Chapter – II

Review of Literature

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An overview of available literature pertaining to the aspects under consideration on the present study.

In recent years, there is an increase in awareness among the farmers on various technologies developed for the vertical and horizontal growth of the sericulture industry. This awareness has been possible mainly due to the project envisaged by DOS and CSB viz., JICA, IVLP, CDP etc., In the present chapter ample literature for the fast one decade has been collected on various aspects covered under the present study.

Socio economic characters of farmers in relation to technology adoption

The adoption of a new technology is quite cumbersome process and influenced by social, economical, institutional, psychological, physical and biological factors (Singh and Yadav, 1989). Improved technologies even when sound by scientific standards are of limited value if they are not adopted due to their inappropriateness to suit the agroclimatic and socio-economic in which the farmers operate (Raman and Balaguru, 1992). Some of the literatures associating the socio-economic characters of the sericulturists with their knowledge and adoption level are briefed below.

Anatharaman (1977) reported socio-personal characters like socio-economic status, use of mass media, contact with extension organization and about high yielding varieties and knowledge level had shown significant negative relationship with training needs of small and marginal farmers.

Anonymous (1984) reported that in Kolar district, 74 per cent respondents were literates, of which 2 per cent were graduates and 48 and 24 per cent had studied up to primary and secondary level only and their cocoon yield is 28, 24 and 27 kg, respectively. Illiterates (26%) obtained an average yield of 27 kg cocoons.

Shivaraja (1985) observed that the net income of big farmers had a positive and significantly associated with knowledge on bivoltine seed cocoon production.

Age and education hada non-significant relationship with knowledge level of farm men while it had a significant negative relation in case of farm women on knowledge level of recommended practices in sericulture in Tumkur district (Dayananda Patel,1985).

According to Siddappaji *et al.* (1986), 59 per cent of the respondents were literates in Mysore district, of which, 3, 17 and 24 per cent were graduates, educated upto secondary and primary level, respectively and the remaining 41 per cent were illiterates while only a few of them had undergone sericulture training.

Kshama Giridhar *et al.* (1986) reported that 69.4 per cent of male members (N=519) were engaged in sericulture of which 120 as full time job and 235 part times, while 59.8 per cent of the women were engaged in sericulture. Out of which 103 as full time and 156 worked on part time basis. Further, they also stated that 37.61 per cent were uneducated followed by 31.4 per cent educated up to primary, 21.3 per cent up to high school. Most of the sericulturists reared silkworms in their dwelling houses and only 30.8 per cent reared in separate houses. Of which 57.7 per cent of them were tilled roofing's, 38.3 per cent with thatched roofing's and only 4.0 per cent RCC. They also reported that 96.0 per cent of the houses were not ideal for effective disinfection and rearing silkworms.

Prakash Kumar (1986) found that, education, farm size and social participation of the sericulturists had positive and highly significant relationship with their level of adoption of sericulture practices. But, age of the respondents had a non significant relationship with level of adoption of sericulture practices. These parameters along with exposure to mass media had the same effect in Kolar District (Ashwathanarayana, 1989). On the contrary, (Sreenivasa, 1989) found that the age, level of education, farm size and mass media participation of respondents had non significant relationship with the adoption level of recommended sericulture practices, while family size and social participation had significant positive relationship with level of adoption of sericulture practice.

Ashwathanarayana (1989) found that there was significant association between age, education, social participation and extension participation of farmers and their knowledge on silkworm rearing practices. There was highly significant association between mass media participation and knowledge of sericultural practices. But there was no significant association between the size of land holding and the knowledge of improved silkworm rearing practices.

Sreenivasa (1989) revealed that there was a positive and highly significant relationship between education, social participation, mass media participation and extension participation and the knowledge of sericulturists with regard to mulberry cultivation. But there was no relationship between age, farm size and family size with knowledge level of sericulturists with regard to mulberry cultivation.

Sreenivasa (1989) revealed that age, farm size and family size was found to have no relationship with the knowledge level of sericulturists with regard to silkworm rearing practices. Whereas, education, social participation and extension participation, mass media participation were found to be having positive and highly

significant relationship with the knowledge level of sericulturists about silkworm rearing practices.

Satheesh (1990) found that education level, land holding, mass media participation had positive and significant relationship with the level of adoption of chawki rearing practices. Whereas, the age and social participation of the beneficiaries and non beneficiaries of chawki rearing centers had no significant relationship with the level of adoption of chawki rearing practices, in Bangalore district.

Gopala (1991) found that the education level, size of land holding and mass media participation had positive and significant relationship with the adoption of sericulture practices in developed area, while non significant in the less developed areas. While the age and social participation had similar relationship with the adoption level of sericulture practices in both the developed and less developed area.

Prabhakar *et al.* (1992) reported that hardly 10-14% of the sericulturists in Chikkamangalore district, participated in different social organizations reflecting low education level. The association of age and education with knowledge level was significant.

Similarly Geetha (1993) studied the impact of socio-economic factor on adoption of improved sericultural technologies in Hassan district, revealed that age, education, caste, occupation and experience in the field of sericulture influenced the adoption of sericulture technologies significantly.

The extent of adoption of recommended dosage of fertilizer by farmers of Ramanagaram taluk was significantly associated with education, land holding, extension participation and economic motivation (Siddaramaiah and Prakashkumar, 1994).

Singhvi *et al.* (1994) the rate of adoption was significantly associated with sericulturists education, land holding, mass media participation, extension contact and cosmopoliteness.

Rathala *et al.* (1995) found that there was a direct relationship between the human labour input and size of land under mulberry. Also reported the opinion of the experienced sericulturists to engage the family labour for rearing silkworms effectively and used the labour rationally. They also opined mulberry land holding size of 1.01 to 1.5 acres as optimum for mulberry sericulture and for silkworm rearing.

Naresh (1996) analyzed the knowledge and adoption of improved sericulture practices among trained women in Bangalore rural district and found significant difference in overall adoption between trained and untrained farm women. Knowledge and adoption level of the trained farm women was found to be associated with mass media use and decision making ability of their adoption.

Similarly, Srinivasa *et al.* (1996) reported that caste, education level and size of land under mulberry had significant positive influence with the level of adoption of the improved sericulture practices in traditional sericulture area. Whereas, the caste and size of land holding had non significant relation to adoption of sericulture practices in new sericulture areas, while education level had significant and positive relationship.

Shreedhara (1996) observed that education was found to be significantly related to their knowledge level with regard to recommended sericultural practices among farmers in Tumkur district. Further, he also reported that education mass media participation, material possession and risk preference among big farmers and education mass media participation and extension participation among small farmers

were significantly related to their knowledge level. With respect to adoption level, education, mass media participation, social participation, material possession and risk preference, credit facilities and employment potential among big farmers. Further, education, mass media participation, extension participation and net income among small farmers were significantly related.

A study was conducted in Dharwad district of Karnataka on adoption behavior of sericulturists. The results revealed that adoption was significantly influenced by education and mass media participation as indicated by their elasticity coefficients. The probability levels of those who adopted the techniques ranged from 0.43 to 0.61 (Srinivasa *et al.*, 1998b).

Jagadisha (1999) reported that total land area, cosmopoliteness and extension participation showed highly significant relation with the knowledge of small farmers. But none of the socio-economic characters of the medium farmers showed significant relation with their knowledge level. Among large farmers, education and mass media participation were significantly related to their knowledge level.

Borker *et al.* (2000) reported that the highly significant association seen between education of the farmers with their knowledge level of bio fertilizers, age, land holding, annual income, socio-economic status. Scientific orientation, risk preference, mass media exposure, extension contact and cosmopolitness characteristics of the farmers were found significantly associated with knowledge level of bio-fertilizers.

Shinde *et al.* (2000) observed that 44 per cent of the respondents were old i.e., above 50 years of age. As regards to their educational qualification majority of them were educated up to high school level (42%) over ninety per cent of the respondents had farming a main occupation. The data further revealed that majority of the

respondents were medium farmers associating the land from 2.00 to 10.00 ha (51.30%). It was also further observed that over half of the respondents (58.67%) had enough experience of farming above 15 years. Majority of the farmers were moderate recorded status, majority of the farmers have moderate levels of value orientation and social economic status.

Mahanthesh (2000) reported that age had significant relationship with their knowledge on indigenous sericultural practices among sericulturists.

The study conducted to find out the socio-economic status of the farmers and its influence on the level of technology adoption in non-traditional sericulture belts of Karnataka, indicated the various socio-economic factors such as caste, family form main occupation, experience, family size, yield./100 dfls, income, education, land holding size, mulberry under irrigation, as more influencing parameters (Geetha *et al.*, 2001). Other socio-economic variables like family form, family size, occupational status, experience in sericulture, extension support, cocoon yield for 100 dfls and income also had a positive significant correlation with the level of adoption.

Munikrishnappa *et al.* (2002) observed that the total land holding and extension participation had a significant association with the knowledge level of small sericulturists but cosmopoliteness was negatively significant. Similarly, age and area under mulberry significantly influenced the adoption level, but cosmopoliteness and extension participation were hampering the adoption of improved practices among small farmers. In case of medium farmers, cosmopoliteness and extension participation had a high and positive association with the knowledge level, whereas area under mulberry and cosmopoliteness were having a negative and significant association with adoption level. Extension participation depicted a strong and

significant association with knowledge level of big farmers but it was not influencing the adoption level.

Srinivasa *et al.* (2003) reported that the variables such as age, land holding, area under mulberry, cosmopoliteness and mass media participation in small farmers, area under mulberry, area under mulberry and cosmopoliteness in medium farmers and cosmopoliteness in large farmers were found to have a significant association with technology adoption.

