JAGGERY PRODUCTION AND MARKETING VIS-A-VIS SUGARCANE SUPPLY TO FACTORIES IN CHITTOOR DISTRICT OF A.P. - AN ECONOMIC ANALYSIS

BY

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CERTIFICATE

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Date : 3.2.93.

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CERTIFICATE

This is to certify that the thesis entitled **"JAGGERY PRODUCTION AND MARKETING VIS-A-VIS SUGARCANE SUPPLY TO FACTORIES IN CHITTOOR DISTRICT OF A.P. - AN ECONOMIC ANALYSIS"** submitted in partial fulfilment of the requirement for the degree of **MASTER OF SCIENCE** in Agriculture of Andhra Pradesh Agricultural University, Hyderabad is a record of the bonafide research work carried out by **Miss P.A.LAKSHMI PRASANNA** under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee.

No part of the thesis has been submitted for any other degree or diploma or has been published. Published part has been fully acknowledged. All the assistance and help received during the course of the investigation have been duly acknowledged by the author of the thesis.

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DECLARATION

I, **P.A. LAKSHMI PRASANNA,** hereby declare that the thesis entitled **"JAGGERY PRODUCTION AND MARKETING VIS-A-VIS SUGARCANE SUPPLY TO FACTORIES IN CHITTOOR DISTRICT OF A.P. - AN ECONOMIC ANALYSIS"** submitted to Andhra Pradesh Agricultural University, Hyderabad for the degree of **Master of Science in Agriculture** is the result of original research work done my me. It is further declared that the thesis or any part thereof has not been published earlier in any manner.

P.A. Lakshmi Prasanna.

(P.A. LAKSHMI PRASANNA)

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P.A. LAKSHMI PRASANNA

ABSTRACT

Author	:	**P.A. LAKSHMI PRASANNA**
Title of the thesis	:	Jaggery production and marketing vis-a-vis sugarcane supply to factories in Chittoor district of A.P. -An Economic analysis.
Degree	:	Master of Science (Agriculture)
Faculty	:	Agricultural Economics
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The present study entitled "**JAGGERY PRODUCTION AND MARKETING VIS-A-VIS SUGARCANE SUPPLY TO FACTORIES IN CHITTOOR DISTRICT OF A.P- AN ECONOMIC ANALYSIS**" was taken up with the objectives of evaluating costs, returns, profits, input use efficiency, cost-output relationship in sugarcane and jaggery production, and to identify production and marketing problems associatd with cane supply and jaggery production in Chittoor District.

Chittoor district was purposively selected as it is a major sugarcane producing district in the State. Four villages, two from Thavanampalli mandal and two from Bangarupalem mandal constituted the study area, from which 120 respondents, 45 cane suppliers (category I) and 75 jaggery producers (category II) constituted the sample for the study. Data pertaining to the Agricultural year 1990-91 was collected from respondents by personal interview. Both conventional and functional analyses were applied in the study.

Cost of production on hectare basis was higher (Rs.32227.16) on category II farms compared to Rs.26597.64 on category I farms, exhibiting

direct relation with farm size on category I farms and an inverse relationship on category II farms. However cost of production per unit of output was higher (Rs.393.8 per tonne) on category I farms compared to Rs.364.76 per quintal jaggery on category II farms.

Per hectare Gross returns were higher on (Rs.35200.98) category II farms compared to (Rs.28028.55) on category I farms and was directly related with farmsize on both category farms. Gross returns per unit of output on an average was higher on category I farms (Rs.414.99 per tonne) compared to Rs.409.29 per quintal of jaggery on category II farms. Net returns per hectare were higher (Rs.2973.82) on category II farms over category I farms (Rs.1430.91).

Net returns per unit of output on an average was higher on category II farms (Rs.44.53 per quintal of jaggery) compared to Rs.21.19 per tonne of cane on category I farms.

Resource use efficiency analysis revealed several resource use inefficiencies on both category farms, cost-output analysis revealed better fit of quadratic function on category I farms and linear function on category II farms.

Marketing costs on average were higher (Rs.36.94 per tonne) on category I farms compared to Rs.23.57 per quintal jaggery on category II farms and was directly related with farmsize on category I farms and inversely related with farmsize on category II farms.

Shortage of inputs viz., labour, credit and water, lower caneprice, problem in obtaining cutting permit were the major problems in the production and marketing of cane. Limited input availability, lack of infrastructural facility, lack of Regulated market yard, fluctuations in jaggery price were the major problems in production and marketing of jaggery in Chittoor district.

INTRODUCTION

CHAPTER - I

INTRODUCTION

Sugarcane is one of the important cash crops grown in India. It forms the principal source of sugar, a highly calorific essential food item of daily consumption of the masses. The total area under sugarcane cultivation in India increased from 28.50 lakh hectares[1] in 1985-1986 to 36.82 lakh hectares in 1990-1991 with a total cane production of 2402.87 lakh tonnes.

Though India has been the world's largest producer of sugarcane, its sugar industry stands only second in the series of large industries in the world. The reason is that from times immemorial sugarcane is used not only for the production of sugar, but also to a large extent for manufacturing other sweetening agents known as gur and khandsari which are referred as "Non centrifugal sugars" in terms of international sugar trade.

Total sugarcane production in the country in 1989-1990 was 2255.69 lakh tonnes, out of this 1111.58 lakh tonnes cane was utilised for white sugar production, 873.41 tonnes of cane was utilised in the manufacture of gur and khandsari, 270.7 tonnes of cane was used as seed, feed and for chewing. In terms of percentage 49.3 per cent of cane was used in sugar production, 38.7 per cent was used in jaggery and khandsari production and 12 per cent was used as seed feed and for chewing. Percentage of sugarcane utilised for different purposes in the country varied from year to year.

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1. Sugarcane statistics - Cooperative sugar Vol. 23 (10): 686.

Sugarcane by means of sugar is earning foreign exchange for our country in the international trade market. At the domestic level it is contributing to exchequer of both Central Government and State Government.

About 35 million[2] farmers constituting about seven per cent of the rural population are engaged in growing sugarcane. Besides this, important byproducts from sugar industry viz. molasses and baggasse are being used in distilleries, paper making industry and other byproducts industries. There by sugarcane is a versatile commercial crop, providing an opportunity to create sugar complexes in the interior rural areas. This places the sugar industry at a vantage position in the context of the Government's thrust on agrobased products and industries. Sugar industry in India is instrumental in bringing about rural development by creating employment for rural population directly as well as indirectly.

Traditional gur industry and khandsari units are also providing employment to rural population. Thus sugarcane crop is an important commercial crop for a developing country like India.

Problem Setting:

Two major sugarcane based industries in our country are sugar industry and jaggery industry, both the industries have their own peculiar characteristics. The sugarcane farmers enjoy the liberty of supplying the cane either to the factory or converting it into jaggery depending upon the relative profitability. The pricing of sugarcane and jaggery is not uniform in

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2. Balasubramaniam - Pricing Policy anomalies distort sugar economy - The Hindu dated February 21, 1991.

the sense that sugarcane farmers enjoy statutory minimum price, while the farmers preferring jaggery making have to accept the prevailing prices, which more often than not fluctuate, leading to the prevalence of a sort of dichotomy in pricing of sugarcane. In this situation the farmers have their own reasons in their option of going either for sugarcane or jaggery. Keeping this background in view, the present study entitled "**Jaggery production and marketing Vis-a-Vis** sugarcane supply to factories in Chittoor District of A.P. an economic analysis" was carried out. The objectives of present study are:

1. To evaluate costs, returns and profits of jaggery production and sugarcane supply to factories in Chittoor District,
2. to analyse the input use efficiency in jaggery production Vis-a-Vis cane production,
3. to study the cost-output relationship through cost functions,
4. to study the marketing aspects of jaggery in Chittoor Distrct,
5. to analyse price variation in jaggery and sugarcane over a period of time and finally,
6. to identify production and marketing problems associated with cane production and jaggery making in Chittoor district and to suggest suitable measures to overcome them.

Scope of the Study:

The results of the study are expected to throw light on the profile of costs, returns, profits and input use efficiency in jaggery Vis-a-Vis sugarcane production. The outcome of price analysis helps to know in which of the preferences (ie. jaggery or sugarcane) the farmers are better off with regard to remunerative prices. The cost-output relationship discloses in which of the enterprises a given level of output is obtained at minimum cost. The results of the study will also aid in determining the level of ouput needed to offset the costs. Finally the marketing study will un-earth the problems associated with regard to jaggery and sugarcane.

Limitations of the Study:

The study being one man research project, suffers from some draw backs. The study is carried out in a limited period of time in limited area of a particular agroclimatic situation. Hence, generalisation of results is not advisable. The necessary primary data regarding production of sugarcane and jaggery was collected from repondents based on their recall memory by interview method and has inherent limitations.

Plan of Thesis:

The thesis is presented in six chapters.

The first chapter brings out the importance of sugarcane in Indian economy, besides indicating problem setting and objectives of the study, scope and limitations of the study.

In the second chapter literature pertinent to the present study is reviewed.

The third chapter deals with the methodology adopted in the study.

The fourth chapter presents an account of Agroclimatic features of the District and Mandals selected for the study.

In the fifth chapter the Results of the present study are presented and discussed.

Summary and conclusions drawn from the study are presented in the sixth chapter.

REVIEW OF LITERATURE

CHAPTER - II

REVIEW OF LITERATURE

For any investigation, the findings of earlier studies may possibly give indications of the problem and guidelines for the present study. In addition, the earlier studies provide the lacunae in the existing information and form the basis of formulating new studies. In this chapter an attempt was made to review the literature of the past research work in relevance to the present study.

2.1 LABOUR UTILISATION

Ramdhan Singh and Dulip Singh (1960) from their study on economics of production of surgarcane reported that 50 per cent of average cost of production of sugarcane was spent on manual labour and 25 percent of the average cost of production was spent on bullock labour. They also reported that imputed value of family labour constituted 68.21 per cent of the total human labour value.

Rao (1965) from his study revealed that the proportion of family labour input to the labour input per acre declined consistently as the size of the farm increased.

Patil (1966) from his study "Input cost and returns of major irrigated crops in Mandya District" observed that labour cost constituted 40.42 per cent of total cost of production of sugarcane.

Rao (1966) revealed from his study on sugarcane that on an average 150.50 man days and 7.00 cattle pair days were utilised per acre. He also reported an inverse relationship of family labour with farm size.

Parthasarathy (1974) reported that in sugarcane cultivation the labour utilisation per acre was inversely related with the farm size in North and South Circars whereas the same was directly related to the farm size in Telangana region of A.P.

Singh, Gangware, Chikkara and Singh (1974) from their study "Production function for commercial crops in Haryana" inferred that sugarcane affords more employment potential for human labour compared to cotton or rape and mustard.

Acharya et al. (1976) from their study "Impact of mechanisation on capital investment and resource use pattern on sugarcane farms of Kolhapur District" observed that the employment of total human labour days on owned tractor farms were slightly less (373.93 days) than on the Non-tractor use farms (398.95), Bullock labour days on owned tractor farms were very low (31.32 days) as compared to the hired tractor use farms (67.48 days) and non tractor use farms (85.79 days).

Ashok Chamotra et al. (1976) in their study on sugarcane in Himachal Pradesh revealed that the bullock energy consumption was substantial on all categories of farms in sugarcane when compared to other crops under study viz. maize and wheat. The total bullock energy revealed an inverse relationship with the farm size. It was 120.95, 88.51, 72.45 and 42.56 H.P.

days on marginal, small, medium and large farms respectively. 75 to 90% of the total bullock energy was consumed in operations of land preparation and sowing.

Garg et al. (1976) revealed from their study in Uttar Pradesh that the energy requirements in sugarcane was 200 and 1478 in terms of machine hours and the man hours in planted crop.

Rebello et al. (1976) while analysing the utilisation of inputs in sugarcane cultivation at two different time periods in Karnataka reported that human labour requirement declined while that of plough units increased during the period 1975-1976 over 1972-73. The human labour requirement per hectare was 306.55 and 313.05 days for the above periods respectively. The plough units used per hectare were 39.32 and 34.22 for the two periods of time.

Shakuntala (1976) revealed in her study on sugarcane that the human labour employed per hectare was related inversely with the farm size. It was 187.70 mandays per hectare on the farm size below 2.87 hectares and 146 mandays on the farm size of 10.66 hectares and above.

Shukla et al. (1976) revealed that the use of human labour and bullock labour was minimum on the large holdings. Bullock and tractor utilisation was highest in land preparation. The use of energy was highest in harvesting in all the size groups.

Singh and Dhawan (1976) observed that human labour utilisation was slightly low on tractor operated farms when compared with that of bullock operated holdings. It was further observed that there was a sharp decline in the energy supplied from animal source on the tractor operated farms in comparison with bullock operated farms.

Singh and Singh (1976) estimated that in sugarcane cultivation, the bullock operated farms consumed lower amount of energy (910.08 H.P. hrs) when compared to tractor operated farms (1218.36 H.P. hrs). The manual power and bullock power were slightly more on bullock operated farms than on tractor operated farms, while mechanical power was considerably greater on tractor operated farms. The mechanical energy use constituted to 68.73 per cent and 57.21 per cent of the total energy use on the tractor operated farms and bullock operated farms respectively.

Soham and Rathore (1976) revealed that improved agricultural technology resulted in increased human labour employment per acre and the highest being on medium and small farms. The utilisation of bullock labour was more on the progressive farms when compared to the traditional farms. Machine power showed an increasing trend as the size of farm increased.

Thakur et al. (1976) from their study in Himachal Pradesh observed that the utilisation of both human labour and bullock labour per unit of land was greater on the small farms than on the large farms.

Rambabu (1980) revealed a direct relationship between human labour utilisation and farm size and an inverse relationship between cattle labour

and farm size in A.P. through his study on sugarcane cultivation. The human labour utilisation per acre on small, medium and large farms was respectively 117.5, 120.5 and 127.5 mandays. In the case of cattle labour it was 7.29, 6.84 and 6.56 pair days respectively.

Verma (1981) reported that the percentage utilisation of family labour days decreased with the increase in the size of farms while that of hired labour increased with increase in the size of farms.

Gangadharamma (1982) observed in her study, a direct relationship between human labour utilisation and farm size in sugarcane cultivation in A.P. It was 285, 303.07 and 316.10 mandays per hectare on small, medium and large farms respectively.

George et al., (1983) in their study on sugarcane farming estimated the utilisation of human labour, bullock labour at different points of time in Maharashtra and U.P. They observed that the utilisation of Human labour per hectare was 349.5 days in Maharashtra and 152.51 days in U.P. during the period 1973-75 as against 390.53 days in Maharashtra and 133.84 days in U.P. during 79-80. The utilisation of bullock labour was 35.35 pair days and 27.17 pair days during 1973-75 in the above two states as against 17.52 and 8.17 pair days in 1979-80.

Gupta and Sharma (1985) observed in sugarcane cultivation that the human labour requirement per hectare was of the order of 332.70 mandays.

Ramkumar (1985) observed an inverse relationship between the utilisation of labour and farm size in sugarcane cultivation in A.P., same with bullock labour. The Human labour utilisation per hectare on small, medium and large farms was of the order of 447, 460 and 493 mandays respectively. The cattle labour per hectare was 41.50 pair days, 34.90 pair days and 21.6 pair days in planted crop.

Meenakshi (1987) from her study on crop rotation revealed that in the two years sugarcane-sugarcane-groundnut rotation the human labour utilisation slightly declined as the size of the farm increased. It varied from 445.64 mandays on medium farms to 442.62 mandays per hectare on large farms. The cattle labour utilisation per hectare on the above mentioned farms was 34.30 and 34.22 plough units respectively.

Jayamma (1988) observed in sugarcane cultivation an inverse relationship of human labour with farm size in A.P. It varied from 321.86 mandays on small farms to 281.64 mandays per hectare on large farms. Family labour utilisation inversely related with farm size. It ranged from 47.51 to 115.03 mandays.

Ramesh (1988) observed a direct relationship between the utilisation of human labour and farmsize in sugarcane farming in Andhra Pradesh. He also observed an inverse relationship between family labour and farmsize. The human labour utilisation per hectare varied from 367.46 mandays to 419.21 mandays.

Kedarnath (1991) in his study "Increasing income and employment through optimal cropping pattern in Chandragiri Mandal of Chittoor District in A.P." reported that existing human labour utilisation was below the optimal level of Human labour requirement in all categories of farms viz., small farms, medium farms, large farms and pooled farms. He also reported that the existing level of human labour utilisation is mostly due to, increase in the area under labour intensive crop sugarcane.

