Chapter I

Introduction and Design of the Study
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INTRODUCTION AND DESIGN OF THE STUDY

1.1 INTRODUCTION

India is the seventh largest country at geographical level and second in population and twelfth largest country in economy wise. The economy of India is as diverse as it is large, with a number of major sectors including manufacturing industries, agriculture, textiles and handicrafts and services. Agriculture is a major component of the Indian economy. Mahatma Gandhi said “Indian economy lives in her villages” and many of the industries getting their raw material from agriculture sector. Agriculture, the predominant sector of the Indian economy, is the principal source of livelihood for more than 52 per cent of the population though its contribution to the national GDP had declined to 13.9 per cent due to the high growth in the industries and service sectors. The importance of agriculture to the country is best summed up by this statement: "If agriculture survives, India survives". Agricultural sector is more useful to the economic development of the country either directly or indirectly.

“Agriculture is the backbone of the Indian Economy” said Mahatma Gandhi. Even today, as we entered the new millennium, the situation is still the same, with almost the entire economy being sustained by agriculture, which is the mainstay of the villages. The agricultural division plays an important role in the large scale employment to people. Large and fairly large farms employ workers to undertake various jobs relating to farming of crops and care of farm animals. In most of the countries of the world, agriculture still remains the biggest division responsible for the employing and feeding a large percentage of the population. Agriculture is also important from the viewpoint of assessing the standard of a country’s development based on the capability of its farmers. Poorly trained farmers cannot apply the higher methods and new technologies.

The importance of science and technology in the development of agriculture is fairly clear from the words of Deng Xiaoping- The growth of agriculture depends

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primarily on policy and next on science. There is neither any limit to developments in science and technology, nor to the role that they can play in the field of agricultural growth’. Even if agriculture frequently plays a contributory role in the ‘Gross Domestic Product’ of most countries, it nevertheless requires a substantial increase from both the local and the international community. Agriculture is conventionally based on bulk manufacturing. Harvesting is done once a season, most of the times and stocked and used later. In fact, some thinkers opine that people have begun to adopt ‘batch processing’ and ‘stocking’ in manufacturing, as a result of the practices from agricultural thinking. Before industrialization, people with the biggest stocks of food and other supplies were considered more stable and they were able to face challenges of nature without having to starve. So, important is the role of agriculture that new concepts keep ‘cropping up’ to give the traditional activity a modern turn. One such new idea the world is gibbering about these days is the importance of organic farming, drip method of irrigation, sugarcane sustainable initiative, adoption of new technology, etc.

**SUGARCANE**

The history of sugar and sugarcane in India goes back to several thousand years BC. Indian mythology vouches for this since it contains some legends depicting the origin of sugarcane. The word ‘sugar’ is derived from the word Sarkara. Thus, it could be rightly said that India has been the original home for sugarcane as well as sugar manufacture.

Sugarcane provides the raw material mainly for the production of white sugar, jaggery [gur] and khandsari. It is also used for chewing and extraction of juice for beverage purpose. Sugarcane is a multi-product crop and has immense potential for diversification. Beside the production of sugar, green top of sugarcane is used as fodder for milk cattle; similarly molasses, a by-product of sugar processing is also used as a cattle feed. During the year 2012-2013, sugarcane used by factory for white sugar 73.90 per cent and khandsari sugar 14.80 per cent and seed, feed and chewing 11.30 per cent of the total production in India.²

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Sugarcane and sugar beet are the main sources of sugar in Asia and Europe respectively. Sugarcane is grown primarily in the tropical and sub-tropical zones of the southern hemisphere; sugar beet is grown in the temperate zones of the northern hemisphere. During 1970s, sugarcane and sugar beet accounted for 60 per cent and 40 per cent respectively of the total sugar production in the world. However, during 1990s, the corresponding figures were 68 per cent and 32 per cent\(^3\). During the year 2012-2013, sugarcane accounted for 77 per cent of the total sugar production in the world and sugar beet accounted for the rest. These figures amply demonstrate the growing importance of sugarcane in sugar production.

**SUGARCANE: WORLD SCENARIO**

At present, 115 countries of the world cultivate sugarcane for sugar production and produce about 133 million tonnes of sugar, which is three fourth of the total sugar production (169 million tonnes) of the world\(^4\). The major sugarcane producing countries are Brazil, India, China, Pakistan, USA, Australia, Thailand, Philippines, etc. India is the second largest producer of sugarcane in the world. Brazil is the major producer of sugarcane in the world.

**SUGARCANE: INDIAN SCENARIO**

In India, sugarcane is the second largest crop in the country in terms of value next to rice and wheat. About 52 million sugarcane farmers and their dependents have been involved in sugarcane cultivation. In India, there are two distinct zones for sugarcane cultivation, tropical-south and subtropical north. Tropical regions are Maharashtra, Gujarat, Tamil Nadu, Andhra Pradesh and Karnataka. The Sub-Tropical regions are Uttar Pradesh, Bihar, Punjab and Haryana.

Sugarcane being a tropical crop finds favourable agro climatic conditions for its growth in this region i.e. higher yields. Growth after 1950’s was more in this region and by 1994-1995 the sub-tropical region; sugarcane area was 65 per cent and production was 55 per cent of the total sugarcane produced. Now, the tropical region is already developed and reached near saturation level. The biggest state in this region- Maharashtra faces an acute problem of lack of water, which affects cultivation of sugarcane. The sub-tropical

\(^3\) www.iisr.nic.in, retrieved on 17.10.2013  
\(^4\) ibid
belt with fertile land, high water table and irrigation, appears to be the area for future growth. About 9 states produce 97 per cent of sugarcane and 5 states contributed to about 87 per cent of sugarcane produced in 1994-1995. Subtropical north comprising 60 per cent of total cane area contributes only 48 per cent to total cane and 37 per cent to total white sugar production in the country. The average cane productivity in subtropical north zone was 54.7 and 56.4 tonnes per hectare in comparison to 81.9 and 80.8 tonnes per hectare in tropical south zone (2009-2010 and 2010-2011 respectively)\(^5\).

Sugarcane is grown by a large number of farmers its command area supply, marketing and payment to the farmers etc., have been regulated by various Acts and Sugarcane Control orders promulgated and amended by the Government from time to time. Sugarcane development has received due importance both at the national level as well as at the state (province) levels. The rapid developments in sugarcane cultivation and sugar industry in the country have earned India a prestigious position among sugar producing nations in the world.

**SUGAR PRODUCTION IN INDIA**

Indian sugar production growth came up under structured and planned sugar programme. The demand, the production requirement, the capacity needed and cane production went through a planning process and close monitoring by the planners over the past 4 decades. Further, in order to achieve the set targets, the government has been setting up committees, task forces from time to time to make policy changes in consultation with industry, State agriculture Departments, etc., in areas such as cane and sugar pricing policy, levy price fixation, free sales/levy sugar ratio, etc. Also, the government has been closely monitoring the licencing policy. In India, sugarcane is also utilised for production of traditional sweeteners like gur and khandsari. The country produces a total of about 10 metric tonnes (9 metric tonnes gur and 1 metric tonne khandsari). This sector enjoys all the freedom. No controls, no restriction on cane prices, the sector can pay commercial price.\(^6\)

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\(^5\) ibid

SUGAR INDUSTRY IN INDIA

Sugar industry is one of the agro-based industries in India and it is the second largest industry next to textile industry. About 0.4 million skilled and unskilled workers are employed by the industry and additional employment is also generated by the allied industries for the socio-economic development of the nation. During 2012-2013, there are 526 sugar mills operating in India with an aggregate installed capacity of 4125 metric tonnes. The total production of sugar at that time was only about 25140 thousand metric tonnes in India.7

Sugar industry in Tamil Nadu plays a vital role in the rural development. At present, there are 46 sugar mills in Tamil Nadu consisting of 16 sugar mills in cooperative sector, 3 sugar mills in public sector and 27 sugar mills in the private sector. During 2012-2013, the total area used for sugarcane production 3.95 lakhs hectares, total sugarcane crushing capacity 213.95 lakhs metric tonnes with sugar production of 1958 lakhs metric tonnes and sugar recovery 9.15 per cent in Tamil Nadu.8

SUGARCANE: TAMIL NADU SCENARIO

Agriculture is the most predominant sector of the economy of Tamil Nadu, a state in India. 70 per cent of the state’s population are engaged in agriculture and allied activities for their livelihood. Tamil Nadu has an area of 1.3 lakh km² with a gross cropped area of around 58.43 lakh hectares, of which the gross irrigated area is 33.09 lakh hectares which is 57 per cent and the balance 43 per cent of the area are under rain fed cultivation. Tamil Nadu is the homeland of Dr. M.S. Swaminathan, known as the “Father of the Green Revolution” in India. The state is historically known for its agriculture from ancient times. Tamil Nadu has been agro-climatic zones based on rainfall distribution, irrigation pattern, soil conditions, cropping pattern and other physical, ecological and social characteristics including administrative divisions.