Independent variables like mass media participation and cosmopoliteness exhibited a positive and significant relation with the perception of CSR hybrids in Kolar district. While variables like education, family type, social participation, innovation proneness and risk orientation had significant effect on the adoption level (Rajeev, 2004).

Further, Srinivasa *et al.* (2004) indicated that variables like female family members and mulberry area were found to have a positive and significant association with the cocoon yield. Whereas, age family size and male family labour depicted a negative association with cocoon yield. With respect to income, size of land holding, extension contact and extension participation of the farmers were found to have a positive and significant association.

Chandrashekar *et al.* (2005) conducted a study in Belgaum district of Karnataka and revealed that the knowledge level of sericulturists for recommended sericulture practices was found positive and non significant with education, land holding experience in sericulture and mass media participation and negative and non significant with extension contact and participation. However, their value exhibited a positive and significant relation between annual income and the knowledge level of the sericulturists.

Qadri *et al.* (2005) investigated the socio-economic profile of sericulturists in Erode, Coimbatore and Dharmapuri districts of Tamil Nadu. The results revealed that higher literacy rate (71.4%) found in Erode district had enhanced the adoption of improved sericulture technologies. Consequently the income/unit area was found high in Erode and Coimbatore districts.

Multiple regression analysis reveals that independent factors such as education (X1), irrigation frequency (X13), dose of nitrogen (X16), dose of phosphorus (X17) showed dominant influence on mulberry leaf productivity and independent factors including spacing of silkworm (X25), method of rearing house disinfection (X26) and leaf productivity (X3) were found to have significant influence on cocoon productivity (Pandit *et al.,* 2005).

Sujatha *et al.* (2006a) reported that education, experience in sericulture and mass media participation had a positive and significant association with the adoption level of sericulturists in Anathapur district.

Vijayakumari and Rajan (2006) revealed that experienced and literate people wee actively involved in commercial chawki rearing. Area under mulberry, family size and experience of CRC owners in sericulture had significant correlation with adoption of chawki rearing technologies. Age and occupation were found non significant.

Meenal and Rajan (2007) revealed that majority of the farmers had adequate knowledge on mulberry cultivation and silkworm rearing and the rate of adoption of improved sericulture technologies and socio-economic characters were positively correlated in both the taluks. The regression analysis of Gobichettipalayam area showed that all the variables included in the model had influenced cocoon production. Hence, it is concluded that the socio-economic characters of farmers are crucial in

determining technology adoption. So the policy makers should consider the socio-economic conditions of the farmers while formulating developmental programmes for transferring the improved sericultual technologies.

Lakshmanan and Geethadevi (2007a) observed that there was significant relationship between education, family size and total land holding with knowledge level of the farmers about bivoltine and cross breed sericultural technologies.

Jayaram and Indumati (2010) revealed the variables such as average of price per kg of cocoons attitude towards new technologies in sericulture, awareness about the technologies and experience in sericulture emerged as the strong determinants for classification between bivoltine silkworm races and cross breed races.

Balasaraswathi *et al.* (2010) suggested that, creating awareness and interests among the farmers about the benefits / advantages of the need of new bivoltine sericulture technologies through handouts/bulletins/pamphlets and also print electronic media.

Hiriyanna *et al.* (2009) clearly indicate that the mulberry and cocoon yield levels improved significantly after implementation of the extension programme. There were more than two fold improvements in profitability due to the adoption of techniques recommended under the new extension programme. The farmers should be educated to adopt the improved technologies in toto as a package to obtain higher yields along with crop stability. Further, the demonstrations should be continued with the adopted farmers repeatedly over a period of time for sustenance of technology adoption.

Sreenivasa and Hiriyanna (2014) reported that cocoon yield and cocoon price influence the adoption of technologies, rate of education and the participation of the

farmers in the extension contact, mass media programmes also hasten the rate of adoption of technologies.

Sreenivasa and Hiriyanna (2014) observed that, there is a wide yield gap in mulberry leaf and cocoon production in the study regions of chitradurga district. The magnitude of gap is much higher in the holding size I as compared to size II and III. Therefore, it is suggested that the extension functionaries should take adequate care and educate the farmers in adoption of improved technologies practices to narrow down such yield gaps at different level.

An overview of work carried out on knowledge and adoption of sericulture technologies by the sericulturists.

Knowledge is a familiarity, awareness or understanding of someone or something, such as facts, information, descriptions, or sikills, which is acquired through experience oreducation by perceiving, discovering or learning. Knowledge can refer to a theoretical or practical understanding of a subject. It can be implicit (as with practical skill or expertise) or explicit (as with the theoretical understanding of a subject) it can be more or less formal or systematic.

Eight per cent of big farmers and 2% of small farmers had the knowledge about the role of nutrients in plant growth (Govindappa, 1974).

Puttaswamy *et al.* (1978) observed that majority of the farmers in Bangalore and Kolar districts were aware of the recommended race of silkworm; and the percentage of farmers having knowledge of pebrine disease was 64.0, flacherie was 87.0 grasserie was 91.0 and Muscardine .

Bhilegaonker (1978) concluded that a little over half of the farmer respondents had “medium” level of knowledge of fertilizer use. The study also revealed that 21.0, 22.2 and 18.4 per cent of big, medium and small farmers respectively belonged to the

"high" knowledge level category. Where as, 22.3, 25.0 and 28.9 per cent of big, medium and small farmers respectively, "low" knowledge level category.

Rajashekharaiah (1979) reported that 78 per cent of farmers had medium knowledge on improved sericultural practices, while remaining 22 per cent were equally shared by high and low knowledge categories. It was also reported that size of holding had significant influence on the overall knowledge of the farmers on sericulture practices.

Kantharaj (1980) found that a majority of farmers had possessed medium knowledge with respect to season, seed rate, spacing, pest and diseases and only 16 per cent of the farmers had low knowledge with respect to suitability of soils, manure application and intercultivation in rice. Similar findings were reported by Sinha (1981) about wheat cultivation.

Dayananda patel (1985) reported that there was significant difference in the knowledge level of farm men and women with respect to improved practices of sericulture. Nearly 75 per cent of farm men and 66 per cent of women possessed "medium level" of knowledge. About five per cent of farm men and nine per cent of farm women had "high level" of knowledge.

Aswathanarayana (1989) reported that about 35.83 per cent of farmers belonged to high knowledge category while 29.17 per cent to medium knowledge category and 35 per cent to low knowledge category. Thus, the results indicate that nearly 65 per cent of farmers had medium to high knowledge on silkworm rearing practices.

Srinivas (1989) reported that 100% of farmers had correct knowledge abut mulberry variety, preparation of land, planting system and irrigation of mulberry and

location of rearing house, race of silkworm, number of feedings per day, stages and number of moults in silkworm rearing.

It was reported by Satheesh (1990 that majority of the beneficiaries had the knowledge of chawki rearing, silkworm race, rearing place, diseases, disinfection and leaf preservation methods

Shivamurthy *et al.* (1992) observed hat majority of the farmers had more knowledge n respect of type of leaf to be fed to chawki worms, number of feeds per day and disinfection procedure.

The studies of Gowda *et al.* (1992) revealed that the transfer of improved sericulture technology to the Indian farming community is a basic requirement for rural development. It was found in general that recommended silkworm rearing practices were adopted more by large farmers than small and tenant farmers; most farmers, irrespective of size, were not applying the recommended dosage of fertilizer to the mulberry crop;

Singhvi *et al.* (1994) showed that majority of the respondents were aware and adopt most of the mulberry cultivation and silkworm rearing practices except some of the crucial practices like fertilizer application, plant protection measures, bed cleaning by net and pebrine disease control measure where knowledge level and adoption were abysmally low.

Jayakumar and Vasanth Kumar, (1999) reported that the farmers perceived in better way about usefulness of technologies like ploughing the field for 3-4 times, applying 300 kgs of enriched FYM, spacing carbendzuim, seed treatment, biofertilizers application and applying fertilizers as per soil test report as useful ones for getting higher yield.

Krishnamurthy *et al.* (1999) observed that 70 per cent of the sericulturists had medium level of knowledge on recommended sericulture technologies in the traditional area of Gowribidanur and Sidlaghatta taluk of Kolar district in Karnataka.

Jagadisha (1999) reported that knowledge level of different categories of farmers in K. R. Nagar, Mysore district with regard to disinfection, egg transportation, black boxing, bed cleaning and maintainance of humidity was same.

Borker *et al.* (2000) reported thaty in Maharashtra state more than fifty per cent of farmers (58.67) had medium knowledge on biofertilizer followed by 34.67 and 18.66 per cent of them with high and low knowledge of biofertilizers .

Rajendra (2000) highlighted that majority of the respondents in Akola district of Maharastra had medium level of knowledge (75.91) about bicontrol measures, followed by high (16.05%) and low level (8.04%) respectively.

Anithakumari and Kalavathy (2001) observed lack of skill in identification of pest attack symptoms due to lack of knowledge.

Thiagarajan (2002) reported that majority of the farmers in rainfed areas had poor knowledge about recommended mulberry variety, silkworm breed, application of FYM, fertilizer and biofertilizers, rearing space, disinfection, hygiene and bed disinfectant. Adequate knowledge was observed only for plant spacing. Most of the farmers had partial knowledge on method of leaf harvest, IPM against uzifly, silkworm mounting and cocoon harvesting.

Balavenkatasubbaiah *et al.* (2003) reported that the sericulturists perceived sanitech as better floor disinfectant in controlling diseases than other chemicals.

Studies of Darling and Vasanthkumar (2004) in Kanyakumari district of Tamil Nadu had indicated that 59.16 per cent of the respondents possessed medium

level of knowledge and 28.33 per cent of the respondents had low level of knowledge on various dimensions of botanical pesticides.