Venkata Ramana Rao (1991) from his study during the year 1987-1988 reported that human labour utilisation in plant crop was maximum in coastal Andhra region followed by Rayalaseema and Telangana. Total human labour utilisation per hectare exhibited a direct relationship with farm size in Rayalaseema it revealed an inverse relationship with farm size in Telangana. There was no perceptible relationship in coastal Andhra region. The total labour utilisation per hectare for the sample as a whole was of the order of 324 mandays in coastal Andhra region, 291 in Rayalaseema and 273 in Telangana. Utilisation of family labour has indicated an inverse relationship with farm size in all the regions. He further reported that labour utilisation in sugarcane cultivation in A.P. revealed inter regional and inter farm variations. He also reported that in plant crop the total cattle labour utilisation showed an inverse relationship with farm size in Rayalaseema, in other two regions no perceptible relationship was noted. He also reported that tractor power utilisation per hectare ranged from 3.5 hr in Rayalaseema to 6.52 hr in coastal A.P. and it was 6.45 hr in Telangana. He concluded that tractor power utilisation showed a direct relationship with farm size.

2.2 COST AND RETURNS:

Ramdhan Singh and Dulip Singh (1960) reported that average cost of production of sugarcane giving an average outturn of 73.34 maunds of Gur and allied product per acre was Rs 795 $\pm$ 166.74 (S.E) per acre. He also reported that the Gross income per acre was Rs.993.66 $\pm$ 209.90 (S.E.). Average cost of production of Gur per maund was Rs. 8.32, for shakkar Rs. 8.38, for khand Rs. 20.17 and for rala Rs. 6.74. Profit per maund on an average in the case of gur was Rs. 2.73, for shakkar Rs. 2.87, for khand Rs. 4.83 for Rala 1.26.

Arjuna Rao (1966) from his study inferred that total cost of production of sugarcane showed a direct relationship with farm size. It varied from Rs. 1104.35 to Rs. 1473.53 per acre with an overall average of Rs. 1341.06/acre, the Gross and net returns per acre did not display any discernible relationship with the farm size. The gross returns and net returns per acre on an average were Rs.1948.71 and Rs. 475.18 respectively. The cost of production per tonne was Rs. 36.83.

Patil (1966) reported that average cost of production of sugarcane was Rs. 3200.45 per hectare, Gross returns per hectare was Rs. 6660.47, average cost per tonne of sugar was Rs. 27.58.

Bhale Rao and Singh (1972) from their "Study on economics of sugarcane cultivation in U.P. reported that profitability was slightly more in large size groups than in smaller size groups.

Singh et al. (1973) from their study on impact of input supply system in U.P. analysed the economics of fertilizer use in sugarcane under different supply systems reported that supplying fertilizer through the cooperative supply system was more profitable to the farmers over Agricultural seed stores and market purchase. They observed that value of additional yield of sugarcane on account of fertilizer application was Rs. 1066.67 in the case of cooperative supply system, Rs. 1054 and Rs. 841 in the case of Agricultural seed store and market purchase respectively.

Parthasarathy (1974) reported that there were wide variations in the cost of production of sugarcane in A.P. The total costs per acre showed a positive relationship with the farm size in Telangana region alone, while no relationship existed in North and South Circars. The per acre costs varied from Rs. 2006.52 to Rs. 2584.13 in Telangana while it varied from Rs. 1924.36 on medium farms to Rs. 2078.10 on large farms in North Circar and Rs. 1951.70 to Rs. 2258.69 on the above said farms in South Circars. On an average the total cost varied from Rs.2032.48 in North Circar to Rs.2584.13 in Telangana. The gross returns per acre revealed a positive relationship with the farm size in all the 3 regions. It varied from Rs. 1521.00 to Rs. 1833 in North Circars, Rs. 2027 to Rs. 2154 in South Circars and from Rs. 1944 to Rs. 2809 in Telangana on an average it varied from Rs. 1722 in North Circars to Rs. 2669 in Telangana. Net returns per acre revealed that on an average Telangana farms registered a profit of Rs. 84.61, while the North and South Circar farms incurred a loss of Rs. 310.85 and Rs.74.44 respectively.

Shanmugam (1974) reported that sugarcane crop responded well to fertilizer application. The fertilizer cost constituted 25.30% of total cost of cultivation.

Sharma and Chauhan (1974) reported that the cost of cultivation of sugarcane per hectare was Rs.3500/-.

Singh and Srivatsava (1974) reported that per hectare cost of production of sugarcane in U.P. varied from Rs.7202.41 in central region to Rs. 3004.43 in western region with an overall average cost of production of Rs. 2809.67. The net returns per hectare varied from Rs. 2295.42 in Eastern region to Rs. 2895.88 in the western region with an overall average of Rs.2567.78 for the sample as a whole. The per quintal cost of production on average was Rs.6.79.

Singh et al. (1974) reported from their studies in U.P. that on medium and large farms sugarcane is profitable as compared to paddy wheat rotation while on small farms it was vice-versa. They opined that depressed yields of sugarcane on small farms was on account of lower irrigation application as these farms were handicapped with respect to their own source of irrigation.

Garg (1975) from his studies in U.P. found out that the net income per hectare had directly related with farm size.

Kirtikar and et al. (1975) reported that cost of cultivation of sugarcane was Rs. 3416.4 per hectare. The gross and net incomes were Rs. 13063.4 and Rs. 9647 per hectare.

Mathur (1975) reported that per hectare cost of cultivation of sugarcane as Rs.2592.10 while the per hectare gross and net incomes were Rs.6569.42 and Rs.3977.32 respectively.

Naidu (1975) reported that Human labour charges accounted to a greater extent in sugarcane production.

Rathi and Tripathi (1975) in their study "Intercropping with autumn planted sugarcane III - cultivation of mustard with sugarcane in a scientific way" reported that total cost was Rs.2700 per hectare while the gross returns and net profit were Rs. 10667 and Rs. 7967 respectively during 1970-71 to 1971-72.

Rathi and Tripathi (1975) in their study "Intercropping with autumn planted sugarcane IV cultivation of late variety of potato with sugarcane in scientific way" revealed that total cost was Rs. 2700 per hectare where as total returns and net returns were Rs.12706.98 and Rs.10006.98 respectively.

Acharya et al. (1976) reported that cost of cultivation of sugarcane varied from Rs.856.78 per hectare under canal irrigation to Rs. 2058.80 under well irrigation with oil engine pump. It was Rs.1414.93 under well irrigation with electric motor pump and Rs.1832.79 under lift irrigation.

Gawhahe and Patil (1976) in their study "Intercropping cereals in sugarcane" revealed that total cost per hectare was Rs. 9187.85, gross income Rs.22570.84 and net income Rs.13382.99.

Naidu and Chennarayudu (1976) studied on two varieties of sugarcane in A.P. revealed that cost of production of sugarcane per acre was Rs.1472.9 and Rs.2849.67 in variety Co 419 and 69 A 37 respectively. The total returns were Rs.2400 and Rs.5520 per acre respectively. The net returns per acre for the above varieties were Rs. 927.10 and Rs.2770.93 respectively.

Rebello et al. (1976) in their study "the impact of increase in the prices of inputs on the profitability and production of sugarcane and paddy in Mandhya District of Karnataka" reported that total operation cost was Rs.6065.21 and Rs.9821.54 per hectare during 1972-73 and 1974-75. The gross and net returns over operational costs were Rs. 14435 and Rs. 8369.79 respectively during 1972-73 and Rs. 16517.36 and Rs. 6695.82 during 1974-75. They further reported that while the total operational cost increased by 62 percent, increase in gross return was only 14%, as a result of which the margin between returns and operational cost decreased by 20% during 1974-75 over 1972-73.

Singh and Singh (1976) from their study in U.P. reported that in sugarcane, the cost on manual power, bullock labour and mechanical power on bullock operated farms was Rs.1122.05, Rs.209.92 and Rs.247.14 while the same on tractor operated farms was Rs.1105.70, Rs.204.08 and Rs.397.81 per hectare respectively. The fertilizer cost was Rs. 413.74 per hectare and Rs.575.82 per hectare on bullock operated farms and tractor operated farms.

Singh et al. (1976) in their study in Jaunpur District of U.P. opined that output and net income showed a rising trend with a rise in the farm

size. The net returns per hectare was highest in sugarcane (Rs.2315.27) when compared to the net returns of wheat and paddy per hectare.

Behl and Narwal (1977) studied the feasibility of intercropping of Rabi crop in autumn planted sugarcane reported that per hectare expenditure was Rs.4825, gross income was Rs.9737 and net income was Rs.4912.

Naidu and Hota (1977) reported that total costs per hectare as Rs. 4950 and gross returns as Rs.7826.00.

Lavania et al. (1978) observed a direct relationship between farm size total costs, gross returns, net returns, family labour income and farm business income on borrower as well as non-borrower farms.

Narwal and Behl (1978) studied effect of intercropping on the yield of spring planted sugarcane revealed that per hectare total costs, gross income and net income as Rs.4950, Rs.7826 and Rs.2876 respectively.

Sastry and Ramana (1978) reported that cost of cultivation and gross returns as Rs.8057.40 and Rs. 12106.54 respectively. They also reported that cost of production per tonne as Rs 74.04.

Parashar et al. (1979) reported that total cost of cultivation as Rs.4698 per hectare, gross income and net returns as Rs.11537 and Rs.6839.10 respectively. They further reported that a rupee invested in sugarcane has yielded a return of Rs.1.50.

Patil et al. (1979) observed an inverse relationship between farm size and total cost of cultivation as well as gross returns per hectare. Total costs ranged from Rs.6359 to Rs. 7563 per hectare, gross income ranged from Rs. 17608 to Rs.19138 and net income ranged from Rs.11250 to Rs.11576. They also observed a decreasing trend in cost of production per tonne with an increase in farm size. It was Rs.59.27 in small farms, Rs.56.26 in medium farm and Rs.54.17 in large farms.

Bose and Thakur (1980) revealed that total cost per hectare was Rs.2954.0, gross return was Rs.8676 and net return was Rs.5722.

Hasan and Parthasarathy (1980) reported that the variable cost was less than 40% of the price of sugarcane in both mechanised and non-mechanised sugarcane farms. They further reported that the mechanised farms were reaping greater profits of 7.02 t hectare when compared to non-mechanised farms, in both the type of farms medium size farms have fared well.

Jagadish Lal (1980) reported a direct relationship between the cost of cultivation and farmsize, the cultivation costs varied from Rs.2350.20 to Rs.3075.52 per hectare in western region, Rs.2817.81 to Rs.3522.06 in Eastern region and Rs.1931.15 to Rs.2799.74 in central region, the cost of production per quintal indicated an inverse relationship with farm size in western region as against a direct relationship in Eastern and central regions, the per quintal cost of production varied from 10.32 on large farms to Rs.11.39 on small farms in Western regions, Rs.11.66 on small farms to Rs.13.10 on large farms in Eastern region and Rs.5.71 on small farms to Rs.18.25 on large farms in

central region. The net returns per hectare had directly related with farm size in Eastern region and inversely related in Western and central regions. It varied from Rs.152.43 to Rs.259.51 in Western region and from Rs.261.66 to Rs.852.15 in Eastern region.

Mathur (1980) reported that total costs as Rs.2795.54 per hectare, gross returns as 4599.80.

Rambabu (1980) observed that the farmers in Nizamabad obtained on an average a gross returns of Rs.4030 per acre by incurring Rs.3341 towards cost of cultivation in sugarcane.

Bhutada and Parashar (1981) reported that total costs/hectare was Rs.3759.2, total returns Rs.10401.06 and net returns Rs.6641.86.

Ethirajan et al. (1981) reported total cost per hectare as Rs.5000.

Krishnaiah (1981) reported that sugarcane cultivation costs incurred on labour, seed, manures fertilizers and irrigation as the major items of cost.

Narwal and Malik (1981) reported that cultivation costs per hectare of sugarcane was Rs.4675, the gross and net returns were Rs.5898.10 and 1238.10 respectively.

Patel et al. (1981) reported that cost of cultivation of sugarcane per hectare was Rs.12622, gross returns and net returns were of the order of Rs.12994 and Rs.372.00.

Pitamber Sethi and Parashar (1981) observed that cost of cultivation of sugarcane per hectare was Rs.3787, gross returns Rs.8022, net income Rs.4235.

Rajeshwar Tiwari and Singh (1981) reported that per hectare total costs, gross returns and net returns were Rs.8193.76, Rs.9967.92 and Rs.1774.16 respectively.

Verma et al. (1981) reported total costs as Rs. 5802 and gross returns of the order of Rs.16600.

Gangadaramma (1982) found that the total costs were high on large farms both for plant and ratoon crops, net returns highest on large farms.

Rajeshwar Tiwari and Singh (1982) observed that total costs, gross income and net income as Rs.8193, Rs.9967.92 and Rs.1774.92 respectively.

Chougule and Patil (1983) reported that cost of producing sugarcane per tonne increased as the size of the farm decreased.

Dhoble and Khuspe (1983) reported that total cost was Rs.6000 per hectare, gross returns was Rs.14481 and net returns Rs.8481.

George et al. (1983) revealed that the cost of production and net returns of sugarcane at two different periods of time in Maharashtra and U.P. In Maharashtra the cost per hectare increased from Rs.6558.06 during 1973-75 to Rs.10487.54 in 1979-80 while the cost per quintal was Rs.7.74 and

Rs.10.92 in the above said periods . The gross value of output increased from Rs.11945.5 to Rs. 18431.51, while the net returns increased from Rs.5357.44 to Rs.7943.97. In U.P. the cost per hectare increased from Rs.3,169.24 in 1973-75 to Rs.3994.90 in 1979-80 while the cost per quintal increased from Rs.7.49 to Rs.9.05. The gross value of output increased from Rs.5,035.07 to Rs.8458.60 while the net returns increased from Rs.1865.77 to Rs.4553.70.

Naidu and Gupta (1983) while analysing costs and returns per acre on sugarcane farms in East Godavari district revealed the commercial cost of cultivation of sugarcane per acre as Rs.3245.68, Rs.3958.27, Rs.2377.11 and Rs.2603.20 on small, medium, large and pooled farms respectively.

Kahlon and Kurien (1984) revealed that with increased use of purchased technological inputs, gross value of output declined in case of sugarcane crop.

Praduman Kumar (1984) in his study on sugarcane cultivation estimated the cost of cultivation and net returns per hectare and cost of production per quintal as Rs.12504.00, Rs.2537.00 and Rs.1081.00 respectively. The rate of return on production cost was of the order of 20%.

Porwal and Kumpawat (1985) concluded from their study that the gross and net returns per hectare were Rs.14370.00 and Rs.10590.00 respectively in sugarcane cultivation.

Ramakumar (1985) stated that the total cost of cultivation was positively correlated with the farm size under all the three situations viz. main crop, ratoon crop and main and ratoon crop system. He also stated that the gross and net returns were positively correlated with the farm size in all the three situations mentioned earlier, cost of production per tonne negatively related with farm size.

Balasubramanyam (1986) observed a direct relationship between cost of cultivation per hectare and farm size. It ranged from Rs.12623.41 on small to Rs.13670.87 on large farms with an overall average of Rs.13214.43 on the sample as a whole in the planted crop. A positive relationship between cost of cultivation/returns and farm size was observed, gross returns varied from Rs.13969.81 on small farms to Rs.14778.91 on large farms in main crop.

Rao et al. (1986) estimated the total cost of production of rainfed sugarcane in A.P. as Rs.11,987.00 per hectare. The net income derived per hectare was negative and the cost benefit ratio was 1: 0.89.

Raghuram and Rao (1986) in their study on sugarcane vis-a-vis the competing crops in A.P. revealed that the total cost of cultivation of sugarcane per hectare was Rs.10954.00. The gross and net returns of sugarcane per hectare were Rs.15399.00 and Rs.4445 respectively. The study further revealed that sugarcane cultivation was not as profitable as paddy, blackgram or paddy + black gram rotation.

Raghuram and Rao (1987) estimated the cost of cultivation of sugarcane in dry and irrigated tracts of A.P. The costs incurred were

Rs.5891.00 and Rs.13377.00 respectively. The gross incomes were Rs.8802.00 and Rs.17020.00 while the net income were Rs. 2911.00 and Rs.3643.00 respectively. The return for every rupee investment in the above tracts were 3.18 and 1.10 on the above farms.

Rahman and Islam (1987) in their study in Bangladesh revealed that the cost of cultivation per acre in sugarcane was Rs.5401.00, gross and net returns per acre were Rs.10568.00 and Rs.5167.00 respectively.