Sugarcane is one of the traditional crops grown abundantly in the state of Tamil Nadu. The area under sugarcane cultivation is increasing year by year due to the increased demand in consumption of sugar and also demands from sugar mills as raw

8 Government of India, (2013), Ministry for agriculture, Policy Note, Demand No.5- Agriculture, pp. 81-87.
material. During the sugar season year 2012-2013, the sugarcane crop is cultivated in about 43 to 44 lakhs hectares in India whereas it is cultivated in 3.95 lakhs hectares in the state and the total estimated sugarcane production is 422.20 lakhs metric tonne\(^9\). The average productivity of sugarcane in India is 67 to 68 tonnes per hectare but Tamil Nadu is with the highest productivity of 100-106 tonnes per hectare compared to other states\(^10\).

In Tamil Nadu, major sugarcane growing districts are Villupuram, Erode, Cuddalore, Tiruvannmalai, Vellore, Namakkal, Dharmapuri, Thanjavur, Perambalur, Salem, Pudukkottai, Theni, Coimbatore, Karur and Thiruvallur. Erode has the second highest productivity of sugarcane in the state.

**SUGARCANE SCENARIO IN ERODE DISTRICT**

Erode district is one of the important districts in Tamil Nadu and has an important role in the economic development of the state. Erode district is having a notable development in various fields viz., agriculture, textile products, trade, food products, etc. Erode is one among the Districts in Tamil Nadu where sugarcane is cultivated on a large scale. In Erode District, the total sugarcane production is 37,53,260 tonnes per annum. Abundance of labour force, availability of irrigation facilities and Government support, liberal loan facilities from bank etc., are the factors which favoured for the large scale cultivation of sugarcane in this district. The average sugarcane yield in the district is 119 tonnes per hectare\(^11\).

**1.2 STATEMENT OF THE PROBLEM**

Sugarcane occupies a prominent position as a cash and commercial crop. The major sugarcane producing countries are Brazil, India and Cuba. In India, the top sugarcane producing states are Uttar Pradesh, Maharashtra, Karnataka and Tamil Nadu. Tamil Nadu has registered with the highest yield in sugarcane production. In Erode district, sugarcane plays a pivotal role in the economy of the district and it is cultivated mainly under irrigated conditions. It is a base for many agro industries in this district.

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\(^9\) ibid.
In terms of the area and production per hectare, Erode district is the second highest among various districts of Tamil Nadu but the productivity of sugarcane in Erode district is far average level of overall districts of Tamil Nadu. The role of sugarcane cultivation in uplifting the rural masses and the rural economy through sugar industry cannot be ignored. This is the only crop which plays a very significant role in the rural area of this district. The favourable climate and soil conditions coupled with assured irrigation enable Erode district to emerge as one of the largest sugarcane growing belts of the state.

A steep rise in production cost and wide fluctuation in the prices of agricultural commodities are the two major factors affecting the income levels of farmers. The price elasticity of demand for these commodities raising steadily, their price instability is largely attributed to the changes in their production and the consequent changes in the market arrivals. The price instability is more pronounced in the case of commercial crops like groundnut, sunflower, chilly and sugarcane. The minimization of fluctuation in the prices of commodities over space and time through adequate processing, transportation, storage, government policies and other facilities not only stabilises the income of the farming community but also synchronizes the demand for and supply of farm products.

The State Government fixes State Advisory Prices for sugarcane per tonne which is above the Central Government’s Minimum Statutory Price every year. The sugarcane farmers incur high input cost of labour and materials in sugarcane cultivation. They have the option of selling sugarcane to the sugar factories or to jaggery producers or producing khandsari sugar and selling in the market. If the sugarcane farmers are selling their sugarcane to sugar factory, they get delayed payments and incur the high cost of cutting charges. So, the farmers prefer to supply their sugarcane to jaggery producers for reasonable price based on the conditions of jaggery market. At present, most of the sugarcane farmers are not ready to take risk for producing khandsari sugar due to high input cost, non-availability of trained labourer, lower price of khandsari sugar, problem in grading & analysing and also high marketing costs involved. In the view of said constraints, it is very much essential to look into the present position of sugarcane farmers, khandsari sugar and jaggery producers in Tamil Nadu. The farmers are losing
their interest in sugarcane cultivation which ultimately affects the economy of the state and nation where sugarcane is considered as one of the important valuable crops of India. It is in this context, several pertinent questions are raised:

- What is the growth in area, production and productivity of sugarcane?
- What are the cultivation practices followed by the farmers?
- What is the cultivation cost incurred by the farmers?
- Why do farmers adopt drip irrigation system in cultivating sugarcane?
- What are the marketing practices followed by the sugarcane farmers?
- What are the problems of farmers in cultivation and marketing of sugarcane?

Hence, the present research is undertaken to study the cultivation and marketing practices of sugarcane farmers in Erode district of Tamil Nadu with an aim to improve the cultivation and marketing of sugarcane in the study area.

1.3 REVIEW OF LITERATURE

In any study, the review of previous studies are considered as important for getting a better understanding of the problem, objectives, the methodology followed and to identify the unexplored part of the field of study under consideration. In this regard, a review of some of the studies relating to the present study has been undertaken and presented in the following section.

Singh and Jagdish Lal\textsuperscript{12} (1992) analysed the sugarcane production targets and results revealed that the compound growth rate of sugarcane production in sub-tropical states were less than the tropical states. The contribution of area in increasing the output was more than the productivity. There is disparity in yield in different tropical and sub-tropical states. The sugarcane yield in tropical belt is generally higher 84.11 tonnes per hectare when compared to those in sub-tropical belt 50.4 tonnes per hectare. Further, it is found that Tamil Nadu has recorded the highest average yield 104.8 tonnes per hectare followed by Maharashtra 86.1 tonnes per hectare as against the Punjab and Uttar Pradesh.

Singh et al.\textsuperscript{13} (1994) conducted a study to examine the annual compound growth rate of area, production and productivity of sugarcane by making use of an exponential equation. The results revealed that the acreage, production and productivity of sugarcane have increased with moderate year to year fluctuations in the different agro-economic regions and Uttar Pradesh as a whole except Bundel-Khand region of the State. The major factors significantly and positively influencing to sugarcane area are found that rainfall, gur price, competitive crop price and current year’s price of sugarcane.

Baliyan et al.\textsuperscript{14} (1995) estimated that the cost of production of sugarcane (planted), sugarcane (ratoon) and sugarcane (planted+ratoon) shows the direct relationship with the size of farms. The profitability of the sugarcane (planted), sugarcane (ratoon) and sugarcane (planted+ratoon) increases with the increase in the size of the farm. Further, the study suggested that and more preferably to medium and large farms to allocate more acreage under sugarcane crop in their cropping pattern. However, there is a need for educating small farmers to adopt improved practices for the production of sugarcane and also to sell their produce to the appropriate purchasing agencies paying higher prices.

Jagdish Lal\textsuperscript{15} (1996) identified that there should be only one price regime fixed by the union government and that should permit premium for higher quality. An efficient marketing network is also called for, which requires direct contact between growers and the millers as prevailing in certain tropical states. Prompt payment of cane price will act as an incentive for raising cane supply to sugar factories. However, the problem of diversion could also be checked to some extent if the cane price announced by the government is made applicable to these industries.

Teggi et al.\(^{16}\) (1996) estimated the price-spread in marketing of jaggery and analyse the pace and pattern of jaggery prices and arrivals. The results noted that the decision to process sugarcane into jaggery largely depended on the cane price offered by the sugar mills operating in the area and the prices of jaggery. The study also showed that the processors to crush cane into jaggery at times of attractive jaggery prices coupled with low prices offered for sugarcane by the sugar mills. Further, the study revealed that there was no significant seasonal pattern in the prices and arrivals of jaggery in Jamakhandi market. The price indices were generally higher during the months in which the indices of arrivals were low. Thus, the study showed an inverse relationship between prices and arrivals of jaggery in Mahalingpur market.