Ramanjaneyalu (2004) reported the sericulturists perceived CSR hybrids as superior in respect of its yield compared to other breeds.

According to Sariful Islam (2004) farmers adopted under JICA had sufficient knowledge on mulberry cultivation and silkworm rearing technologies, but the full adoption level varies from 35% (paired row system) to 100% (pruning method) for mulberry cultivation technologies and 35 % (rotary mountages) to 100% (shoot rearing and separate rearing house) for silkworm rearing technologies.

Geetha *et al.* (2005) reported cent per cent of farmers had knowledge on technologies like silkworm bed spacing and shoot rearing.

Narayanaswamy *et al.* (2005) observed majority of farmers in Kolar district have moderate knowledge about organic sericulture practices (54%) followed by low (30%) and high categories (16%).

Madhu Prasad *et al.* (2005) in their survey in Kolar district observed that, most of the sericulturists had cent per cent knowledge on animal excreta based manures. However, 98 percent of respondents had high knowledge in application of Neem cake followed by Pongamia cake (91.00%), Groundnut cake (86.00%) and Hippe cake (52.00%). Only 49-52 percent of respondents had knowledge on application of bio fertilizers.

Gope (2006) in his study in traditional and non traditional areas noticed that all selected farmers had high knowledge of mulberry variety, plant spacing, quality of leaf, size of the leaf and bed cleaning. Most of the sericulturists in non-traditional area had better knowledge about new technologies than those in traditional area. But

the knowledge regarding soil type and manure was more in traditional area than non-traditional area.

Mallikarjuna *et al.* (2006) reported that the knowledge level of sericulturists on mulberry cultivation technologies in chamarajanagara district varied from 7% (vipul application) to 82% (application of FYM) and the full adoption level varied from 1% (garden spacing). Further, the knowledge level of silkworm rearing technologies ranged from 2% (use of bed cleaning net and egg transportation bags) to 32% (separate rearing house).

According to the studies of Lakshmanan and Geethadevi (2007b) the knowledge and adoption level of sericulture technologies of farmers in Malavalli and Srirangapatna taluks of Mandya district, Karnataka was high regarding high yielding mulberry varieties., shoot harvesting method and separate rearing house. This is because majority of the farmers were selected under JICA and had the opportunity to gain knowledge about the improved technologies.

The study conducted by Dayananda and Kamble (2008) in Anekal takuk , knowledge level of 42.50% of respondents on integrated technology package (ITP) of mulberry cultivation was medium while 38.33 and 19.17% of the respondents had low and high knowledge levels respectively.

The study of Sathasivam *et al.* (2009) in Bhuvanagiri block of Cuddalore district majority of respondents (43.34%) were found to have medium level of knowledge about bio-fertilizers followed by low (33.33%) and high 23.33%) level of knowledge.

Mallikarjuna *et al.* (2009) reported that in Mandya and Tumkur districts, all the farmers having knowledge on advantage of separate rearing house / separate entrance to rearing house, disinfection of rearing house, new silkworm breeds, shoot rearing, bed spacing, bed disinfectant and rotary mountage. Similarly 97.5%, 67.5% 72.5% and 82.5% of farmers possessed knowledge on time of harvest, deflossing, sorting and transportation of cocoons respectively.

Srinivasulu Reddy *et al.* (2010) in their stud in Ananthpur, Chittore and coastal areas of Andhra Pradesh y observed that cent per cent of the farmers had full knowledge with respect to improved mulberry varieties (85-100%), partial knowledge with Vipul and biofertilizer application (34-42%). With respect to other character such as soil testing, fertilizer application, FYM application, chawki garden maintenance and plant protection the knowledge level was less/nill on coastal area compared to Ananthpur, Chittore. Further, the knowledge level of farmers with respect to disinfection and rearing hygiene, temperature and humidity in young age rearing, separate rearing house and shoot rearing (52-96%) was almost full in all the three regions.

According to Rogers (1962) adoption refers to continued use of recommended practice by an individual. Some of the relevant studies have been reviewed for the purpose of present investigation.

Puttaswamy (1977) observations of farmers in Sira and Anekal taluks revealed that small farmers had low to medium adoption of recommended practices in dairy and sheep enterprises.

Similarly Puttaswamy *et al.* (1978) in his survey observed that only 21 per cent of the farmers were rearing silkworms in separate buildings. It was also found that majority of the farmers were adopting recommended control measures for

Mscardine disease, as against very few (10%) in the case of “Grasserie disease”. It was also revealed that none of the farmers took control measure against “Pebrine” and “Flacherie” diseases.

Rajashekaraiah (1979) revealed that the adoption of selected recommended practices of silkworm rearing was higher among big farmers compared to small farmers, except with regard to recommended source of layings, race of silkworm, type of leaves to be fed and leaf preservation measures, for which there was hundred per cent adoption among both small and big farmers.

Thangaraju and John Knight (1980) reported that training to sericultureists promote the adoption of technologies. He observed that there was better adoption of all the recommended practices by the trained sericulturists than with that of the untrained. Twenty five per cent of the trained sericulturists cultivated mulberry in potential farm area. More than 90 per cent of the trained sericulturists followed correct spacing for mulberry and used the recommended space for silkworms and the practices like mulberry variety, fertilizer application, disease control measures and bush type pruning.

Shivaraja (1985) in his study found that the levels of adoption of recommended practices of bivoltine silkworm rearing by big, small and marginal farmers were promising. All the three categories of farmers had followed the leaf preservation methods and temperature manipulating measures to an appreciable extent. The adoption behavior with reference to practices like spacing, type of leaves to be fed, number of cleanings of bed, mounting density of worms in chandrike, number of feedings per day, time of feeding and the correct day of harvesting of cocoon from chandrike was high in case of big and small farmers compared to marginal farmers.

According to Shivamurthy (1988) 70 percent of the farmers followed time of picking mulberry leaves, day of brushing, cleaning of the rearing seat, formalin preparation, control of uzi fly and grading of silk cocoons. He also reported that none of the respondents adopted the practices like egg disinfection, black boxing of eggs and proper method of bed cleaning by using cleaning nets. The same author mentioned that 69.2 percent of the sericulturists wee not having separate houses for rearing silk worms.

Siddappaji and Vasundhara, (1988) observed that most of the respondents in new sericulture area, grew the improved variety of mulberry *viz.*, M_5 under irrigation and reared bivoltine breeds of silkworm *viz.*, $NB_{18,}$ NB_7 and NB_4 D_2 except in a few pockets adjacent to traditional silk raising districts, where they raised local cultivar *viz.*, Mysore local and crossbreeds (multi x bivoltine) of silkworms.

Majority of the big farmers had high adoption and high net income levels, while it was quite the inverse in case of small and marginal farmers. The adoption behavior of big, small and marginal farmers with respect to recommended practices of bivoltine silkworm rearing was found to have significant positive relationship with their knowledge level Shivaraja (1988).

Aswathanarayana (1989) observed that in Kolar district nearly 75 per cent of the farmers belonged to medium and high adoption categories in respect of silkworm breeds, source of layings chawki rearing practices, separate rearing houses and leaf quality, quantity and preventive measures against pests and diseases, spacing of worms, bed cleaning care at moulting, disease control, mounting and harvesting practices.

Srinivasa (1989) reported that, majority of respondents applied FYM, followed by bed cleaning, disinfection, adequate number of mountages required per 100 DFLs, worms space, control measures against uzi fly. .

Study conducted by Satheesh (1990) in Kanakapura taluk of Bangalore rural district revealed that chawki rearing practices like selection of races (98%), disinfection (96%), bed cleaning (95%), source of dfls (93.5%) were followed by majority of both beneficiaries and non-beneficiaries. While few respondents (beneficiaries as well as non-beneficiaries) had maintained separate mulberry garden and black box method in incubation.

Significant difference was observed in the overall adoption of recommended sericultural practices like adoption of varieties and sowing, rearing house practices, environmental requirements, leaf quality, quantity and preservation; spacing of worms and bed cleaning; moulting uzi fly control and disease control practices between farmers of developed and less developed areas by Gopara (1991). And there was non-significant difference with respect to adoption of manures and fertilizers and irrigation practices.

Raghuprasad (1992) observed that in Chitradurga district majority of sericulturists had adopted recommended races (94.5%), chemical used for disinfection, black boxing (92%) and time of plucking leaves (84%), low adoption was reported with respect to disinfection of rearing house, care during moulting and method of bed cleaning using nets.

Chowdhary *et al*. (1993) compared groundnut yield obtained by an average farmer under traditional method of farming and improved techniques of farming in their study of yield gaps of groundnut in Ananthapur region of Andhra Pradesh. The study showed that the average yield obtained by improved techniques of farming was

12.5 quintals per hectare, whereas the realized average yield under traditional method was only 6.25 quintals per hectare in yield between the two methods of farming.

Dolli *et al.* (1993) in his study observed that majority of the respondents adopted the sericulture practices fully like spacing and bed cleaning, while partially applied FYM and disinfection practices. The practices like chopping method, incubation care, application of fertilizer and mulberry variety were adopted.

According to Anjaneya Gowda (1993) marginal farmers showed better adoption as they had less land area that made to concentrate and involve deeply in the activities.

Siddappaji and Prakashkumar (1994) reported that majority of the sericulturists adopted improved rearing practices like getting worms reared at CRC's (90%), giving recommended spacing for different instars (80%), maintaining optimum temperature and humidity measures (80%) followed by use of chemicals for disinfection (63%), adoption of disease and uzi fly control measures (87.50%), optimum density of mounting (80%) and harvesting of cocoons at appropriate time (80%).