Jayamma (1988) reported that cost of production was highest on large farms followed by medium and small farms. Gross returns per hectare were highest on large farms followed by medium and small farms. The input output ratio and cost benefit ratios are the highest for large farms.

Ramesh (1988) revealed from his study that the cost of production of sugarcane per hectare was directly related with farm size. Similar relationship did exist with regard to gross and net returns. The total costs varied from Rs.22000 to Rs.26187.16 in plant crop. Net returns per hectare ranged from Rs.1040.48 to Rs.1931.65 in plant crop. The per unit cost of production was inversely related with farm size. It varied from Rs. 265.81 to 249.80 per tonne in plant crop.

Kedarnath (1991) reported that cost of cultivation of sugarcane was highest on medium farms followed by small farms and large farms. He also studied varietal wise costs and returns taking two varieties Co 8201 and Co 671. He observed that both costs and returns were highest in the case of variety Co 671.

Venkata Ramana Rao (1991) reported that the analysis of cost structure of plant as well as ratoon crops clearly revealed inter-regional variation as well as inter-farm variations within in the region. The total cost of cultivation related directly with farm size in all the three regions in plant crop. The total cost per hectare for the sample as a whole varied from Rs.19450 in Rayalaseema region to Rs.28,207 in coastal Andhra region. The variable costs per hectare ranged from Rs. 11,719 in Rayalaseema to Rs.17871 in coastal Andhra region. Further, he reported a direct relationship between gross returns per hectare and farm size in all regions for both plants and ratoon crops, the gross returns too indicated regional as well as inter-farm variations within each region for both plant crop and ratoon. It varied from Rs.21918 in Rayalaseema region to Rs.28004 per hectare in coastal region for plant crop. Net returns had indicated a direct relationship with farm size in Rayalaseema and Telangana region in plant crop.

2.3 PRODUCTIVITY OF SUGARCANE:

Garg et al. (1960) in their study on sugarcane indicated that the average yield per acre was 358 maunds.

Singh and Singh (1960) from their study in Punjab revealed that the production of gur was 73.34 maunds for sugarcane produced in one acre.

Arjuna Rao (1966) revealed that productivity of sugarcane in A.P. was not related with farm size. It varied from 34.05 tonnes in the size group 1.5 to 3.5 acres to 37.14 tonnes in the size group of 5 acres and above. the average productivity of sugarcane per acre was 36.35 tonnes.

Bhagat Singh (1966) observed a direct relationship of output per acre with the farm size.

Dhawan (1967) reported that farmers growing sugarcane for gur purposes operate under price conditions which are not as favourable as those for the farmers growing sugarcane for sugar mills. This difference in price condition tend to pull down the overall yield performance of the growers vis-a-vis the factories. He further reported that some times the gur area lie entirely outside the factory zones with the results that farmers in such outlying areas are completely deprived of the beneficial developmental schemes, undertaken by the came cooperative societies etc. The combined results of a dictotomy in price conditions and the absence of contact with cane coop societies as well as the mills is that the yield in factory zones were significantly higher than those prevailing in the outlying areas.

Parthasarathy (1974) observed regional variations in the productivity of sugarcane in A.P. The average yield of sugarcane per acre showed a direct relationship with farm size in all the three regions. It varied from 28.37 tonnes per acre to 34.2 tonnes in North Circars and 36.24 tonnes to 52.4 tonnes in Telangana. The average yield was 32.11, 39.57 and 49.79 tonnes in the above said regions respectively.

Sharma and chauhan (1974) found out from their study that the yield per hectare was 675.23 quintals.

Singh et al. (1974) observed that the sugarcane yield per hectare indicated an increasing trend with an increase in farm size in Nainital District of U.P.

Agarwal and Pal reported that productivity of sugarcane had been more or less stagnant around 40 t/hect.

Kirtikar et al. (1975) opined from their study that the average yield of sugarcane during the period 1968-69 to 1971-72 was 106.64 tonnes per hectare.

Mathur (1975) from his study revealed the yields per hectare of autumn sugarcane as 85.31 tonnes, 88.09 tonnes and 89.29 tonnes during the year 1968-69, 1969-70 and 1970-71 respectively.

Rathi and Tripati (1975) from their study revealed that the average yield of sugarcane per hectare during the period 1970-71 and 1971-72 was 820.54 quintals.

Rathi and Tripathi (1975) estimated the yield of sugarcane as 977.46 quintals per hectare during the period 1971-72 and 1972-73.

Jagadish Lal et al. (1976) in their study on resource productivity in relation to farm mechanization observed that the yield per acre in sugarcane indicated a direct relationship with the degree of mechanization. It varied from 184.06 quintals on bullock farms to 197.08 quintals on mechanised farms in plant crop. The yield on partially mechanised farms was 191.57 quintals.

The study conducted by Naidu and Chennarayadu (1976) revealed considerable variations in yield with regard to the sugarcane varieties taken

for cultivation. In variety Co 419 the yield was 20 tonnes per acre while in the variety 69 A 37 the yield was 46 tonnes per acre.

Rebello et al. (1976) assessed the productivity of sugarcane per hectare as 120.47 tonnes and 123.70 tonnes during 1972-73 and 1975-76 respectively.

Singh and Singh (1976) estimated the productivity of sugarcane per hectare as 570 quintals, and 608.69 quintals on bullock and tractor operated farms respectively.

Wankhede and Parashar (1976) in their study revealed that the yields of sugarcane per hectare during 1971, 1972 and 1973 were 62.7 tonnes, 69.6 tonnes and 79.2 tonnes respectively.

Behl and Narwal (1977) found out from their study that the yield of sugarcane was 749 quintals per hectare.

Naidu and Hota (1977) from their study on sugarcane farms in Anakapalle area of A.P. revealed that the average yield per acre was 58 tonnes, in plant.

Tripathi and Singh (1977) assessed from their study that cane yield per acre was 225 quintals.

Lavania et al. (1978) reported a direct relationship between farmsize and yield of sugarcane. The yield per hectare varied from 719.38 quintals to 905.24 quintals in borrower farms and from 605.70 quintals to 741.87 quintals in non-borrower farms.

Narwal and Behl (1978) from their study found out the yield of spring sugarcane as 602 quintals per hectare.

Nath and Ali (1978) revealed from their study during the periods 1970-71 and 1971-72 that the average sugarcane yield at Mundla farm Baheri was 100.95 tonnes per hectare.

Sastry and Ramana (1978) estimated the productivity of sugarcane as 108.82 tonnes per hectare in plant crop.

Parashr et al. (1979) estimated the average productivity of sugarcane as 854.60 quintals per hectare.

Patil et al. (1979) from their study found out an inverse relationship between farmsize and productivity ofsugarcane. The yields per hectare on small, medium and large farm were 127.59 tonnes, 123.35 tonnes and 117.39 tonnes respectively.

Behl et al. (1980) examined the variations in the sugarcane yields. The yield of mid variety (G-37/76) was 845.45 quintals per hectare while the yield of late variety (Co 1148) was 902.80 quintals per hectare.

Bose and Thakur (1980) estimated from their study, the average yield of sugarcane as 723 quintals per hectare.

Iagdishlal and Kartar Singh (1980) studied trend and variability in area, production and productivity of sugarcane in U.P. over the period from 1950-51 to 1974-75 and pre and post 1965 period reported that, the area, production and productivity of cane in different regions and U.P. as a whole have been increasing significantly over the years with moderate year to year fluctuations.

Hasan and Parthasarathy (1980) observed in sugarcane cultivation that the productivity was 135 tonnes per hectare on mechanised farms and 126 tonnes per hectare on non-mechanised farms. Productivity was inversely related with farm size on non-mechanized farms. It ranged from 126.45 tonnes to 112.00 tonnes per hectare. The yield on mechanised farms varied from 131.98 tonnes per hectare on small farms to 141.40 tonnes per hectare on meidum farms.

Mathur (1980) concluded that the mean yield of sugarcane (autumn) when taken as sole crop was 86.98 metric tonnes per hectare during the period 1968 to 1970-71.

Rambabu (1980) observed that the productivity of sugarcane had directly related with farmsize. It varied from 32.88 tonnes per acre on small farms to 36.28 tonnes per acre on large farms with an overall average of 34.59 tonnes per acre for the whole sample.

Ethirajan et al. (1981) assessed the per hectare yield of sugarcane as 50 tonnes per hectare when taken as a sole crop as against 66 tonnes per hectare when bengal gram was taken as an intercrop in sugarcane.

Narwal and Malik (1981) from their study concluded that the yield of sugarcane per hectare varied from 40.69 to 58.18 tonnes.

Chougule (1982) from his study revealed that the sugarcane yield was more on capitalistic farms than on peasant farms. The cane yield on capitalistic farms was 45 metric tonnes per acre in plant crop on peasant farms the yield per acre was 43 tonnes in planted crop.

Chougule and Patil (1982) opined from their study that the sugarcane yield during the period 1969-70 to 1970-71 was 95.375 tonners per hectare in plant crop.

Gangadharamma (1982) from the analysis of her study reported that the sugarcane output per hectare had directly related with the size of the farm in A.P. The yield per hectare varied from 66.47 tonnes on small farms to 83.75 tonnes on large farms.

Gupta and Prasad (1982) found out that the average yield of sugarcane in U.P. had ranged from 34.20 tonnes to 46.90 tonnes per hectare during the period 1950-51 to 1979-80.

Rajeswhar Tiwari and Singh (1982) estimated the yield of sugarcane (autumn) as 848 quintals per hectare.

George et al. (1983) revealed that the productivity of sugarcane in Maharashtra increased from 779.3 quintals per hectare in 1973-75 to 900.12 quintals per hectare in 1979-80. In U.P., the productivity increased marginally from 371.25 quintals per hectare to 389.65 during 1973-75 and 1979-81 respectively.

Dhoble and Khuspe (1983) estimated the sugarcane yield per hectare as 83.37 tonnes.

Singh (1983) observed that the productivity of sugarcane indicated a negative growth rate in Bihar, Haryana, Andhra Pradesh and Karnataka. He opined that insufficient credit and inadequate credit facilities, poor ratoons, perdominance of old cultivars and lack of technology transfer were the obstacles in increasing output and productivity.

Ramakumar (1985) in his study on profitability of sugarcane farming observed that productivity had directly related to the farm size. The per hectare yield varied from 72.56 tonnes to 86.58 tonnes in plant crop.

Sinha et al. (1985) found out from their study the yield of sugarcane per hectare as 807.90 quintals during the period 1980-81 to 1982-83.

Balasubramanyam (1986) reported that average productivity of sugarcane in tonnes per hectare was 65.64, 68.44, 70.06 and 68.04 in planted crop for small, medium, large and pooled farms respectively. He further reported that there existed a wide gap between the acutal yields obtained by farmers and the yields achieved on the research station farms, the gap

indicated an inverse relationship with farm size both in main and ratoon crop.

Jayamma (1988) reported that the productivity of sugarcane was directly related with farm size in plant and ratoon crop. It ranged from 69.96 tonnes to 84.88 tonnes in plant crop.

Ramesh (1988) concluded from his study that the productivity of sugarcane showed a direct relationship with farm size. It varied from 67.73 tonnes to 85.69 tonnes in ratoon crop.

Venkata Ramana Rao (1991) observed that the average yield of sugarcane in both plant, ratoon crops indicated a direct relationship with farmsize in all the three regions of Telangana, Rayalaseema and Costal Andhra. Overall average yield was 93.24, 82.09 and 81.39 tonnes per hectare in coastal Andhra, Rayalaseema and Telangana respectively.

2.4 RESOURCE USE EFFICIENCY

Agarwal and Foreman (1959) used Cobb-Douglas production function analysis in their study. They reported that in sugarcane, diminishing factor returns prevailed for all the inputs considered while the scale coefficient was 1.809. The coefficient of multiple determination was 0.56. Among the inputs included in the model, land, human labour, bullock labour, seed, manures and fertilizers turned out to be significant and were positive.

Acharya (1965) studied the resource productivity and resource allocation on sugarcane farms in queensland and worked out optimum resource

allocation through Cobb-Douglas production function analysis. He observed, the marginal return to fertilizer was greater than marginal cost, the labour productivity was below the ruling wage rate. The marginal productivity of land was high.

Arjuna Rao (1966) revealed the prevalence of constant returns to scale and diminishing factor returns in sugarcane farming in A.P. He reported the marginal productivities of land, labour and other expenses as 1.3185, 2.1280 and 1.539 respectively.

Tambad and Hiregoudar (1969) studied the functional relationship between the cost on human and bullock labour, size, seed rate and cost on manures and fertilizers as independent variables and yield as the dependent variable for sugarcane by using Cobb-Douglas production function. The regression coefficients cost of manures and fertilizers was significant at 1% level and the regression coefficient for cost of human and bullock labour was significant at 10% level. R = 96.36, individual 'r' values are less than one indicating diminishing marginal returns to each of the input factors.

Nagabhushanam (1970) by using Cobb-Douglas type of production function evaluated the resource-use efficienty in important crop enterprises such as paddy, sugarcane, chillies, tobacco and whole farm of these crops under different size group in Guntur and Krishna District of A.P. He reported that in sugarcane large farms were more efficient over other farms.

Singh and Sirohi (1973) by using Cobb-Douglas production function observed that the coefficient of multiple determination was high in sugarcane. Capital resource on sugarcane farm was not optimally allocated.

Azard and Garg (1974) from their study reported diminishing factor returns. The elasticity coefficient of manures and fertilizers was highest followed by irrigation both in main crop and ratoon in sugarcane.

Parthasarathy and Suryanarayana (1974) used Cobb-douglas production function and reported constant returns to scale on sugarcane farms in A.P. The coefficient of multiple determination was high and significant in all the three regions ie. Rayalaseema, Coastal Andhra and Telangana. Further resource use efficiency revealed high degree of resource use in-efficiency in sugarcane farming.

Patil and Acharya (1974) by using Cobb-Douglas production function analysis found out the operation of diminishing factor returns and constant returns to scale. The coefficient of multipledetermination (R^2) was high and significant. The production elasticities of land and labour were more in banana than on sugarcane and for manures and fertilizers, for seed were more on sugarcane than on banana. MVP of land was higher in sugarcane.

Singh et al. (1974) revealed in sugarcane the MVP of labour employment was positive indicating the possibilities of increasing the input. 87.5 per cent of variation in the output was explained by the use of human labour, fertilizer and irrigation water.

Sohani and Pawar (1977) estimated resource productivities of sugarcane farms in Maharashtra by using Cobb-Douglas production function. He reported that all the input factors were highly correlated with area under sugarcane. There was significant correlation between human labour and bullock labour.

Gangadharamma (1982) reported that MVP of land was higher than its price both in plant crop and ratoon. R^2 was 0.91 and 0.85 on plant and ratoon crops.

Naidu and Gupta (1983) reported the operation of constant returns to scale in sugarcane with significant elasticity coefficients for human labour and land.

Som P Pudasaini (1983) revealed the prevalence of diminishing factors in sugarcane with R^2 approximately 0.78. The partial regression coefficients of land, labour were 0.437 and 0.236 and significant, that of fertilizer and capital were 0.080 and 0.059 respectively.

Subba Reddy et al. (1983) by using Cobb-Douglas production function observed the elasticity coefficients of land, human labour, manures and fertilizers and other working cost to be 0.45, 0.18, 0.03 and 0.17 revealing the existence of diminishing factor returns with an R^2 value of 0.83.

Ramakumar (1985) in his study on sugarcane used Cobb-Douglas production function analysis revealed the operation of constant returns to scale on pooled farms, diminishing returns to scale on small farms and increasing returns to scale on medium and large farms as against the widely accepted phenomena of constant returns to scale. The study on resource use efficiency revealed high degree of inefficiency.

Jayamma (1988) in her study on sugarcane revealed that the coefficient of multiple determination was considerably high. The study further

revealed diminishing factor returns, with high degree of resource - use inefficiency.

Ramesh (1988) reported R^2 to be high both in plant and ratoon sugarcane crop, with constant returns to scale. Diminishing factor returns were observed for all most all the inputs excepting land on medium and large farms of ratoon crop. The study on resource-use efficiency revealed that human labour had to be curtailed on small and medium farms in plant crop while irrigation was underutilised in case of large farms. In case of ratoon manures and fertilizers on small and large farms had to be reduced while irrigation had to be increased on large farms.