Ravi Kumar and Raju\(^{17}\) (1996) highlighted that the marketing of jaggery involves a number of middlemen and market functionaries between the producer and the final consumer. However, there is a large scope for improving the efficiency of jaggery marketing in this market. The study revealed that regulated market suffers from lack of good storage facilities for storing the jaggery during peak seasons. It is presently housed in a municipal market with an area of 2.71 acres, which is considered to be highly insufficient in view of the volume of business taking place in the yard. Hence, it is suggested that market committee could not provide sufficient storage facilities for want of space. The basic amenities and facilities expected from a market of this importance (second biggest market for jaggery in India) are also lacking. The credit facilities for marketing of jaggery also need to be strengthened, besides development of transport and other infrastructural facilities in the study area.

Pani and Dibakar Naik\(^{18}\) (1997) revealed that the growth rate of productivity is also negative in five districts which together contribute 32 per cent to state average production due to lack of suitable high yielding varieties and modern technology for


increasing productivity in these districts. On average positive trends in area, production and productivity of sugarcane in Orissa and it’s evident that the performance of the crop in the state is satisfactory compared to national level. Further, the study revealed that the growth rate in this state in respect of area, production and productivity are 0.69, 1.47 and 0.76 respectively. At national level, the growth rate of area, production and productivity are positive and significant. It implies that the growers of sugarcane at national level have adopted modern technology which has increased productivity significantly. Along with the significant rise in productivity, significant rise in area clearly indicates that there is dependable market support for sugarcane in India.

Vijaya Kumar and Venkatachalam\(^1\) (1997) found that the annual growth rate of sugarcane area in Tamil Nadu is 2.44 per cent which is more than all India growth rate (1.37 per cent) and also significant at 1 per cent level of significance. Despite all difficulties, no other industry in the state of Tamil Nadu has developed as fast as the Sugar Industry. The Industry has indeed very bright prospects, as there is abundant supply of raw materials, cheap labour and huge local market. The Government is bound to continue on a long-term basis partial control and dual pricing system so that the interests of consumers one the one hand and that of industry are Protected and reconciled.

Jagdish Lal\(^2\) (1997) conducted a study to analyse the performance constraints and prospects of sugarcane production in India. The study concluded that the growth rates of sugarcane production were higher in tropical states when compared to sub-tropical states. The downward trend in certain states was because of switching over to marginal and waste lands for cane cultivation and problems of water stress. Sugarcane productivity performance up to seventies was better in tropics but its rate declined in the subsequent years. Further, the study suggests that an efficient management of ratoons, varieties, inputs, biotic and abiotic stress along with partial mechanization of sugarcane cultivation and effective dissemination of available technology are essential for achieving the sugarcane production targets by the end of this century.


Baliyan et al.\textsuperscript{21} (1998) analysed the costs and returns per hectare from sugarcane (planted) and sugarcane (ratoon) and to determine comparative profitability of sugarcane production with its main competing crops. For the purpose, a multistage stratified random sample was used, in which 90 cane growers of different size groups were randomly selected from four randomly selected villages in the two development blocks. The results concluded that, in case of sugarcane (planted) as well as in case of sugarcane (ratoon) also, the higher net returns were on medium and large farms which may be attributed to the higher yields and higher prices received by them. This indicates that these farmers are more efficient than small farmers. Therefore, there is a need of educating small farmers to adopt new practices and advanced technologies of higher production and also to sell their produce to the agencies paying higher prices.

Patil et al.\textsuperscript{22} (1999) made an attempt to estimate the cost of planted sugarcane cultivation, costs in marketing of raw sugarcane, jaggery and the returns from sugarcane. It is found that regarding income and benefit cost ratio of sugarcane growers are presented the average quantity of sugarcane sold to factory was 108.44 tonnes per hectare. The gross income obtained by them was ₹ 87736.79 per hectare. Farm business income and family labour income worked out to ₹ 55670.45 and ₹ 50977.45 per hectare and net income realised by the farmers was ₹ 44395.51 as against total cost of ₹ 43341.28 while benefit cost ratio with cost was found to be 2.08. The jaggery producers of planted crop sold 110.50 quintals of jaggery per hectare at the rate of ₹ 592.30 per quintal. Thus, gross income obtained by them was ₹ 65449.15 per hectare. Farm business income, family labour income and net income worked out to ₹ 33382.81, ₹ 28689.81 and ₹ 20084.30 per hectare respectively, while the benefit cost ratio with cost of these farmers was 1.44.

Grover\textsuperscript{23} (1999) made a study to identify the various factors responsible for fluctuations in the price of sugar and other sweetening agents and to suggest measures


that would help stabilise the prices of sugar and other sweetening agents and hence the sugar economy in the country. The sugarcane price was found to be positively and significantly influenced by the price of sugar and supply of sugar. The gur price was positively and significantly influenced by the price and sugarcane supply to the factories while it was negatively and significantly influenced by the production of sugarcane. The sugarcane supply to the factories was positively and significantly influenced by the price of sugarcane, production of sugarcane and installed crushing capacity of the factories. The sugar industry in the country is plagued by instability arising out of the variations in sugarcane production on the one hand and the presence of a more competitive gur and khandasari industry on the other. The higher gur price becomes the cause of diversion of sugarcane from sugar factories. The study suggested that any attempt to stabilise sugar price should not only seek or stabilise sugarcane production but also try to ensure that each industry whether gur, khandasari or sugar gets its due share.

Ramasamy et al.\textsuperscript{24} (1999) examined the supply response of cane producers to price and non-price factors and discern out the decision process relating to allocation of cane between jaggery and white sugar production by Tamil Nadu farmers. To study the decision behaviour of farmers who grow cane factory supply and jaggery production, farm level data were collected by contacting 60 sugarcane growers in Erode district. It is found that allocation of sugarcane between supply to sugar mills and jaggery making has been an intractable problem for cane growers as several factors influence the decision. Most often jaggery production by the farmers offers higher profitability. Labour shortage pulls back the farmers from jaggery making and supply cane to factory. Production of jaggery also involves a bit of complex organisational efforts and also faces price risks. In view of these factors, experienced farmers handle jaggery production and marketing easily than less experienced farmers.

Murthy\textsuperscript{25} (1999) made a study to identify the marketing margin and marketing cost of sugarcane and sugar. This would facilitate ascertaining the share of price paid by


the consumer to the sugarcane cultivating farmers. The cooperative sugar factories perform better than private sugar factories in terms of several growth indicators and physical performance variables, while opposite is the case with the profit earned. The reason for this is the relatively better financial management of the private sector. This profit motive has helped them realised the higher returns to the investment. The farmers registered with the private sugar factories incurred lesser cost of cultivation, those with the co-operative sugar factories were found to incurring more cost of production. He also found out that the cultivation of sugarcane is more economical in cultivation and more profitable in terms of returns when compared to other crops like paddy, tobacco, pulses, turmeric, cotton, ground-nut oil, palm oil etc. It is evident that cane growers are very much happy about the present cane marketing methods and Government's dual pricing policies.

Uttam Kumar Deb et al.26 (1999) made a study to analyses growth and variability in sugarcane production. The results revealed that sugarcane area and production in Bangladesh has increased over time while the yield has decreased. There was no significant change in variability in sugarcane production, area and yield in succeeding periods in Bangladesh though different regions showed a mixed pattern. The study concluded that researchers and policy makers of Bangladesh should develop a mechanism to increase sugarcane yield on a priority basis. Unless the declining trend in sugarcane yield can be reversed it would not be possible for Bangladesh to increase sugarcane production in future because it is unlikely to have an expansion in sugarcane area in future due to the land scarcity.

Padmanaban et al.27 (1999), the study found that contribution of crop pattern was the major factor that accounted for the growth of sugarcane output. The next major contribution of output is through yield increase. Therefore, the future efforts need to be focused towards stabilization and expansion of sugarcane area and increasing the yield level. For this aspect introduction of pest and disease resistant clones and varieties with higher recovery of sugar is needed. Moreover steps should be taken extensively to


motivate the farmers to grow more sugarcane by making available subsidies, credit facilities and timely supply of agricultural inputs, such as good seed materials, fertilizer and chemicals, etc. Timely forecast of pest and disease incidence should be made available to the growers to take up sufficient steps needed to overcome the problems and tackle the situation. It is also necessary to increase the sugarcane production for meeting the increased demand and also for exports. The import of sugar should be cut down and Government policy towards sugarcane production may be suitably refined to motivate the farmers to increase sugarcane production.

