INSTITUTION OF AGRICULTURAL TECHNOLOGISTS,

BENGALURU

EVALUATION OF RKVY PROJECTS

OF

UNIVERSITY OF AGRICULTURAL SCIENCES,

BENGALURU

"PRODUCTIVITY ENHANCEMENT IN SERICULTURE THROUGH COMMUNITY CLUSTER APPROACH"

INSTITUTION OF AGRICULTURAL TECHNOLOGISTS,

#15, QUEENS ROAD, BENGALURU 560 052

PRODUCTIVITY ENHANCEMENT IN SERICULTURE THROUGH COMMUNITY CLUSTER APPROACH

EXECUTIVE SUMMARY

The art of silk production is called sericulture that comprises cultivation of mulberry, silkworm rearing and post cocoon activities leading to production of silk yarn. Silk, a highly priced agricultural commodity, accounts for about 0.2% of the total world production of textile fiber. Sericulture is an agro-based industry that involves rearing of silkworms for the production of raw silk which is the yarn obtained out of cocoons spun by certain species of insects. The major activities of sericulture comprise of food-plant cultivation to feed the silkworms which spin silk cocoons and reeling the cocoons for unwinding the silk filament for value-added benefits such as processing and weaving. Domesticated silkworm (Bombyx mori) are raised for the purpose of production of cocoons.

Apart from silk, there are several other by-products from sericulture. The mulberry fruits are rich in minerals and vitamins and from the roots, barks and mulberry leaves several ayurvedic and herbal medicines are prepared. Some of the woody mulberry trees provide timber which are resistant to termites and the timber is used for making sports items, toys etc. The mulberry branches after silkworm feeding are generally dried and used as fuel particularly in the villages. The foliage of mulberry is used as a fodder for cattle. The silkworm pupae are rich in oil content and pupal oil is used in cosmetic industry and the remaining pupal cake is a rich source of protein suitable for poultry and fisheries.

Sericulture is one of the major agro-based activities which can provide gainful self-employment for poor families in rural areas on their own land. It is an enterprise with a very short gestation period, having the potential to generate adequate returns from a very small piece of land. The pursuit of sericulture offers gainful employment to the rural masses. Being a labour intensive rural based industry it offers a qualitative and quantitative change in the poverty alleviation with a chain creation of employment from unskilled farm labourers to skill artisans to all sections in rural areas. The silk industry encompasses different on-farm and non-farm activities, with diversified nature of skills, involving a heterogeneous group of people, bringing people of various walks of life together work for the production of silk. Sericulture is a continuous activity and employment is available throughout the year.

The major silk producing countries in the world are; China, India, Uzbekistan, Brazil, Japan, Republic of Korea, Thailand, Vietnam, DPR Korea, Iran, etc. Few other countries are also engaged in the production of cocoons and raw silk in negligible quantities; Kenya,

Botswana, Nigeria, Zambia, Zimbabwe, Bangladesh, Colombia, Egypt, Japan, Nepal, Bulgaria, Turkey, Uganda, Malaysia, Romania, Bolivia, etc. The major silk consumers of the world are; USA, Italy, Japan, India, France, China, United Kingdom, Switzerland, Germany, UAE, Korea, Viet Nam, etc. the major producers are in Asia (90% of mulberry production and almost 100% of non-mulberry silk).

India occupies a predominant position in the world in silk production and India is the second largest producer of silk in the World (35,261 tonnes), next to China (1,20,000 tonnes), with 16.14% share in global raw silk production. India is also the largest consumer of silk in the world. Among the four varieties of silk produced in 2018-19, Mulberry accounts for 71.50 per cent (25,213 tonnes), Tassar 8.44 per cent (2,977 tonnes), Eri 19.40 per cent (6,839 tonnes) and Muga 0.66 per cent (232 tonnes) of the total raw silk production of 35,261 tonnes. (CSB, 2016). Though, Indian breeds/hybrids have the potential to produce the same quality, our system of sericulture practices is entirely different from that of China. The strict maintenance of discipline and better linkage from farmers to weavers, large-scale operation of egg production, reeling and weaving using modern machineries, strict control measures for diseases, uniform adoption of new technologies, supply of required quantity of quality eggs in time to avoid the chances of contamination of young silkworm etc. make the Chinese sericulture more vibrant economically sound and sustainable. Another area of difference is that the entire production is state controlled with no open marketing/auction systems for silk cocoons and yarns.

