CHAPTER – I

INTRODUCTION

India has witnessed significant technological change in the agricultural sector over the years due to the thrust given to research and extension. Agriculture once considered being a system for improving the production of agricultural commodities for providing food security, has now been transformed to a system contributing to the income of farming families and thereby contributing to improvements in the quality of living of farming communities. With the introduction of new technologies, the subsistence agriculture was transformed to a commercial agriculture. The introduction of new varieties and the use of chemical fertilizers, coupled with the development of irrigation infrastructure led to the growth in production and productivity in agriculture. Development in sericulture sector witnessed similar facets as did the agriculture sector, during late nineties in India.

Technological change ensures avenue for the use and adoption of new and improved factors, techniques, methods and know-how for more agricultural production in place of old and traditional techniques of production. Introduction of new technology in the farm or the technological change include the use of high yielding varieties of seed or plant material, chemical fertilizers, improved method of irrigation, mechanization of the farm etc, in place of the traditional practices. According to Pause and Singh,¹ technological change in agriculture consists of adoption of farming techniques developed through research and calculated to bring about diversification and increase of production and greater economic returns to the farmers.

In view of the above, it can be said that the technological change in agriculture necessarily a process assisting the shift in production function. Changes pertaining to farm technology may also be distinguished with increased farm mechanization and technical knowledge, besides the adoption of improved package of practices. Of late machineries in farming have taken a lead role in reducing the cost burden in the farm. The use of new technology warrants new knowledge among the farmers. Agriculture technology dissemination is a dynamic process wherein, it can be transferred to differentiated groups of the society.

New farm technology tends to decrease the unit cost of production without decreasing the output. New mechanical-biological technologies such as improved machines, seeds, fertilizers and pesticides, etc, have resulted in enhanced production without increasing total inputs and have helped in improving input-output relationship. By virtue of improving input–output relationships, new technology tends to reduce the cost of production and hence affects the level of agricultural prices. Technology, therefore, plays a vital role in the form of increasing production as well as reducing cost and ultimately lowering the price per unit. In the recent years, farm technology has played a significant role in bringing dynamic changes in improving productivity per unit area. In the absence of rapid technological advances in agriculture, the world must have been facing gloomy prospects.

Modern technology, which is both capital-intensive and labour-intensive, brings desirable changes in the intensity of land use, cropping and also mixture of crops which helps in farm productivity. Use of high yielding mulberry varieties, quality compost/manure, chemical fertilizers, plant protection chemicals, disinfectants in rearing, etc, are the some important technology components which are directly related to productivity in sericulture. Depending on the level of adoptability of these technologies, the impact on productivity, level of farm employment and income are affected.

Mulberry sericulture, which is predominant in Karnataka and parts of Andhra Pradesh, Tamil Nadu and West Bengal in India, has been elemental in uplifting the welfare of the people living in the rural areas. Sericulture has been fast spreading to the different agro climatic zones in these areas, as there is advancement in the availability of region specific technologies. In the recent past, many improved sericulture technologies were evolved at a faster pace. However, there is a differentiated level of adoption of these technologies to improve the productivity and increase the efficiency in production, which is mainly due to prevalent field constraints.
1.1. Focus of the Study

Sericulture occupies a unique position in Indian economy and assumes more importance in alleviating the problems of the rural poor. It is highly suitable in the context of diversification of farm enterprises and integration with the farming system with other enterprises and has the capacity to generate attractive income and year round employment. There are only a few other farm enterprises that can match sericulture in providing employment to rural poor. Sericulture is thus considered as one of the important activities which can provide continuous and gainful employment. Sericulture has attained a significant growth in the past four decades in India. The growth rate of raw silk production reduced in the later part of the last decade due to the reduction in mulberry area, but still there is an improvement in the silk production due to increased productivity.

