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Technology adoption pattern of sericulture farmers: A study in Chikkaballapur district of Karnataka

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Abstract
India is the agriculture based country and 65 per cent of its population depends on agriculture for their livelihood. In order to provide livelihood to rural poor and to control migration of rural poor to urban places, Government of India has been encouraging regular income and employment oriented farming approaches. One such potential farming enterprise is Sericulture and its end product has been intermingled with the life and culture of the Indians. The very nature of this industry with its rural based on-farm and off-farm activities and enormous employment generation potential has attracted the attention of the planners and policy makers to recognize the industry among one of the most appropriate avenues for socio-economic development. New technologies development and its proper dissemination play a vital role for the development and success of any agriculture / farm based activity. This is because of good number of innovative and highly productive technologies developed by the State and Central sector research institutes have contributed for the success of sericulture not only in traditional areas but also in new areas. However, still there is a lacuna in the dissemination and adoption of improved practices by the farmers.
Hence the study was taken up in Chikkaballapura district of Karnataka to know the adoption level of improved sericulture technologies and the factors influencing the process of their adoption. The study found that socio-economic factors and the participation in extension activities plays a major role in the adoption of various technologies.

Keywords: sericulture, improved technologies, adoption, socio-economic factors

Introduction
India is the agriculture based country and 65 per cent of its population depends on agriculture for their livelihood. Further, about 70 per cent of the people live in rural areas and more than 40 per cent of the rural population still lives below the poverty line. In order to provide livelihood to rural poor and to control migration of rural poor to urban places, Government of India has been encouraging regular income and employment oriented farming approaches, one such potential farming enterprise is Sericulture. It is the technique of making silk, is a traditional agro-based industry, playing a very important role in the rural economy of any developing country. This welfare-oriented enterprise provides scope for fast and sustainable economic growth and more employment opportunity within a very short gestation period with less capital investment. It is a land-based occupation suitable for establishment in the rural areas where land is sufficiently available. This industry is rightly described as "*The Industry of the poor*" and it comprises three distinct activities *viz.* cultivation of mulberry, rearing of silkworms and reeling of cocoons. The cultivation of mulberry and rearing of silkworms come under agricultural sector and the reeling of cocoons comes under industrial sector.
In recent years sericulture has emerged as one of the potential enterprises for generating income at short intervals and employment opportunities in rural areas and semi urban areas. Superiority of the end product, silk has been recognized as a natural textile fiber and as one of the high-value, low volume commodities to trade between the continents from time immemorial. Even today no other fabric can match its luster, durability, lightness, elegance and luxury. Silk is the most elegant textile in the world with unparalleled grandeur, natural sheen and inherent affinity for dyes, high absorbance, light weight, soft touch and high durability known as the "Queen of Textiles" the world over. On the other hand, it stands for livelihood opportunity for millions owing to high employment oriented, low capital intensive and remunerative nature of its production. The very nature of this industry with its rural based on-farm and off-farm activities and enormous employment generation potential has attracted the attention of the planners and policy makers to recognize the industry among one of the most appropriate avenues for socio-economic development of a largely agrarian economy like India.
Compared to other agricultural crops, sericulture provides more employment round the year and fetches higher income to the rural farm families. Sericulture has been an important income generating cottage based industry in the country. This industry has been providing sustainable income for different strata of people in the rural society including the landless all throughout the years and small land holdings. In fact, the recent technological advancements have made it possible to practice it on an intensive scale, mainly due to increased profits obtained from it as compared to most of the crops and enterprises. New technologies development and its proper dissemination play a vital role for the development and success of any agriculture / farm based activity. This is because of good number of innovative and highly productive technologies developed by the State and

Central sector research institutes have contributed for the success of sericulture not only in traditional areas but also in new areas. However, still there is a lacuna in the dissemination and adoption of improved practices by the farmers. Hence the study is aimed to know the adoption level of improved sericulture technologies and influence of various socio-economic factors. The specific objectives of the study were as follows.