Singhvi *et al*. (1994) reported that 51.7 per cent of the respondents applied recommended dose of FYM and the remaining 48.3 per cent resorted to partial adoption. In the respect of fertilizer application, only 22.4 and 4.1 per cent of big and small farmers respectively resorted to full adoption. They also reported that 1.7 per cent of respondents were having separate rearing houses and followed recommended disinfection measures and the remaining 98.3 per cent reared silkworms in dwelling-cum-rearing houses following improper disinfection measures. The overall adoption of recommended measures of bed cleaning i.e., by using cleaning ne was only at 16.7

per cent. They also reported that cent per cent of the respondents used nylon net for uzi fly control and none of them used both nylon net and uzicide against uzi fly.

Ganapathi Rao *et al.* (1995) observed direct relationship between the labour input and the size of land under mulberry. They also opined that the experienced sericulturists to engage the family labour for rearing silkworms effectively and used the labour rationally. Land holding size of 1.01 to 1.50 acres was optimum for mulberry sericulture and for silkworm rearing.

Chikkanna *et al.* (1995) found that the level of adoption of high in respect of FYM application, low or poor in respect of application of fertilizers, care at incubation and worms space. The adoption level among different categories of farmers was in the order of big farmers, followed by small and marginal farmers. Among the constraints lack of separate houses for rearing silkworms, non-availability of good disease free layings, non-remunerative prices for silk cocoons, non-availability of financial assistance as main reasons identified for non-adoption.

Manju (1997) reported that Belgaum district majority of farmers adopted cross-breeds (72.5%), bivoltine (27.5%) followed by use of disease free laying, separate rearing house, disinfection, feeding of silkworms, leaf storage, feeding of chawki worms, shoot feeding method, bed cleaning and disease and pest management. Siddappaji and Vasundhara (1998) found that most of the respondents in new sericulture area reared bivoltine races of silk worms like $NB_{18,}$ $NB_{7,}$ NB_4 D_2.

Srinivas *et al.* (1998a) reported that small farmers had high adoption index followed by medium and big farmers in nontraditional belt of Karnataka.

In Kolar district Raghu *et al.* (1999) observed that the adoption level of recommended sericulture technologies was 36, 49 and 15 per cent under high, medium and low categories, respectively. In mulberry cultivation, planting of

improved mulberry cultivars and application of FYM was 69, 65 per cent and 31, 35 per cent were full and partial adopters. Application of fertilizers was partial (60%), 36 per cent were full adopters, followed by 4 per cent non adoption. In silkworm rearing cent per cent adoption was in rearing recommended breed and feeding the larvae four times a day. Highest per cent adoptions (82%) were in the usage of number of circular bamboo trays in rearing and required mountages for the ripe worms. None of the respondents followed black boxing of eggs and not used leaf preservation chamber. Majority of the respondents (60%) harvested the cocoons on fifth day of spinning. Uzi fly management was adopted to the extent of 81 per cent were non adopters. Timely guidance and development activities are the hindrances in achieving proper adoption of improved sericulture technologies.

Munikrishnappa *et al.,* (1999) in their study observed a wide gap in the knowledge and adoption of improved silkworm rearing practices. The small farmers were found to adopt the technologies better than the medium and large farmers in the study area. It was seen from the results that the farmers in general were found to have better knowledge and adopt the low cost technologies compared to high cost technologies. It could also observed that, small farmers were reluctant to adopt the technologies like bed disinfection and the large farmers were not adopting the technologies like, black boxing and bed disinfection. They identified fluctuation in cocoon prices, lack of finance and poor knowledge level as major constraints.

The studies on adoption of improved sericulture practices by different categories of farmers in Hoskote taluk of Bangalore district (Narayanaswamy *et al.,* 1999) revealed that most of the farmers preferred government grainages for procuring eggs and their own chawki. The other recommended practices like maintenance of temperature and humidity, mulberry leaf storage methods and use of round bamboo

trays for silkworm rearing have been practiced by most of the farmers as per the recommended package. As regards to black boxing of eggs, hardly 15 to 25 per cent of the farmers follow it irrespective of their size. The new technology of platform rearing with whole shoots has not been followed by any farmers in the study area. Most of the farmers have used the recommended chemicals for control of diseases. The predominant silkworm diseases found were Muscardine (30%) and Sappe (30%). The average cocoon yield of 56 kg/100 DFLs was recorded, wherein large farmers have a slight edge (58 kg) compared to the marginal farmers (50 kg). Correlation studies revealed that the cocoon yield per unit area may be related to the acreage under sericulture whereas the other practices like chemicals used/litre of water, total spray solution and rearing space did not influence much on the cocoon yield /100 DFLs.

Saxena and Singh (2000) reported that majority of the farmers (40.90%) belong to medium level of adoption category. They were following 5 to 7, out of 10 organic farming practices. Also, more than 33 per cent of farmers were following more than 7 numbers of organic farming practices, 25 per cent farmers were following only 3 to 5 practices and are placed in low adoption category.

Sudhakara Rao and Choudhary (2001) reported 100 per cent respondents adopted recommended rearing technologies like separate rearing houses, using various disinfection measures like Vijetha, Suraksha, Sanjeevini and Wrap-up method of chawki rearing and also rotary mountages for rearing CSR hybrids.

Venkataramana *et al.* (2002) found that majority of the respondents adopted integrated technologies like shoot rearing method, sanitech disinfectant, wrap up method of chawki rearing and Raksha, Rekha

Qadri *et al.* (2002) in their study found that sericulturists adopted new recommended rearing methods for bivoltine rearing like shoot feeding, shoot harvest, use of plastic mountages and building pucca rearing houses.

In two villages of Bidar district majority of respondents adopted recommended rearing technologies like separate rearing houses, using various disinfection measures like vijetha, suraksha, sanjeevini and wrap-up method of chawki rearing and also rotary mountages for rearing CSR hybrids (Ramesha *et al.*,2003).

Mohamed and Baldeo Singh (2003) observed that majority of respondents (90%), had fully adopted high yielding silkworms race followed by time rearing (85%), harvesting of cocoons (75%) time of disinfection of rearing house and equipments (72%).

Jaishankar and Dandin (2004) reported high adoption level (91.1%) in the practice of application of farm yard manure (8 MT/acre/year) among sericulturists in Kolar district, whereas adoption level is low in recycling of farm and rearing residues for making compost or vermicompost.

Philip and Qadri (2004) revealed that, nursery preparation, spacing, plant training, plant protection measures, application of biofertilizer, triacontanol and Vesicular Arbuscular Mycorrhizas (VAM), green manuring and vermicomposting were the technologies least adopted by the farmers in Ernakulam. Similarly, in Trichur, application of biofertilizer, triacontanol and VAM, vermicomposting and green manuring were not well accepted, while mulberry cultivar, spacing and nursery preparation were fully adopted. Vital inputs such as organic manure and chemical fertilizers were not applied as per the recommended dose in both districts. Silkworm rearing practices such as separate rearing house, disinfection of rearing house and

equipment, incubation, black boxing, wrap up, shoot feeding, use of vijetha, application of lime powder and bed spacing had higher level of adoption in Trichur.

Rajeev (2004) conducted a study on adoption and perception of CSR hybrids in Kolar districts, Karnataka and reported that 44.17% of the sericulturists had high, 31.66% had medium and 24.17% had low level of perception about the performance of CSR hybrids. But 41.67% farmers showed medium level of adoption.

Hiriyanna *et al.* (2004) the results revealed that there was a significant yield improvement in mulberry as well as cocoon production and reduction in crop losses due to the demonstrations conducted by RECs. This methodology may be advocated for motivating the farmers to adopt improved sericultural technologies in the areas, where the sericulturists are available in cluster. Participatory research may be conducted with the farmers for refining the technologies to suit to the needs of the farmers. One of the major constraints expressed by the farmers for non adoption of technologies was non availability of inputs at village level to practice the technologies.

Srinivasa *et al.* (2005) reported the usage of FYM was adopted by maximum number of sericulturists (82.9%) followed by disinfection and hygiene (46.5%), separate rearing house (38.7%) and mounting care (34.7%) in non traditional areas of central Karnataka.

Vijaya Prakash and Dandin (2005) observed that adoption of mulberry technologies by the farmers related to plant spacing and harvesting of mulberry leaves were highest (100%), followed by irrigation (95.08%), farmyard manure application (91.80%), dusting with vijetha (86.89%), disinfection (83.61%), uzi fly control (82.40%), shoot rearing (82.00%), use of improved mulberry variety (77.78%), use of separate rearing house (70.49%) and harvesting of cocoons (34.43%).

Singh (2005) reported that there was no difference in yields of arid land crops grown by different categories of farmers (marginal, small and large farmers). Moreover, the difference between the actual yield obtained by farmers and that obtained at the research station suggests that there is a great potential to increase crop yield. He also reported that priority should be given to educate the farmers about improved agriculture practices to bridge the wide yield gap between that of the research station and of the farmers' fields.

Prakash and Dandin (2005) in their study on yield gaps and constraints in bivoltine cocoon production in Mandya District of Karnataka showed that the magnitude of the yield gap was 30.01 per cent in small farms and 45.56 per cent in large farms, which means that approximately 30-45 per cent of cocoon yield could be increased with the technology package adopted by the demonstration farmers. It was found that the crucial inputs such as mulberry leaf, disinfectants, human labour and mountages significantly influenced the bivoltine cocoon production. It is suggested that farmers must be educated regarding the optimal use of farm inputs.

Geetha *et al.* (2005) reported that the adopton level of bed disinfection (Vijetha) for CSR rearing was better (57%) compared to that of CB (34%).

Sujatha *et al.* (2006a) observed high adoption for plantation spacing, application of FYM, disinfection, bed spacing, temperature and humidity maintenance during rearing. Adoption was nil/low for practices like biofertilizer, vermiculture and mulching. The adoption level among different categories of farmers was on order of big farmer>small farmers>marginal farmers.

