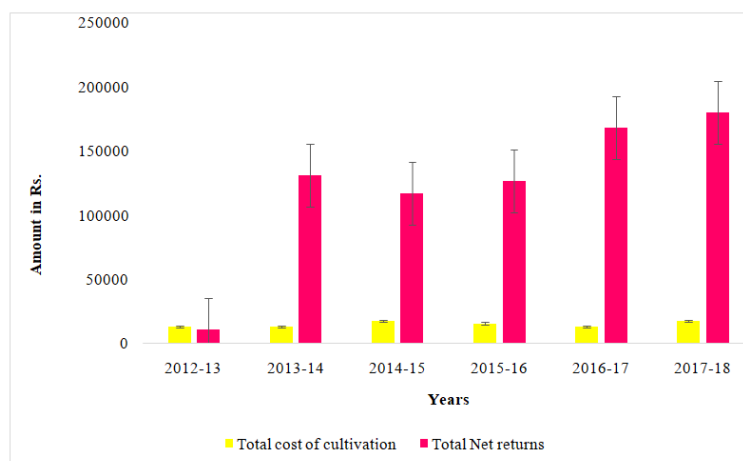


Fig. 2. The bar graph representing total cost of cultivation and net returns of silkworm *Bombyx mori*.

Sericulture has recorded good yields from 2012-13 to 2017-18. However, the first year 2012-13 we are not able to take full crops as time lapsed in establishing the mulberry garden. After first year, every year six hundred dfls were brushed and got pretty good yields with encouraging profits. If we expand the mulberry garden area we can have still more profits with minimum expenditure increase. A normal family of four members can easily brush three hundred dfls and can able to manage one hectare mulberry garden. The similar trend was found in Raigarh district of Chhattishgarh by Santosh Kumar and Dewangan (2018) in a comparative study of economics of sericulture.

Advantages of Sericulture sector: Employment generation: Sericulture can generate employment up to 11 persons for every kg of raw silk produced. Out of which more than 6 persons are women. More than 60.00 lakh persons are employed as full time workers in the production chain out of which 35-40 lakh persons are women.

Low gestation period: Sericulture operations require very low investment for its initial establishment. Mulberry takes only 6 months to grow for commencement of silkworm rearing. Mulberry once planted will go on supporting silkworm rearing year after year for 15- 20 years depending on management provided.

High returns and women empowerment: Sericulture provides more opportunities to the women in the rural areas particularly in silkworm rearing and reeling activities. Sixty percent of the women employed in sericulture sector starting from mulberry garden management, leaf harvesting and silkworm rearing.

Best programme for weaker sections of the society: Sericulture is having low gestation and higher returns hence, it is an ideal programme for weaker section of the society.

Eco- friendly activity: Mulberry is a perennial crop with good foliage contributes to soil conservation and provides greenery. Waste from silkworm rearing can be recycled as inputs to garden.

Income generation: Sericulture is one of the best option to raise economic status of the farming community and also to earn foreign revenue (Thapa and Shrestha 1999).

CONCLUSIONS

Sericulture is the most important cash crop with minimum investment, low gestation period and high net returns. Sericulture is suitable for every section of society including a big farmer to a landless person irrespective of gender. It involves simple skill, which is easy to understand and adopt. Thus, Sericulture has provided employment and income generation in rural and semi-urban areas, high participation for low-income and socially under privileged groups.

Based on the earlier experiences it has been observed that there are several advantages in sericulture, including an established rearing system, cost effectiveness, reproducible, health applications, no ethical issues and no danger of biohazard. Thus, it is

being the utmost labor intensive division, which provides many opportunities for employment generation. Silk proteins like sericin and fibroin have various applications in many versatile fields as excellent biomaterials to be used beyond their traditional applications in textiles industry. Silkworm is an excellent tool for drug screening in biomedical wings also. So, new races and value addition to the cocoons will be very useful and worthy to enhance the profits for the farmers.

FUTURE SCOPE

The best agronomic practices of the host plant, advanced skills of managing the larvae with automation and disinfection protocols will be useful in increasing the yields.

Ethics approval and consent to participate: This article does not contain any studies with human participants or animals performed by any of the authors.

Availability of data and material: The data sets generated during and/or analysed during the current study are available with the corresponding author on reasonable request.

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