- To study the adoption level of improved sericulture practices, socio-economic status and their extension practices
- To know the supportive schemes / financial incentives extended by the government.
- To document the constraints faced by the farmers in sericulture industry

Methodology

The methodology outline the features of the study area, sampling procedure, collection of data and analytical frame work employed. The present investigation was carried out in Karnataka state, as it is the major contributor to the country's raw silk production. Chikkaballapura district was purposely selected as many of the farmers are practicing sericulture on priority. Within the district, for the present study Chintamani taluk was chosen where sericulture is being practiced by a good number of households since many decades. It is one of the well planned and developed Towns in the district and known for its silk and tomato production. Chinthamani falls in the tropical semi-arid type of climatic region in India and the soil is of clayey-loam type. For the present study, sixty farmers were chosen by random selection and the data was collected by direct personal interview method with a pre structured questioner. The present study was taken up during the year 2019 covering all the activities of mulberry cultivation, land holdings, irrigation and fertilization, socio-economic conditions, education, experience, type of silkworm rearing, type of rearing house, livestock, extension, Govt. schemes, etc. The data thus collected from 60 respondents of both crossbreed and bivoltine silkworm rearing farmers was subjected to a simple tabular analysis. It includes the computation of means, percentages etc., were employed to present the data in respect to demographic feature, socio-economic profile and cropping pattern adopted by sericulture farmers.

Results and Discussion

The data collected from the respondent was subjected to statistical tools to draw informative conclusions. In the present study, age, education, area under mulberry, extension contact etc. of the respondents was collected and the results of the study are presented under the following sub-headings.

1. Profile of the Sericulture Farmers

a. Age of the farmers: It is a segment of the population that is of approximately the same age or within a specified range of ages. It is very essential for identifying the population and also to know the engagement of different age groups in the process of sericulture activities in the study area. The data reveals that out of 60 respondents who is practising sericulture, majority of them belongs to the age group of 41 - 45 years which amounts to be 36.60 % followed by 12 respondents (20.00 %) are in the age group of 31-35 years and a total of five respondents belongs to the above 50 years of age group (Table 1).

b. Educational qualification of the farmers: The educational system of a nation is the true indicator of its strength, its quality of life and well-being of its citizens and its potential to find its place in the world. Education means inculcating moral values, positive thinking, attitude of helping, attitude of giving to society and ethical values. In the present study the qualification of the respondents has been classified as illiterate, primary and higher education. A total of 15 (25.00 %) respondents have studied higher education followed by 14 (23.33 %) are illiterate. Further, 10 (16.67 %) have studied primary education and 9 (15.00%) respondents have completed their graduation (Table 1).

c. Mulberry cultivated land area: Mulberry is a fast growing deciduous woody perennial plant and it has a deep root system practiced in various climates. Majority of the respondents (21) have 2-3 acres and above which accounts to be 35.00 % and 14 (23.33%) respondents have 1-2 acres and only 6 (10.00%) respondents have less than 1 acre of mulberry cultivated area. A total of 19 respondents have more than 3 acres of mulberry cultivated area (Table 1).

Table 1: Details of the sericulture farmers

Age of the farmer		Education level of the farmer		Mulberry acerage	
Category	**No. of respon-dents**	**Category**	**No. of respon-dents**	**Category**	**No. of respon-dents**
31-35	12 (20.00 %)	Illiterate	14 (23.33%)	Below 1 acre	6 (10.00 %)
36-40	11 (18.33 %)	Primary	10 (16.67%)	1-2acre	14 (23.33%)
41-45	22 (36.67%)	High School	12 (20.00 %)	2 – 3 acres	21 (35.00 %)
46-50	10 (16.67 %)	Higher Secondary	15 (25.00 %)	>3 acres	19 (31.67%)
>50	5 (8.33 %)	Graduation	9 (15.00 %)		

2. Adoption of Sericulture Practices

1. Mulberry planting system: A crop that can be planted in rows or row system wide enough to allow it to be tilled. Row crops are generally grown on irrigated land during the growing season, the inter row spaces are hoed two to four times and the rows are weeded to conserve moisture and improve aeration. As a result, the soil's microbiological activity increases and mobilization of nutrients is intensified. In the paired row system, two cane rows are brought together followed by a wide gap before the next set of two rows. The paired rows may be at 90 cm with 120 cm gap. The number of rows per hectare remains the same. The advantages are that wide spacing is available between the any two sets of paired rows can be utilized for growing profitable intercrops. Out of 60 respondents, 41(68.33%) followed row system of plantation while 19 (31.67%) respondents followed paired row system**.**

2. Pests affecting the mulberry crop: Mulberry is the sole food of monophagous silkworm *Bombyx mori*.

Like other crops mulberry is also attacked by several pests. These pests can stunt a plant's growth especially smaller ones disturb the soil, harm the foliage's appearance and drastically reduce the overall quality of crop, when left untreated; pests often result in the plant's death. Out of the 60 respondents, 25 (41.6%) respondents expressed that their crop is being affected by thrips, 10 (16.67 %) are with mealybug, 9 are with both thrips and mealybug, 9 (15.00%) with tobacco caterpillar and 7(11.67 %) are with Bihar hairy caterpillar (Table 5).