Lakshmanan and Geethadevi (2007b) reported 79 per cent of sericulturists adopted shoot harvesting method followed by technologies such as separate rearing house (69%), high yielding mulberry varieties (62%), application of manure (36%),

maintenance of temperature and humidity (35.50%), leaf harvesting method (33.75%) and cocoon harvesting (32%).

Deepa and Sujathamma (2007) studied the technology adoption in semi arid conditions of chittoor district of Andhra Pradesh. Soil testing and application of biofertilizer was not adopted by 86.11% and 70% farmers respectively. But 70% of the farmers had planted the recommended mulberry variety. Most of the silkworm rearing technologies was fully adopted *viz.*, disinfection (82.22%), recommended brushing (87.22%), new silkworm races (80.00%) and mounting care (76.66%).

Lakshmanan (2007) revealed that total yield gap of bivoltine and cross-breed races were estimated to be 23.18 and 19.52 per cent, respectively. The index of potential yield realisation was to the tune of 87.5 for bivoltine and 92.86 per cent for cross-breed cocoon production. The magnitude of yield gaps at different levels, yield gap I for bivoltine was estimated to be 12.50 per cent while it was 7.14 per cent for cross-breed races. With regard to yield gap II, it was 12.21 and 13.32 per cent for bivoltine and cross-breed, respectively.

Dayananda and Kamble (2008) reported the adoption level on Integrated Technology Package (ITP) of mulberry cultivation to be medium (42.50%) among the respondents. While 30% and 27.5% of the respondents had low and high level of adoption, respectively.

The results of the survey conduced by Shivamurthy *et al.* (2008) in Srinivaspur taluk of Kolar district of Karnataka revealed that 46.7 per cent of big farmers belonged to high adoption category when compared to 35 per cent small farmers. Further, 28.3 per cent small farmers belonged to low adoption category when compared to 23.3 per cent big farmers.

Kasi Reddy *et al.* (2008) reported that the adoption of new technologies as a package in mulberry cultivation and silkworm rearing with CSR Hybrid dfls improves the socio-economic status of the farmers. Therefore, the adoption of integrated sericultural technologies in a cluster approach is one of the solutions for attaining sustainability of sericulture.

Mallikarjuna *et al.* (2009) observed majority of the farmers harvested the cocoons in right time (77.5%), while 47.5% farmer have done deflossing, 62.5% of farmers have sorted the cocoons before marketing and 32.5% farmers have adopted proper method of transportation both in Mandya and Tumkur districts.

Lakshmanan (2009) reported that demand for labour in sericulture is intensive as it has a direct relationship with farm size and brushing capacity. Like wise, high yielding mulberry varieties (V1 and S36) under irrigated condition require use of recommended quantity of chemical fertilizer and farm yard manure to produce optimum output. Therefore, extension personel of DOS have to educate the farmers about optimum utilization of resources. This could help to reduce cost of production on the one hand and conserve the scare resources on the other hand.

Sixty four per cent of farmers in Ananthapur, 73% of farmers in Chittoor and 85% of farmers in coastal area had fully adopted the separate rearing houses, adopted shoot rearing. The adoption level was greater in Ananthapur and Chittoor followed by Coastal area (Srinivasulu Reddy *et al.*,2010).

Sreenivasa *et al.* (2009) reported that the improvement indicates the success of IVLP through identification of specific problems in the cluster and development of technologies with the involvement of farmers. Therefore, the adoption of integrated technology in cluster approach is one of the solutions for attaining sustainability of sericulture. This approach with suitable refinement can be adopted elsewhere in the

sericulture areas of the country to ensure higher rate of adoption of technologies and in turn higher returns from sericulture.

Himantharaj *et al.* (2011) revealed that the use of rotary mountages save the labour in cocoon harvesting, better ventilation improves the quality of the cocoon and thereby enhances the reelability and it also contributed to increase the cocoon price ranging from 10-15%.

Sreenivasa *et al.* (2010) observed that increase in mulberry leaf yield per acre per year because of adoption of high yielding V1 mulberry vaiety and application proper inputs. In addition, cocoon yield / 100 dfls was also drastrically changed after IVLP. Before IVLP, 90% farmers were getting cocoon yield of less than 50 kg /100 dfls, non of the farmers were getting more than 71 kgs /100 dfls. After IVLP 60% of farmers wee harvesting 51-60 kg, 20% of farmers were harvesting 61-70 kg and 10% of farmers were havesting more than 71 kg / 100 dfls. The increae in the cocoon yield may be due to better adoption of critical technologies like disinfection, hygiene and better rearing management and the results are in agreement with the study conducted by Jaishankar & Dandin, 2005. This study is also collaborated with the similar study conducted by Hiriyanna *et al.* (2008), Krishnamurthy *et al.* (2008) and Himanthraj *et al.* (2007).

Lakshmanan *et al.* (2011) revealed that, the socio economic variables like age, land holding size, family size, training in sericulture, extension contact, source of information, knowledge level and cocoon price were positive and significantly related to adoption of mulberry and silkworm rearing technologies/practices. Thus, the practice / technology, which had low adoption by the farmers, should be given prime importance by the extension agencies to create more awareness about such technologies. This could be done by periodically orgaziing demonstrations, field

visits and exhibitions. Since sericulture is picking up in the non traditional regions, DoS has to provide necessary institutional and credit support to the needy farmers.

Mallikarjuna *et al.* (2012) reported from the study that, the technology adoption by the lead farmers and the fellow farmers varies with respect to mulberry cultivation and silkworm rearing technologies. Adoption of technologies by sericulturists varies from FFS to FFS and still there is scope to motivate and make sericulturists to adopt all the technologies. During the survey, sericulturists have expressed that credit is the main constraint for construction of separate rearing house and vermicompost unit. High cost and non availability of inputs area the other constraints for non adoption of the recommended dose of manure, fertilizer, bed disinfectants, bio fertilizer and seriboost.

Economics of mulberry leaf and cocoon production

Sericulture is a remunerative crop for all categories of farmers with short gestation periods and quick returns. The economics of sericulture is dependent on how various resources and inputs are managed. Sericulture uplifts and ameliorates the economic conditions of farmers by way of diversifying the farming system, high income generation at frequent intervals and providing off farm employment opportunities (Bajpai *et al.*, 2003). Though vast literature on the cost and return structure of mulberry and cocoon production is available, the recent ones are briefed here below:

Chandrasekar (1985) reported that the cost of establishment of one acre mulberry garden under irrigated conditions of Dharmapuri district of Tamil Nadu was Rs. 8860.72 and that of cocoon production was Rs. 11,972.00. The gross return from

cocoon production was Rs. 19,997/acre/year and net returns realized was Rs. 8025.00 which was 2.6 times higher than that of other competitive crops.

An empirical analysis of the costs and returns from mulberry sericulture in Karnataka by Nagaraj *et al.* (1986a) revealed that the net return per acre of irrigated mulberry garden was around Rs. 11,000/- from four crops.

A study on the economic benefits of sericulturists belonging to six different mulberry holdings and regions indicated that the economic gains obtained are both land specific and region specific (Hanumappa, 1987). Because, the returns accrued was comparatively lower in sericulturists having land area of 0.5 – 1 acre in the rain fed region than other classes. But in irrigated region, the sericulturists having land area of 1.00 to 2.00 acres and above 2.00 acres were able to derive much higher returns.

Murtuza khan (1987) reported that production of bivoltine seed cocoons was more profitable than that of multivoltine in Anekal taluk of Bangalore district. The total cost per acre of bivoltine seed cocoon production was Rs. 14,245.16 with a gross return of Rs. 18,987.75 as compared to Rs. 12,827.22 and Rs. 15,895.02 respectively in multivoltine seed cocoon production.

The total cost of production and net returns in sericulture had a direct relationship with the size of the farm. Returns per rupee of investment were higher from sericulture than any other crop in Chittoor district, Andhra Pradesh (Chandra Reddy, 1987).

Kerutagi (1991) reported that the cost of maintenance of one hectare mulberry garden under irrigated conditions in Bijapur district, Karnataka was Rs. 18,043.99. The gross and net return from silk cocoon production was Rs. 88,961.96 and Rs. 52,680.16 per hectare per annum respectively.

Ragavendra *et al.* (1992) estimated that the cost of cultivation per acre per year for producing cross breed cocoons under irrigated conditions accounted for Rs. 4,312.05 in less than 0.5 acre, Rs. 3,037.39 in 0.5-1.0 acre and Rs. 2,514.27 in more than 1.0 acre farms. The labour cost per acre per year for these farm categories was Rs. 18,986.27, Rs.13,175.07 and Rs.11,056.45 respectively.

Doreen Rose (1992) reported that farmers spent an amount of Rs. 2,251.99 for establishment of one acre mulberry garden under rainfed conditions. The maintenance cost was Rs. 596.77, the cost of production of one kilogram of mulberry leaf was Rs. 0.85 and the net income earned was Rs. 617.84.

Raveendran *et al.* (1993) from the data collected from 50 mulberry farmers in Anna district of Tamil Nadu concluded that silkworm rearing was one of the most profitable enterprises compared to others even for small farmers with less mulberry area.

Dolli *et al.* (1993) observed that the average cocoon yield per acre of rain fed mulberry garden was 79 kg and the net income realized was Rs. 6,400 in Mysore and H. D. Kote taluks.

In a study on income and employment generation in dry land sericulture. Basavaraju (1993) observed that the average cost of establishing one acre of mulberry for large farmers was Rs. 3,125.00.