Venkata Ramana Rao (1991) reported the operation of increasing return to land in coastal Andhra and Telangana regions and diminishing returns in Rayalaseema. For all the other inputs included in the model, irrespective of region and size, diminishing factor returns were observed. The analysis further showed a constant returns to scale, a high degree of resource use inefficiency for various resources.

2.5 PROFITABILITY THROUGH BREAK-EVEN ANALYSIS

Parthasarathy (1974) used the break even analysis to findout the profitability in sugarcane cultivation in all the regions found it difficult to attain the break-even output which implies that majority of the sugarcane in the loss zone. The break-even output was found to be directly related with farm size.

Parthasarathy and Suryanarayana (1976) measured the break-even output at two points of time in sugarcane cultivation in A.P. They observed that sugarcane cultivation was a losing proposition in 1964-65. Inspite of the increase in the minimum price in the year 1970-71, the growers did not achieve reasonable profits so as to induce them to continue the production of sugarcane.

Hasan and Parthasarathy (1980) revealed that break-even output in the case of mechanised farms was 60.80 tonnes while it was 53.48 tonnes in case of non-mechanised farms. The difference between the average output and the break-even output was more in mechanised farms than the non-mechanized farms indicating that the mechanised farms were reaping greater profits of 7.02 tonnes per hectare when compared to non-mechanised farms. In both the type of farms medium size farms had fared well.

Gangadharamma (1982) revealed the profitable nature of sugarcane cultivation in A.P. though break-even analysis. The break-even outputs were 31.37 tonnes, 29.39 tonnes and 28 tonnes on small, medium and large farms respectively.

Ramakumar (1985) reported that sugarcane cultivation was a profitable enterprise. The break-even output estimated was 44.10 tonnes and 45.10 tonnes for the sample as a whole in plant and ratoon crops respectively as against the average yield of 58.7 tonnes and 63 tonnes respectively.

Jayamma (1988) estimated Break-even output as 51.13, 55.24 and 55.20 tonnes per hectare for small, medium and large farms respectively in plant

crop of sugarcane. Break-even output for sample as a whole was 54.36 tonnes per hectare in plant crop. She further reported that average yield in all the cases was higher than the break-even output.

Venkata Ramana Rao (1991) reported that the break-even outputs for the sample as a whole were of the order of 227.69, 118.24 and 146.37 tonnes in Coastal Andhra, Rayalaseema and Telangana respectively in plant crop while the corresponding average yields were 223.22, 155.97 and 164.41 tonnes per farm.

2.6 BULK-LINE COST

Parthasarathy (1974) used bulk-line cost to find-out whether the minimum price fixed for sugarcane was remunerative or not. He observed that bulk-line cost was higher than the minimum price indicating non-remunerative nature of sugarcane cultivation.

Azad et al. (1981) in their study, revealed that the bulk-line cost of sugarcane in U.P. was Rs. 21.6 per quintal and the opportunity cost price was Rs. 23.93 per quintal. They further opined that while fixing the level of statutory price of sugarcane, the cost production and price relationship of different sugarcane products together with the cost of production of sugarcane on the basis of bulk-line cost and opportunity cost should be taken into consideration.

Jayamma (1988) revealed that the bulk-line cost was lower than the average price received revealing that sugarcane cultivation was a paying proposition.

Venkata Ramana Rao (1991) estimated the bulk-line cost as Rs. 305.80, Rs. 233.33 and Rs. 289.2 in plant crop for coastal Andhra, Rayalaseema and Telangana respectively. All these were higher than the respective price per tonne, indicated the non-remunerative nature of sugarcane growing except in the case of Telangana. This is the case with main crop.

2.7 COST OUTPUT RELATIONSHIP:

Parthasarathy (1974) came across the case of both falling average cost and marginal cost in sugarcane farm under the large and pooled farms category of Telangana region with indeterminate point of rising cost within the observed range of output.

Parthasarathy and Suryanarayana (1975) after analysing the statistical cost curves in sugarcane farming reported all the conventional cost functions viz., linear, quadratic and cubic forms.

Ramkumar (1985) reported linear cost function with constant marginal cost and decreasing average cost on small, medium and large farms of plant crop and quadratic form of cost function with increasing marginal cost and 'U' shaped average cost on pooled farms of plant crop and on all farm size group in ratoon crop.

Venkata Ramana Rao (1991) used three forms of cost functions viz; linear, quadratic and cubic form. By analysis he revealed that linear cost function was the best fit for small farms in all the three regions of Coastal Andhra, Rayalaseema and Telangana, for medium farms in Coastal Andhra, large farms in Rayalaseema and Telangana regions. Quadratic form was the

best fit, for medium farms in Rayalaseema and Telangana, large farms in coastal Andhra and for pooled farms in coastal Andhra region. Cubic polynominal was the best fit for pooled farms in Rayalaseema region. From the cost functions cost curves were derived, which are of 3 types viz. constant marginal cost and declining average cost, 'U' shaped average cost and ever increasing marginal cost curves, 'U' shaped average and marginal cost curve. He observed a situation wherein minimum point of average cost curve was indeterminate resulting in falling average cost and marginal cost curves.

2.8 SUPPLY FUNCTION

2.8.1 Influence of price of gur or price of sugarcane

Agarwal (1954) studied price and production trends of rice, wheat and sugarcane in U.P., observed the correlation between area and price was not significant in case of wheat but highly significant for rice and sugarcane. A significant relationship between the area under wheat and sugarcane explained that the area under sugarcane in U.P. expanded at the expense of wheat.

Sur (1956) observed year to year variations not only in sugarcane output but also the supply of sugarcane to sugar industry and the indigenous gur manufactures. He stated that of the total sugarcane only 25 per cent was converted into sugar during the years of high gur price. Supply of sugarcane was considerably increased during years of low gur price as sugarcane growers found preparation of gur as unremunerative.

Majumdar (1963) suggested that price may be used as instrument for regulating acreage under crops like sugarcane and jute.

Malya (1963) observed that there was no significant relationship between acreage and price of rice, sugarcane and groundnut in Tamil Nadu through a correlation study.

Grewal and Kahlon (1966) reported from their study that higher the divergence between the cost of gur making and market price of gur in a supply season, the lower is the supply to the sugar factory.

Satyanarayana (1967) reported that changes in sugarcane acreage was positively associated with the price of Gur as the price of gur was more profitable than the prices of its competing crops in Bihar. In Mysore farmers had responded negatively to relative price movements of gur during the period.

Muniraj (1968) reported that availability of cane to factories was closely connected with gur price levels.

Mehta (1969) reported that during periods of sugarcane shortage with no control on gur/khandsari prices farmers were allowed to rule at much higher levels which enable the producers of these commodities to offer much better price for cane. Consequently there was a large scale diversion of cane supplies from factory areas to gur and Khandsari.

Subba Rao (1969) concluded that changes in relative acreage under sugarcane in A.P. were positively associated with changes in its relative price. A 10% increase in relative price will result in atleast 5% increase in relative output, as a result of shifting land from rice rather than by

increasing relative yield. He further studied the rationality of the farmer's response by testing the predictive efficiency of lagged relative price by means of an autoregression and found it to be positive.

Dayanatha Jha (1970) stated in his study that changes in sugarcane acreage in factory areas of Bihar were induced by changes in relative prices, yield and rainfall. He tested this using an adjustment model of Nerlovian type with relative price of sugarcane, yield per acre of cane all with one year lag, area under competing crops, rainfall as independent variables.

Dhawan and Kahlon (1974) reported that greater price incentive was required to increase the acreage under sugarcane because a 25% rise in the price of gur could not bring the whole area under sugarcane though some acreage fit for sugarcane was left uncropped. Marginal increase in the price of gur was required to incorporate this crop in Groundnut Zone, where as more than 25% increase in the price of gur was needed to bring all the suitable area under this, in Paddy Zone.

Naidu et al. (1986) carried out microanalysis with an objective of examining the impact of jaggery price on the supply of sugarcane to the factory and reported that the regression co-efficient of jaggery price was statistically significant at 5% level and was 0.8690 indicating that one percent increase in jaggery price result a decrease of 0.87% in the sugarcane supplied to the factory. Further an addition of one rupee in the price of jaggery decreased the supply of sugarcane to the factory to the extent of 398.47 tonnes, for one rupee increase in the price of sugarcane there was an increase of 475.57 tonnes of sugarcane supply to the factory.

Thuljaram Rao (1986) reported that stabilisation of sugarcane production did not result in stabilisation of supply of cane to white sugar factories one important factor on this wide fluctuation was the diversion of cane from the sugar factories to the other two constituents i.e. gur and khandsari.

Rajeswhar Tiwari (1989) found elasticity coefficients of various factors responsible for sugarcane acreage fluctuations. The elasticity coefficient of previous year price of sugarcane was positive and highly significant.

Sreedevi (1989) in her study applied supply function of Cobb-Douglas type revealed that lagged price of sugarcane per tonne was positive, significant on small farms, large farms and pooled farms of Gajulamandyam factory area and on small and large farms of Chittoor factory area. Lagged price of jaggery per quintal was negative significant on small farms in Chittoor factory area.

2.8.2 Other factors

Lala Bansidhar (1965) reported that competetion from Gur/khandsari manufactures was greatly hampering the cane supplies to the sugar factories.

Ramachandra Murthy (1965) indicated that due to certain limitations like untimely issue of cutting permits, it was not always possible to harvest cane crop at the optimum time of maturity for supply to the sugar factories, resultantly the cane growers suffered great losses and preferred diversion to gur preparations.

Muni Raj (1968) indicated that the sugar factories were seriously affected in the matter of cane procurement as sugar is placed under a rigid system of control leaving gur/khandsari completely free.

Gundu Rao (1969) identified irrigation and prevalence of varying degrees of competition for sugarcane by gur/khandsari as responsible for fluctuations in production and supply of sugarcane to the factories.

Mehta (1969) reported that the uncertainities in cane supply were further aggravated due to keen competition which the factories faced from gur producers.

Jagadish Lal (1987) studied response of sugarcane producers to prices and non-price factors. He foundout that the major factors significantly and positively influencing sugarcane in different District of U.P. were the farmer's own adjustment lags in area, relative sugarcane profitability, rainfall during sowing months and time trend. The study suggests that the price of competing crops must be taken into account while evolving suitable price structure for sugarcane. Secondly the risk arising out of precise fluctuations need to be minimized. Thirdly the study suggests that if the farmers of the area are assured of irrigational facilities from canal or other sources there is great scope for increasing cane area inspite of low rainfall in pre planting period.

Das and Krishen Singh (1988) indicated that there is need to locating more factories in sugarcane producing area and to make changes in sugar policy to attract more sugarcane to factories. There is need to locate more

collection centres and arrange cash payments to growers immediately after taking delivery. The farmers go for gur making as a last resort if they do not get payment immediately. The factories do not take their cane when they want to harvest cane to prepare field for sowing the next crop. The effective radius of a factory should not be more than 50 KM and the collection centre should not be more than 10 KM from a grower. If the payment is deferred for more than 3 months the farmers are likely to switch over to substitute crops which they can sell in the market immediately after harvest.

Manohar Rao (1989) stated the following reasons for the limited supplies of cane to sugar factories in India.

1. Limitation in the area under sugarcane.
2. Lack of irrigation facilities.
3. Existance of millions of small sugarcane growers with less than one hectare of land leading to poor yields and
4. Severe competition from thousands of gur and Khandsari manufacturers utilising as much as 55% of the total sugarcane grown in India.

Rajeswhar Tiwari (1989) found elasticity coefficients of various factors responsible for sugarcane acreage fluctuations. The elasticity coefficients of the previous year acreage of sugarcane was observed to be positive and significant. The elasticity coefficients of both the competing cereals were negatively significant indicating that with an increase in the price of paddy and wheat, area under sugarcane decreased.

Jain (1990) reported that rigorous control over sugar mills and no control over Gur and Khandsari, as one reason for fluctuations in sugar production. Further, he opined that because of non disposal of cane in time, many of the small farmers bow down to terms offered by Gur and Khandsari units.

2.9 MARKETING OF SUGARCANE

Latchumibathy (1977) reported that the harvesting charges did not reveal much difference between the three groups because the wages for cutting was paid on tonnage basis. After cultivation charges like loading decreased with increase in size group because of employing relatively less labour with increasing farm size.

Sreedevi (1989) reported that total marketing costs per tonne of sugarcane was Rs. 39.66 in Gajulamandyam factory area and Rs. 38.27 in Chittoor factory area. The cost was maximum in case of small farmers compared to other size groups. Of different costs, transportation cost was the major item accounting for nearly 78 per cent in both the factory areas. Transporting cost was directly related with the farm size.

2.10 MARKETING OF JAGGERY:

Jagadish Lal (1979) studied price spread of Gur in central U.P. He identified three important channels through which products were marketed from sugarcane growers to ultimate consumers. He observed that price spread study indicated that the gur producer, wholesalers and retailers together appropriated about 17, 23 and 28 per cent, sugarcane producers received about 71, 60 and 52 per cent and marketing cost covered the

remaining 12, 17 and 20 per cent of the consumer's rupee in village market, Lucknow mandi and Calcutta market respectively. Thus he proved the validity of the hypothesis that the share of the producer in the consumer's rupee will be higher when the channel between producer and consumer is smallest. He viewed that the price spread between different markets can be minimised by restricting the number of intermediaries and unauthorised deductions, the producers share can be increased for payment of sugarcane by gur and khandsari producers is made on the basis of recovery percentage.

Krishnaiah and Subbarama Raju (1989) studied price spread in marketing of jaggery at Anakapalli jaggery market in A.P. (1980) identified two channels of marketing. One being producer-commission agent (wholesaler) retailer-consumer, the other was producer-wholesaler cum retailer - consumer. They further observed that 75 per cent of marketable jaggery was handled through channel one. In the first channel net share of producer was 71.43, net margin to wholesaler (commission agent) was 9.06 per cent, margin for retailer was 8.66 per cent and price spread was 28.57 percent. In the channel II net share of producer was 80.06 per cent, margin of wholesaler cum retailer was 10.86, and price spread was 19.93 per cent.

Padmanabhan (1991) studied performance efficiency of cane jaggery marketing and the scope for cooperative marketing in North Arcot District by analysing the pricing efficiency, operational efficiency and price spread. He identified three important distinct channels for marketing of jaggery. In channel I commission agents operated between producer and retailer, and acted also as a wholesaler. In Channel II there was no commission agent. In Channel III regulated markets operated between producer and the wholesaler.

He observed that Channel III brought the largest share of consumer's rupee to the producer seller because no charge was collected from the producers and elimination of all malpractices. However he found that the Channel III was the channel which attracted the least supply from the farmers, because of preharvest contracts of producer with commission agents and wholesalers to sell the produce to them.

2.11 COMPARATIVE STUDY OF ECONOMICS OF SUGARCANE SUPPLY VIS-A-VIS JAGGERY PRODUCTION:

Ramdhan Singh and Dulip Singh (1960) reported that profit per maund on an average in the case of gur was Rs. 2.73, for shakkar Rs. 2.87 for khand Rs. 4.84 and for Rala Rs. 1.26.

Ramachandra Murthy (1965) reported that although gur manufacturing involved greater amount of risk time and labour, it was more remunerative than supplying sugarcane to sugar factories. He pointed out that an additional income of Rs. 1000 per tonne was derived from cane if converted to gur instead of supplying to the factory.

Naidu (1975) reported that production of jaggery instead of selling cane to sugar factory gave more returns.

Krishnaiah (1981) from his study on comparative economics of sugarcane converted into sugar and jaggery revealed that the input-ouput ratio was 2.07 when cane was converted into jaggery and 1.29 when cane was sent to the factory.

METHODOLOGY

CHAPTER III

METHODOLOGY

In this chapter, an attempt has been made to give an account of methodology adopted in the study. The chapter is presented under the following heads.

3.1 Sampling procedure

3.2 Collection of data

3.3 Terminology and concepts used in the study

3.4 Methods of computation

3.5 Tools of analysis used

3.1 SAMPLING PROCEDURE

3.1.1 Selection of the district

For the present study Chittoor district was purposively selected as it is a major sugarcane cultivating district in Andhra Pradesh constituting 15.9 per cent of area under sugarcane in the state and 15.7 per cent of total sugarcane production of the state (1989-90).

3.1.2 Selection of mandals

Among 66 mandals of Chittoor district Thavanampalli and Bangarupalem stood first and second respectively in terms of acreage under sugarcane in the year 1990-91, additional characters associated with the two mandals were (i) prevalence of two types of practices (practice of jaggery making and the practice of supplying sugarcane to the factory) in the mandals, (ii) nearly 70-80 per cent of sugarcane produced in these mandals is being converted into gur, rest of it is

being supplied to the factory. Hence, the two mandals were purposively selected for the study.