3. **Silkworm rearing method:** A rearing house should be established nearer to the mulberry garden that reduces the excess expenditure for man power, transportation, communication as well as it provides better management. Generally round bamboo trays are used for tray method. Under this method in each stand ten trays are arranged and the worms are fed with individual leaves and whereas shoot rearing method is easy and most economical method of all. The rearing sheets are one meter wide and length can be extended according to the size of rearing room. The rearing seats are arranged 20cm above the ground. Depending on the space available three or four tiers can be arranged with a gap of one meter in between the tiers. A total of 35 (58.33 %) respondents are practicing shoot rearing method while 25 (41.67 %) farmers are practicing tray method of rearing.
4. **Method of disinfection:** Disinfection is an integral part of healthy and successful silkworm rearing which aims at the total destruction of disease causing pathogens. Several diseases caused by bacteria, viruses, fungi and protozoa affect the silkworms. These pathogens released by diseased silkworms easily accumulate and spread in the rearing environment through different routes. They are not easily destroyed and can persist / survive for long periods under congenial conditions. The spores of the pathogens, especially those of fungi are light and can easily be drifted by air current resulting in easy spread of diseases. There are no curative methods for any of the silkworm diseases and they are best prevented than cured. This is achieved by adoption of proper and effective methods of disinfection and stepwise maintenance of hygiene during rearing. Hence it is so important in deciding the success of the crops. Out of 60 respondents, 39 (65.00 %) respondents are using power sprayer for disinfection which happens to be a good practice and 21(35.00%) are using multipurpose pump for disinfection.
5. **vii. Cocoon production/crop:** Mulberry sericulture is one of the income assuring occupation to rural folks which ensures year round employment opportunities. The cocoon production consists of two major economic activities namely, cultivation of mulberry and rearing of silkworms. Out of 60 respondents, a total of 24 (40.00 %) farmer's produce 70 – 75 kg, 16 (26.67%) farmers produce 60 – 65 kg cocoons and 15 (25.00 %) farmers produce 51 – 60 kg cocoons per 100 Dfls. It is recorded that a total of 5 farmers are recorded with below 50 kgs of cocoons yield (Table 2).

Table 2: Sericulture practices by the respondents

Plantation system	No. of respondents	Crop pests	No. of responders	Rearing Method	No. of respondents	Method of disinfection	No. of respondents	Cocoon production / 100 Dfls (Kg)	No. of respondents
Paired row system	19 (31.67 %)	Thrips	25 (41.67 %)	Shoot Rearing	35 (58.33 %)	Power sprayer	39 (65.00 %)	below 50	5 (8.33 %)
Row system	41 (68.33 %)	Mealy bug	10 (16.67 %)	Tray Rearing	25 (41.67 %)	Multipurpose pump	21 (35.00 %)	51 - 60	15 (25.00 %)
		Both thrips and Mealy bug	9 (15.00%)					60-65	16 (26.67 %)
		Tobacco caterpillar	9 (15.00 %)					70-75	24 (25.00 %)
		Bihar hairy caterpillar	7 (11.67 %)						

3. **Subsidies Providing by Govt:** A subsidy is a benefit given to an individual, business or institution usually by the government in the form of a cash payment or a tax reduction. The subsidy is typically given to remove some type of burden and it is often considered to be in the overall interest of the public, given to promote a social good or an economic policy. The Department of Sericulture, Government of Karnataka is implementing Catalytic Development Programme (CDP) in Collaboration with Central Silk Board for the development of Sericulture. These programme aims at increased productivity, quality and promotion of new technologies / packages of practices developed by Research Institutes. A total of 47 farmers were benefitted through various subsidies provided by the government. Out of the 47 farmers, 23 (38.33%) farmers were benefited for rearing house, 7(11.67%) farmers for rearing equipment and 17(28.33%) farmers were benefited for mulberry garden (Table 3).