Rajesh (1995) observed that farmers of Chamarajanagar invested Rs. 64.34 for producing one kilogram of cocoons and the return was Rs. 73.34. The cost benefit ratio worked out was 1:1.14.

The cost of cocoon production declined with the increase in farm size, because of the operation of economics of scale relatively in large farms. The net income of big farmers per acre was two times more than that of the marginal farmers (Jagannathan, 1995).

Lakshmanan (1995) found that the net return per acre/year from cocoon production was Rs. 31,289.19 in holding size I, Rs. 29,663.85 in holding size II and Rs. 27,710.23 in holding size III. He also observed that farmers with holding size I had accrued higher returns than holding size II and III and concluded that farmers having 0.5 or less acres of mulberry garden (mostly marginal farmers) could obtain more benefit from sericulture. The most probable reasons suggested were the more number of crops raised and high participation of family labour in holding size I as compared to other holding sizes.

Doddamani (1996) reported that the cost incurred for establishment of one hectare of mulberry garden was Rs. 6534.37 and the expenses were concentrated in few items like leaf, labour and marketing cost.

It was estimated that the cost benefit ratio for one hectare of mulberry garden was high in Dharmapuri district (1:1.41) as compared to Salem district (1:1.30) (Lakshmanan *et al.*, 1996).

Srinivasa *et al.* (1996b) reported that the investment on silkworm rearing is highly lucrative and economically viable in spite of the risk of fluctuations in labour wages, cocoon yield and price. They studied the economic viability of sericulture enterprise in Kolar district of Karnataka and indicated that the establishment cost of one hectare mulberry garden was Rs. 6,480.00 and that of rearing assets was Rs. 29,557.50. The net present value at the discount rate of 12.00 per cent was found to

be Rs. 70,940.08. The internal rate of return was 35.02 per cent and the benefit-cost ratio was worked out to be 2.82 at the discount rate of 12.00 per cent.

It was reported by Kerutagi and Shankara Murthy (1996) that the gross returns from silk cocoon production was Rs. 88,961.96 with a net return of Rs. 52,680.16 per hectare of mulberry garden.

Shah (1996) studied the cost of cocoon production in progressive and non progressive farmers of Jammu & Kashmir and opined that progressive farmers invested more infixed capital and hence, the cost of leaf production per acre was 1.68 times more in progressive farmers. However, due to effective management, the leaf produced was 1.76 times higher than non progressive farmers, thus reducing the cost of leaf/kg.

Cost of mulberry garden maintenance was more in irrigated areas compared to rain fed areas because of frequent inter cultural operations, more input usage and involvement of more labour (Suma, 1997).

Lakshmanan *et al.* (1997a) suggested that specific development schemes like implementation of minimum support price for cocoons, coverage of crop insurance for silkworm rearing and diffusion of cost effective new technologies would enhance the sericulture industry in Salem and Dharmapuri districts of Tamil Nadu.

Economics of sericulture widely differs across the states and regions due to the varying sericultural practices adopted according to the socio economic conditions of farmers. The cost benefit ratio is governed chiefly by the price of cocoons. In the absence of a price policy, the benefit fluctuates widely (Lakshmanan *et al.*, 1997b).

Smaller holdings had spent higher amount and it decreased as the holding size increased. The higher cost incurred by marginal land holders was due to the excess use of both FYM and family labour. An interesting relationship observed was that the

cost of production and quantity of leaf decreased as land holding size increased. Similarly, remarkable difference was observed in the cost of production of one kg of cocoon among the different holding sizes. It decreased as the area of mulberry increased and this was due to the higher production cost and realization of low cocoon yield in small holding sizes (Lakshmanan *et al.*, 1997c).

Rajesh and Afshan (1998) analyzed the cost structure of rain fed sericulture of Chamarajanagar area and compared it with that of ragi and jowar. They observed that though the net returns realized was more in ragi (Rs. 786/ha/crop) compared to sericulture (Rs. 690/ha/crop) the cost benefit ratio was more in sericulture i.e 1:1.16 as against 1:1.13 in ragi.

Chandrappa *et al.* (2000) reported that the initial cost of establishment of one acre irrigated mulberry garden was Rs. 8,978 and the cost of garden maintenance was Rs. 15,902 with a labour employment of 256 man days. The total leaf produced per acre per annum was 12 tonnes with a production cost of Rs. 1.33 per kg of mulberry leaf.

A comparison of the economic benefit over investment in production of bivoltine and cross breed cocoons in K. R. Nagar taluk of Mysore district had revealed that bivoltine earns higher net return than cross breeds owing to the climate, skilled man power and technical guidance received from developmental agencies (Lakshmanan *et al.*, 2000).

A comparative study of cocoon production in coastal area with traditional area of Andhra Pradesh revealed that the cost benefit ratio was 1:1.70 and 1:1.19 respectively (Rao *et al.*, 2000).

Roy and Sain (2000) conducted a cost-benefit analysis of silk cocoon production among different categories of farmers in Malda district, West Bengal. The estimated return-cost ratio was greater than unity and NPV was found positive in all cases. The observed value of IRR was more than 50 per cent for marginal farmers, while the pooled value of IRR was 44 per cent. The rate of return on investment was almost 50 per cent, with an attractive short payback period ranging from 2.37 years (marginal farmers) to 3.37 years (large farmers).

Landless farmers earned nearly 50% income from sericulture whereas marginal and small farmers earned 22.89% and 12.11% respectively from sericulture (Padma Tripathi, 2000).

Kumaresan and Vijaya Prakash (2001) studied the economics of sericulture *vs* competing crops such as sugar cane, paddy, turmeric etc., in Erode district of Tamil Nadu and concluded that the revenue obtained from sericulture was higher than that of all the other major crops cultivated in that area namely paddy, sugarcane, gingerly, groundnut and sorghum.

The linear analysis of the data collected from 120 farmers from Hassan and Mandya districts of Karnataka on the cropping patterns and income levels of cross breed and bivoltine rearers indicated that the area under mulberry should be increased to 30.75% during kharif and 33.61% during rabi season for CSR farmers for maximizing the returns (Srinivasa *et al.,* 2001).

The average cost incurred for producing one kg of cocoon was higher in shelf rearing (Rs. 77.71) compared to shoot feeding (Rs. 69.43) method. Similarly the net return per rupee investment was also high in shoot feeding (1:1.76) when compared to shelf rearing (1:1.58) (Chandrappa *et al.,* 2001).

A comparative analysis of shoot feeding and shelf rearing methods indicated that irrespective of the methods, major part of the expenditure incurred was for mulberry leaf followed by labour component and chawki worms (Umesh *et al.,* 2001). For every rupee invested in cocoon production a return of Rs. 1.82 and Rs. 1.63 were realized in shoot and shelf rearing methods.

Hiriyanna *et al.* (2002b) reported that the expenditure incurred for rearing CSR hybrids was higher than that of multi x bi hybrid rearing due to usage of more inputs. Similarly the benefit cost ratio was also higher in CSR hybrids (1:1.92) compared to multi x hybrids (1:1.35).

Kumaresan *et al.* (2002) studied the economics of CSR hybrid cocoon production under PPPBST project in Karnataka. The cost of cocoon production was worked out to Rs. 10485.11 for CSR hybrids and Rs. 6917.04 for cross breeds. The high production cost of CSR hybrids was due to usage of more inputs, particularly leaf, disinfectants and rotary mountages. The net revenue was estimated to Rs. 3545.66 for CSR hybrids and Rs. 1099.27 for cross breed. The BC ratio was 1:1.34 and 1:1.16 respectively for CSR hybrids and cross breeds.

Dandin and Kumaresan (2003) empirically analysed the cost of cocoon production and reported that cost of production per 100 dfls was Rs. 4901.12 with a B. B: C ratio of 1:1.54. The cost of production of one kg of cocoon was estimated at Rs. 81.68. Further they also informed that ten crops schedule was more efficient for 2-4 acres of mulberry garden with two plot system.

Viswanathan *et al.* (2003) reported that the maintenance cost of one acre of mulberry garden was worked out to Rs. 8030 and Rs. 7912 in Kolar and Tumkur districts respectively.

Behera (2004) studied the impact of technological change among CSR and cross breed rearers of Mandya district, Karnataka and reported that the cost of leaf production was Rs. 111,295.56 per acre per year for CSR hybrids while it was Rs. 9,879.87 in cross breeds. In both cases labour was the major item followed by FYM, fertilizers, bullock power and irrigation. Similarly the cost of cocoon production per acre per year was also high in CSR hybrids. The B: C ratio was worked out to 2.09 in CSR hybrids and 1.79 in cross breed for every one rupee invested. It clearly revealed that the returns from CSR hybrids was more than cross breed due to higher cocoon yield and more prices fetched for CSR cocoons.

An economic analysis of mulberry sericulture among the farmers of Mandya district, Karnataka revealed that the net profit earned from bivoltine cocoon production was much higher than cross breed rearing (Lakshmanan & Geetha Devi, 2005a). The net profit estimated was Rs. 40364.23 for bivoltine breeds and Rs. 25367.69 for cross breeds per acre per year. The cost of production of one kg of bivoltine cocoons was Rs. 80.35 and Rs. 74.64 for cross breed cocoons. The Cost-benefit ratio was 1: 1.76 and 1: 1.54 for bivoltine and cross breed cocoons respectively.

A study was conducted in rain-fed condition of Chamarajanagar district to work out the economics of sericulture at selected sample households. The study revealed that farmers incurred loss by taking up sericulture in the study region. However, there were no alternative economic opportunities other than sericulture in the study areas where the prevailing climate suits sericulture and offer regular own family employment round the year (Lakshmanan & Geetha Devi, 2005b).

