Sericulture which includes mulberry cultivation as well as cocoon production is an enterprise provides large scale employment and yields very high income. Moreover, sericulture requires less capital and it is more labour intensive as compared to many other cash biased crop enterprises.

Sericulture has several unique features. Silk is a high value natural fiber. It transfers urban wealth to rural producers. Sericulture is now gaining popularity and getting expanded to almost all states in the country. During 2001-2002 the export earning from raw silk was Rs.2421.98 crores. The area under mulberry was 232076 hectares, the total raw silk production was 15842 million tones. This activity is being practiced in 57936 villages in the country.

Sericulture is an employment oriented rural and cottage industry and it is playing a vital role in generating employment opportunities and improvement of rural economy in the country. The industry has many advantages. It involves simple techniques to follow even by the illiterate farmers. It is a household industry and sericulture does not involve hard labour. Family labour including women and old people can attend to feeding of silkworms very conveniently. It ideally suits the small and marginal farmers, since it does not require heavy investment.

The input and output ratio is very high in sericulture and it pays comparatively higher returns than any other agriculture / commercial crops. It
also pays in quick succession. Sericulture is considered as a means of distributing wealth from affluent to poorer class of people, while poor farmers, reelers, weavers, produce silk, it is mostly the rich who buy and use silk fibers.

Sericulture is one of those sectors where the employment potentialities are quite high. It is because of this particular reason that both government of India and government of Karnataka were interested in contemplating upon such measures which would expand silk production in Karnataka where soil, climatic conditions and also other cultural and economic aspects are favourable for its growth. Thus the primary discussion between the government of India and the World Bank which took place in early 1977 led to the ambitious Karnataka sericulture project which aimed at creation of higher level employment and higher level of income potentialities in the state.

Considering the importance of sericulture in improving the rural economy the government of India and the state government have been paying greater importance in its developments. Presently the on going National sericulture project conceived by the Central Silk Board for development of mulberry is assisted by the World Bank and the Swiss Development Corporation and the Japanese International Co-operation Agency.

The project is being implemented since 1979 in 17 major states in India. The broad objectives of the project are:
a) expansion of mulberry area;

b) Improving quality and productivity of raw silk;

c) Increasing production of raw silk; and

d) Increasing the quantum of Indian silk exports.

This is sought to be achieved by strengthening infrastructure, research development, extension support etc. The impact of the project on completion, will generate employment for additional one million people in rural areas, a majority of whom belonged to economically weaker sections.

In view of this, the present study was carried out to find the economic viability of sericulture crop on the generation of income and employment to rural folk. It also seeks to analyses the relative role of sericulture in employment generation and income generation to the household.

The data were collected with the help of pre-tested questionnaire from the sericulturists. The sericulturists were stratified into five categories on the basis land owned. The different categories were namely landless, marginal, small, medium and large farmers. From each of the category 20 farmers were selected in each gramapanchayath. 100 sericulturists were selected from each of the selected taluk. Totally, 300 sericulturists were selected by following multi-stage stratified random sampling. The data pertain to 2001-02 agricultural year.
The data were analyzed to fulfil objectives, by using tabular, percentage, averages, labour output ratio's, capital output ratio's and whether sericulture is labour / capital intensive.

The data were also regressed in order to find out the viability of sericulture crop in terms of employment and income generation. The study made an attempt to delineate the factors that conditions the labour use in sericulture using simple linear regression model. The following models were used to study the contribution of some of the important variables in determining labour absorption in sericulture. Non-linear, Cobb-Douglas type of production function was found to be most suitable in explaining the variability in sericulture income.