Ahamed et al.\(^{28}\) (2001) conducted a study to analyses the variation in yield, cost & return of sugarcane under the spaced transplanting method and factors responsible for the variations. The study concluded that under STP method of sugarcane cultivation, variation in yield, cost and return is high within the expected yield group irrespective of different factors responsible for variations.

Sani et al.\(^{29}\) (2002) examined the cost benefit and major constraints of sugarcane production as well as the resource use efficiency. The result of this study showed that despite the low level of resource-use efficiency in small scale sugarcane production in the study area, it is still profitable to produce. It is evident from the result that profit can be increased through efficient resource use. Also, the constraints identified to be affecting the business should be properly alleviated for increased production.

Naresh Nain et al.\(^{30}\) (2002) found that the processing cost of sugarcane for manufacturing one quintal of sugar was found higher in co-operative sugar mill (₹ 193.50) in comparison to the private sugar mill (₹113.44). The higher processing efficiency in private sector may be attributed to lower fixed as well as overhead expenses and more quantity of sugarcane crushed. The irregularity in the distribution of sugarcane


purchase indent delay in payments of sugarcane to the farmers (by co-operative sugar mill), delay in unloading, lack of transportation facilities etc., were the major problems reported by in selected respondents in the marketing of sugarcane to the sugar mills. Thus, there is a need to improve the operating efficiency of sugar mills especially in the co-operative sector to lower down the processing cost as well as to make them economically viable units. All the problems faced by the farmers needs to be attended by the sugar mills on priority basis for the development of sugar industry in the state.

Yousuf Ali et al.\(^{31}\) (2003) found that the mill authority cannot distribute enough money to the cane growers to produce large amount of cane because they do not have sufficient amount of capital that they can distribute among the farmers. For these reasons, middlemen come to the cane market. They offer money to the farmers and acquire money from the transactions between mill and cane growers. Regarding the existence of middlemen, farmers are losing returns from selling sugarcane to the mill. Government should take care of this situation to make both mill and growers profitable. By allocation sufficient amount of capital to the sugar mill, government can develop sugar industries in the country and farmers will also be encouraged to cultivate sugarcane in their lands to raise their economic conditions.

Archana Singh and Srivastava\(^{32}\) (2003) made a study growth and instability in sugarcane production. It estimated that compound growth rates in area, production and productivity was measured through co-efficient of variation analysis by using semi-log equations method. Further, it is found that growth rate the problem of instability in sugarcane production has engaged the attention of scientists and planners in the recent past. The production of sugar too in Uttar Pradesh recorded sharp fluctuations over time. The primary reason for the instability in sugar production is the uncertainty in supply of raw material, i.e., sugarcane which has itself recorded wide fluctuations. The study revealed that the growth rate and instabilities in sugarcane production in different region.


Narayanamoorthy\textsuperscript{33} (2004) analysed the impact assessment of drip irrigation under sugarcane cultivation using farm-level data from Maharashtra. Using a discounted cash flow technique, it was found that productivity was 23 per cent higher than that under the flood method of irrigation, with water saving of about 44 per cent per hectare and electricity saving of about 1059 kWh per hectare in short, drip investment in sugarcane cultivation remains economically viable even without subsidy.

Rao and Ravi Kumar\textsuperscript{34} (2005) studied the marketing scenario of jaggery in India, Anakapalle regulated market in Andhra Pradesh was selected purposively as it ranks next to Muzaffarnagar market in Uttar Pradesh. The total marketing costs paid by the producer, exporter, wholesaler and retailers were higher in channel I (\textcurrency\textnbsp;190.62 i.e. 18.85 per cent of consumers price) when compared to channel II (\textcurrency\textnbsp;148, 96 i.e. 14.73 per cent of consumer’s price). As the total marketing costs are lower in channel II, the producers’ share in consumer’s price is higher in channel II (85.27 per cent) when compared to channel I (81.15 per cent). Further, suggested that there is a greater need to improve the export competitiveness of jaggery in the international market, as the jaggery is found to competitive only in UAE and UK countries. Hence, selecting suitable variety of seed, improving processing efficiency, reducing cost of production of jaggery, encouraging farm level grading and storage facilities, improving transportation and market information network etc. should be given more attention.

Narayanamoorthy\textsuperscript{35} (2005) made an attempt to analyse the various economic advantages of drip method of irrigation in sugarcane cultivation by selecting a model farmer from Sivagangai district in Tamil Nadu. While the productivity gains due to drip method of irrigation is about 54 per cent (30 tonnes per acre), water saving due to DMI comes to about 58 per cent flood method of irrigation. Owing to less consumption of well water, the farmer is able to save about 1260 KWh/ acre of electricity, which is used for


fitting water from wells. Besides these advantages, the farmer could reduce the cost of cultivation to the tune of ₹ 3450 per acre particularly in operations like weeding, intercultural and irrigation cost (both labour and other costs). The benefit cost ratio varies from 1.98 to 2.02 under without subsidy condition and the same varies from 2.07 to 2.10 with subsidy (30 per cent) at different discount rates. Further, the results of net present worth indicate that the farmer can cover the entire capital cost of drip set from the income of the very first year itself even without subsidy. The study suggested that drip method of irrigation is economically viable even without subsidy in water intensive crops like sugarcane.

Panwar Sanjeev et al.\textsuperscript{36} (2006) conducted a study on forecasting the profitability of sugarcane farming in major states of India. This study is based on the data of cost of cultivation of sugarcane in different states of India for the period 1990–2001. Multiple regression models have become the methods of choice in the area of forecasting. In the study, the Holt's two-parameter Model is used (Exponential smoothing adjusted for trend). The results revealed that there was an increasing trend in sugarcane production in India.

Pawar et al.\textsuperscript{37} (2007) made a study to ascertain the share of major sugar export and import countries in world trade and sugar prices. It is found that India has less than 0.20 per cent share in world sugar trade while Brazil accounts for only about 10 to 13 per cent of world production and it has a share of over 23 per cent in world export. Brazil dominates the foreign market due to better quality and minimum per unit cost of production of sugar. In the world trade of export of sugar, India’s share was 0.18 per cent and per kg price realized was ₹ 14.26. The Cuba, Australia, Thailand and France are the four major sugar exporting countries contributing each about 10 per cent of the total sugar export.

Sale and Lohar\textsuperscript{38} (2007) conducted a study to estimate per tonne cost of production of sugarcane, to per quintal cost of production and marketing of jaggery and to identify the


problems faced by the sample farmers in respect of production and marketing of jaggery. Per tonne cost of cultivation of suru sugarcane was estimated to ₹ 648.24. The per quintal cost of production of jaggery including marketing charges worked out to ₹ 982.16. Per quintal cost of marketing of jaggery was ₹ 58.67. The net profit per quintal and per hectare from jaggery production was worked out to the tune of ₹ 117.84 and ₹ 11219 respectively.

Anjugam et al.\(^{39}\) (2007) found that the growth rates in area and production of sugarcane are positive during the post-liberalization period in India and Tamil Nadu. The study found that the productivity of sugarcane has shown a negative growth rate in India and Tamil Nadu, which might be due to monsoon failure during this period. The productivity of cane in the western zone of Tamil Nadu has shown a low but positive growth rate, may be due to change in the cropping pattern and better access to sugar mills and also found that the net income realized from jaggery production has been recorded as ₹ 14138, which is higher than that farm the cane produced for sugar factory. Delays in cutting of cane by the sugar factories and labour problems during harvesting season have been found as the major reasons for jaggery making. Further, it is found that non-remunerative prices, lack of government support in price policies and traditional technology have been identified as the major constraints in jaggery production. The study suggested that introduction of modern technologies, creation of infrastructure and formulation of appropriate price polices need to be encouraged to enhance jaggery production among the farmers to get remunerative price for their produce.

Ankur gaurav\(^{40}\) et al. (2007) identified the various marketing channels being adopted by the sugarcane cultivators. The results of the study revealed that large farmers were observed to enjoy higher net returns than small farmers as the farmers supplied their sugarcane produce to the sugar mills, which was found to be paying higher prices to the farmers than what the traditional jaggery making units were paying. And also revealed that majority of the farmers (about 60 per cent) were supplying their sugarcane to the


sugar mills irrespective of the land size category to which they belonged. The producer's share in consumer rupee was found to be 83.70 and 50.11 per cent in channel-I and channel-II, respectively. There is an urgent need for setting up of a sugar mill or khandsari unit in the una district as it holds the promise of vastly increasing the sugarcane cultivation along with providing employment hundreds of people on farm and non-farm sectors.