A comparative economic analysis of cocoon production in Kolar district by Lakshmi Prasad (2005) estimated that the cost of establishment of one acre mulberry garden was Rs. 5492.12 and that of silk cocoon production was Rs. 6987.10 per 100 dfls. The gross and net returns were Rs. 8251.96 and Rs. 1264.86 per 100 dfls respectively.

The revenue obtained from sericulture was comparatively higher than all other major crops cultivated in Erode district, except that of banana. The major reasons expressed by the farmers for practicing sericulture were higher profitability and continuous income throughout the year. Further in sericulture, apart from the advantages of higher returns and regular income for farmers, the crop losses are minimized and the yield levels are stabilized due to the popularization of standard scientific technologies (Dandin *et al.,* 2005b).

Dandin and Basavaraja (2005) made a case study of large scale farming in Talawadi of Tamil Nadu and Anekal of Karnataka and found that the production cost of one kg of cocoons was Rs. 70/- in both places.

The expenditure incurred for rearing of CSR hybrids were higher in nontraditional area compared to traditional area. The Benefit cost ratio in traditional area was better (1:1.92) than that of non traditional area (1:1.72) (Hiriyanna *et al.,* 2006).

It was reported by Venkatesh *et al*. (2006) that a regular and substantial income of 80-90% out of the 14-40% land used for sericulture (25000-50000rupees/acre/year) was generated in Kanakapura, Channapatna and Kunigal taluks of Bangalore rural district in Karnataka.

Although profitability in sericulture is positive, its stability depends on two major factors *viz.*, cocoon price stability and cost of cocoon production. So, minimum support price for cocoons should be advocated to increase both productivity and profitability (Lakshmanan and Mallikarjuna, 2006).

A comparative economic analysis of CSR hybrid *vis-à-vis* cross breed cocoon production in Karnataka indicated that though the expenditure incurred for rearing CSR hybrids was higher than that of cross breed rearing due to usage of more inputs for the former, the benefit cost ratio of CSR hybrid (1:2.05 was better than cross breed (1:1.89) (Kumaresan et al., 2006).

Hiriyanna *et al*. (2007) compared the performance and economics of CSR hybrids with the popular cross breed, Kolar gold. The total cost of leaf and cocoon production per acre per year was Rs. 36,443.26 and Rs. 32,982.15 for CSR hybrids respectively. It was Rs. 35,027.57 and Rs. 27,284.10 for Kolar gold. The total income including the income from by products was higher in CSR hybrids (1, 30,081.00) than Kolar gold (Rs. 1, 07,624.00). The same trend was reflected in net income also *i.e* net returns from CSR hybrids was Rs. 60,655.59 as against Kolar gold (Rs. 45,312.33). The cost benefit ratio worked out was 1:1.87 for CSR hybrids and 1:1.72 for Kolar gold.

The findings of Hajare *et al.* (2008) reveal that the contribution of sericulture enterprise in Vidarbha region of Maharashstra was found to be the highest at 52% (Rs. 82,315/ha/yr) when compared to other competitive crops in that region.

According to the studies of Dandin *et al*. (2008) large scale farmers, possessing more than 5 acres of mulberry incurred a total expenditure of Rs. 65,655.35 and Rs. 64,167.90/ acre/year respectively in Karnataka and Tamil Nadu towards cocoon production. In case of small/medium scale farmers, the total cost of

production was Rs. 72,677.93 and Rs. 64,537.58/acre/year in Karnataka and Tamil Nadu respectively.

Lakshmanan *et al.* (2008) revealed that gross return and net return were quite high under assured irrigated condition in Karnataka and Tamil Nadu than that of semi-irrigated condition in Andhra Pradesh. In the absence of minimum support price for cocoon, most of the sample farmers were reported to be scaling down their cocoon production, which calls for framing of suitable developmental policies to increase silk cocoon productivity.

Mallikarjuna *et al.* (2008a) reported that, the sericulture in rainfed area comparatively gives better return than other rainfed crops such as ragi, jowar, horse gram and pulses. Farmers are to be educated and motivated to adopt new technologies recommended for rainfed areas to increase their productivity. It is suggested to use organic manure, green manure, soil and water conservation practices together with new variety as technology package to increase the productivity of mulberry and new silkworm breeds with proper disinfection and hygienic measure and bed disinfectant to harvest good cocoon crop and higher return in water stress areas.

Mallikarjuna *et al.* (2008b) indicated that, sericulture provides the highest return compared to sugarcane, ragi, paddy and tomato crops. The farmers are interested in sericulture due to less fluctuation in the price of the produce compared to other crops and assured market for the produce.

Purushotham and Rama Mohana Rao (2009) concluded that the revenue obtained from sericulture is fairly higher. The other major advantage was the continuous income throughout the year. The advantages and other important aspects

of sericulture and its high profitability nature can be made known to the farmers and popularized through extension programme.

Constraints in technology adoption

Non adoption of improved technologies results in variability in production and affects the diffusion of technologies. Some of the constraints opined by the farmers are indicated below.

Puttaswamy (1977) observed that lack of knowledge and resources as the primary reason for non-adoption of recommended practices by farmers. Other reasons he found were low prices for the produce and disease of the crop.

Rajan (2002) reported that major problems remaining for the popularization of bivoltine technologies are, timely supply of quality silkworm eggs in required quantity organizing large number of chawki rearing centres, providing hygienic conditions and supply of all required equipments and disinfectants.

Rajashekaraiah (1979) revealed that non-availability of credit, failure of crop, lack of trays and mountages lack of knowledge about the control of disease were the most mportant disincentives for non-adoption of silkworm rearing technologies.

Chandrashekara (1985) reported that the major constraints expressed by 95 per cent farmers was the lack of advise relating to the information on ruling prices at various market and low price. Lack of grading facilities and high fluctuation in prices of silk cocoons were also considered as constraints in obtaining food returns.

Khan (1985) reported that all the respondents producing multivoltine cocoons (100%) expressed the incidence of uzi fly as the major problem in getting good cocoon crop. On the other hand, 22 and 26 per cent of the farmers expressed the problem of shortage of irrigation water and human labour. Regarding marketing of

cocoons 50 per cent of the respondents expressed the lack of transportation facilities, under weighment and poor price for cocoon as the major problem.

Siddappaji and Vasundara (1988) found that the reasons for low cocoon yield in Mysore district are:

a) Non-application of right dosage of fertilizers but use of more quantity of nitrogen in the form of urea for cultivation of local variety of mulberry.
b) Rearing traditional cross-breeds which were crossed from Pure Mysore x C niche.
c) Lack of sufficient space during rearing leads to low yield of cocoon.
d) Silkworm rearing in the dwelling houses.
e) Negligence in uzi control

Further, they revealed that the cocoon loss due to occurance Flacherie 14.36%, Grasserie 1.456%, Muscardine 0.38%, Pebrine 0.094% and Uzi fly 11.57%.

Kamble *et al.* (1987) reported that lack of knowledge (58.18%), problems regarding timely supply (21.00%) and lack of knowledge about how to use (20.02%) as the major constraints experienced by the farmers in adoption of bio-fertilizers.

The constraints as perceived by the sericulturists for non adoption and partial adoption of recommended sericulture technologies were lack of knowledge, lack of finance, scarcity of water and lack of labour (Shivamurthy, 1988).

Das *et al.* (1988) reported that the main constraints in confronting the expansion of Indian sericulture non availability of cheap agriculture labour, lack of sound technical man power, absence of local market, lack of improvement of marketing facilities, lack of production of good quality silkworm seeds.

Sarkar (1988) reported that the constraints contributing to get low yield of mulberry cocoons in West Bengal were lack of use of high yielding varieties, lack of knowledge in adopting improved agronomical practices and lack of adequate training on the improved techniques of rearing.

Sreenivasa (1989) reported that, the sampled farmers in mulberry cultivation were lake of water, non availability of labour and high yielding varieties, harvesting and transportation of leaves during rainy seasons. Ultimately supply of layings, high cost of dfls, uzi menance, lack of separate rearing house, lack of disease control measures, lack of finance and fluctuation in the cocoon price were the constraints observed in silkworm rearing.

Satheesh (1990) reported that reasons for not utilizing chawki rearing centers by the non-beneficiaries was lack of adequate care and inadequate technical guidance at chawki rearing centers.

Gopala (1991) indicated that lack of knowledge about disease control was the most important reason for non-adoption of recommended sericultural technologies by both developed and less developed areas. Lack of irrigation facilities got second rank in developed area while non-availability of M5 variety of mulberry got second rank in less developed area. Non-availability of labours in right time received fourth rank in developed areas as against lack of knowledge about disinfection measures which received fourth rank in less developed area.

Raghuprasad (1992) reported that the major problems faced by sericulturists were distant cocoon markets, non-availability of labour input and dfls, non-availability of guidance about disease control, lack of financial assistance and irrigation potential, water as well as good prices for silk cocoons.

Gopal and Krishna (1993) reported that the major constrains faced by the sericulturists were lack of knowledge about control of silkworm diseases, lack of irrigation facilities, separate rearing houses, labour availability in time, lack of knowledge about disinfectant measures and non-availability of M5 planting mulberry variety.

The study on the knowledge level of the sericulturists on the recommended sericultural practices and the characteristics associated with the adoption behavior (Singhvi *et al.,* 1994) showed that majority of respondents were lack of knowledge about disease control, lack of capital, high cost of fertilizers, shortage of trays and non-availability of quality chemicals were the main reasons identified for non-adoption.