Over the last six decades Indian silk industry has registered an impressive growth, both horizontally and vertically. Plans and schemes implemented by Central and State agencies and relentless efforts of thousands of dedicated persons in the fields of research and extension have helped in this context. For instance, the age old multivoltine hybrids have been replaced by Multivoltine, Bivoltine and Bivoltine hybrids. The sericulture has witnessed a quantum jump in raw silk productivity. The average yield of 25 kg of cocoons/ 100 DFLS in the recent past has increased and currently the average yields are in the range of 60 – 65 kg/ 100 DFLS. The new technology, besides doubling yields has also led to qualitative improvements in cocoon production with considerably reduced renditta and has also helped break the climate barrier.

India’s dependence on China for the import of high-quality silk is likely to come down in the next 3-4 years, with the country striving to become self-sufficient in silk production by 2022. In 2016-17, India imported close to 3,700 tonnes of high-quality silk from China, compared to close to 7,000 tonnes in 2013-14. The decrease in import volumes has been primarily on the back of an increase in production of the ‘better quality’ bivoltine silk.

There is an urgent need to bring in a holistic approach, i.e., from leaf to fabric production and marketing and ancillary units of the industry to produce the best at the lowest possible cost so that the country could benefit and rely less on the imported silk in view of the present global scenario. The challenges ahead and strategies required to face the challenges are many:

- Production of silk in India has been rationally driven by domestic demand mainly for heavier handloom-based fabrics like sarees. Silk in India is produced from the hardier and indigenous variety of multivoltine silkworms, the silk produced from these silkworm strains is not gradable. The changing consumer tastes in the domestic market as well as export market from the traditional heavy handloom fabrics like sarees to lighter materials, are sending signals to the industry to reorient its production plans to match the changing demand patterns, by developing the bivoltine silk sector.
- The Indian reeling sector is mainly cottage based and highly decentralized; employing a variety of reeling devices and producing low to medium quality of silk in limited quantities. The equipment used in the silk industry are simple, conventional and less capital intensive. This leads to low value addition, heavy dependence on manual skill and attention and scale and scope economies being negligible. Much needs to be done in the silk machines manufacturing sector to make the industry highly competitive. Unless adequate infrastructure and capabilities are built within the country, it will be difficult to be competitive. There are certain gaps and links that are amiss. Fragmented and very small units would not have the strength to upgrade or understand and react to the market forces. In this context systematic and organized restructuring of the silk industry to emphasize and enhance the production of high quality raw silk on a commercial scale, so as to facilitate export of Indian raw silk and lowering of imports is an essential component in global perspective.
- The pre-requisites for a progressive silk industry would be the availability of raw silk of the right quality in adequate quantities at competitive prices consistently. The present-day problem is that the raw silk lots are quite small and the cocoon prices are quite high (for the quality levels anywhere in the world) and as a consequence the demand for good quality raw silk in bulk quantity at a competitive price is not being met.
- The multi-end reeling technology designed and developed by the Central Silk Technological Institute, Bangalore addressing the quality and productivity issues provides the advantages of pollution free working conditions, reduced health hazards and discourages child labour.
- There is a strong domestic market for silk in India which is expected to continue for a long period. However, the domestic production of raw silk is not sufficient to meet the rising domestic and export requirements. Hence the country is dependent

upon imports to fill the demand and supply gap, mostly from China. Import of raw silk and silk fibre to India negatively affects the domestic producers and forces the Indian government to impose antidumping duty for imports. Self-sufficiency in domestic production of raw silk and suitable business protection for domestic producers of silk may be a solution. The past trends show that the demand supply gap will reduce gradually probably due to improvement in domestic raw silk production and its quality.