Jitender Singh et al.\textsuperscript{41} (2007) conducted a study and it revealed that on an overall average, the percentage of marketable surplus of sugarcane was found increasing in the size of farms. Large farms had larger marketable surplus in the command area. Marketable surplus in outside area was slightly less than that in the command area. Marketed surplus of sugarcane in the command area was 538.99 quintal per farm of which the maximum i.e. 67.69 per cent was supplied to sugar factories and 32.31 per cent to the commercial gur processing units. The quantity of sugarcane supplied to sugar factory was larger on the large farms. In the outside area of sugar factories, total marketed surplus to only gur processing units due to lack of sugar factories. The marketing cost was ₹ 7.52 per quintal in the command area. The net price received by the sugarcane growers from the gur processing units in the outside area of sugar factories was ₹ 50.60 quintal and the average price paid by the gur-processing unit was ₹ 57.90 per quintal. The total marketing cost was ₹ 7.30 per quintal. On an average in the outside area of sugar factories. The production share was the highest i.e. 89.69 per cent in the command area against the lower i.e. 87.32 per cent in the outside area of sugar factories. The marketing efficiency of sugarcane was the highest in case of supply to sugar factories in the command area due to impact of sugar factories.

Bahgat et al.\textsuperscript{42} (2007) made a study to identify the production and marketing problems facing sugar cane growers in Qena governorate. The most important production problems perceived by focus groups of farmers and extension personnel were: spread of different kinds of weeds and insects, weak role of agricultural extension, shortage and


high costs of fertilizers and labour, high costs of production, insecticides and irrigation. High costs and unsystematic cutting, shortage and high costs of transportation, delay of cutting and delivery of product to the factory, inaccurate weigh and low prices of the product were the most important marketing problems mentioned by farmers and extension personnel in Qena governorate.

Chockalingam and Nagarajan\textsuperscript{43} (2008) made a study and found that Namakkal is one among the districts in Tamil Nadu where sugarcane is cultivated in 9,476 hectares. This works out to 2.82 per cent of the total area under cultivation in Tamil Nadu. In Namakkal District, the total sugarcane Production is 13,06,920 tonnes per annum, which is 5.34 per cent of the total production of Tamil Nadu. Abundance of labour force, availability of irrigation facilities and Government support, liberal loan facilities from bank etc., are the factors which favoured for the large scale cultivation of sugarcane in this district. The Government as a stakeholder is responsible to protect the interests of the primary stakeholders’ viz., farmers. Hence it has to make concerted efforts with the help of agricultural department, Tamil Nadu Agricultural University and also with coordination from the co-operative bank, commercial bank, sugar mills and voluntary agencies to mitigate the above said problems. Such integrated effort of Government would solve most of the problems. If these problems are solved or minimized not only the primary stakeholders viz., the sugarcane farmers but also all other stakeholders will enjoy the benefits and the rural economy would ultimately prosper.

Vijay Gorakh Patil\textsuperscript{44} (2009) conducted a study to examine the cost of cultivation of sugarcane. The study revealed that the cost of preparatory village 5.13 per cent, the cost of seed bed preparation 1.11 per cent, the cost of seed and sowing operation was 18.30 per cent, the cost of intercultural operation 7.76 per cent, irrigation labour charge 6.99 per cent, electricity charge 5.74 per cent, the cost of chemical fertilizers and FYM 18.97 per cent, the cost of plant protection 2.77 per cent, interest on investment 6.0 per cent, the cost of harvesting 11.09 per cent, the cost of land rent for 12 months 13.86 per cent.


agricultural income tax 0.28 per cent and management charges for 12 months were 2.00 per cent. The total cost of production of sugarcane ₹802 per tonne.

Rajula Shanthy and Senthil Kumar\textsuperscript{45} (2010) conducted a study by using descriptive type of research design applying ex-post facto approach and the respondents were selected among drip laid farmers. Drip irrigation for sugarcane cultivation is a valuable technology and an essential foundation for the development of sustainable sugarcane cultivation. With the shrinking water resource, the available water has to be used judiciously. Drip irrigation is the product of trial and error and keen observation through various irrigation technologies. So it should be our endeavour to assess the feasibility of drip irrigation in sugarcane cultivation and utilize it along with other modern technologies.

Shinde et al.\textsuperscript{46} (2010) reported that total sugar production in the world during 2008-2009 was 153.27 million tonnes (raw value), out of which sugarcane and sugar beet contributed 121.54 (79.32 per cent) and 31.68 (20.68 per cent) million tonnes respectively. In India, during 2008-2009, sugarcane was planted on 44.08 lakh hectares with production of 2946.56 lakh tonnes, which produced million tonnes of sugar. It is estimated that, sugar output of India will rise to 18.50 million tonnes in 2009-2010. India’s sugar output is expected to rise to over 24 million tonnes (by around 30 per cent as compared to 2009-2010) in season 2010-2011, mainly because of higher cane prices paid by the sugar mills to the sugarcane growers and thereby the area under sugarcane has been increased substantially.

Karpagam et al.\textsuperscript{47} (2010) analysed the impact of drip irrigation on sugarcane cultivation through various efficiency indicators under farmers’ field condition. They revealed that higher efficiency percentage (40.64) was observed in case of water use efficiency followed by input use efficiency (34.88 per cent), yield efficiency (24.98 per cent) labour and energy use efficiency indicators in drip irrigation system.


Amit Kumar Dwivedi\textsuperscript{48} (2010) examined the cost-return analysis, profitability and operational efficiency of Gur manufacturing units in the study area. The study revealed that units of medium and large sizes were able to cover their operating expenses with significant level of profit but small size units were earning a marginal profit. The profit earned by this category was very low as compared to other two sizes.

Deokate et al.\textsuperscript{49} (2010) made a study and it revealed that the jaggery processing units are profitable even if only own sugarcane is processed. Further, findings showed that more profitable when the jaggery processing unit prepares the jaggery of other’s on rent basis. The most important two marketing channels were observed in the sale of jaggery viz., Channel-I: Producer-Commission agent- Wholesaler- Retailer- Consumer, Channel-II: Producer- Co-operative Sangh- Wholesaler- Retailer- Consumer. The producer’s share in consumer’s rupee and channel wise marketing efficiency index was highest in Channel-II.

Kumar Suresh and Palanisami\textsuperscript{50} (2010) studied the impact of drip irrigation on farming system in terms of cropping pattern, resources use and yield. The study found that the significant impact on resources saving cost of cultivation, yield of crops and farm profitability. Hence, the policy should be focused on promotion of drip irrigation in those regions where scarcity of water and labour is alarming and where shift towards wider-spaced crops is taking place.

Malarkodi et al.\textsuperscript{51} (2010) found that sugarcane productivity was 126.66 tonne per hectare in safe and semi-critical areas while it was 123.72 tonne per hectare in critical and over exploited blocks in the western zone. The total cost of cultivation (variable cost) was \textcurrency{R} 79272 per hectare in critical and over exploited blocks whereas it was only \textcurrency{R} 75802 per


hectare in safe and semi-critical blocks. Strategy to maintain or increase the current western zone cane production can be done by continuation of sugarcane production only in the safe and semi-critical blocks (13 blocks) and expansion of the sugarcane area in safe and semi-critical blocks, which presently has minimum area under sugarcane cultivation.

Rama Rao\textsuperscript{52} (2010) made an attempt to work-out costs and returns of sugarcane production, to identify the major marketing channels and problems of jaggery growers. Multistage sampling technique was adopted in selecting the sampling units at various levels during 2007-2008. Analytical tools like simple averages, Benefit Cost Ratio (BCR), Garrets Ranking Technique and Kendall's co-efficient of concordance (W) test were employed to achieve the objectives. The study revealed that cost of cultivation of sugarcane is the prime factor in the various value added products. Among the value added products sugar juice production was found more profitable, which needs further study of technical and financial feasibility on large scale.

Balamurugan and Vetriselvan\textsuperscript{53} (2010) found that 36.00 per cent of marginal farmers had low level of adoption on sugarcane technology, whereas only 47.50 per cent of small farmers had medium level of adoption. In case of big farmers, 58.75 per cent of them had high level of adoption. Out of ten technologies of sugarcane cultivation, the difference could be observed between the marginal, small and big farmers for adoption of four technologies viz., sett treatment, herbicide application, bio-fertilizer application and use of bio- control agents.