**SUMMARY OF THE MAJOR FINDINGS**

The average mulberry area owned by marginal farmers was 0.09 acres, small farmers owned 0.37 acres, medium farmers have 0.81 acres, and large farmers owned 0.47 acres in Byadanur village of Pavagada taluk. In Rantavala village of Madhugiri taluk the farmers are owning on an average mulberry area of 0.12 acres, 0.25 acres, 0.16 acres and 0.44 acres by the marginal, small, medium and large farmers respectively. While in Madihally village of Turuvekere taluk, the marginal, small, medium and large farmers have owned an average area under mulberry was 0.12 acres, 0.31 acres, 0.31 acres and 1.5 acres respectively.
It is noticed that in the selected villages of Madhugiri and Pavagada taluk both the varieties of mulberry cultivation local and HYV (M5) are found. Where as in Turuvekere taluk S36, V1 and M5 varieties of mulberry gardens are found. Since mulberry is grown under irrigated conditions in Tumkur district, majority of area is under M5 variety only. Mulberry is planted in row system and pit system also in Turuvekere taluk and have adopted shoot harvesting system to harvest leaves.

In the type of rearing house of the selected sericulturists in the district, except marginal farmers, all other categories are rearing silkworm in a room which is separate from dwelling house in Madihally village of Turuvekere taluk. Farmers of Byadanur village of Pavagada taluk rearing silkworms in a room which is adjacent to dwelling units except large farms who are doing it in a separate room from dwelling house. While in Rantavala village of Madhugiri taluk 100 percent landless, small, medium and 50 percent of the marginal farms are rearing silkworms in a room which is adjacent to dwelling house and rest of the farms are rearing in a separate room from the dwelling house.

It is found that among different activities of mulberry cultivation ploughing of land weeding and pruning have generated more number of mandays in all the categories of farmers in Tumkur district. It is noticed that cultivation activities have absorbed more number of hired labourers, than family labours in all the categories of all the villages. As the size of
landholding increases, the participation of family labour decreases simultaneously the dependence are hired labour increases in all the villages. An acre of mulberry garden has generated on an average of 8.8 man days of male, 8.0 man days of female in the case of family labour while 14.6 man days of male and 14.6 man days of female of hired labours in Byadanur village.

It could be seen that more number of man days was generated in Rantavala village where family member participation is also high in comparison with other villages, it was 11.75 man days for male and 10.75 man days for female. While it was 18.25 man days for male and 17.25 man days of female for hired labourers. Whereas in Madihally village family labour absorption was 10.4 man days to male and 9 man days to female labour and it also generated employment to hired labour in the range of 14 man days and 13.6 man days respectively to the male and female labours.

It is noticed that among different activities of silkworm rearing harvesting of leaves, feeding, cleaning, extending and harvesting of cocoon have generated more employment opportunities than others. Even across villages it shows a similar trend. It is interesting to note that the absorption of family members in silkworm rearing is more compare to cultivation activities in all the size classes of all the villages in the district. The average employment generated per crop is also higher than cultivation activities say 29.4 man days of male and 28.4 man days of female in the case of family labour. While it was
only 14 man days of male and 16.4 man days of female for hired labourers in Byadanur village. In Rantavala village an acre of land had absorbed an average of 31.25 man days of male and 24 man days to the female of family members. At the same time it has generated less number of man days to the hired labourers about 14 man days 22.5 man days for male and female respectively. While in Madihally village rearing activities have generated more employment opportunities for family labour than other two villages and it was 35.4 man days for male and 29 man days for female. But it has provided less employment opportunity to hired labour than other two villages and it was only 7.4 man days to male and 11.2 man days to the female labourers. It is interesting to note that the dependences on hired labour can be seen only by the small, medium and large farmers across all the villages.

The total labour absorption per crop for both the activities across land holding size classes shows that family participation is higher than hired labour in the case of land less, marginal and small farm of all the villages. Further, as the size of land holding increases, the absorption of hired labourers simultaneously increases. It is true in the case of medium and large size class of all the villages in the district.

The involvement of family members of male and female labours shows that though there is more participation of both male and female labourers the participation of family female labourers is comparatively less in the size class
of medium and large farms of all the villages. On the other hand, comparatively high absorption of hired labourers of both male and female as in the case of medium and large farms of all the villages.