- India has a number of distinct silk weaving clusters that are known for unique designs, weaves, colours, patterns, traditional knowledge (TK) and processes that are specific to a geographical region and are guarded for centuries. Over the period, these products have become a brand by themselves and recognized by their place of origin. Muga silks of Assam, Mysore silks of Mysore (Karnataka), Kanchipuram silks of Kanchi (Tamil Nadu), Brocades of Banaras (Uttar Pradesh), Pochampalli saris, Gadwal silks (Andhra Pradesh) are just to cite a few. The globalization has brought about enormous challenges to the trade and industry. The GI Act stipulates protection of the market of the producers and safeguards the interests of the consumers of these unique products through registration and taking infringement action against the infringers. It is believed, that the IPR Protection of unique textile products of the country with a predetermined market linkage strategy would help in brand building of the product, providing market linkages, generating more employment opportunities and enhanced income to the stakeholders. It is hoped that all traditional silks will get the protection under the GI registry umbrella to avoid the exploitation especially in view of globalization.
- With the cheaper silk-like imitations, the consumers are easily being drawn away from silk. They are trying to derive a pseudo satisfaction of wearing a fabric with designs and colours hitherto available only on silk and the feel and appearance with a resemblance of silk. In the market there are numerous other textile materials sold in the name of silk i.e., Art silk, artificial silk and other glamorous names. It is time to educate consumers about the virtues of silk that makes it worthy of possession and drive home the fact that only silk is silk. The emotional chord, luxury image, status and eco-friendly nature of silk is to be brought to focus and this can happen with a strategy for generic promotion of silk. In view of this SILK MARK was launched on 17th June 2004 as an initiative of Central Silk Board, Ministry of textiles, Government of India with major objectives such as protecting the interests of the consumer, protecting the interest of genuine traders and manufacturers of Silk, Generic Promotion of Natural Silk.
- Efforts for quality improvement should necessarily include quality-based pricing of cocoons prior to transaction. Quality standards for seed cocoons, commercial eggs, reeling cocoons and raw silk is of utmost importance to build quality at all stages. Create a brand image for silks from India and build quality into the products, blending heritage with the market requirements.

- One of the serious problems for the sericulture industry is the wide fluctuations in cocoon prices. Unless steps are taken to have efficient and effective marketing organization to prevent wide fluctuations in the prices of cocoons, farmers will not have assured income and also new farmers may hesitate to take up this vocation. Hence, efficient marketing conditions will go a long way in bettering the conditions of sericulturists.
- Sericulture with its unique features plays an important role in upgrading the socio-economic conditions of the rural folk and with employment opportunities to the educated rural youth and women. Therefore, there is a need to provide appropriate forward and backward linkages with necessary technical backup will provide a gateway to the future prosperity of the industry.
- There are five major types of silk of commercial importance obtained from different species of silkworms. These are Mulberry, Oak Tasar & Tropical Tasar, Muga and Eri. Except for mulberry, other non-mulberry varieties of silks are wild silks, known as vanya silks. India has the unique distinction of producing all these commercial varieties of silk. The Vanya silks have more potentialities to grow as ''Very Indian Silk'' in the global market. Being treated as tribal crafts of the hill folks, these silks have great commercial importance because of huge demand in Indian as well as foreign markets. This is one of a huge area to be focused.

Understanding the various stages of growth of silkworms and techniques to be followed for successful rearing of silkworms is essential for farmers to make the activity a viable one.

Economics is an important criterion to evaluate, acceptance and wider adoption of any technology which is economically sound and that can be accepted by the sericulture farming community. Among different indicators of economic efficiency in sericulture, net returns have greater impact on the practical utility and acceptance of the production technology by the farmers. Identification of suitable reasons and management of economic problems to increase the productivity in sericulture is the key for success crop potential (Vinayak Hosmani et al., 2020).