3.1.3 Selection of villages

From each mandal, two villages were selected for the study in such a way that each village has a good number of farmers taking up jaggery production as well as farmers supplying sugarcane to the factory.

3.1.4 Selection of respondents

All the sugarcane growers in the selected four villages were pooled, then broadly categorized into

a. Farmers supplying sugarcane to factory - Category I

b. Farmers taking up jaggery production - Category II

Then the farmers under each category were classified into two size groups.

1. **Small farmers:** Farmers having operational holding below 2 hectares in terms of standard irrigated land.

2. **Large farmers:** Farmers having above 2 hectares.

Thus hence forth in the study 'category' refers to farmers indicating whether they are taking up jaggery production or sugarcane supply to the factory, size group indicates whether the farmers are small farmers or large farmers

From each category and size group respondents were selected at random, in proportion to their number in the total population. The total sample size in the study is 120. Thus stratified random sampling was

adopted in selecting the respondents. Overall picture of the sample selected for the study is as follows.

Size group	Category of farmers	
	Sugarcane suppliers I	Jaggery makers II
Large farms	30	25
Small farms	15	50
Total	45	75

Grand Total : 120

Total Population size 143

3.1.5 Marketing : Selection of Markets

3.1.5.1 Marketing of sugarcane

As the selected villages lie in the Chittoor cooperative sugar factory area, the factory was selected for the study.

3.1.5.2 Marketing of jaggery

Chittoor jaggery market was purposively selected as the majority of respondents are marketing their produce in the market under the superivision of Agricultural Market Committee, Chittoor. Various channels of marketing of jaggery in the market were traced out, and different intermediaries in each channel were identified. Later, adequate number of different intermediaries viz 20 commission agents (6.7 per cent of total commission agents) and four exporters (10 per cent of total exporters) ten wholesalers and ten retailers were selected for the study.

3.2 COLLECTION OF DATA

3.2.1 Poduction of sugarcane

Selected respondents supplying sugarcane to Chittoor Sugar Factory were interveiwed by means of specially designed, pre-tested schedule. The required data for the year 1990-91 were obtained from them.

3.2.2 Production of jaggery

Data regarding production costs involved in the jaggey production, jaggery recovery and returns from jaggery production for the year 1990-91 was collected from the selected respondents by using same pre-tested schedule.

3.2.3 Marketing of sugarcane

Primary data regarding marketing costs involved in the supply of sugarcane to factory and price received by them were collected from the same respondents mentioned earlier.

Secondary data regarding marketing of sugarcane was obtained from Chittoor sugar factory like variety wise sugarcane price, subsidised transportation charges according to distance and various incentives given by factory, quality of sugarcane supplied to the factory in various years etc.

3.2.4 Marketing of jaggery

At producers' level data regarding various marketing costs incurred by them, price realised by them for their produce in the year, were obtained.

Later, data regarding various channels of marketing of jaggery were collected from the Agricultural market committee, Chittoor. Data regarding number of registered intermediaries, jaggery arrivals, price etc. were also collected from the market committee.

Later, among different categories of intermediaries adequate number of intermediaries (as specified earlier) were interviewed personally, data regarding marketing costs incurred by them were obtained.

3.2.5 Production and marketing problems

An opinion survey was carried out to identify various production and marketing problems in sugarcane as well as jaggery. The respondents who were selected earlier were made to respond for this opinion survey also.

3.2.6 General information

Other general information needed in the study was obtained from appropriate sources like Chief Plannig Office, Chittoor; Chittoor Cooperative sugar factory and Agricultural market committee, Chittoor.

3.3 TERMINOLOGY AND CONCEPTS USED IN THE STUDY

3.3.1 Operational holding: It is the total holding of a farmer which is being cultivated.

3.3.2 Average size of holding: In the present study average size of holding was worked out based on sugarcane acreage as well as operational holding.

3.3.3 Farm assets: Land, farm buildings, wells, livestock, farm machinery, farm implements were included under farm assets.

3.3.4 Manday: It refers to the work turned out by a normal healthy human being in a day of 8 hrs.

3.3.5 Cattle pair day: It refers to the work turned out by a pair of cattle in a day of 8 hrs.

3.3.6 Cost of production: It includes all the costs incurred by a producer in producing a unit output until it reaches the market. In the present study cost of production includes rental value of owned land also as followed by Singh and Singh in 1960.

More precisely cost of production of sugarcane includes the value of manual, cattle and machinery labour, various costs incurred towards inputs like seed, fertilizer etc, interest on working capital, fixed expenses, interest on fixed capital, transportation and other charges incurred in bringing the sugarcane to factory.

Cost of production of jaggery besides the above mentioned costs, includes other variable costs like rent for crusher, clarificants cost, power charges for crushing, labour charges in jaggery making etc.

In general, cost of production includes variable costs and fixed costs.

3.3.7 Variable costs: It refers to the various costs that are incurred towards various inputs like seed, manures and fertilizers, irrigation charges, payments towards manual labour, cattle labour and machinery labour.

In the case of jaggery production additional costs on inputs like clarificants, power charges for crushing, rent for crushers and labour charges are included. Interest on working capital was also included under variable costs.

3.3.8 Fixed costs: These are the costs which the farmer has to incur irrespective of whether he is taking up production or not. In the present study rental value of owned land, depreciation on farm assets and implements, land revenue and interest on fixed capital were considered under fixed costs.

3.3.9 Imputed costs: These are the costs which were not really paid out by the farms but considered for accounting only. They are rental value of owned land, family labour wages.

3.3.10 Farm management cost concepts: Cost A_1: It includes value of hired human labour, hired bullock labour and owned bullock labour, hired machinery charges, owned machinery charges, value of fertilizers, value of manures, value of seed, value of insecticides and pesticides, irrigation charges, land revenue, cesses and other taxes, depreciation on farm implements, farm buildings etc, interest on working capital and miscellaneous expenses.

Cost A_2: Cost A_1 + Rent paid for leased in land

Cost B: Cost A_2 + Rental value of owned land + interest on fixed capital (excluding land)

Cost C: Cost B + imputed value of family labour

3.3.11 Gross returns: It equals to total output multiplied with its corresponding price.

3.3.12 Net returns: It is equal to gross returns less total costs.

3.3.13 Breakeven output: It is the output level at which total costs equal total returns i.e., it is the output level at which there is neither profit nor loss.

3.3.14 Bulkline cost: It is the cost of production of 85 per cent of the output.

3.3.15 Cost of marketing: This includes various costs incurred in moving of the product from the point of production, until it reaches in the hands of consumer. In this process of transfer of produce several intermediaries are involved, hence marketing costs for different categories of intermediaries were worked out separately. This is with reference of marketing costs in jaggery.

In sugarcane supply to factory main marketing costs being transportation costs, other costs were expenses towards obtaining cutting permit, cheque collection etc.

3.3.16 Market intermediaries: Different types of agents who figure between producer and consumer in marketing of a commodity were referred to as market intermediaries eg. commission agent, exporter, whole saler, retailer etc.

3.3.17 Commission agent: The person who disposes the commodity to wholesalers on behalf of producers is known as commission agent. Commission is charged as per rules laid out by Agricultural market committee.

3.3.18 Exporter: The person who purchases produce from the producer and then sells the produce in other states.

3.3.19 Marketing margin: It refers to the difference between the price paid and received by a specific marketing agency such as a single retailer or any marketing agency such as a wholesaler or assembler or by any combination of marketing agencies such as the marketing system as a whole.

3.4 METHOD OF COMPUTATION OF COST COMPONENTS

3.4.1 Labour cost

For certain operations wages were paid at daily rate. In that case, total number of labour units engaged per day was considered in computing labour cost.

For certain operations like propping, harvesting, at times in planting also labour is employed on contract rate. In such case total amount incurred

towards the operation was considered, to arrive at number of labour units employed, here total amount paid was divided by standard wage rate.

Man-equivalent day is considered as standard labour unit. Female labour days were converted into standard man equivalent days by taking into consideration wage rates for male labour and female labour prevailed.

Labour put by the farmer and his family labour were charged (imputed) at the rate of standard wage prevailed in the area.

3.4.2 Cattle labour costs: Prevailed cattle labour wages for a 8 hr day (in 1990-1991) was taken into account in computing bullock labour cost.

3.4.3 Tractor power cost: Payment was made on hourly basis, hence total number of tractor hours used was multiplied with hourly wage rate, to arriave at total cost incurred towards tractor power.

When tractor is used in transportation of products, payments were made based on distance and the same was considered in the study.

3.4.4 Seed costs: For sugarcane suppliers mostly seed was supplied by factory. Hence, the rate at which seed was supplied and transportation costs if any incurred were considered in computing seed costs. For owned seed, local rates were used in computing seed cost.

Most of the jaggery producers purchase cane locally and hence the actual price at which they purchased cane was considered, together with transportation costs if any, in computing seed cost.

In the present study no ratoon crop was considered and hence each and every respondent in the sample invariably incurred seed cost.

3.4.5 Manures and fertilizers cost: Data regarding different types of manures and fertilizers used, quantity and price at which they were purchased were taken into consideration in calculating the cost, transport charges incurred also considered here in accounting. Manures produced on the farm were valued at local rates prevailed.

3.4.6 Irrigation charges: These were paid based on slab rate system according to horse power of motor. These charges are apportioned based on acreage under sugarcane.

3.4.7 Transportation costs: It varies according to the distance and mode of transportation.

3.4.8 Variable costs: By summing up all the above said costs in 3.4.1 to 3.4.7 variable cost was obtained.

3.4.9 Interest on working capital: It was calculated at an interest rate of 11.5 per cent. Interest here was computed for half of the amount for full crop period and for the rest of amount for half of crop period, as the investment is not made at one time but it was spread over time.

3.4.10 Fixed costs: It included rental value of owned land, depreciation on farm assets and building, farm machinery, farm implements etc, interest on fixed capital and land revenue.

3.4.11 Rental value of owned land: Though the practice of leasing out of land is not prevalent among the sample farmers, prevailed rental value in the area for similar type of lands was taken into consideration for imputing rental value of owned land.

3.4.12 Depreciation: Depreciation was calculated at two pre cent on wells, five per cent on farm machinery, Straight line method was used to calculate depreciation on farm implements. Later, depreciation was apportioned according to acreage under sugarcane.

3.4.13 Land revenue: Prevailed land revenue, which were actually paid by the farmers for the year 1990-91 were considered.

3.4.14 Interest on fixed capital: It was worked out at an interest rate of fourteen per cent.

3.4.15 Total costs: By adding together the variable costs and fixed costs, total cost was obtained.

3.4.16 Marketing costs: These varied at producers' level and at different intermediaries level in jaggery marketing.

At producers level the marketing charges include transport charge, Hamali charges and commission payments.

Commission agents incurred costs on telephone bills, rent for godown and licence fee etc.

A purchaser, who purchases produce through commission agent or directly from producer has to incurr charges of weighing and packing, cost of packing material, transport charges.

Wholesalers cum exporters pay licence fee and incur other marketing costs like transportation charges and commission charges etc., according to rate prevalent in the state to which he exports jaggery.

In the marketing of sugarcane, producers incurred transportation costs, costs in obtaining cutting permit etc., hence, the same were considered in computing the marketing costs.

3.4.17 Some costs specific in jaggery production alone viz., power charges for crushing, clarificants cost, rent for crushes etc.

3.4.17.1 Power charges for crushing: According to power of the crusher, number of days for crushing, electricity charges were levied at slab rates on monthly basis. The same was considered in computing power charges for crushing.

3.4.17.2 Cost of clarificants: In jaggery preparation several clarificants like hydros, lime, castoroil etc. are used. The quantity of each clarificant used, together with price of each type of clarificant was considered in computing cost of clarificants.

3.4.17.3 Rent for crusher: Prevailed rental rate was considered in computing rent for crusher both for the farmers owning crusher and farmers hiring the crusher.

3.5 TOOLS OF ANALYSIS USED

Both conventional and functional analyses were used in achieving the objectives and then valid conclusions were drawn.

In production, conventional analysis was used to arrive at gross income, net income, cost benefit ratio and farm efficiency measures.

3.5.1 Farm efficiency measures

1. Farm business income: Gross income - Cost A_1
2. Family labour income: Gross income - Cost B
3. Net income : Gross income - Cost C
4. Farm investment income : Net income + rental value of owned land + interest on owned fixed capital.

3.5.2 Break even analysis

Breakeven analysis, a management tool was used to evaluate the profitability of farms. The usual measure of farm profitability i.e., the net income fails to indicate the point from where the farm starts getting profits. It also does not reveal what happens to the fixed costs and variable costs with varying volume of production, relationship between the costs and total revenue at different levels of output. The draw backs mentioned here are rectified by the tool of break even analysis.

Break even output was computed by using the formula:

$$\text{Break even output} = \frac{\text{Fixed costs}}{\text{Price/unit} - \text{variable cost/unit}}$$

In marketing, conventional analysis was used in evaluating marketing costs incurred by different intermediaries and margins realised by them.

3.5.3 Bulk line cost analysis

Bulkline cost is worked out to evaluate whether the farmers receive remunerative prices. Generally in order to do this evaluation, price realised by a farmer will be compared with average cost of production. However in recent studies it has been indicated that, for fixing support price for a commodity, the Government should consider bulk-line cost, so as to satisfy a substantial proportion of farmers. Hence, for evaluating remunerative price of commodities bulkline cost is considered.

If the price realised for a commodity is greater than the bulk-line cost, then the price is said to be remunerative and vice versa. By considering total cost of production, cost of production per unit was calculated initially. Then cumulative percentage of production on farms worked out and is plotted against cost of production per unit output in graph. Bulkline cost is located at the point where cumulative percentage of total production is 85%. Later cumulative percentage of number of farms and acreage was also plotted on graph to find out the extent of farms and acreage covered by bulkline cost.

Functional analysis was used to evaluate cost-output relationship and input-output relationship.

3.5.4. Cost function: It is a bivariate function the general form of a cost function is

$$C = f(y)$$

where C = total costs, y = total output

In the present study three functional forms viz., linear, quadratic and cubic polynomial were used

Linear form : $C = a + by$

Quadratic form : $C = a + by + Cy^2$

Cubic form : $C = a + by + Cy^2 + dy^3$

For these equations the coefficient of multiple determination was computed to decide about the suitability of the model. Later by using the equation, marginal cost and average cost were estimated.

3.5.5 Production function: Two forms of production function analyses were carried out in the present study viz., multiple linear regression and Cobb-Douglas production function analysis.

Multiple linear regression: In the present study multiple linear regression analysis was carried out for both catogeries of farmers i.e. farmers producing jaggery and farmers supplying sugarcane to factory.

The model included eight variable, one dependent variable and seven explanatory variables. The linear model used is

$$Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + U_i$$

where in the case of sugarcane suppliers

Y = yield of sugarcane in tonnes/farm

x_1 = land in acres

x_2 = tractor hrs/farm

x_3 = bullock labour days/farm

x_4 = human labour days/farm

x_5 = seed cost/farm

x_6 = manures and fertilizers in terms of rupees/farm

x_7 = other cash expenses/farm.

In the case of jaggery producers

Y = jaggery yield in quintals/farm

x_1 = land in acres

x_2 = tractor hrs/farm

x_3 = bullock labour days/farm

x_4 = human labour days/farm

x_5 = seed cost/farm

x_6 = manures and fertilizers in terms of rupees/farm

x_7 = other cash expenses/farm.

Here b_0 is the intercept term, giving average effect on Y when all the included variables were absent. The stochastic disturbance term U_i is useful to reflect intrinsic randomness in the data.

b_1, b_2 ..... b_7 are partial regression coefficients. The meaning of partial regression coefficient is that b_1 measures change in the mean value of Y per unit change in x_1, holding other variables at constant. Like-wise other partial regression coefficients viz., b_2, b_3, b_4, b_5, b_6 and b_7 measure change in the mean value of Y per unit change in use levels of respective variable keeping other variables at constant.

Cobb-Douglas model: The number of variables included in the model was same as in MLR. The form of the model is

$$Y = b_0\ xb_1\ xb_2\ xb_3\ xb_4\ xb_5\ xb_6\ xb_7\ eU_i$$

where Y and explanatory variables x_1 to x_7 are as stated earlier.

In this model also b_0 represents the intercept term. The model is rewritten in logarithmic form as

$$\ln Y = \ln b_0 + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + b_4 \ln x_4 + b_5 \ln x_5 + b_6 \ln x_6 + b_7 \ln x_7 + U_i$$

thus transforming it into linear form.