It is observed that the participation of family labours in mulberry cultivation activities goes on decreasing as the size of land holding increases. This type of situation is commonly observed in all the villages. In the rearing of silkworm activities, a larger participation of family labour than hired labour was noticed. The dependence on hired labours are found only in the farms of medium and large farmers of all the villages.

It is observed that the participation of women of family labour in cultivation activities is comparatively less in all the size class of all the villages except landless and marginal farmers of Madihally where there is slightly higher involvement of family women labour than hired labour. On the other side the dependence of hired women labourers by all the farms of all the villages is more than that of family women labour. Where as the women labourers of both family and hired are engaged in silkworm rearing activities. But it was found that as the size of land holding increases the participation of female labour declines so as to absorb more hired female labourers in all size class of all the villages. The small farms of Madihally shows negligible involvement of hired labourers.
Even among different crops across different size class of all the villages in the district shows that, sericulture provides greater employment opportunities and income than any other crop grown in the particular villages.

Among all the activities of mulberry cultivation fertilizers, farm yard manure, weeding have taken significant participation of cost across different size class of all the villages in the district. Irrigation has also taken good amount of the total cost in all the farms of the district.

Among different activities of silkworm rearing harvesting of leaves, feeding, cleaning, picking up of ripen worms and harvesting of cocoons have taken more share out of the total cost. This is commonly observed in all the size class of all the villages.

The aggregate cost on cultivation across villages shows that average cost of producing mulberry leaves per acre was Rs. 1072.8 in Byadanur village followed by Rs.1274.50 in Rantavala and Rs.1144.8 in Madihally village.

The farmers have spent an amount of Rs. 1704.2, Rs.1600.8 and Rs.1569.5 respectively in Madihally, Byadanur and Rantavala villages respectively for producing of cocoon per crop in an acre.

It is found that on an average number of DFL’s reared per crop per acre in the district was 210 DFL’s in Byadanur, 212.5 DFL’s in Rantavala and 210 DFL’s in Madihally. It is also noticed majority of farmers have reared cross breed variety of DFL’s in the district. The average yield per crop, per acre
shows that 52.2 Kg’s of cocoon produced in Byadanur followed by 50.5 Kg’s in Rantavala and 55.2 Kg’s in Madihally village.

The cocoon produced by the farmers of the district have obtained good price to their products of cross breed variety on an average Byadanur farmers received Rs.100.8 per Kg of cocoon followed by 96.2 Kg’s in Madihally and Rs. 88.75 by Rantavala village.

In order to find out the net income derived from sericulture, which have been calculated deducting the cost of cultivation, cost of DFL’s, cost of rearing and depreciation charges from the gross income of sericulture. It is interesting to note that on an average farms in the district have derived good income per crop. It was found that the gross income from sericulture varies from village to village and it is Rs. 5269 for Byadanur farmers, Rs. 4492 to Rantavala farmers and Rs.5319 to the Madihally village. While net income also varies it was Rs. 1769, Rs.999 and Rs. 1784 for the farmers of Byadanur, Rantavala and Madihally villages respectively.

Sericulture activity may be concluded that it is labour intensive rather than capital intensive . Our study reveals that initially one as to spend good amount to establish proper facilities required to rear silkworms. Subsequently, it requires less capital for maintenance of garden and rearing equipments. In turn, a good yield will fetch significant income for the house hold.
The data were regressed to find out the importance of various factors which influence labour absorption in sericulture. The results show that in the district the coefficient for land holding is negative (-0.826) and statistically significant. It clearly indicates an inverse relationship between land holding size and family labour participation in sericulture. As expected, larger the family size higher is the labour participation. An increase in family size by one person day will result in an increase of family labour participation by 0.642 person days.