In addition to the understanding of the technology of silkworm rearing, the farmers face several other problems that limit realization of optimum returns. The scarcity of labour with high wage rate is a major problem. Skilled labour is required for planting of mulberry cuttings and other operations. Costly inputs such as cost of fertilizers, growth regulators, irrigation water and labour requirement are prominent problems. Other problems like non-availability of good quality mulberry cuttings followed by unsuitable soil type, and un-favourable climate are affecting quality of mulberry bio-mass production. High temperature during summer is the major constraint in case of cocoon production. It affects the health of silkworms there by the yield of cocoons. Difficulty in obtaining disease

free layings, high incidence of uji fly were other problems faced and volatility of cocoon price, less number of reeler's participation in the auction, lack of local market facility are the major constraints in marketing of cocoon (G. N. Anil Kumar et al., 2019).

There has not been adequate thrust on quality due to the absence of quality-based price fixation. Absence of quality-based pricing has been a major deterrent factor in the pursuit for quality improvement. The seasonality associated with cocoon quality, cocoon supply and price as also the raw silk price almost always determine the fate of reeling activity.

Reeling sector is a vital component of sericulture linking the agriculture-based activity of cocoon production with the industrial activity of fabric production.

Keeping the above in view, the project, "**PRODUCTIVITY ENHANCEMENT IN SERICULTURE THROUGH COMMUNITY CLUSTER APPROACH"** was taken up by University of Agricultural Sciences, Bengaluru with Rashtriya Krishi Vikas Yojana funding. The project was implemented from 2012-13 to 2015-16. The details of the project are as under:

1.	**Title of Project**	**:**	"**PRODUCTIVITY ENHANCEMENT IN SERICULTURE THROUGH COMMUNITY CLUSTER APPROACH"**
2.	**Nodal officer and Principal Investigator**	**:**	**DR. S. CHANDRASHEKHAR** Professor of Sericulture, College of Sericulture, Chintamani, UAS, GKVK, Bengaluru
3.	**Implementing Institution (S) and other collaborating Institution (s)**	**:**	College of Sericulture, Chintamani
4.	**Date of commencement of Project**	**:**	2012-13
5.	**Approved date of completion**	**:**	2015-16
6.	**Actual date of completion**	**:**	2015-16
7.	**Project cost**	**:**	Rs. 125 lakhs

The objectives of the project are as follows:

1. To promote community cluster approach in silkworm rearing to produce uniform quality cocoons and to encourage rearing of bivoltine breeds.
2. To encourage farmers in clusters to effectively utilize sericulture byproducts to increase the returns per unit area from sericulture enterprise.
3. To design and install efficient silk reeling units to produce high quality raw silk.

4. To establish appropriate power loom to convert high quality raw silk into a standard fabric.

The focus of Evaluation is:

i. To evaluate the impact of community cluster approach in silkworm rearing to produce uniform quality cocoons and to encourage rearing of bivoltine breeds.
ii. To evaluate the efficiency of encouraging farmers in clusters to effectively utilize sericulture byproducts to increase the returns per unit area from sericulture enterprise.
iii. To evaluate the impact of designing and installing efficient silk reeling units and establishing appropriate power loom in producing high quality raw silk and converting it into a standard fabric.

A cluster approach for development of sericulture in Chintamani taluk was adopted. Two villages, viz., Kathriguppe and Lakshmidevakote were selected as there was concentration of sericulturists in these villages. A group of 30 farmers with 32 acres under mulberry in Kathriguppe and group of 16 farmers with 26 acres under mulberry in Lakshmidevakote were selected for the project. Participatory Technology Development (PTD) was adopted in the project area. The farmers were motivated to take up bivoltine silkworm rearing by emphasising on the economic and quality aspects of bivoltine silk.

Two village level societies, i.e., Kathriguppe Bivoltine Reshme Belegarar Sangha and Manjunatha Swamy Reshme Belegara Sangha were formed and registered and provided all inputs required for improving mulberry garden and to popularize the bivoltine cocoon production. By laws were framed to fix the responsibility of different stake holders.