Rajesh kumar et al.\textsuperscript{54} (2010) made an attempt to analysed the annual linear and compound growth rates for the period 1996-1997 to 2003-2004 were estimated to measure the growth in cost of cultivation of sugarcane in different states of India. The highest growth rate was registered for Maharashtra (11.17 per cent) followed by


Karnataka (9.51 per cent), Haryana (8.70 per cent) and Uttar Pradesh (4.49 per cent). However, there was no significant change in cost of cultivation in Tamil Nadu and Andhra Pradesh. As far as in cost term, there was ₹ 5261 hectare per year increase in Maharashtra followed by Karnataka (₹ 3778 hectare per year), Haryana (₹ 3657 hectare per year) and Uttar Pradesh (₹ 1248 hectare per year). In case of value of sugarcane, there was 8.38 per cent growth in Haryana followed by 5.84 per cent in Karnataka and 4.74 per cent in Maharashtra per year.

Clainos Chidoko and Ledwin Chimwai\textsuperscript{55} (2011) made a study to identify and explain the economic challenges faced by sugar cane farmers. The study showed that while sugar cane industry is a critical sector to the economy, its productivity is going down. It was discovered that the low productivity is largely due to failure to plough out old cane, lack of equipment for operations, low prices paid for the harvested cane, high transport and haulage charges, limited training and unavailability of inputs. This is largely due to limited access to cheap finance and credit. The study recommended that farmers be given cheap finance and easily access credit using their crop as collateral security.

Murali and Balakrishnan\textsuperscript{56} (2011) found that in the recent past, labour scarcity coupled with high labour wage rate has greatly affected the irrigation and harvesting of sugarcane crop in time. It has reduced sugarcane area from 3.91 lakh ha in 2006-2007 to 3.14 lakh hectare in year 2009-2010 in Tamil Nadu. The study found that mechanical operations to be superior to manual operations in sugarcane cultivation. These have reduced cost of production and have enabled efficient utilization of resources with better work output. Further they concluded that it has become inevitable to use modern sugarcane machinery, which is now available in the country. Although its initial cost is very high, the advantages accrued in their use are many and suggested the use of drip irrigation and mechanical harvesters to mitigate the acute labour scarcity (farm operation and harvesting). It has also proposed to implement custom hiring system on co-operative basis/or owned and operated by the sugar factories for sugarcane harvesters in the state.


Arjinder kaur and Sukhjeet Saran\textsuperscript{57} (2011) found that climatic constraints for sugarcane cultivation in Punjab will continue to account for disparity in cane productivity and sugar recovery in this area. The constraints regarding the sugarcane cultivation were mainly related to the payment problems, absence of any sugar mill in the sub-division, the long waiting period for the disposal of cane besides harassment of the farmers by the staff of sugar mills. The long distance between sugarcane growers of the sub division and sugar mill has added to difficulties of sugarcane growers, which has led to decline in area under sugarcane.

Deokate et al.\textsuperscript{58} (2011) examined the cost-price relationship of different commodities affects the relative profitability and economic incentives to produce. The harvest prices of sugarcane were not sufficient to cover the increased prices of inputs and parity between prices of output and input was not favourable. Price-cost ratios of sugarcane, at MSP are less than unity during the period under study, except from 1995-1996 to 1999-2000, indicating thereby that the cost of production was more than output prices. The price cost ratio of sugarcane at FHP was more than unity for the entire period under study, indicating thereby that the growth in output prices is more than the cost of production.

Deokate and Yadav\textsuperscript{59} (2011) conducted a study to examine economics of jaggery production in Maharashtra. The study revealed that the total cost of jaggery processing was \textsterling 7,78,489. The cost of raw materials was the major item of variable cost accounting for 67.09 per cent of the total cost. Per quintal total cost incurred for own jaggery preparation including the cost of raw material (sugarcane) was worked out to \textsterling 1436.29. Per quintal average price realized for jaggery was \textsterling 1812.06 and thereby the net return obtained from own jaggery preparation was \textsterling 375.77 per quintal. The per quintal profit

earned from rent basis jaggery preparation was ₹ 122.42. The per unit total net returns from jaggery processing unit was ₹ 249,129. Further, the study concluded that the jaggery processing units are profitable.

Deokate et al. 60 (2011) conducted a study on marketing of jaggery in western Maharashtra. It is concluded that higher quantity of jaggery was sold through Channel-I (Producer-Commission agent-Wholesaler-Retailer-Consumer) than Channel-II (Producer-Cooperative union-Wholesaler-Retailer-Consumer). The price received through Channel-II was more (₹ 1875.10) than of the price received through Channel-I (₹ 1785.05). It indicated that there is a need of formation of 'co-operatives' in the sale proceeds of jaggery for the benefit of the producers. Commission and packaging charges, were major items of total marketing cost in both the Channels. The producers received comparatively better returns, i.e. 70.10 per cent of consumer price in Channel-II than in Channel-I (67.61 per cent). Higher marketing efficiency was noticed in Channel-II as compared to Channel-I. The marketing of jaggery involves a number of middlemen and market functionaries between the producers and the final consumers. Hence, there is need to establish large number of jaggery cooperative marketing unions for improving the producers’ share in consumer's rupee from jaggery marketing.

Awaradi et al. 61 (2011) made a study to analyse the cost and returns in sugarcane cultivation and to estimate the cost and returns of different categories of jaggery production units. A sample of 30 jaggery producers was selected randomly from six villages of Jamakhandi Taluk. Per tonne cost of cultivation of sugarcane was estimated to ₹ 877.15. The major items of cost of cultivation were human labour (27 per cent) followed by chemical fertilizers (17.24 per cent) and seed material (17.10 per cent). The per quintal cost of jaggery preparation is decline with an increase of crushing capacity. Thus, study indicated that production of jaggery is a profitable business.

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Anitta Fanish et al.\textsuperscript{62} (2011) stated that micro-irrigation is introduced primarily to save water and increase the water use efficiency in agriculture. Reduction in water consumption due to drip method of irrigation over the surface method of irrigation varies from 30 to 70 per cent and productivity gain in the range of 20 to 90 per cent for different crops. By introducing drip irrigation, it is possible to increase the yield potential of crops by three fold with the same quantity of water. All these emphasize the need for water conservation and improvement in water-use efficiency to achieve “More Crop per Drop of water”.

Rama Rao and Sunil Kumar Babu\textsuperscript{63} (2011) made an attempt to work-out costs and returns in value added products of Sugarcane viz., sugar, jaggery and sugarcane juice, in order to suggest the sugarcane growers, the profitable and sustained way to deal with sugarcane. Multistage sampling technique was adopted in selecting the sampling units at various levels during 2010-2011. The results revealed that cost of cultivation of sugarcane is the prime factor in the various value added products. Among the value added products, sugarcane juice production was found more profitable, which needs further study of technical and financial feasibility of keeping quality in order to produce on large scale.

Anwar Hussain and Naeem-ur-Rehman Khattak\textsuperscript{64} (2011) found that the socio-economic variables like capital employment, labour employment, marketing, credit and financing and sources of income were more closely related with sugarcane production. The major economic practices were preparation of land, water management, weed control, insecticides and making of black sugar (Gur). Main sugarcane varieties grown were 77/400, 44, Mardan-92, 48, 310 and 722082. Variety 77/400 was observed as the most profitable variety. The average per acre cost was calculated as ₹ 35450 for all varieties. The major cost elements were land rent, labour input, seed, manure, irrigation, land preparation, fertilizer and hand weeding and making of black sugar (Gur). The net


revenue of variety-77/400, 44, Mardan-92, 48, 310 and 722082 were observed as ₹ 54550, 48550, 48550, 45550, 48550 and 45550, respectively. Sugarcane crop was characterized by increasing returns to scale. The study recommended that modern techniques should be adopted for making Gur. Awareness among sugarcane growers about improved varieties should be created.

Sunil Kumar Babu and Rama Rao$^{65}$ (2011) made a study to identify the important factors influencing the input use efficiency in sugarcane production. The study examine the costs and returns in cultivation by using Benefit Cost Ratio (BCR) and Cobb-Douglas type of production function. It is found that total cost of cultivation per hectare in Sugarcane was ₹ 1, 72,288, ₹ 1, 19,945 and ₹ 1, 08,215 respectively in irrigated plant, irrigated ratoon and rainfed conditions. There was 62 per cent higher yield in irrigated condition vis-à-vis rainfed conditions. BCR on operating cost was highest (1.53) in irrigated ratoon followed by irrigated plant (1.41) and rainfed (1.36). Further revealed that the most important factors influencing production were labour availability and manures usage in both irrigated and rainfed conditions.