With regard to hired labour absorption, results of the regression analysis indicated a positive relationship between land holding size, number of disease-free layings. As expected, family size has shown an inverse relationship with total hired labour. In other words, large families augment their labour requirement through family labour and hence dependence on hired labour is less.

The positive relationship between land holding size and hired labour utilization is explained by the fact that as land holding size increases, labour requirement also increases. Another feature to be observed here is that as the land holding increases, participation by family labour decreases. The size of land holding increases, farm income also increases and as the family income increases, it leads to the withdrawal of family labour from the work force. This situation leads to an increase in utilization of hired labour. In case of total labour, all the four explanatory variables considered as expected signs.
The results of the adjusted co-efficient of multiple determination ($R^2$) were 0.561, 0.78 and 0.727 for family labour, hired labour and total labour utilization respectively indicated that three models explained 56, 78 and 72 percent of the variations in the labour use in sericulture. The co-efficient for size of holding was negative and statistically significant indicating inverse relationship between size of holding and family labour use in sericulture. This could be explained by the fact that as land holding size increases, social status and economic status and any family as bound to be elevated. This elevated status results in decreasing participation of family labour in agricultural / sericultural activities. With the increasing social and economic status as it was observed in many studies, this tend to look towards other white collared jobs when compared to participation in agriculture.

To study the factors affecting income levels in sericulture Cobb-douglas type of production function were found suitable in explaining the income generation. The model explained the variation in income levels to the extent of 94 percent in the district. The higher of $R^2$ indicates that the variables included in the analysis explained major variation in sericulture income. The individual co-efficient indicate elasticities of parameters used in the models. In other words, the magnitude of individual co-efficient indicate percentage increase in total sericulture income in respect to one percent increase in input level ceterus peribus.
The labour output ratio and capital output ratio explain widely the general trends discussed in the study. While the inverse relationship between labour output ratio and size of holding exhibits the higher productivity of labour in the case of landless, marginal and small farmers. The positive relationship between the capital output ratio and land size explicates the higher productivity or capital among the medium and large farmers. It also explains the higher employment generation by less resources farmers particularly family female labour.

CONCLUSION

To conclude, sericulture is one of the crops which can provide not only income but also employment to those families which are engaged in the activities. The findings shows that as the size of the land holding increases the participation of the family members in the cultivation of mulberry decreases. In other words, as the size of land holding goes up, the dependence on hired labour increases in all the selected villages in the district.

Women participation in both the mulberry cultivation and rearing activities are significant than male. Family women are more engaged in rearing activities than mulberry cultivation.

Despite higher cost of establishment, sericulture has contributed significant share of income to the total income of the households than any other crop grown in the selected villages.
The findings also shows that among several problems faced by the farmers disease is one such. Generally silkworms are prone to disease which will affect the production causing frustration to the farmers. The findings indicated that mostly this is because of their negligence in following the guidelines given by the extension staff to control diseases. These can also be attributed by many factors like money problems, poor technical knowledge, irrigation etc. Irrigation place a dominant role in producing nutrient and luxuriant mulberry leaves to feed the worms for better yields.

Capital is one of the important inputs required for the initial investments to undertake the sericulture activity and it is also necessary to create proper infrastructure facilities to rear silkworms. The study shows that many of the farmers have no proper assess to institutional credit. This is because of their small land holdings and are treated economically non-viable by the lending agencies. It was also found that whatever the loans availed by the sericulturists are utilized other than the purpose. This feasibility nature of the loan given to sericulturists confused the lending agency to give a second thought over the sericulture loans.

The analysis of the asset position of the selected sericulturists showed that all most all the sericulturists have owned some of the basic equipments required to rear silkworms like trays, stands, antwells, choppers, uzinets etc. But chandrikes are generally hired from others. The study reveals that land less,
marginal and small farmers in the district have owned in sufficient number of trays, rearing stands, choppers and other related equipment to rear 100 DFL’s. They manage with their existing stock. But chandrikes are hired from others on payment of lumsum / per chandrikes basis per crop.