Nikhade *et al.* (1995) highlighted that the important constraints in adoption of sericultural technologies were situation constraints like non-availability of irrigation (100%), non-availability of good quality laying in time (96%), non-availability of labour (74%), non-availability of mountages (66%); technical constraints like lack of knowledge about control of silkworm pests and diseases (92%), lack of knowledge about disinfectants and their concentration (77%), lack of knowledge about fertilizer dozes (77%); Financial constraints like ignorance about procedure for getting credit (100%), non-availability of credit to all (100%) and non availability of subsidy to all (92%) and marketing constraints like low weighing of cocoons (100%), delayed payment (100%) and quick deterioration in quality of cocoons(92%).

Doddamani (1996) reported that the constraints of sericulturists in Gulbarga district of Karnataka were non-availability of Dfl's and lack of disease and pest controlling measures were the reasons for low production.

Datta and Diliokumarpradhan (1996) observed that major problems faced by sericulturists are lack of knowledge about to maintain optimum temperature and humidity during silkworm rearing and lack of investment.

Geetha *et al.* (1996) reported that lack of scientific information, poor extension and organizational contacts, lack of sufficient credit facilities and training

programmes were the major constraints for adoption of sericulture technologies by the farmers in South India.

Doddagadad (1996) indicated that insufficient transport facilities, contact with the scientists, inadequate salary, lack of training, lack of participation of extension personnel at planning stage, lack of furniture and residential facility at the working palace were the major constraints for extension personnel. He further mentioned that non-availability of cocoon market, lack of sufficient credit facilities, lack of separate rearing houses and non availability of improved mountages were the major constraints faced by the farmers for effective adoption of improved sericulture technologies.

Lack of knowledge about diseases, fear of toxicity to silkworms, lack of inputs and poor extension are the constraints for non adoption of plant protection measures (Govindaiah *et al.*, 1996).

Important reasons cited by farmers of Tumkur district for partial and non adoption of improved sericultural practices were lack of knowledge, lack of finance, lack of water, non availability of cuttings, FYM and fertilizers in time (Shreedhara, 1996).

Further, Srinivasa *et al.* (1998b) reported that, lack of knowledge as the main constraints (81.30%) folled by low prices for cocoon (70.50%) and high costs (63.30%) opined by farmers of Dharwad district.

Raghu (1997) found that majority of respondents in Kolar district opined that non-availability of quality Dfls as major constraint followed by silkworm diseases and lack of proper guidance.

Das *et al.* (1999) reported that the major problems faced by the sericulturists are lack of information, lack of technical guidance, distant markets that prevent from rearing these hybrids.

Lack of finance, lack of knowledge, non availability of inputs in time and fluctuations in cocoon rate were the major constraints observed for non adoption among different categories of farmers in K. R. Nagar taluk, Mysore district (Jagadisha 1999).

Venkatesh Kumar *et al.* (1999) inferred that the reasons for non adoption of improved sericultural practices among multivoltine seed cocoon producers in Magadi taluk of Bangalore rural district were lack of economic resources, indifference on the part of rearers, lack of coordination between farmers and extension workers and lack of effective extension activities.

Further, Ganapathy *et al.* (1999) reported that, the major reasons affecting the adoption of recommended sericultural practices were lack of knowledge about use of fertilizer dose, disease control measures, lack of capital and high cost of fertilizers. No good price exploitation by middlemen and distant market place were the major constraints faced by the sericulturists in marketing cocoons.

Nadadur (2000) observed that sericulturists perceived lack of separate rearing house, lack of adequate space and susceptibility of silkworm to various diseases and pests that lead low production.

Chandrappa *et al.* (2000) study revealed that a large number of sericulturists (37.5%) were low adopters of recommended practices. The major reasons affecting the adoption of recommended sericulture practices were lack of knowledge about fertilizer dosages and disease control measures, lack of capital and high cost of fertilizers. Non existence of good price, exploitation by middlemen and distant

market place were the major constraints faced by sericulturists in marketing of cocoons.

The major problems in adoption of bivoltine sericultural technologies were timely supply of quality silkworm eggs in required quantity, organizing large number of chawki rearing centres, providing hygienic condition and supply of required equipments (Rajan, 2002).

Munikrishnappa *et al.* (2002) indicated the constraints faced by the farmers in the adoption of improved sericultural practices. The major constraints for small farmers were lack of finance (42%), lack of knowledge (35.3%), lack of separate rearing house (31.5%) followed by non-availability of inputs in time (22%) and fluctuation in cocoon price (10%). Among the medium farmers, the major constraints were fluctuation in cocoon price (21%) followed by financial constraints, lack of proper knowledge, lack of separate rearing house (15.70% each) and non-availability of inputs in time (10.5%). Among the large farmers, the major constraints were fluctuation in cocoon price (72%) followed by lack of proper knowledge (21%), non-availability of inputs in time (17.8%), lack of separate rearing house (10.5%) and lack of finance (10.5%).

Lack of finance, non availability of separate rearing houses, inadequate rearing materials, non availability and high cost of inputs and unstable cocoon price were the major constraints for non/partial adoption (Hiriyanna *et al.*, 2002).

Dandin and Basavaraju (2003) indicated that the farmers constraints like high cost of mountages, control of diseases and pests, high operational costs make rearing of CSR hybrids difficult.

Further, Rajeev (2004) reported that, 91.67% of the respondents expressed lack of capital for construction of separate mounting sheds was the major constraints for non adoption of CSR hybrids.

Dandin *et al.* (2004) found that recommendation with regard to application of fertilizers, disinfectants and pest control measures were not adopted either partially or completely due to high cost. The limited use/non use of FYM were due to its non availability. Further, lack of awareness about different technologies like new mountages, density in mounting, correct time of harvesting, new system of pruning and thinning hindered the improvement in productivity.

Lakshmi Prasad, (2005) reported that the main problems encountered by sericulturists of Kolar districts were shortage of water in summer seasons, pest and disease incidence, high temperature in summer, non availability of dfl's and chemicals in time.

Narayanaswamy *et al.* (2005) reported that a foremost constraint faced by the sericulturist was non-availability of adequate quantity of organic manures ranked first. The second ranked constraint was high cost of manure followed by low quality of manure and lack of knowledge about improved composting techniques, in Kolar district.

Vijaya Prakash and Dandin (2005) revealed that major constraints in the adoption of sericultural practices include the non-availability of input in time (72.22%), fluctuations in cocoon price (56.56%), requirements for a separate rearing house (33.32%) and high cost of inputs (12.00%).

Lack of knowledge, lack of technical guidance, lack of finance, traditional practices, storing belief on own ideas, over confidence, non availability of cuttings in

time and high cost of fertilizers were the main reasons identified for non adoption of technologies by farmers of Ananthapur district (Sujatha *et al.*, 2006a).

The main constraints faced by sericulturists of Chittor district, Andhra Pradesh were lack of knowledge, lack of finance, scarcity of water, lack of technical guidance, traditional practice, lack of skilled labour, high cost of fertilizer and scarcity of electric power (Sujatha *et al.*, 2006b).

Madhu Prasad (2006) revealed that the major constraints faced were difficultly to pickup ripen worms on top racks, requirement of more input for the chawki garden, tukra problem, high price, pungent smell and duplicates of bed disinfectants in the market with synonymous names. Hence, the scientists may modify the technologies to make them more suitable for sericulture farming conditions. Further, the extension personnel should intensify the educational programme to impart the knowledge on integrated management of tukra, use of quality inputs and identification of duplicate bed disinfectants in the market.

Mani *et al.* (2006) noticed reasons for non adoption of new sericultural technologies by farmers of erode district, Tamil Nadu were assessed with high cost, lack of awareness and non-availability of inputs in time.

Geethadevi *et al.* (2006) indicated that the development of new sericulture technologies does not yield benefits by itself. The new technologies are required to be transferred to the farmers field. The reasons for non-availability/poor adoption of new technologies were attributed mainly to (a) poor performance of technologies at field level, (b) poor knowledge of the farmers about new technologies; and (c) defective approaches/one sided traffic of technology transfer/dissemination. Among these factors, the third aspect appears, to be a serious issue. The shifting emphasis of Indian sericulture towards diversifications, commercialization, sustainability and

efficiency necessitates for the state extension organizations to critically examine their extension approaches.

Mallikarjuna *et al.,* (2006) reported that, the major constraints in adoption of mulberry cultivation technologies were more belief in traditional practices and lack of awareness of new technologies. Similarly, high cost and investment and more belief in traditional practices were the constraints in adoption of silkworm rearing technologies.

Dayananda and Kamble (2008) revealed that, the main constraints faced by the sericulturists in Anekal taluk on mulberry cultivation were lack of knowledge about certain technologies (83.75%), non-availability of technical guidance (81.25%), lack of easy finance (61.25%) and uncertainty of irrigation and power (30%).

Srinivasa *et al.* (2008) reported that the quantum of resource used was found less with the farmers of Chamarajanagara district compared to that of Kolar district and hence these farmers are to be equipped with necessary information through extension prograammes to use recommended doses of inputs. The usage of bullock power in Chamarajanagar and fertilizers in Kolar district should be increased up to the point of equilibrium as they are yielding more additional out put for every additional units used. Hence judicious usage of these in puts has to be encouraged through the efforts of extension. The adoption rate at farmers' level could be increased by motivating farmers in group discussions and by planning more and more result demonstrations at village level.

Ram Mohan Rao and Kamble (2009) the main constraints with the farmers in adopting the new technologies were multiple cropping system and land allocation, non-availability of irrigation and fertilizers, labour non-availability, assessment of mulberry leaf; quality of mulberry leaf and mulberry spacing.

Srinivasulu Reddy *et al.* (2010) revealed that non availability of inputs in time, high cost of fertilizers, lack of finance, lack of proper knowledge, scarcity of labour, lack of technical guidance, traditional practice etc were the main constraints for partial/non adoption at traditional districts like Anathapur and Chittor and nontraditional districts like Coastal districts of Andhara Pradesh.