In this model b_1, b_2 ..... b_7 individually are known as elasticity coefficients. For example b_1 measures the elasticity of Y with respect to x, that is the average percentage change in Y for a given percentage change in x_1.

Cobb-Douglas model is popular in applied research analysis because of its associated advantages like providing directly elasticity coefficient, measuring returns to scale by summing up regression coefficients.

Later for this model also R^2 is calculated to study the percentage variation explained by explanatory variables x_1, x_2 ..... x_7.

Adjusted R^2:

It is good practice to use $\bar{R}^2$ (adjusted R^2) rather than R^2, because R^2 tends to give an overly optimistic picture of the fit of the regression,

particularly when the number of explanatory variables is not very small compared with the number of observations.

Hence in the present study also adjusted R^2 values were calculated by utilising the formula.

$$R^2 = 1 - (1-R^2)\frac{N-1}{N-K}$$

where R^2 = original coefficient of multiple determination

N = sample size

k = number of parameters in the model

The term adjusted R^2 means it is adjusted for the degrees of freedom associated with the sums of squares entering into R^2.

In both models to test the regression coefficients, 't' values were calculated using the formula

$$t = (bi)/(\text{SE of } b_i)$$

where SE stands for stndard error.

Later marginal value product of each significant factor included in the model was calculated. In the Cobb-Douglas model MVP was calculated by using the formula:

$$\text{MVP of } x_1 = b_i\ (\bar{y}/\bar{x})$$

Henri Theil, Introduction to econometrics, Prentice Hall, Inc., Eugle Wood Cliffs, N.J., 1978, p. 135.

where $\bar{y}$ = geometric mean of output

$\bar{x}$ = geometric mean of input x

b_i = regression coefficient of x_i

Later these MVP values are compared with their respective acquisition costs in order to study input use efficiency. A resource is said to be efficiently used when its MVP = acquisition cost of the resource.

3.5.6 Study of price variations

Trend values were calculated for cane price and jaggery price by fitting least square fit of straight line

The equation of this is

$$Yc = a + bx$$

where

Yc = Trend value of price

x = year

Compound growth rate in price of cane and jaggery was worked out by fitting exponential equation of the type $Yc = ab^x$. This is expressed in linear from as $\log Yc = \log a + b \log x$.

Compound growth rate = $(e^b - 1) \times 100$

$$\text{Coefficient of variation} = \frac{\text{Standard deviation}}{\text{Mean}} \times 100$$

Simple correlation between different variables like price and quantity supplied etc., in the present study were worked out after adjusting the data

for trend, i.e. by following the standard procedure*. As a first step, linear trend was fitted for timeseries data. Later percentage of trend was calculated by using the formula.

$$\text{Trend percetage} = \frac{Y}{Yc} \times 100$$

where in Y = observed value

Yc = Estimated trend value.

Finally correlation between these percentage of trends were worked out to evaluate the nature of association between the variables in timeseries data.

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* Croxton and Cowden 1964 Applied General Statistics.

AGRO-ECONOMIC FEATURES

CHAPTER IV

AGROECONOMIC FEATURES

In this chapter an attempt has been made to describe Agroeconomic features of Chittoor District and the selected Mandals.

4.1 BOUNDARIES AND TOPOGRAPHY

Chittoor District is bound on the North by Ananthapur and Cuddapah Districts, on the East by Nellore District and Chengalpattu District of Tamil Nadu, on the South by North Arcot District of Tamil Nadu and on the West by Tamil Nadu and Karnataka States. The District covers an extent of 15,152 sq.kms. It is divided into 3 Revenue divisions viz. Chittoor, Tirupati and Madanapalli. It is situated between 12^{o} - 37" to 14^{o} - 8" of North latitude and 78^{o} - 33" to 79^{o} - 55" of the eastern longitude.

The two mandals selected in the present study viz Thavanampalli and Bangarupalem are located in Chittoor division. Thavanampalli is bound on the East by Chittoor Mandal, on the West by Punganur Reserve forest, on the North by Irala Mandal and on the South by Bangarupalem Mandal. Bangarupalem is bound on the North by Thavanampalli Mandal, on the South by Tamil Nadu, on the East by Yadamari mandal and on the west by Palamaner mandal.

4.2 POPULATION STATISTICS

Population Statistics of Chittoor district as per 1971 census and 1981 census is furnished in Table 4.1. From the table it is evident that

Table 4.1 Population Statistics of Chittoor District

	Item	Unit	Years		Decinnial growth
			1971	1981	
1.	Population	Lakhs	22.86	27.37	+ 19.73
	(i) Males	Lakhs	11.20	13.92	+ 24.29
	(ii) Females	Lakhs	11.66	13.45	+ 15.35
2.	Females per 1000 males	Number	960	966	+ 0.62
3.	Rural Population	Lakhs	19.78	22.75	+ 15.01
4.	Urban Population	Lakhs	3.07	4.62	+ 50.49
5.	Literates	Lakhs	5.81	8.72	+ 50.09
6.	Workers	Lakhs	9.39	11.53	+ 33.44
	(a) Marginal workers	Lakhs	-	1.00	
7.	Non workers	Lakhs	13.46	14.85	+ 10.33
8.	Cultivators	Lakhs	4.08	5.04	+ 23.53
9.	Agricultural labourers	Lakhs	3.18	3.68	+ 15.72
10.	Density of Population	Number per sq.km	145	181	+ 24.83
11.	Scheduled Castes	Lakhs	3.99	4.79	+ 20.05
12.	Scheduled Tribes	Lakhs	0.67	0.79	+ 17.91

Source: District census Hand book : 1971-1981

Table 4.2 **Area, Population, density of population in the selected mandals and Chittoor District**

	Thavanampalli Mandal	Bangarupalem Mandal	Chittoor District
Area in Sq.Kms.	154.57	200.85	15152.00
Population	43,323	50,590	27,37,316
Density of population	280	252	181

Source: Census of India - 1981

Table 4.3 **Distribution of Population by workers in selected mandals and the District - 1981**

	Thavanampalli Mandal	Bangarupalem Mandal	Chittoor District
Total population	43323	50590	2737316
Total Mainworkers	18728	21974	1152579
Agricultural Workers			
(i) Cultivators	7328	10195	503504
(ii) Agrl.labourers	8389	8360	368256
Household industry	413	535	40495
Other Workers	2598	2884	240324

Source: Hand book of statistics - Chittoor District - 1989-90.

population in 1971 was 22.86 Lakhs and in 1981 it was 27.37 Lakhs, there by indicating decinnial growth rate of 19.73.

Rural population was 19.78 Lakhs in 1971 constituting 86.53 per cent of total population, where as it was 22.75 lakhs in 1981 constituting only 83.12 per cent of total population, thus indicatig decline in percentage of rural population to total population. On the contrary urban population percentage to total population, showed an increasing trend.

The number of cultivators was 4.08 Lakhs in 1971, accounting for 17.85 per cent of total population. The corresponding figures in 1981 were 5.04 Lakhs and 18.41 per cent.

The population of Agricultural labourers was 3.18 lakhs in 1971 and in 1981 it was 3.68, constituting 13.91 per cent and 13.45 per cent of total population respectively. From Table 4.2 it is evident that population in Thavanampalli mandal in 1981 was 43,323 constituting 1.58 per cent of population of the District, Bangarupalem constituted 1.85 per cent of population of the District. Total population in these two Mandals was rural type as there are no towns in thsese two mandals.

Table 4.3 showed that as per 1981 census 42.11 per cent of total population of the District (11,52,579) constituted total main workers group, out of which cultivators were 5,03,504 constituting 18.39 per cent of population (43.68 per cent of Main workers). Agricultural labourers constituted 13.45 per cent of Total population (31.95 per cent of Main workers).

In Thavanampalli Mandal, cultivators constituted 16.91 per cent of the total population (39.13 per cent of Main workers), Agricultural labourers constituted 19.36 per cent of the total population in the Mandal (44.79 per cent of mainworkers in the mandal). Thus 83.92 per cent of main workers in the mandal were cultivators and Agricultural labourers.

In Bangarupalem Mandal the number of main workers was 21,974 constituting 43.44 per cent of the total population of the Mandal. Caltivators, together with Agricultural labourers constituted 84.44 per cent of main workers in the Mandal (36.68 per cent of Total population in the Mandal).

4.3 SOILS

The major portion of Chittoor District is covered by Red soils with portions of alluvial soil in Chittoor and Bangarupalem East-West taluks. According to an assessment made on the basis of village Records, 57 per cent of the soils of the District are Red loamy and 34 per cent Red sandy. The remaining 9% is covered by black clay (3 per cent) Black loamy (2 per cent), Black sandy (1 per cent) and Red Clay (3 per cent).

4.4 CLIMATE

The climate of the District is dry and healthy. The upland Mandals consist of 31 mandals of Madanapalle division are comparitively cooler than the Eastern Mandals except Chittoor where the climate is moderate.

4.4.1 Temperatures Recorded in Chittoor District in the Year 1990 are presented in Table 4.4.

Table 4.4 Mean maximum and minimum Temperature in Chittoor district in the year - 1990

(in degree centigrade)

	Normal		Arogyavaram		Tirupati	
	Mean Maximum	Mean Minimum	Mean Maximum	Mean Minimum	Mean Maximum	Mean Minimum
January	27.1	15.3	28.2	14.4	30.7	17.2
February	30.1	16.7	31.0	17.3	33.9	20.8
March	33.2	19.1	33.8	20.7	36.5	24.4
April	34.7	22.0	36.9	22.9	41.1	26.5
May	34.7	23.5	32.8	22.5	36.1	25.7
June	32.0	22.7	31.8	22.2	36.7	26.5
July	30.0	21.7	31.6	21.3	36.7	25.8
August	30.0	21.7	29.7	21.2	34.3	25.6
September	29.8	21.2	29.9	20.5	35.2	25.1
October	28.3	20.1	27.7	19.7	31.7	24.1
November	26.5	17.6	26.3	17.2	30.4	21.7
December	25.5	15.2	25.6	15.5	29.7	20.6

Source: Meterological Centre, Hyderabad.

4.4.2 Rainfall

The District has the benefit of receiving rainfall during both the South West and North East Monsoon periods. While the normal rainfall of the District during the South-West Monsoon period is 380.4 mms and that of North-east Monsoon period is 410.5 mms. The rainfall received during the winter period and hot weather period is negligible, their respective normals being 24.6 mms and 92.6 mms. The annual normal rainfall of the District is 908.1 mms.

The rainfall received from the South-West monsoon is more copious compared to North East Monsoon in the Western mandals and in the central part of the District where as the rainfall received from North-East monsoon is comparatively copious in the Eastern mandals of the District. Data of Rainfall in Chittoor District during 1989-90 and 1990-91 is presented in Table 4.5.

From the table it is evident that, normally maximum rainfall was recorded during the month of October (178.1 mm) followed by November (169.0 mm). Minimum rainfall was recorded during February.

During the year 1989-90 rainfall received due to South West monsoon was 443.7 mm and is more than normal (380.4 mm). Rainfall due to North-East monsoon was 287.7 mm and is less than normal (410.5 mm). Rainfall received during winter period and hot weather period was 11.1 mm and 191.4 mm respectively as against a normal rainfall of 24.6 mm and 92.6 mm respectively. On the whole the rainfall received in the year 1989-90 was more than normal annual rainfall. In the year 1990-91 rainfall received due

Table 4.5 Rainfall in Chittoor District in mms.

Month	Normal Rainfall	Actual rainfall	
		89-90	90-91
June	58.3	47.5	22.7
July	90.0	243.5	60.9
August	107.4	15.6	85.3
September	124.7	137.1	216.7
October	178.1	85.7	164.6
November	169.0	118.9	189.9
December	63.4	83.1	17.3
January	17.8	2.8	12.3
February	6.8	8.3	0.3
March	8.5	25.5	0.3
April	23.4	16.0	26.0
May	60.7	149.9	23.3
Total	908.1	933.9	819.6

Source: Chief planning office - Chittoor.

to South west monsoon was 385.6 mm, in North east monsoon it was 371.7 mm. Rainfall during winter period was 12.6 mm and during hot weather period it was 49.6 mm. Thus it is evident that in the year 1990-91, except for South-West monsoon season, in all other seasons actual rainfall was lower than normal rainfall. Thus annual rainfall received in the year 1990-91 (819.6 mm) was lower than normal annual rainfall (908.1 mm).

4.5 LAND UTILISATION PATTERN

Land utilisation pattern in Chittoor District and selected mandals during 1989-90 is presented in Table 4.6.

In Chittoor District net area sown during the year 1989-90 constituted 31.61 per cent of the total geographical area. In Thavanampalli Mandal net area sown in the year 1989-90 was 18,721 acres, constituting 34.3 per cent of total geographical area of the mandal. In Bangarupalem Mandal Net area sown in the year was 28995 acres constituting 37.2 per cent of total geographical area of the Mandal.

4.6 PRINCIPAL CROPS GROWN IN THE DISTRICT AND SELECTED MANDALS

Area and production of the Principal crops grown in the District and in the selected mandals is presented in Table 4.7 and 4.8. Principal crops grown in the District are paddy, groundnut and sugarcane. In Thavanampalli mandal groundnut (9169 acres) was the major crop followed by sugarcane (3,577 acres). In Bangarupalem mandal also groundnut was the major crop with 15896 acres and was followed by sugarcane (4351 acres).

Table 4.6 Land Utilisation in Chittoor Dist and Selected Mandals in 1989-90 Agricultural Census (in Acres)

	Thavanampalli	Bangarupalem	Chittoor
Geographical area	54630 (100)	77958 (100)	3703537 (100)
Forest	16351 (30.0)	18390 (23.6)	115476 (30.12)
Barren Uncultivable land	4175 (7.6)	8230 (10.6)	415512 (11.22)
Landput to Non-Agrl. use	7978 (14.6)	13320 (17.1)	346053 (9.34)
Permanent pasture and other grazing lands	450 (0.8)	1226 (1.6)	100999 (2.73)
Miscellaneous crops and Groves	341 (1.6)	1030 (1.3)	66598 (1.80)
Cultivable wastes	1377 (2.5)	2012 (2.6)	125632 (3.39)
Other fallow lands	2508 (4.6)	3321 (4.2)	255144 (6.89)
Current fallow	2729 (5.0)	1434 (1.8)	107616 (2.91)
Net area sown for the year	18721 (34.3)	28995 (37.2)	1170537 (31.61)

Note: Figures in parentheses indicate percentage to total geographical area.

Source: Chief planning office, Chittoor.

Table 4.7 Area and production of Principal crops in the District in 1989-90

Sl. No.	Crop	Area (000' Hectares)	Production (000' Tonnes)	District characters as percent of the State	
				Area	Production
1.	Rice	99	212	2.4	2.1
2.	Jowar	8	10	0.6	1.1
3.	Bajra	6	5	2.3	2.8
4.	Ragi	20	22	11.7	10.6
5.	Groundnut	277	273	12.1	13.1
6.	Sugarcane	25	1750	15.9	15.7

Source: Hand book of Chittoor District Statistics - 1989-90.

Table 4.8 Under Principal crop in Chittoor District and selected Mandals in 1989-90

(in acres)

	Thavanampalli Mandal			Bangarupalem Mandal			Chittoor District		
	Kharif	Rabi	Total	Kharif	Rabi	Total	Kharif	Rabi	Total
Rice	866	833	1699 (0.69)	1957	933	2890 (1.18)	117490	12503	2,44,993
Jowar	305	-	305 (1.43)	546	-	546 (2.57)	20544	723	21267
Bajra	-	-	-	75	-	75 (0.52)	13977	205	14182
Ragi	52	101	153	413	132	545	42406	6878	49,284
Small Millets	-	-	-	-	-	-	11781	-	11781
Horsegram	42	-	42 (0.26)	164	58	222 (1.37)	9249	6962	16211
Greengram	1	-	1 (0.16)	34	-	34 (5.40)	608	21	629
Mangoes	2896	-	2896 (5.51)	3422	-	3422 (6.51)	52570	-	52570
Fruits and Vegetables	2935	-	2935 (3.66)	3558	170	3728 (4.65)	66679	13569	80248
Chillies	-	132	132 (1.46)	28	140	168 (1.86)	11413	7622	9035
Sugarcane	3577	-	3577 (5.81)	4351	-	4351 (7.06)	61614	-	61614
Groundnut	9126	43	9169 (1.47)	15890	6	15896 (2.23)	604435	78262	682697
Sesamum	-	-	-	-	-	-	1251	1141	2392
Total crops	18211	1145	19356	28551	1451	30002	1016889	248301	1265190

Source: Hand book of Chittoor District 1989 - 90.