Krishna Priya and Bajpai$^{66}$ (2011) conducted a study on computation of compound growth rate for sugarcane using the non-linear growth models. The results of the parameter estimated and goodness of fit measures indicated that among the three models Logistic model is appropriate for the present study. The compound growth rates have been calculated for Logistic model and the results of compound growth rates for sugarcane production data is 2.96 per cent, for area and productivity of cane, the growth rates have been estimated as 1.73 per cent and 1.12 per cent respectively.

Mandla Dlamini and Micah Masuku$^{67}$ (2012) made a study and the Cobb-Douglas production function was used to identify the factors affecting sugarcane productivity.


The results indicated that farm size, labour, basal fertilizer and topdressing fertilizer were statistically significant (p<0.05) in influencing sugarcane productivity. The adjusted $R^2$ was 0.68 suggesting that 68 per cent of the variation in sugarcane yield per hectare is explained by the explanatory variables. Farmers should take note to use labour according to the industry standards in order to get good yields. Basal fertilizer and top dressing fertilizer need to be applied in the recommended amounts. Good crop husbandry practices like timely weeding, fertilization, irrigation should be adopted to produce a good crop which will enhance productivity. Government and the private sector need to intensify the out grower technical services rendered to sugarcane farmers, so that they can improve the productivity of sugarcane farming.

Basavaraj Banakar et al.\textsuperscript{68} (2012) conducted a study to assess the export competitiveness of jaggery. The Nominal Protection Co-efficient (NPC) was found to be less than unity (0.57), which implies that jaggery is a good exportable product; hence there is competitive advantage for export of jaggery from India. Similarly Domestic resource cost (DRC) was found to be less than unity. All these ratios indicated comparative advantage in production and export of jaggery. Therefore, its export should be encouraged to earn foreign exchange.

Girei and Giroh\textsuperscript{69} (2012) conducted a study to analyse the productivity and resource use efficiency in sugarcane production by random selection of 120 out grower farmers. The study revealed that 40 per cent of the respondents had farming experience of between 16-20 years with an average farming experience of 10 years and cultivated a mean farm size of 1.5 hectare. The study identified inadequate and late allocation of farms and inadequate credit as the major constraints of sugarcane production and possible suggestions to overcome the identified constraints were made in the study.


Gomatee Singh\(^0\) (2013) made an attempt to analyse the economics of sugarcane based farming system i.e. sugarcane cultivation by all the categories of farmers, cost benefit ratio from sugarcane cultivation, major products of sugarcane and their economy etc. Sugarcane is one of the major cash crop of India and most important crop of Uttar Pradesh, which not only support the economy of Uttar Pradesh but also the major crop which is the source of income of millions of farmers, whether marginal, small, medium or large.

Nazir et al.\(^1\) (2013) found that a majority (68 per cent) of the farmers faced moderate problem in sugarcane cultivation, while 8 per cent low and 24 per cent serious problem in sugarcane cultivation. Correlation analysis indicated that among 13 selected characteristics of the farmers, education, credit availability, input availability, extension, media contact, training exposure and knowledge had significant negative relationship with their problem faced in sugarcane cultivation and the rest age, family size, land possession, annual family income, sugarcane cultivation area, organizational participation and innovativeness had no significant relationship with their problem faced in sugarcane cultivation. Further, it is observed that “high price of fertilizer and pesticide”, “non-availability of fertilizer and pesticide in time” and “insect and pest attack of sugarcane” were the major three problems in sugarcane cultivation.

An overview of the studies reviewed above shows that most of the studies pertain to the cultivation of sugarcane and production of jaggery units. No study on farmers’ attitude in adoption of drip irrigation system in sugarcane cultivation and production and marketing of khandsari sugar could be traced out. Moreover, not a single comprehensive study for sugarcane crops covering various aspects such as cost and returns, factors, satisfaction and problems in adoption of drip irrigation system in sugarcane cultivation, problems in sugarcane cultivation, marketing cost, price spread, marketing problems, satisfaction about the functioning of sugarcane and khandsari sugar marketing channels, growth in area, production and productivity of sugarcane in Tamil Nadu, India, World

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and also export and import of sugar in India in terms of volume and value. Therefore, the study differs from the earlier studies in respect of its scope, nature, contents and the area covered.

1.4 IMPORTANCE OF THE STUDY

The present study is thus significant and it is expected to be useful not only to the sugarcane farmers in the Erode District of Tamil Nadu but also to sugar factories, jaggery producers, traders, intermediaries in different places and Government policy makers. It is worth to mention that proper investigation into cost & returns of sugarcane farmers would through light on the economy of sugarcane cultivation and it would help to judge the profitability of farming. This could help the farmers in formulating suitable production strategies to improve the productivity of sugarcane and identifying the proper marketing channels. This study would help to identify the major problems faced by the farmers in cultivation and marketing of sugarcane and offer suggestions to solve their problems.

1.5 OBJECTIVES OF THE STUDY

The present study has been undertaken with the following specific objectives.

➢ To find out the growth in area, production and productivity of sugarcane.
➢ To identify the cultivation practices of sugarcane.
➢ To study the adoption of drip irrigation system in sugarcane cultivation.
➢ To analyse the marketing practices adopted by the sugarcane farmers.
➢ To examine the cultivation and marketing problems of sugarcane farmers.

1.6 HYPOTHESES

The following hypotheses have been framed based on the opinion of the farmers, discussion with research experts, review of past studies and researcher’s own perception.

Ho₁ : There is no significant positive compound growth rate in area, production and productivity of sugarcane among the sugarcane producing countries in the world.
Ho₂ : There is no significant positive compound growth rate in area, production and productivity of sugarcane among the sugarcane producing states in India.
Ho3 : There is no significant positive compound growth rate in area, production and productivity of sugarcane among the sugarcane producing districts in the state.

Ho4 : There is no significant positive compound growth rate in export and import of sugar in India.

Ho5 : There is no significant association between the socio-economic characteristics of the farmers and their level of satisfaction about the adoption of drip irrigation system in sugarcane cultivation.

Ho6 : There is no significant association between the socio-economic characteristics of the farmers and their level of satisfaction about the functioning of sugarcane and kHANDSARI sugar marketing channels.

1.7 OPERATIONAL DEFINITIONS

Productivity

Productivity is a measure of the efficiency of production in the form of an average, expressing the total output of sugarcane divided by the total area of land used for the production of sugarcane.

Marketing Cost

The cost incurred from the point of production to the point of consumption is known as marketing cost.

Marketing Margin

Marketing margin involves the cost of moving the product from the point of production to the point of consumption and the profit of various market functionaries.

Price Spread

Price spread refers to the difference between the price paid for by the consumer and the price received by the producer for the same quantity of product. It consists of marketing cost and margin of the intermediaries.
Communality

Communality is the amount of variance, a variable shares with all other variables being considered. This is also the proportion of variance explained by the common factors.

Eigen value

The Eigen value represents the total variance explained by each factor.

Factor loadings

The loadings are simple considerations between the variables and the factor.

Planted sugarcane

The sugarcane setts which are freshly used in a land is called as sugarcane planted crop.

Ratoon sugarcane

It is a method of harvesting a crop which leaves the roots and the lower parts of the plant uncut to give the ratoon or the stubble crop.

Drip emitters or drippers

Drip irrigation is sometimes called trickle irrigation and involves dripping water onto the soil at very low rates (2-20 litres/hour) from a system of small diameter plastic pipes fitted with outlets called emitters or drippers.

1.8 SCOPE OF THE STUDY

This study is primarily undertaken with a view to examine the cultivation and marketing practices of sugarcane farmers in Erode district of Tamil Nadu. Though sugarcane is grown in most of the districts in Tamil Nadu, this study confines to Erode district only as this district is one of the leading districts in sugarcane cultivation in the state. This study also focuses the cost of sugarcane cultivation. This study pertains to analyse the attitude of farmers towards the adoption of drip irrigation system in sugarcane cultivation. This study further analyses the price spread along with the level of satisfaction of farmers about the functioning of sugarcane and khandarsi sugar marketing channels. This study also analyses the problems of sugarcane farmers in cultivation and marketing. This study also covers the area, production and productivity of sugarcane at National, State and District level.
1.9 PERIOD OF THE STUDY

The study includes both primary and secondary data. Required primary data have been collected from sugarcane farmers and intermediaries during the year 2011-2012 in Erode District of Tamil Nadu. The required secondary data have been collected from various sources like Co-operative Sugar Journal, websites of Sugarcane Breeding Institution of Coimbatore, Food and Agricultural Organisation, Cane info, Directorate of Economics and Statistics of Government of India, Season and Crop Report of Government of Tamil Nadu and District hand book of statistics for the period of ten years from 2003-2004 to 2012-2013 during the year 2013-2014.