Kolar and Chikkaballapur district sericulturists are traditional multivoltine rearers and the selected villages had no bivoltine rearing exposure in the past. The farmers were motivated to take-up Bivoltine silkworm rearing. Totally 11 OFDs and 33 FFS were conducted to educate the farmers on various aspects of sericulture. By participating in FFS, farmers got season long educational activity. Farmers were empowered to solve the sericultural problems by interaction, joint decision making and self-confidence. All the technologies were provided through training programmes and practical demonstrations to transfer the appropriate technologies to the farmers. Selected farmers were given technical guidance through crop inspections to produce quality Bivoltine cocoons and to enhance productivity per unit land value so that their economic uplifting is achieved. Totally 494 farmers were trained on advanced bivoltine sericulture technologies and they were considered for biovoltine rearing. The farmers were trained on aspects related to identification of the diseases, integrated management practices, method of secondary level multiplication of bio control agents and their application. were trained in seven

batches through demonstrations at the Karnataka State Sericulture Research and Development Institute on integrated nutrient and Root Disease Management in mulberry.

The members of the groups were trained on integrated approaches in mulberry production, chawki rearing, silkworm rearing house management, silkworm rearing, grading, packing, etc. They were provided mulberry garden management technologies and critical inputs including chemical fertilizers (Urea, Single Super Phosphate, Muriate Of Potash). Rearing inputs like minimal modification of rearing houses (inputs for Rearing house alterations, i.e., PVC Pipes, mesh and gunny sacks for micro environment improvement) were also supplied. The disinfectants (Seriswach, Sanitech super, Bleaching powder & Decol), bed disinfectants (Vijetha supplement & Vijetha green) and Chawki reared worms were supplied at their door step at free of cost. Inspections were carried out at timely interval and members were provided technical guidance on age and stage of development on day to day basis by the project supervisory staff housed in the village. In addition, common facilities such as power sprayer, brush cutter, plastic montages and mulberry leaf chopping machine were supplied to the society to use on hired basis. Uniform brushing of silkworm breed/ hybrid, management of rearing, harvesting and grading of cocoons were also promoted. Further, they were encouraged for the effective utilization of by products to generate value added products viz., compost/vermicompost, silage, energy cakes, bio gas bio-crafts from defective cocoons, etc. The uniform quality cocoons produced by the group were utilized within the project for its conversion as quality raw silk by using Multi end reeling machine installed at Sericulture College, Chintamani. Standardized the reeling practices for effective conversion of graded cocoons for quality raw silk production and initiated the silk production process. The quality raw silk produced was converted into standard silk fabrics using design. Power loom unit was established at Sericulture College, Chintamani. Studies were initiated to standardize the procedures for effective utilization of reeling waste water as per emerging needs.

Impact

All the farmers were rearing cross breeds with low yield potential prior to the project period. The mulberry gardens were not maintained properly. The average cocoon yield was about 55 kg/ 100dfls and the annual cocoon production from the entire village was about 14000 kg and approximate returns of Rs. 25,20,000 with an average cocoon price of Rs.180/ kg.

The farmers started rearing Bivoltine hybrids after effecting modifications in the mulberry gardens and silkworm rearing houses. The modifications in mulberry gardens were mainly broader rows at 6 feet apart, soil test based application of fertilizers, spraying of plant protection chemicals and following package of practices as guided by the project supervisors. Appropriate production, grading, packing and marketing technologies were adopted by all the members. The average cocoon yield increased to 70.00 kg/ 100dfls and

the total cocoon production in 10 months-time was about 25000 kg with an approximate returns of Rs. 57,50,000 (more than doubled) at average price of Rs.230/ kg for the better quality cocoons.

About 55000 kg high quality cocoons were produced by the cluster farmers every year for the next two years. It amounts to 20 per cent increase in yield and production of 150 ton of quality compost using sericultural wastes.

In Lakshmidevakote cluster, significantly higher yield (30%) was obtained by the farmers compared to the taluk average yield in the preceding years. The average Bivoltine cocoon yield recorded was 79.25 kg/ 100 dfl and the price obtained was Rs.300-375.

The results confirm that under handholding technology adoption and timely technical guidance the traditional multivoltine farmers learnt about Bivoltine rearing technologies and produced an appreciable uniform quality cocoon crop and got an annual return of Rs. 2 lakhs acre/ year.