This was a common practice across villages whereas medium and large farmers, though owned trays which were in-sufficient for their large scale brushing. This leads to congestion without providing required spacing for silkworms at the later ages and would result in partial / total failure of crops due to congestion related diseases like grassaire(Halu roga). Even medium and large farmers have not owned sufficient chandrikes. This is because of their negligence to invest on equipments in-spite of the usefulness. Many a time this causes total crop failure. The average crop failure ranges between 25 to 40 percent.

It is observed across all the villages in the district that while some farmers are doing well, majority of the participants either obtained below the average or a very poor yield or ended in total failure. The following have been identified as the possible reasons for their failure.

a) Inadequate water / untimely irrigation, not attending to inter-cultivation practices indicating poor maintenance of garden resulting in shortage of leaf / immature / over matured leaf.
b) Poor quality layings resulting in poor / irregular hatching and irregular moulting.

c) Inadequate and ineffective disease control measures.

d) Insufficient rearing house facility and inadequate equipments.

The results also indicated a higher productivity of labour among the land less, marginal and small farmers but in the case of medium and large farmers, capital seems to show higher productivity. Nevertheless, the total income generation and employment generation aspects of sericulture highlight some interesting features. Even though the income generated by sericulture is higher than all the other crops.

When the wage of the family labour, both male and female (whose opportunity cost would have been zero otherwise ) is included as the income from sericulture this figure tends to be incomparably higher than any other crop among all the categories of farmers. Thus, the results draw the inference that sericulture is more of an employment generating activity than of income generating activity.

The results of regression analysis for labour absorption in the district shows that all the four explanatory variables have positive signs and are statistically significant. The direct relationship between total labour absorption and identified explanatory variables is quite obvious, increase in landholding or the increase in number of layings calls for additional hands, which in turn
increases total labour absorption of four variables landholding size, total family labour were found to be significant. It is quite natural that land holding size as shown positive and significant co-efficient with total labour absorption. Other things ceterus-peribus increase in area by an acre will result in employment of additional by 2.115 person days.

With regard to income levels in sericulture the regression analysis results shows a 10 percent increase in the number of DFL’s will increase income from sericulture by 8.6 percent while other parameters remaining unchanged. However, increase in the number of disease free layings and the number of crops to be grown crucially depends on the availability of mulberry leaves productivity of mulberry garden. The nutrients which comprise of both chemical and organic manure has shown positive and significant co-efficient. The increased use of nutrients augments the income from sericulture namely increased leaf production which facilitates to increase number of DFL’s as well as more number of crops per year days.

**IMPLICATIONS OF THE STUDY**

To reap better results irrigation is a must to produce the nutrients and luxuriant leaves. The concerned department therefore, should provide or facilitate them to make their own irrigational facilities in one or the other form by way of extending institutional credit either from banks or through government programmes to dig borewells. Thus it would help the farmers to
fulfil the dreams of enhancing the total income of the households by shifting the cropping pattern towards sericulture and other remunerative crops.

1) Extension staff should also make efforts in bringing more and more new farmers into sericulture activities and also ensure them the economic viability of the crop. It will not only serve the purpose of increasing the area under mulberry but also improve the standard of living of the farmers through enhanced income from sericulture.

2) Transporting of cocoon is a great problem for the producers. Sometimes farmers have experienced theft of cocoon bags during journey, loss of cocoon due to rain and more over the location of markets is away from the bus stand which has caused heavily on the packets of the farmers to meet the expenses of transporting of cocoons from bus stand to market. Therefore the study suggests that the department of sericulture should make an attempt to provide adequate transport facilities from bus stand to market by charging a nominal fee. It would be appropriate to consider Passenger-cum-Goods Service (PGS) where equal importance given to both the luggage of the passengers and the passengers themselves. This service can ply from important sericulture pockets to the market center. This service is in practice in Tamilnadu in the coastal areas to facilitate the fisherman. Thus it would help to get rid of the hardships of the farmers.
3) Government should continue the system of supporting price to the cocoon by enhancing little higher than the prevailing price per kilogram of cocoon. So, that farmers will be compensated in case of partial / total failure of the crop. The price fixation should also take into account 25 – 40 percent crop loss in addition to the cost of rearing.