Karnataka state is an important producer of raw silk in India. The prosperity in sericulture was brought about during 80s and 90s, while the level of production is almost stagnant in recent years due to decline in area under mulberry. However, the productivity level of sericulture gained enormously during the recent period due to the wide acceptability of technological innovations in sericulture.

The improvement in productivity of silk in India in general and Karnataka in particular can be attributed to diffusion and adoption of improved technologies over time. This is due to the advent of many improved sericulture technologies. However, the adoption of these technologies still remains a challenging task in sericulture due to diversified end users in the field. The wide range of factors influencing adoption and performance of new technologies at the field level can be attributed to (i) Seasonal, environmental and biological factors; (ii) Socio-economic factors which influence the adoption of technologies and usage of inputs; (iii) Linkage efficiency between research stations and farmers through extension agencies; (iv) Inherent weakness and higher cost of technologies besides its ease in adoptability; (v) Technical constraints, which include size of the field, farm assets, finance/credit availability, expected yield and remunerative prices; and (vi) Managerial efficiency of farmers, input use, risk taking behavior, decision-making etc.
Basically, when economists talk about efficiency they are trying to answer the following questions. First, are producers using capital, labour and other inputs efficiently in their production process? In other words, can they produce more output with the same amount of input? Second, to produce the same amount of output, can they reduce the amount of inputs? This type of efficiency is called technical or productive efficiency. This efficiency is measured by comparing a farm to other producers in the same activity or to its own past.

In addition, combining few diversified enterprises with sericulture has been considered to be viable in the recent years. The mulberry sericulture based integrated farming system can effectively bring about enterprise diversification for sustainability and additional benefits as well as helps in promotion of better management of important farm resources like land, labour and capital. The integrated farming system approach provides an opportunity for effective recycling of the product and by-products of any one of the components as input on the other components linked in the system. It helps to generate income to the farmers round the year through disposal of silk cocoon, milk, fruits, fuel, manure etc., beside other agricultural outputs.

In view of importance attached to the changes in the level of productivity, income and employment, due to level of adoptability of technologies, it necessitates the analysis of the existing farming situation. Attempt to investigate the impact of physical, biological, chemical, socio-economic constraints on income, productivity and employment in the existing farming situation provides adequate feedback for the dynamic research system. Efficiency in production is one other parameter of study, which is to be addressed in the current situation, as it involves the use of some important resources in production. In the present situation, the issues about the efficiency in production, constraints in adoption of new technologies which has resulted in the yield gaps between the farmers and the research station, have to be addressed for a necessary refinement of technologies. The productive performance of the sector has been greatly influenced by the significant contributions from the research and extension activities. However, it necessitates the study of the whole gamut of the sector from the viewpoint of impact of technologies on the productivity, efficiency and socio-economic development of the farmers. An attempt is therefore, made to reveal the importance of technology in sericulture production in the present study.
1.2. Objectives

The introduction of new technologies in sericulture has evoked a spontaneous growth in the rural sector of Karnataka. There is a continuous jolt in improving the overall farm efficiency and hence it calls for a careful analysis of the situation. In this regard, the current study is conducted by proposing the following objectives:

- To study the impact of technological change in sericulture in Karnataka;
- To evaluate the farm productivity and efficiency in production due to technological change;
- To examine the feasibility of mulberry sericulture based farming system;
- To study the pattern and level of adoption of sericulture technologies by different categories of the farmers;
- To assess the production constraints in sericulture;
- To delineate the factors discriminating adopters and non-adopters of technologies in sericulture; and
- To elucidate the important socio-economic determinants for the adoption of technological practices for bivoltine cocoon production;

1.3. Hypotheses

To ascertain the facts in the study, following hypotheses have been tested:

- Significant momentum in the growth and development of sericulture and allied farming systems in Karnataka has been due to the advent of relevant technologies.
- Improvement in the farm productivity of sericulture has been crucial in improving the farm efficiency in sericulture.
- It’s only by employing resources of production amicably in the prevailing farming systems that farmers can avoid risk in production and aim at higher income per unit.
- Sericulture based farming system has been instrumental in bringing about desirable changes in the lives of farmers in Karnataka.
- Prevalence of traditional methods of farming, lack of knowledge and skills, non-existence of desirable attitudinal factors with the farmers have led to differential rate of production efficiency.
1.4. Brief Description of the Study Area

The agrarian economy of Karnataka comprises many valuable enterprises. The normal net cultivated area in the State is 106.09 lakh hectares with a total geographical area of 190.50 lakh hectares. The major crops grown are cereals, pulses, oilseeds and cash crops. Important food crops of the state are ragi, paddy, jowar, maize and bajra. Pulses like red gram, bengal gram, field bean, cow pea and horse gram are also grown. The important oil seed crops in the state are groundnut, sunflower, safflower and sesamum. Cotton, sugarcane, coffee, tobacco and mulberry are the major commercial crops. The vegetable crops include potato, carrot, cabbage, beetroot, radish, cauliflower, brinjal, beans and leafy vegetables. The major fruit crops such as mango, guava, sapota, grapes and the flower crops such as rose, chrysanthemum, crossandra, aster, jasmine, champaka and marigold are grown. The unique feature of the Karnataka state is the existence of sericulture from the time immemorial. It is said that during the rule of Tippu Sultan, sericulture attained prominence in terms of its growth in the state. Now, Karnataka accounts for more than 55 per cent of the raw silk produced in the country.

District wise performance of sericulture in Karnataka during 2005-06, indicated that, out of the total area under mulberry (87,734 hectares), the major share was from Kolar district (34.92 per cent) followed by Bangalore (Rural) district (20.40 per cent), Mandya district (12.66 per cent), Chamarajanagara district (9.80 per cent), Mysore district (5.27 per cent) and Tumkur district (3.78 per cent). Chamarajanagara and parts of Mysore districts constituted the major area under rainfed mulberry.

1.5. Sampling Design

The districts covered under the study included Kolar, Mandya, Hassan and Bangalore (Rural) districts in Karnataka. The sample districts have been selected following purposive sampling procedure. Further, a multi stage random sampling procedure has been adopted to select the sample respondents. Out of the four districts selected, a total of eight taluks at the rate of two taluks from each district have been selected. Three villages from each taluk have been selected making the sample taluks to twenty four. Finally, ten sericulturists from each village have been selected to arrive at a sample size of 240.
1.6. Data Source

The study depended on both secondary as well as primary sources of data. The data and information from the secondary sources has been collected from various State and Central Government Departments such as Department of Agriculture, Sericulture, Horticulture etc., besides various Research Organizations and Universities. The primary data has been obtained from the sample farmers through personal interview by using a pre-tested schedule. Primary data collected pertains to the agricultural year 2007-08.

1.7. Methodology

Information collected from the sericulturists included various aspects to ascertain the impact of technologies on production, employment pattern and profitability of sericulture in the selected districts. The two categories of farmers in the current study viz, bivoltine silkworm rearers or CSR hybrid silkworm rearers and cross breed silkworm rearers, have been further classified based on the individual scores obtained on the adoption of different sericulture technologies. A list of 20 important sericulture related technologies which have significant impact on productivity, were prepared, and have been administered while surveying. Consequent upon obtaining the individual scores, the farmers have been again post-classified as ‘adopters’ of the sericulture technology and ‘non-adopters’ of the sericulture technology by deriving the adoption index for each farmer, under both the categories of respondents.