The feedback received from the farmers who participated in the project include the following:

1. There was continuous guidance from the project supervisors in crop cultivation and silkworm rearing.
2. There used to be some crop failures before the project period. After the training and guidance from the project supervisors, no farmer faced crop failure problems.
3. Most farmers were rearing multivoltine cross breds before the project and shifted to Bivoltine cross breeds during the project period and got better yield and income from better cocoon quality and rates.
4. The farmers faced marketing problems as they had to go to only Ramanagar cocoon market to sell the bivoltine cocoons.
5. The farmers found that bivoltine hybrids are good only during rainy season and shifted to multivoltine races during summer.
6. Farmers were happy with the folding model/ rotary mountages used for bivoltine breed worms.
7. There was increase in area under mulberry by 10 to 15 acres as other farmers in the area took up sericulture.
8. The good results enthused farmers from neighbouring villages, viz., Kundagurki and Donnahalli to take up sericulture activity.
9. Most farmers discontinued the Bivoltine rearing during summer due to high temperature, water scarcity. They took up Bivoltine during winter and rainy seasons. Farmers also experienced marketing problem.
10. There was no increase in area under sericulture in Lakshmidevakote as farmers faced water shortage.

The multi end reeling machine in Sericulture College, Chintamani was installed after studying the design and making suitable modifications, especially in the design of the basin. The machine was tested using the bivoltine cocoons produced by the farmers in Kathriguppe and Lakshmidevakote. The uniform quality cocoons produced by the group were utilized for conversion as quality raw silk.

Power loom was also installed in Sericulture College, Chintamani for the conversion of quality raw silk produced into standard silk fabrics using pre-assigned designs. The multiend reeling machine and hand loom are used extensively for demonstration purposes involving farmers and students in quality silk and fabric production.

The project implementation functionaries have methodically and systematically taken up the task of identifying sericulture clusters, educating the farmers to take up rearing of bivoltine breed through training, exposure visits, demonstrations and hand holding, introducing the farmers to latest technological innovations in mulberry growing and silkworm rearing, providing subsidized inputs and guiding the farmers in taking up successful rearing of bivoltine breeds.

The trainings, exposure visits and demonstrations have been exclusively used to educate the farmers in latest technological innovations in mulberry growing and silkworm rearing. The farmers have adopted the modifications suggested like broader row spacing of 6 feet in mulberry planting, drip irrigation, soil test based application of fertilizers in mulberry growing, providing adequate ventilation and aeration in rearing houses, frequent disinfection, using folding model/ rotary mountages, uniform harvest of cocoons, grading of cocoons in silkworm rearing.

The forming of growers' co-operative societies by the farmers has also helped the farmers in taking up group activities like cocoon grading, group marketing etc.

The impact of introduction of technological innovations like broader row spacing of 6 feet in mulberry planting, drip irrigation, soil test based application of fertilizers in mulberry growing on the yield, quality and economics of mulberry production has not been studied. This could have made the farmers to understand the importance of the technology introduced and given impetus to adoption by other farmers.

Similarly, the effect of providing adequate ventilation and aeration in rearing houses, frequent disinfection, using folding model/ rotary mountages on the microclimate in the rearing house, bacterial counts and quality of cocoons in terms of reeling efficiency, renditta, floss density, filament strength could have given a better picture of the improvements made.

The farmers in the clusters used the third instar silkworms purchased from chawki centres. There is need to encourage the farmers to take up chawki rearing also.

The supply of subsidized inputs appears to have had a negative impact on the project as it was observed that the farmers discontinued the technological innovations suggested once the supply of subsidized inputs was stopped after the project was concluded.

The farmers have stopped rearing of bivoltine breed after the project period mainly due to marketing problems. The bivoltine cocoons had to be marketed only in Ramanagar cocoon market. This aspects should have been considered during the project period and suitable steps should have been taken to ensure smooth marketing avenues for the cocoons.

Although, vermicompost and compost units were established for utilization of sericulture waste for production of compost and vermicompost and mulberry twigs were used for making pallettes after chopping, no specific strategy was put in place for improving the use of sericulture waste like uneaten mulberry leaves, floss etc. There does not seem to be any appreciable effort made to make use of the sericulture wastes in preparing by-products to augment the income of farmers.