Table 3: Particulars of subsidies provided

Govt. subsidies for	No. of respondents	Percentage (%)
Rearing house	23	38.33
Rearing equipments	7	11.67
Mulberry garden	17	28.33
Total	47	78.33

4. Extension Methods: Extension is an applied behavioural science and the knowledge which is applied to bring desirable changes in the behavioural complex of human beings usually through various strategies and programmes of change by applying the latest scientific & technological innovations. To update the knowledge on agriculture and allied sectors, farmers generally depend on various extension methods. In the present study, out of the 60 farmers 37 (61.67 %) farmers took part in group method, 7 (11.67%) farmers in Individual method and 16 (26.67%) farmers in Mass extension method (Table 4).

Table 4: Extension methods participated by the respondents

Extension methods	No. of respondents	Percentage (%)
Group method	37	61.67
Individual method	7	11.67
Mass method	16	26.67
Total	60	100

5. Constraints/Problems Faced by the Farmers: The association between the personal and socio-economic characteristics of the farmers and the constraints faced by them in sericulture were studied. The constraints expressed by the farmers in mulberry cultivation are high labour wages, inadequate labour, inadequate irrigation facilities, high cost of manures and fertilizers, lack of guidance and lack of knowledge about mulberry diseases and pests. They as well reported constraints in silkworm rearing *viz*., high cost of rearing room and equipment, lack of credit and subsidy, lack of manpower, difficulty in controlling silkworm diseases, lack of knowledge regarding physical conditions in rearing room and grading of cocoons, long distance of cocoon trading units and fluctuations in cocoon price. The personal and socio-economic characters of the farmers such as caste, social participation and level of knowledge in sericulture were found to have a significant association with the constraints faced by them in sericulture.

Table 5: Constraints faced by sericulture farmers

Constraints/problems	No. of respondents	Percentage (%)
Shortage of water	14	23.33
Uzi fly incidence	22	36.67
Lack of knowledge about advanced technologies in silkworm rearing	9	15.00
Fluctuations in cocoon price	11	18.33
Shortage and high rate of labour	4	6.67

The responses of the farmers regarding the constraints/problems faced / expressed are indicated in the Table 5. A total of 22 (36.67 %) farmers are facing problems with uzi fly incidence, 14 (23.33%) farmers with shortage of water, 11(18.33%) farmers are facing fluctuations in cocoon prices, 9 (15.00%) farmers are facing lack of knowledge about advanced technologies in silkworm rearing and 4 (6.67%) farmers are facing shortage and high rate of labour.

The study indicates that there is a need to educate the farmers about the advantages of the low cost technologies by the State Sericulture Department through establishing a strong linkage between the research extension and input agency to reap the full benefit of the technologies by the sericulturists. In the present study it is found that most of the farmers having knowledge on advantage of separate rearing house, disinfection of rearing house, importance of hygiene, productive silkworm breeds, shoot rearing method, bed spacing, bed disinfectants and rotary mountage. Pamadi (1980) reported that there is no relation between size of the land holding and adoption of technologies. The present study also confirms that the size of mulberry land holding is not related to adoption of technologies. Since most of the farmers are practicing sericulture in a more systematic and technical manner, majority of the farmers have harvested higher yield with successful crop.

Based on the above study it can be concluded that single factor of education level or experience of the farmers or extension methods cannot bring the desired level of changes in skill, attitude and behaviour towards technology adoption and realization of the better income by the farmers. Hence a bi-model approach combining different extension strategies needs to be developed. Farmers need more intensive programmes for technology awareness, infrastructure facilities and other incentives. Whereas, most of the villages in Chinthamani taluk needs programmes for change of mindset of the farmers towards adoption of new methodology/technology as well as higher education levels etc. For rapid expansion of sericulture ensuring better income to the farmers, different approaches with group/community farming like co-operatives, field schools, onsite demonstrations and better pricing and access to the cocoon markets etc. needs to be considered. As women are also involved in several sericulture practices techno economic empowerment of women is also of vital importance for higher income and growth. Hence concerted efforts must be made by the extension personnel to enhance the knowledge level of farmers on sericulture technologies towards greater adoption of recommended sericulture practices for higher cocoon production. In view of the static conditions of the above components, adoption of new technologies has become a matter of debate among the scientists and the administrators.

Conclusion

Based on the present study it could be concluded that single factor of education level or experience of the farmer or extension methods cannot bring in the desired level of technology adoption and realization of the better income by the farmers. Hence a strategic approach combining different extension methods needs to be developed separately for traditional and new areas. New areas / farmers need more intensive technology awareness, infrastructure facilities like marketing and other incentives for start-up tools. For rapid spread of sericulture ensuring better income to the farmers, different approaches with group/community farming through strategic extension approaches are need of the hour.

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