Note: Figues in parentheses statistics indicate percentage to total area under the crop in Chittoor district.

4.7 IRRIGATION

Major sources of irrigation in the District are wells, tanks, canals, tube wells and other sources. Data regarding area of crops irrigated source wise in 1989-90 is presented in Table 4.9. From the table it is evident that major portion of the irrigated area in the District (285561 acres) is under well irrigation accounting for 62.02 percent of total crop area irrigated. The next major source of irrigation was tanks covering 1,45,666 acres accounting for 31.64 per cent of total crop area irrigated.

Data regarding area of principal crops irrigated in the District and selected mandals in 1989-90 is presented in Table 4.10. From the table it is evident that paddy was the main irrigated crop (231922 acres) followed by sugarcane (61,614 acres) in the District. From Table 4.10 it is evident that in Thavanampalli mandal sugarcane was the major irrigated crop (2412 acres) followed by paddy (1172 acres). In Bangarupalem mandal also sugarcane was the major irrigated crop (4351) acres) followed by paddy (2886 acres).

Details of source wise gross irrigated area in Chittoor District and in selected mandals in presented in Table 4.11. From this table it is evident that the major source of irrigation is wells in the District as well as in the selected two mandals, covering 55.84 per cent of total gross irrigated area in the District. In Thavanampalli mandal it covered 97.41 per cent of gross irrigated area whereas in Bangarupalem mandal it covered 81.53 per cent of gross irrigated area. Next to wells the major source of irrigation was tanks.

4.8 AGRICULTURAL MACHINERY AND IMPLEMENTS

Data of Agricultural Machinery and implements in selected mandals and Chittoor District as per 1987 Agricultural census is presented in Table 4.12.

Table 4.9 Area of crops irrigated source wise 1989-90 (in Acres)

	Canals	Tanks	Tube wells	Other wells	Other sources	Total
Rice	6266	118432	4896	99910	2418	2,319,22
Wheat	-	-	50	8	-	8
Jowar	-	55	270	701	-	806
Bajra	23	17	5	4695	-	5005
Maize	-	4	518	221	-	230
Ragi	24	1616	-	4117	84	16359
Horsegram	-	-	-	-	-	-
Greengram	-	1	-	19	-	20
Blackgram	-	-	-	43	-	43
Redgram	-	-	-	1	-	1
Bengalgram	-	-	-	-	-	-
Chillies	40	283	311	7872	2	8508
Turmeric	-	-	3	165	-	168
Sugarcane	-	9329	1407	50778	100	61614
Potatoes	-	16	2	759	-	777
Sweet Potatoes	-	5	-	382	-	387
Onions	-	105	34	1146	-	1285
Other Vegetables	8	785	676	16319	4	17792
Cotton	-	-	-	5	-	5
Groundnut	2687	13067	8423	64419	134	88,730
Gingelly	46	146	19	1555	-	1760
Castor	-	-	-	19	-	19
Coconut	-	101	3	2040	1	2145
Other crops	30	1704	686	20387	34	22841
Total	9124	145666	17303	285561	2777	460431

Source: Hand book of Chittoor District statistics 1989 - 90.

Table 4.10 Area of Principal crops irrigated in selected Mandals and Chittoor District in 1989-90.

(in acres)

Crop	Thavanampalli Mandal			Bangarupalem Mandal			Chittoor District		
	Kharif	Rabi	Total	Kharif	Rabi	Total	Kharif	Rabi	Total
Paddy	604	568	1172	1953	933	2886	106220	125702	231922
Jowar	-	-	-	-	-	-	111	695	806
Bajra	-	-	-	-	-	-	4800	205	5005
Ragi	49	124	173	252	132	384	9481	6878	16359
Chillies	6	210	216	28	140	168	891	7617	8588
Sugarcane	2412	-	2412	4351	-	4351	61614	-	61,614

Source: Handbook of Chittoor District Statistics 1989-1990.

Table 4.11 Gross area irrigated source wise in Chittoor District and in selected Mandals in 1989-90.

(in acres)

	Thavanampalli Mandal	Bangarupalem Mandal	Chittoor District
Canals	-	-	1833
Tanks	77	1627	66952
Tube wells	42	19	4021
Oter well	4468	7268	94312
Other sources	-	-	1783
Total	4587	8914	168901

Source: Chief Planning Office Chittoor.

Table 4.12 Agricultural Machinery and implement in selected.

Mandals and Chittoor District (1987)

	Tbavanampalli Mandal	Bangarupalem Mandal	Chittoor District
Ploughs			
(i) Wood	2638	4753	2909411
(ii) Iron	941	2192	124717
Total	3579	6945	334128
Water Pumps for irigation			
(i) Oil engine	41	186	18350
(ii) Electric Motors	3051	2839	80992
Total	3092	3025	99342
Tractors			
(i) Power tillers	43	34	543
(ii) Tractors	140	166	2994
Total	183	200	3537
Sugarcane Crusher			
(i) Power	886	556	8542
(ii) Bullocks	59	158	6706
(iii) Total	945	714	15248
Sprayers and dusters			
(i) Operated with hand	97	81	9549
(ii) Operated with power	-	7	707
(iii) Bullock carts	833	938	47667

Source: Chief Planning Officer Chittoor.

From Table 4.12 it is evident that, Agricultural machinery and implements in the two selected mandals together accounted for 3.15 per cent ploughs, 6.16 per cent of water pumps in irrigation, 10.83 per cent of tractors, 10.88 per cent of crushers in the District. Power crushers in the two mandals accounted for 16.88 percent of power crushers in the District.

4.9 NUMBER AND AREA OF OPERATIONAL HOLDING IN THE DISTRICT BY SIZE CLASSES 1986-87

From the Table 4.13 it is evident that 97.67 per cent of total holdings area in the District was under individual holdings.

From the Table 4.13 it is also evident that number of individuals having an operation holding of size 0-2.46 Acres were 2,52,779 accounting for 58.03 per cent of the total holdings. Total operational holding of this size group was 285702.36 acres accounting for 19.63 per cent of total individual holdings area. Average size of holding in this group was 1.13 acres.

Number of individuals under the size group of 2.47-4.93 acres was 100460 accounting for 23.06 per cent of total loadings. Total operational holding under this size group was 356910.38 acres accounting for 24.52 per cent of total holding area. Average size of holding under this group was 3.55 acres.

Thus totally 81.09 per cent of individuals held 44.15 per cent of total operational holding area. The rest 18.91 per cent of individuals held 55.85 per cent of total operational holding area.

TABLE - 4.13 Number and area of operational holdings in the district by size classes 1986-87

(Area in Acres)

S. No. 1	Size Class 2	Individual No. 3	Holdings Area 4	Joint No. 5	Holdings Area 6	Institutional No. 7	Holdings Area 8	Total No. 9	Holdings Area 10
1.	Upto - 0.04	1,972	104.51	42	1.22	1	0.04	2015	105.77
2.	0.05 - 1.23	1,51,592	101606.61	1132	713.64	59	29.99	152783	102350.24
3.	1.24 - 2.46	99,215	183991.24	758	1282.89	31	67.27	100004	185341.40
4.	2.47 - 4.93	1,00,460	356910.38	1031	3566.19	23	82.59	101514	360559.16
5.	4.94 - 7.40	41,279	239661.27	633	3663.90	14	81.00	41926	243406.36
6.	7.41 - 9.87	16,704	140349.85	345	2909.20	3	37.31	17052	143296.36
7.	9.88 - 12.35	9,184	102636.45	295	2981.03	2	19.91	9481	105637.39
8.	12.36 - 18.52	8,674	128710.91	261	3996.98	1	13.41	8936	132721.30
9.	18.53 - 24.70	3,260	70174.04	144	3114.65	2	42.88	3406	73331.57
10.	24.71 - 40.41	2,527	84017.20	130	3641.88	8	314.76	2665	87973.84
11.	49.42 - 74.12	495	25044.81	63	3460.42	6	347.39	564	28852.62
12.	74.13 - 98.83	117	10040.73	7	555.39	-	-	124	10596.12
13.	98.84 -123.54	39	4229.54	3	324.01	1	108.84	43	4662.39
14.	123.55 &above	42	7901.86	2	550.69	8	2833.58	52	11286.13
	Total	4,35,560	1455379.40	4846	33762.09	159	3978.97	440165	1490120.46

RESULTS AND DISCUSSION

CHAPTER V

RESULTS AND DISCUSSION

In this chapter the results of the field investigation carried out with the specified objectives mentioned in the introduction chapter are presented and discussed thoroughly. For convenience sake the results are presented under the following heads.

5.1 General particulars of sample farms.

5.2 Production of sugarcane and jaggery

5.3 Marketing of sugarcane and jaggery

5.4 Problems and prospects in production and marketing of sugurcane and jaggery.

5.1 GENERAL PARTICULARS OF SAMPLE FARMS

5.1.1 Family size and family labour contribution on sample farms

Results of analysis of family size and family labour contribution on sample farms are presented in Table 5.1., on small farms of category I, average size of family was composed of 1.33 males and 1.73 females totalling to 3.06 members, on the large farms of the same category, family composition was 4.06 members consisting of 2.2 males and 1.86 females. On combined farms of this category 1.91 males and 1.82 females constituted a family size of 3.73 members.

On category II farms, small farms consisted of 2.32 males and 1.86 females, large farms were composed of 2.12 males and 2.16 females and on combined farms the average family size was constituted by 2.25 males and 1.96 females.

TABLE - 5.1 Family size and family labour contribution on sample farms.

Particulars	Category I			Category II		
	Small farms	Large farms	Combined farms	Small farms	Large farms	Combined farms
I. Family composition						
(1) Male	1.33	2.20	1.91	2.32	2.12	2.25
(2) Female	1.73	1.86	1.82	1.86	2.16	1.96
Sub total	3.06	4.06	3.73	4.18	4.28	4.21
II. Family labour available for farm work						
(1) Male	1.07 (80.45)	1.10 (50.00)	1.09 (57.07)	1.66 (71.55)	1.36 (64.15)	1.56 (69.33)
(2) Female	-	0.03 (1.61)	0.02 (1.10)	0.44 (23.66)	-	0.29 (14.80)
Sub total	1.07 (34.97)	1.13 (27.83)	1.11 (29.75)	2.10 (50.21)	1.36 (31.77)	1.85 (43.94)

Note: Figures in parentheses indicate percentage.

Regarding family labour contribution, on small farms of category I 1.07 males were available for farm work, accounting for 80.45 per cent of males in the family. On large farms 1.1 males and 0.03 females were available for farm work, accounting for 50 per cent of males and 1.61 per cent of females in the family. On combined farms of category I, family labour available for farm work consisted of 1.09 males and 0.02 females accounting for 57.07 per cent of males and 1.1 per cent of females of the family respectively.

On category II farms on small farms family labour available for farm work was constituted by 1.66 males, 0.44 females accounting for 71.55 per cent of males and 23.66 per cent of females in the family respectively. On large farms, family labour consisted of 1.36 males accounting for 64.15 per cent of males in the family. There was no family female labour contribution for farm work in the large size group. On combined farms 1.56 males and 0.29 females were available for farm work constituting 69.33 per cent of males and 14.80 per cent of females in the family.

A comparison between the two categories of farms indicated that on an average family size was higher on category II farms (4.21) compared to category I (3.73). Family labour available for farm work was also higher in category II farms viz. 2.1 on small, 1.36 on large and 1.85 on combined farms, when compared to category I farms of 1.07, 1.13 and 1.11 members on small, large and combined farms.

A critical analysis of family composition and family labour available for farm work in Table 5.1 clearly revealed that family labour available for

farm work was higher in category II farms both in absolute terms as well as in percentage terms. The plausible reason for the higher family labour availability in category II size farms might be due to the fact that the jaggery preparation is a time consuming activity extending several days in which family labour involvement is a must when compared to cutting and transporting of sugarcane to the sugar factory, which involves lesser days of operation.

A size-wise comparison between farms of the two categories revealed that percentage of family labour available for farm work was higher on small farms compared to large farms showing an inverse relationship. The results of the present study are in confirmity with the results of Verma (1981).

5.1.2 Particulars of the holdings of the sample farms

Farm size has its profound effect in determining economics of scale of production, level of resource use as well as farm income. Thus, an analysis of farmsize of sample farms was carried out and the results are presented in Table 5.2 for which both size of operational holding as well as acreage under sugarcane in each category were considered. Operational holdings here were expressed in terms of standard hectares by converting 2 dryland hectares into one standard (irrigated) hectare.

In the category I farms, average size of operational holding for small and large farms were 1.55, and 5.89 hectares respectively. On small farms area under sugarcane was 0.60 hectares constituting 38.71 per cent of operational holding. On large farms area under sugarcane was 1.01 hectares accounting for 17.15 per cent of the operational holding.

TABLE - 5.2 Average size of farm of sample farms (in irrigated hectares)

Particulars	Category I			Category II		
	Small farms	Large farms	Combined farms	Small farms	Large farms	Combined farms
Operational holding	1.55	5.89	4.44	0.91	4.82	2.22
Area under sugarcane	0.60	1.01	0.88	0.53	1.29	0.78
Percentage of area under sugarcane to total operational holding	38.71	17.15	19.82	58.24	26.76	35.13

In the category II farms i.e. Jaggery producing farms, operational holding size of small farms was 0.91 hectares and on large farms it was 4.82 hectares. Corresponding figures of acreage under sugarcane were 0.53 and 1.29 hectares respectively, accounting for 58.24 per cent and 26.76 per cent of the operational holding.

Comparison of farm size of the two category farms revealed that operational holding as well as acreage under sugarcane were higher in the case of combined farms of category I i.e. 4.44 hectares and 0.88 hectares. Corresponding figures on combined farms of category II were 2.22 hectares and 0.78 hectares. Area under sugarcane on combined farms of category I accounted for 19.82 per cent of the operational holding while the same was accounted for 35.13 per cent of operational holding on combined farms of category II. Thus on combined farms of category I, area under sugarcane was higher (0.88 hectares) compared to category II farms (0.78 hectares) but in percentage terms, the category II farms accounted for higher percentage of area under sugarcane when compared to category I farms. The possible reason for the higher area under sugarcane in category I farms compared to category II farms might be due to the factor that the jaggery processing not only involves additional capital and labour requirements, but also time consuming.

Between the size groups of two categories of farms, small farms of category I, even though having higher size of operational holding as well as area under sugarcane, they come only next to small farms of category II in terms of percentage of sugarcane area to operational holding. Unlike this, large farms of category I though having higher operational holding than

large farms of category II, have less acreage under sugarcane. The percentage of sugarcane acreage to operational holding on category II large farms was higher (26.75 per cent), compared to category I large farms (17.15 per cent).

5.1.3 Assets structure of sample farms:

Assets structure of sugarcane supplying farms i.e. category I farms presented in Table 5.3, revealed that land was the major asset on both small and large farms with a value of Rs.172900 and Rs.197600 per hectare respectively. On combined farms land value amounted to Rs.189366.67 per hectare.

On small farms, farm buildings and wells formed the major asset (excluding land value) with a value of Rs.5000 per hectare followed by machinery (Rs4588.89). These two together constituted 63.49 per cent of the total asset value excluding land.

On large farms, machinery was the major asset (Rs.33736.84 per hectare) accounting for 81.36 per cent of asset value excluding land. This higher value was due to the fact that most of the large farmers of category I were owning tractors and their accessaries.

Asset structure of Jaggery producing farms presented in Table 5.4 revealed that on this category farms also land was the major asset, the value of which was Rs.1,77,840.00, Rs.2,09,950 and Rs.1,88,543.33 on small, large and combined farms respectively.

TABLE - 5.3 Assets structure of sugarcane supplying farms

(Rupees per hectare)

Items	Small farms	Large farms	Combined farms
Land	172900.00	197600.00	189366.67
Wells and farm buildings	5000.00 (33.11)	2657.89 (6.41)	3192.89 (9.01)
Farm Machinery	4588.89 (30.38)	33736.84 (81.36)	27078.68 (76.40)
Farm implements	2358.33 (15.62)	1911.12 (4.61)	2013.27 (5.68)
Livestock	3155.55 (20.89)	3157.89 (7.62)	3157.36 (8.91)
Total assets value	188002.77	239063.74	224808.87
Total value of assets excluding land	15102.77 (100.00)	41463.74 (100.00)	35442.2 (100.00)

Note: Figures in parentheses indicate percentages to the total value of assets excluding land.