With an objective to study the efficiency of the farm-firm and to evaluate the shares of different inputs in the production of sericulture and allied crops, an estimate of costs and returns of these selected respondents’ farm was done. The data have been later converted to a unit area of one acre and presented. A normal time period of one year has been considered for assessing the efficiency of the farm. The cost concepts such as cost-A, cost-B and cost-C have been worked out and presented. These distinct costs have been worked out as because much of the inputs used in the respondents’ farms were owned. It is mainly because the farmers try to minimize out of pocket expenses of cultivation, and by and large, they make maximum use of the resources they own.
1.8. Analytical Techniques Used

Qualitative as well as quantitative techniques are applied for analyzing data on factual and the opinion aspects. Simple statistical techniques like frequency tables, correlation analysis, multivariate analysis etc., are employed in the study. The analytical techniques used in the study are listed below:

a) Tabular analysis
b) Production function analysis
c) Markow chain analysis
d) Growth and instability analysis
e) Measure of technical efficiency in production (Frontier production function)
f) Decomposition analysis to measure the technical change
g) Discriminant function analysis
h) Logit function analysis

1.9. Scope of the Study

Efforts to disseminate the technologies to the farmers’ field have been made since many years to woo the sericulture farmers to adopt advanced technology and to maintain the productivity level at the grass roots. Besides, the efforts made by the Central Silk Board and the corresponding State Departments of Sericulture at different states are commendable. Special programmes were drawn on to improve the productivity in sericulture through World Bank sponsored National Sericulture Project (NSP) during 90s. In addition, the Japan International Cooperation Agency (JICA) assisted Project for Strengthening Extension System for Bivoltine Sericulture (PEBS) was implemented through the joint efforts of Central Silk Board, State Sericulture Departments and JICA in Karnataka, Andhra Pradesh and Tamil Nadu.

The new approaches/models such as Institute-Village Linkage Programme (IVLP) and Project for Strengthening Extension System for Bivoltine Sericulture (PEBS) have been evolved with bottom up approach and the joint participation of primary stakeholders, extension staff and researchers (R-E-F linkage). The new approaches incorporate participatory, decentralized, holistic, market oriented and knowledge based and demand driven approaches.
Owing to all these, there has been a continuous improvement in the quality and productivity at the field level. In particular, with the introduction of new technologies in sericulture there has been maximization of yield and productivity level and there is adequate scope for enterprise diversification. Wide range diversification would mean higher rate of value addition. In this connection, sericulture as a major enterprise, would lead to diversified activities through which one can crave for higher range of value addition. A well knit of plans on a broader sense can therefore emanate into group of objectives, that can be accomplished with the idea of Integrated Farming System.

As mulberry is covered under both irrigated as well as rainfed conditions, there is a need to study the importance of all crop enterprises along with which the crop mulberry sericulture is associated. In this context the present study would throw meaningful insights into the process of agrarian development in Karnataka due to the technological impact on sericulture.

1.10. Chapter Scheme

The following chapters have been designed for a systematic study of facts and revealing findings:

Chapter-I Introduction
Chapter-II Theoretical Framework and Empirical Research
Chapter-III Profile of Karnataka State
Chapter-IV Sericulture and Silk Industry: Global, National and Regional Scenario
Chapter-V Technological Change and Its Impact on Sericulture Development
Chapter-VI Technical Efficiency in Sericulture Farming – A Frontier Function Approach
Chapter-VII Economic Importance of Mulberry Sericulture Based Farming System
Chapter-VIII Diffusion of Technologies in Sericulture
Chapter-IX Research Findings and Suggestions
1.11. Chapter Contents

The introductory chapter gives a brief note on the importance of technology evolution, diffusion and adoption on the farm output, in terms of productivity and efficiency. The chapter gives a detailed account of the objectives and hypotheses formulated there on about the current study, method adopted in approaching these objectives followed by the details about the chapter schemes, content etc.

Chapter Two deals mainly with the theoretical framework and empirical research. The highlights of the views as expressed by the economists on the aspect of technology development, in the process of economic development are highlighted in this chapter. The importance of statistical inference, hypothesis testing, design of methodology, sources of data, major features of selected districts, analytical techniques employed in the study are the other inputs provided in this chapter.