4) Farmers are more concerned about quick disposal of cocoons, impartial bid, quick settlement of money are necessary in order to have faith on government markets.

5) Much emphasis should be given to replace local variety of mulberry gardens. Farmers must be made to go for improved variety of mulberry on experiment basis till they get confidence on new variety. In the mean time they can also go for improved variety of DFL’s by replacing traditional variety of DFL’s.

6) Farmers must also be aware of the importance of crop and the problems in brushing more number of DFL’s than the capacity to feed by the existing mulberry gardens. This would avoid the practice of purchasing of leaves from other gardens which causes crop failures due to change in the leaves.

7) To meet the shortage of silkworm seed during summer, which sometimes leads to a rise in the DFL’s price especially of the private grainages, a summer seed production programme should be evolved in
collaboration with CSRTI or any agency. In addition, there should be a thorough accountability on the part of private egg preparers and government grainages to ensure quality eggs. Because the less density of eggs and less quality of DFL’s cause many a time crop failures.

8) Farmers should be given proper orientation training such that they realize and appreciate the importance of aeration, leaf quality, skills to diagnose disease and other related matters. The farmers should also be given orientation about the importance of organic farming which helps the rearing of silkworms with the help of chemical free leaves.

9) A majority of the farmers do not have separate rearing house but majority of them are rearing in the corner of the living / dwelling house, which however not specially suited for rearing silkworm. Farmers could be educated on how to make alterations in the rearing house to provide better aeration, humidity and temperature control. This causes health hazards to the rearers due to increase in the room heat and crop failure due to the movement of more people and the consequent dirt and dust.

10) The non-governmental organizations can play a dominant role in making a break through in sericulture in terms of expansion of mulberry. A similar approach could be made use of for achieving another take off in terms of improved package of practices and increasing yield levels.
11) Sericulture is basically a labour oriented crop it provides employment avenues to all persons irrespective of age, sex in the households. Therefore non-sericulturists can be motivated to venture into mulberry cultivation activities by at least sparing a minimum possible land. This would provide employment regularly and frequent income to the total income of the households.

12) Government should make an attempt to dug bore wells at free of cost where sericulture are extensively concentrated. These bore wells can be used for raising of mulberry plants / existing gardens. A group of farmers can be formed into users group, headed by a number of group who should work honorarily, honestly and sincerely in providing irrigation to all members of the group with out any bias. This can be distributed to all the members by charging a minimum cost for the welfare of the users group. Similar type of group also can be formed among rearers to take up the problems of rearing and marketing. The group can be take up the problem of disease spread, crop failure and marketing with government officials effectively. It can also make arrangements for collective transit of cocoons to the nearest market.

13) Extension should help in carrying out worm testing in cases of suspected diseases infection. Early detection of diseases and remedial measures will reduce the risks of crop failure and also increases the
credibility of the extension staff among the farmers. In providing disinfection services, priority should be given to

a) areas with low yield performance and

b) farmers with continuous crop losses and lower yields.

Thus sericulture should be viewed as a highly potential area to generate more employment to different type of labourers. Like unskilled manual labour to cultivate mulberry, semi-skilled women labour with a soft approach to rear silkworms and skilled labourers to gaining, throwing and weaving silk in both rural household industry and composite mill. It could be one of the more potential areas in an economy where very high rate of un-employment and very low capital availability persist. Hence, devoting attention to sericulture seems to mean that attention diverted on the health of the whole economy.