The establishment of multi end reeling unit and power looms in sericulture College, Chintamani does not appear to have been optimally utilized in the project as no comprehensive and discernible efforts are found to improve the quality of post cocoon processing. However, the multiend reeling machine and hand loom are used extensively for demonstration purposes involving farmers and students in quality silk and fabric production.

REFLECTIONS AND CONCLUSIONS

1. The project has been well planned, efficiently executed and commendable impact has been observed in improvement of income of stake holders in the clusters formed.
2. The identification and formation of clusters have been done meticulously.
3. The introduction of technological innovations in the clusters has been well thought out and executed systematically.
4. The farmers have adopted the technological innovations in right earnest. This is clearly seen more in mulberry cultivation where broader row plantations, drip irrigation, soil test based application of fertilizers are practiced. The farmers have also adopted the improvements suggested in silkworm rearing like providing better ventilation and aeration, frequent disinfection and grading of cocoons.

5. The farmers experienced difficulty in marketing their produce as they had to go to Ramanagar cocoon market only.
6. The impact of technological innovations on the yield, quality and economics of mulberry production could have made the farmers to understand the importance of the technology introduced and given impetus to adoption by other farmers.
7. The effect of providing adequate ventilation and aeration in rearing houses, frequent disinfection, using folding model/ rotary mountages on the microclimate in the rearing house, bacterial counts and quality of cocoons in terms of reeling efficiency, renditta, floss density, filament strength could have given a better picture of the improvements made.
8. The supply of subsidized inputs appears to have had a negative impact on the project as it was observed that the farmers discontinued the technological innovations suggested once the supply of subsidized inputs was stopped after the project was concluded.
9. The farmers have stopped rearing of bivoltine breed after the project period mainly due to marketing problems. This aspect should have been considered during the project period and suitable steps should have been taken to ensure smooth marketing avenues for the cocoons.
10. There does not seem to be any appreciable efforts made to make use of the sericulture wastes in preparing by-products to augment the income of farmers.
11. The establishment of multi end reeling unit and power looms in sericulture College, Chintamani does not appear to have been optimally utilized in the project as no comprehensive and discernible efforts are found to improve the quality of post cocoon processing.
12. The involvement of line departments was not seen except in sanction of subsidy for drip irrigation and a few extension activities for technology dissemination.
13. Criteria for selection of farmers has not been detailed in the project and needs to be spelt out/ brought out.
14. Impact assessment of the technology developed in improving the productivity and quality of cocoon and silk needs to be brought out.
15. Impact of training modules adopted needs to be brought out.

ACTION POINTS

1. The planning and implementation of the project have been meticulous and are praiseworthy. The project is suitable for replication in other sericulture areas of the state.
2. The convergence of line departments is necessary for better implementation of similar projects.

3. Policy issues like online marketing and establishment of post cocoon processing units nearer to sericulture clusters need to be resolved to facilitate and encourage farmers to shift to rearing of bivoltine breeds.
4. The problems associated with rearing of bivoltine breeds during summer months need to be studied and suitable solutions found for successful rearing of bivoltine breeds during summer months.
5. The technological innovations adopted in mulberry cultivation and silkworm rearing should be evaluated and adopted as recommended package of practices.
6. The success stories should be circulated among the sericulture villages in the state to encourage other farmers to adopt the practices.
7. There is need to take a holistic view of the activity from seed to fibre so that the seemless transformation is achieved.
8. There is need to devise methods and systems to make use of the sericulture wastes in preparing by-products to augment the income of farmers.
9. The multi end reeling unit and power loom established in sericulture College, Chintamani should be utilized better to study the problems associated with reeling, rereeling and manufacture of fabrics.

RESEARCHABLE ISSUES

1. Development of package of practices for mulberry cultivation for seed cocoon in seed areas.
2. Documentation of Indigenous Technology Knowledges (ITKs) and their integration in crop husbandry and non-cash inputs in sericulture activities is needed.