Chapter Three deals with the profile of Karnataka, the geographic features, agrarian economy, evolution of sericulture as an important component under the farming system of the state etc. An attempt has been made to assess the instability in the area and production of sericulture as well as the projections of the crop acreage has been estimated using the transitional probability matrix.

Chapter Four gives a brief account of the global, national as well as the regional scenario of the sericulture and Silk Industry. A historical review of the evolution of silk as an important commodity in trading world trade has been done. Along with this the status of production scenario of raw silk in the world as well as India has been discussed. The state wise performance of sericulture in India highlighting the development of the sector through the plans has been discussed elaborately. Impact of technologies on sericulture development and effective dissemination of technologies through the various nationally sponsored programmes have been discussed. The evolution of sericulture in Karnataka and its role in economic development of Karnataka state also has been discussed in this chapter.

Chapter Five deals with the study on the technological change in sericulture. The adoption of technologies brings about changes in output, employment and factor shares. Using the production function frame work the structural break in production
has been worked out, accounting for the sources of output growth and for evaluating the effects of new technology on factor shares. The function has been fitted for two separate groups of farmers who have been classified based on the level of technologies adopted in their farms. The farmers have been post classified into “new technology farms” and “old technology farms” based on the level of adoption of technologies in mulberry production and silkworm rearing. The decomposition of output growth into the technical change and increased level of inputs used, has been further adopted.

The main contribution of Farrel\textsuperscript{2} was to empirically provide a standard reference to compare the firms’ efficiency: the frontier, via the best firms in the sector. Frontier production function analysis has been considered to be one of the best methodologies to study the farm specific technical efficiency. Empirical studies using frontier production function methodology to measure the technical efficiency are highlighted in Chapter Six. The chapter deals thoroughly with the analysis of farm specific technical efficiency among the sericulturists in the study area. The analysis of technical efficiency sets out to compare the empirical performance of two popular approaches to estimation of technical efficiency in production: Corrected Ordinary Least Squares Regression (COLS) and Stochastic Frontier Production Function (SFPF).

An attempt has been made to investigate the impact of biological, chemical and mechanical technologies on income, productivity and employment in sericulture as compared to other crops in Chapter Seven. Distribution of costs on various inputs in production provides an indicator of the pattern of use of various inputs as well as their relative importance in the total cost of production. The distribution of costs in the production of silk cocoon, into cost-A, cost-B and cost-C have been worked out for the selected districts and presented in the chapter.

The rate of adoption of technologies at the farmer level can be attributed to a dynamic process of effective Transfer of Technology (TOT) programmes adopted by

the extension agencies. An analysis of impact of adoption of technologies in sericulture on level of productivity has been analysed and presented in Chapter Eight. The adoption behaviour of the selected farmers has been computed using the adoption score. The factors discriminating the level of adoption were studied through the discriminant function analysis. The determinants of rate of adoption of technologies in sericulture have been analysed using logit function analysis.

Chapter Nine summarizes the major findings of the study and suggests measures to overcome the constraints in production, with appropriate measures to improve the inefficiency in farming and bring about changes for effective technology transfer in the field.

1.12. Outcome of the Study

The output of the study will be gainful in revealing the impact of improved farm technologies on production and productivity of sericulture. An effort to quantify the farm efficiency is also made in the current study. Based on the efficiency and productivity analysis the study provides an insight into the strategies to be adopted in integrating the effective combination of enterprises to augment income at the farm level. So also the study based on the empirical evidences, will help the policy makers to think of formulating strategies to formulate crop plans to disseminate effective and sustainable development of the agricultural economy of the country.

1.13. Limitations of the Study

The current study has been conducted with the sample data of farmers in the selected districts of Karnataka State, India. For a thorough understanding of the production scenario in the state of Karnataka, a detailed classification of regions could have been very effective. However as this requires huge amount of data with a larger sampling, one can not compromise on cost and time. The optimum solution for enterprise combination would still provide insight into the performance of sericulture in combination of other enterprises. Lack of data in this regard, was a constraint to perform this analysis.