1.10 PILOT STUDY AND PRE TESTING

The pilot study is conducted with a sample of 50 farmers during June 2011. In the pilot study, the interview schedule is pre-tested and then refined for use in the final study. On the basis of outcome of the pilot study, appropriate modifications have been made in the final interview schedule. Further, the findings of the pilot study enabled to frame hypotheses and design of the final study.

1.11 METHODOLOGY AND TOOLS

SAMPLING DESIGN

A multi-stage sampling technique is used in the present study. The study is conducted during the year 2011-2012 in Erode district of Tamil Nadu.

STAGE I: SELECTION OF DISTRICT

The present study is confined to Erode District of Tamil Nadu. This district is purposively selected due to the aggressive involvement of farmers in agriculture and it stands second in area and production of sugarcane in Tamil Nadu during the year 2010-2011 (vide appendix iii).

STAGE II: SELECTION OF TALUKS

Erode district comprises of five Taluks namely Bhavani, Erode, Gobichettipalayam, Perundurai and Sathyamangalam. Based on the information provided by the statistical department regarding the area under sugarcane cultivation for the year 2010-2011 (vide appendix iv), two taluks namely Bhavani and Gobichettipalayam are selected purposively as these taluks have the largest area under sugarcane cultivation.
STAGE III: SELECTION OF SAMPLE FARMERS

Farmers who are cultivating sugarcane for the past five years with minimum land holding of one acre are selected from the two taluks. The sample size is 600. The sample farmers are selected by using convenience sampling technique. Out of 600 farmers selected, it is found that 313 (52.17 per cent) farmers are supplying sugarcane to the factory, 72 (12.00 per cent) farmers are supplying sugarcane to the jaggery producers and remaining 215 (35.83 per cent) farmers are producing khandsari sugar themselves.

SELECTION OF INTERMEDIARIES

For the purpose of analysing the marketing cost, data relating to marketing cost incurred by intermediaries are required. Required data have been obtained from 50 intermediaries in the study area and they are selected by using convenience sampling technique.

COLLECTION OF DATA

This study is an empirical research based on survey method. Both primary and secondary data have been used in this study. Required primary data have been collected with the pre-tested, well-structured and non-disguised interview schedules from the sugarcane farmers. Required secondary data have been collected from the Co-operative Sugar Journal, websites of Sugarcane Breeding Institution of Coimbatore, Food and Agricultural Organisation, Cane info, Directorate of Economics and Statistics of Government of India, Season and Crop Report of Government of Tamil Nadu, District hand book of statistics and the records of Erode District Statistical Office.

The necessary data and information have also been collected from the libraries of Tamil Nadu Agricultural University, Bharathiar University, Coimbatore and Madurai Kamaraj University, Madurai. The data relating to the theoretical parts have been collected from various books, journals, magazines and websites.

TOOLS USED FOR DATA ANALYSIS

Data obtained from the field are analysed with the help of statistical package for social science (SPSS) latest version. The statistical tools such as Mean, Standard Deviation, Compound Growth Rate, Chi-Square test, F-test, Z-test, Cobb-Douglas
Production Function, Factor Analysis, Multiple Regression Analysis, Logistic Regression Model, Discriminant Function Analysis, Simple Ranking Technique, Ranked Based Quotient (RBQ) Technique and Garrett Ranking Technique have been used for the study.

Compound Growth Rate has been applied to find out growth in area, production and productivity of sugarcane and export and import of sugar in India.

Factor analysis (Principal components with application of varimax rotation) has been used to analyse the factors influencing the farmers to cultivate sugarcane, factors influencing the farmers to adopt the drip irrigation system in sugarcane cultivation and problems faced by the farmers in sugarcane cultivation. To evaluate the resource use efficiency in cultivation of sugarcane, Cobb-Douglas type of Production Function has been used.

Garrett Ranking Technique has been used to analyse the reasons for not following intercropping, Reasons for using a particular variety, the reasons for non-adoption of drip irrigation system in sugarcane cultivation and problems in adoption of drip irrigation system in sugarcane cultivation.

The influence of the various personal and socio-economic variables of the sugarcane farmers and satisfaction in the adoption of drip irrigation system in sugarcane cultivation is analysed with the help of Chi-square test, F-test, Z-test and Multiple Regression Analysis (stepwise model).

The influence of the various personal and socio-economic variables of the sugarcane farmers and their level of satisfaction about the functioning of sugarcane and khandorsari sugar marketing channels is analysed with the help of Logit Regression Model.

Simple ranking technique has been used for the factors motivating the farmers to market their sugarcane and khandorsari sugar channels.

Discriminant Function Analysis has been applied to analyse the problems in cultivation of sugarcane. A Rank Based Quotient (RBQ) technique has been applied to analyse the marketing problems in sugarcane and khandorsari sugar marketing.
1.12 LIMITATIONS OF THE STUDY

This study has the following limitations:

1. The size of the sample is restricted to 600. Therefore, the limitations of a restricted sample size are applicable to the present study.

2. The study confines to the sugarcane farmers who are residing in Erode district of Tamil Nadu. Moreover, only Bhavani and Gobichettipalayam taluks have been considered for this study. Hence, general application of the results may be restricted only to similar socio-economic environment.

3. As the secondary data collected from many sources, the gap in one source is filled by referring the other sources. There may be some discrepancies if the data are not correctly reported by the referred sources. Hence, any generalization needs in-depth analysis.

4. The farmers are not in the habit of maintaining the detailed periodical accounts regarding cost, return and marketing price in their sugarcane cultivation and marketing. Hence, the information from the memory of sugarcane farmers might be subjected to recall bias.

5. The data for the study have been collected exclusively by personal canvassing of interview schedule. The data so collected are subject to what may be called the error of response in some degree or other. Such errors of response are largely due to lack of awareness, improper maintenance of accounts and fear of revealing trade information of the farmers.

6. In some cases, the farmers failed to give their opinion categorically. In such situations, further questions are asked and logical conclusions are drawn based on their replies.
1.13 CHAPTER SCHEME

Keeping in view of the objectives mentioned earlier, the present study is comprised of seven chapters.

CHAPTER I : INTRODUCTION AND DESIGN OF THE STUDY

The introductory chapter contains introduction, statement of the problem, review of literature, importance of the study, objectives of the study, hypotheses of the study, operational definitions, scope of the study, period of the study, pilot study and pre-testing, methodology and tools, collection of data, tools used for analysis, limitations of the study and chapterisation scheme.

CHAPTER II : GROWTH IN AREA, PRODUCTION AND PRODUCTIVITY OF SUGARCANE

This chapter examine the growth in area, production and productivity of sugarcane and export and import of sugar in India.

CHAPTER III : CULTIVATION PRACTICES OF SUGARCANE FARMERS

In this chapter, existing sugarcane practices have been highlighted. Further, factors influencing the farmers to cultivate the sugarcane, reasons for using a particular variety in sugarcane cultivation and cost & return analysis of sugarcane cultivation have been examined.

CHAPTER IV : ADOPTION OF DRIP IRRIGATION SYSTEM IN SUGARCANE CULTIVATION

This chapter focuses on factors influencing the farmers to adopt drip irrigation system in sugarcane cultivation, satisfaction level of farmers, reasons for non-adoption of drip irrigation system and problems faced by the farmers in adoption of drip irrigation system in sugarcane cultivation.

CHAPTER V: MARKETING PRACTICES OF SUGARCANE FARMERS

In this chapter, factors motivating the farmers to prefer marketing of sugarcane, production of khandsari sugar, to prefer the particular marketing channel of sugarcane and khandsari sugar, level of satisfaction of the farmers about the functioning of
sugarcane and khandsari sugar marketing channels, marketing cost, marketing margin and price-spread of various identified channels in marketing of khandsari sugar have been examined.

CHAPTER VI : CULTIVATION AND MARKETING PROBLEMS OF SUGARCANE FARMERS

This chapter examines the problems faced by the farmers in sugarcane cultivation, production of khandsari sugar and marketing of sugarcane & khandsari sugar.

CHAPTER VII: A SUMMARY OF FINDINGS, SUGGESTIONS AND CONCLUSION

This chapter is the sum of the conclusion that emerged from the study and offers necessary suggestions for improving the cultivation and marketing of sugarcane in Erode district of Tamil Nadu.