TABLE - 5.4 Assets structure of jaggery producing farms

(Rupees per hectare)

Items	Small farms	Large farms	Combined farms
Land	177840.00	209950.00	188543.33
Farm buildings and wells	16460.28	13664.60	14926.39
	(44.00)	(34.43)	(38.61)
Farm Machinery	13560.86	19953.42	17068.23
	(36.25)	(50.29)	(44.15)
Farm implements	2914.15	2272.36	2562.03
	(7.79)	(5.73)	(6.63)
Livestock	4477.50	3788.82	4099.65
	(11.96)	(9.55)	(10.61)
Total value of assets	2,15,252.79	2,49,629.2	2,27,199.63
Total value of assets excluding land	37412.79 (100)	39679.2 (100)	38656.3 (100)

Note: Figures in parentheses indicate percentage to the total value of assets excluding land.

On small farms farm buildings and wells constituted major asset (Rs. 16,460.28) accounting for 44 percent of total value of assets excluding land. Farm machinery was the next major asset after farm buildings and wells amounting to Rs. 13560.86 accounting for 36.25 per cent of the value of assets excluding land.

On large farms, farm machinery amounting to Rs. 19953.42 was the major asset excluding land followed by farm buildings and wells. These two together constituted 84.72 per cent of assets value excluding land on these farms.

On combined farms, farm machinery (Rs. 17068.23) accounted for 44.15 per cent of assets value excluding land followed by farm buildings and wells (38.61 per cent).

A thorough observation from the Tables 5.3 and 5.4, revealed that on both categories of farms per hectare value of assets was directly related with the farm size on an average. Value of assets on jaggery producing farms was higher when compared to cane supplying farms. This might be due to owning of additional farm implements like sugarcane crusher, jaggery making pans etc., by majority of the farms.

A comparison between small farms of category I and small farms of category II with regard to farm machinery and farm implements per hectare showed that, the value of farm machinery was higher on small farms of category II amounting to Rs 13560.86. This is because of the fact that the farmers of category II owned sugarcane crushers and pans.

However, among the large farms, on category I farm machinery value was Rs.33,736.84, on category II farms it was (Rs.19953.42). This is due to the fact that most of the large farmers of category I were owning sugarcane crusher also, as they take up jaggery production during the years when the jaggery prices were high. In addition to this most of them were owning tractors also. This higher machinery value on large farms of category I, resulted in higher machinery value on combined farms of category I.

Assets in the form of farm buildings and wells were higher on small and large farms of category II when compared to corresponding size farms of category I. This might be due to owning of additional farm buildings on category II farms for Jaggery storing. On the average the per hectare value of assets on combined farms of category II was higher (Rs 38656.30) compared to category I farms (Rs 35442.20). The lower assets position itself in the category I farms especially small farms might be one of the reasons behind the farmer's preference, to supply sugarcane to the factory instead of jaggery preparation.

5.2 PRODUCTION OF SUGARCANE AND JAGGERY

5.2.1 Varieties prevalent in the study area

In the study area sugarcane varieties prevalent are co 62175 and other varieties like Co 8014, Coc 671, Co8201 and Co7219. Greater area was under the variety Co62175.

In the sample farms studied, all jaggery producing farms were under Co 62175 variety only as this variety is preferred for its higher jaggery recovery when compared to other varieties. Among sugarcane supplying farms

different varieties were prevalent. However in the present study, these farms were classified into two groups as farms under 'other varieties' and farms under Co62175, in accordance with the differentiation in prices paid by the sugar factory for these varieties. The results of this classification are presented in Table 5.5.

Under this categorization totally 15 farms were under co62175 variety and the rest 30 farms were under other varieties, with an acreage of 13 hectares under co62175 and 26.4 hectares under other varieties.

Among the 15 small farms included in the sample farms, 4 farms were taking co62175 variety with an acreage of 2.8 hectares and the remaining 11 farms were growing other varieties with an acreage of 6.2 hectares. Among the 30 large farms included in the sample farms, 11 farms were under co62175 variety with an acreage of 10.2 hectares and 19 farms were under other varieties with an acreage of 20.2 hectares. Further analysis of Table 5.5 revealed that on small farms 31.11 percentage of acreage was under co62175 and 68.89 percentage of acreage was under other varieties. On large farms 33.55 percentage of acreage was under Co62175 and 66.45 percentage of acreage was under other varieties. Thus higher percentage of area of small farms was under other varieties, when compared to large farms.

5.2.2 Productivity of the sample farms:

Productivity which is defined as yield per unit area, varied in between different size farms of the same category.

TABLE - 5.5 Variety wise sugarcane acreage and productivity of sugarcane supplying farms

		CO62175			Other varieties			Total		
		Number of farms	Acreage (hectares)	Productivity (tonnes/ hectare)	Number of farms	Acreage (hectares)	Productivity (tonnes/ hectare)	Number of farms	Acreage (hectares)	Productivity (tonnes/ hectare)
(1)	Small farms	4	2.8 (31.11)	66.07	11	6.2 (68.89)	63.06	15	9.00 (100)	64.00
(2)	Large farms	11	10.2 (33.55)	70	19	20.2 (66.45)	67.87	30	30.40 (100)	68.59
(3)	Combined farms	15	13.0	69.15	30	26.4	66.74	45	39.4	67.54

Note: Figures in parentheses indicate percentage to total acreage.

5.2.2.1 Sugarcane Productivity: Results of analysis of productivity of sugarcane are presented in Table 5.6. Productivity on small farms of category I was 64 tonnes per hectare whereas on large farms it was 68.59 tonnes per hectare. On combined farms it was 67.54 tonnes per hectare. The results exhibited a direct relationship between productivity and farm size. The results are in accordance with the findings of Jayamma (1988), Rao (1991).

Varietal wise productivity analysis of category I farms presented in Table 5.5 indicated that on small farms productivity of CO62175 variety sugarcane was 66.07 tonnes per hectare and the productivity of other varieties was 63.06 tonnes per hectare.

On large farms productivity of CO62175 was 70 tonnes and the productivity of other varieties was 67.87 tonnes. On combined farms, productivity of CO62175 was 69.15 tonnes per hectare as against a productivity of 66.74 tonnes in the case of other varieties.

The results showed that on both small and large farms productivity of CO62175 variety was higher than the productivity of 'other varieties'.

5.2.2.2 Jaggery productivity: On all jaggery producing farms in the study area the variety prevalent was CO62175. The reasons for this as expressed by farmers were

(1) Jaggery recovery rate was higher for this variety, compared to other varieties.

(2) Suitability of the variety in the area.

(3) Higher productivity of the variety in terms of cane.

TABLE - 5.6 Productivity of sample farms

Farms	Sugarcane (tonnes/hectare)	Jaggery (Quintals/hectare)
Small farms	64.00	87.49
Large farms	68.59	84.78
Combined farms	67.54	86.00

(4) Suitability of the variety for ratooning.

(5) Ability of the variety to withstand dry spells compared to other varieties.

Results of Jaggery productivity analysis presented in Table 5.6 revealed that on small farms, jaggery productivity was 87.49 quintals per hectare and on large farms it was 84.78 quintals per hectare, there by showing an inverse relationship between farm size and productivity. On combined farms jaggery productivity was 86 quintals per hectare.

Comparison of jaggery productivity with that of sugarcane productivity of CO62175 showed that, though the sugarcane yield was lower on small farms when compared to large farms, productivity of jaggery on the small farms was higher than the productivity of jaggery on large farms. This might have led the small farmers mostly to go in for jaggery production.

5.2.3 Labour utilisation on sample farms:

In several previous studies it had been indicated that sugarcane is a labour intensive crop. Keeping this in view, to evaluate employment potential on the sample farms of the two categories, analysis of labour utilisation on these farms was carried out and the results of the same are presented in Tables 5.7, 5.8 and 5.9.

5.2.3.1 Human labour utilisation: Human labour utilisation on sugarcane supplying farms presented in Table 5.7, revealed that on small farms total labour utilisation was 279.46 mandays per hectare, out of which 45.25 man days were of family labour accounting for 16.19 percent of total labour

TABLE - 5.7 Human labour utilisation on sugarcane supplying farms

(Mandays/hectare)

	Operation	Small farms			Large farms			Combined farms		
		Owned	Hired	Total	Owned	Hired	Total	Owned	Hired	Total
(1)	Land preparation	0.33	11.89	12.22 (4.37)	-	13.14	13.14 (3.91)	0.08	12.85	12.93 (4.00)
(2)	Manuring	0.11	3.11	3.22 (1.15)	0.06	8.62	8.68 (2.58)	0.08	7.36	7.44 (2.30)
(3)	Planting	0.11	13.78	13.89 (4.97)	-	20.85	20.85 (6.20)	0.02	19.24	19.26 (5.96)
(4)	Earthing up	-	12.89	12.89 (4.61)	0.30	16.81	17.11 (5.09)	0.23	15.91	16.14 (4.99)
(5)	Fertilizer application	1.22	3.89	5.11 (1.83)	- -	4.05	4.05 (1.21)	0.28	4.01	4.29 (1.33)
(6)	Weeding	-	40.83	40.83 (14.61)	-	39.20	39.20 (11.66)	-	39.57	39.57 (12.25)
(7)	Propping	-	24.49	24.49 (8.76)	-	26.04	26.04 (7.75)	-	25.68	25.68 (7.94)
(8)	Irrigation	43.48	-	43.48 (15.56)	52.84	-	52.84 (15.72)	50.70	-	50.70 (15.69)
(9)	Harvesting and loading	-	123.33	123.33 (44.13)	-	154.14	154.14 (45.87)	-	147.11	147.11 (54.53)
	Total	45.25 (16.19)	234.21 (83.81)	279.46 (100.0)	53.2 (15.83)	282.85 (84.17)	336.05 (100.00)	51.39 (15.900	271.73 (84.10)	323.12 (100.00)

Note: Figures in parentheses indicate percentage to total labour utilisation.

utilisation on these farms. Maximum (123.33 mandays) labour utilised was for harvesting and loading of the sugarcane.

On large farms of category I total labour utilised was 336.05 mandays per hectare, out of this 53.2 mandays was family labour accounting for 15.83 per cent of total labour utilisation. On these farms also maximum (154.14 mandays) labour was used in the operation of harvesting and loading, and was followed by weeding (52.84 mandays).

Table 5.7 showed the existence of a direct relationship between the farm size and human labour utilisation and the results are in confirmity with the findings of Rambabu (1980), Gangadaramma (1982), Ramesh (1988), Rao (1991) and contradictory to the findings of Ramakumar (1985), Jayamma (1988). Further it is evident from the table that the percentage of family labour utilisation to total labour utilisation decreased with an increase in the farm size. It is in accordance with the findings of Verma (1981). On an average the labour utilisation on category I farms was of the order of 323.12 mandays, out of this family labour contribution was 51.39 mandays accounting for 15.9 per cent of total labour.

Per hectare human labour utilisation on category II farms is presented in Table 5.8. On small farms, total humanlabour utilisation was 519.42 mandays, out of this 175.05 mandays accounting for 33.70 per cent of total labour was family labour and 344.37 mandays (66.30%) was of hired labour. On large farms total labour utilised was 481.33 mandays consisting of 101.41 mandays of family labour and 379.92 mandays of hired labour per hectare accounting for 21.07 and 78.93 per cent of the total labour respectively.

TABLE - 5.8 Human labour utilisation on jaggery producing farms

(Man days/hectare)

	Operation	Small farms			Large farms			Combined farms		
		Owned	Hired	Total	Owned	Hired	Total	Owned	Hired	Total
(1)	Land preparation	5.85	8.42	14.27 (2.75)	0.40	10.68	11.08 (2.30)	2.86	9.65	12.51 (2.51)
(2)	Manuring	3.02	7.02	10.04 (1.93)	0.28	15.28	15.56 (3.23)	1.52	11.55	13.07 (2.62)
(3)	Planting	3.23	25.46	28.69 (5.52)	-	25.04	25.04 (5.20)	1.46	25.23	26.69 (5.35)
(4)	Earthing up	5.21	7.87	13.08 (2.52)	3.63	13.63	17.26 (3.59)	4.34	11.03	15.37 (3.08)
(5)	Fertilizer application	2.87	2.83	5.70 (1.10)	0.28	2.86	3.14 (0.65)	1.45	2.85	4.30 (0.86)
(6)	Weeding	-	48.20	48.20 (9.28)		42.35	42.35 (8.80)	-	44.99	44.99 (9.02)
(7)	Propping	-	34.51	34.51 (6.64)	-	27.17	27.17 (5.64)	-	30.48	30.48 (6.11)
(8)	Irrigation	64.71	-	64.71 (12.46)	74.69	-	74.69 (15.52)	70.18	-	70.18 (14.08)
(9)	Harvesting and jaggery preparation	90.16	201.83	291.99 (56.21)	22.13	233.59	255.72 (53.13)	52.84	219.25	272.09 (54.58)
(10)	Loading and unloading of jaggery	-	8.23	8.23	-	9.32	9.32 (1.94)	-	8.83	8.83 (1.77)
	Total	175.05 (33.70)	344.37 (66.30)	519.42 (100.00)	101.41 (21.07)	379.92 (78.93)	481.33 ((100.00)	134.65 (27.01)	363.86 (72.90)	498.51 (100.00)

Note: Figures in parentheses indicate percentage to total labour utilisation.

Thus on the farms of category II an inverse relationship between the farmsize and human labour utilisation was observed. However, on these farms also, like category I farms, percentage of family labour to total labour utilisation decreased with the increase in farm size. The results are in accordance with the findings of Verma (1981).

The lower total labour utilisation on large farms of category II compared to small farms of same category, might be due to the operation of scale economy. Further higher labour utilisation on small farms might be also due to higher productivity on these farms leading to the requirement of more number of days in crushing compared to large farms which is evident from Table 5.6.

On the average total labour utilisation on the jaggery producing farms was of the order of 498.51 mandays. Maximum labour (272.09 mandays) was utilised in the operation of harvesting and Jaggery preparation followed by irrigation (70.18 mandays).

A comparison between the two categories of farms revealed that on an average total labour utilisation was higher on category II farms (498.51 mandays). The same trend was observed on both size group of farms in the two categories. In addition to this, it is evident from the table that percentage of family labour to the total labour was higher on category II farms. This might be due to the reason, that on category II farms both harvesting and jaggery making operations were spread over a number of days employing more family labour compared to harvesting of cane on category I farms. On farms of category I mostly harvesting was done by contract

labour. Another reason was more family labour utilisation in irrigation on category II farms due to longer duration of the crop as all the sample respondents had grown only CO62175, which is a longer duration crop in nature when compared to 'other varieties' in the study.

A comparison of category I and category II farms revealed that jaggery making enterprise is more labour intensive compared to sugarcane production and was also providing employment for more family labour.

5.2.3.2 Cattle labour utilisation on sample farms: Cattle labour was mostly used in land preparation and earthing up operation in sugarcane cultivation. Here a comparison was made between category I farms and category II farms with regard to cattle labour utilisation in cane cultivation only but not in transportation of cane or jaggery. The results of the analysis are presented in Table 5.9.

Cattle labour utilisation was directly related with the farmsize on category I farms. It was 8.67 cattle pair days per hectare on small farms and 8.74 cattle pair days per hectare on large farms. The results are contradictory to the findings of Rambabu (1980), Ramakumar (1985)

On category II farms, cattle labour utilisation was inversely related with the farm size, it being highest on small farms (7.91 cattle pair days) compared to large farms (6.42 cattle pair days).

On an average cattle labour utilisation was higher on category I farms (8.72 cattle pair days) compared to category II farms (7.09 cattle pair days).

TABLE -5.9 Cattle and tractor power utilisation per hectare on sample farms

	Category I			Category II		
	Small farms	Large farms	Combined farms	Small farms	Large farms	Combined farms
Cattle power (Cattle pair days per hectare)	8.67	8.74	8.72	7.91	6.42	7.09
Tractor power (hrs/hect)	6.89	9.01	8.53	9.68	8.11	8.82

However among small farms, category II small farms used lower cattle labour (7.91 cattle pair days) compared to small farms of category I (8.67 cattle pair days). Among large farms, large farms of category I used more cattle labour (8.74) than large farms of category II (6.42).

5.2.3.3 Tractor Power Utilisation: Here also analysis was made with regard to tractor power utilisation only in crop cultivation but not in transportation. Results of the analysis are presented in Table 5.9.

On category I farms, tractor power utilisation was directly related with the farmsize, with more number of hours on large farms (9.01 hours) compared to 6.89 hours per hectare on small farms. On combined farms of this category, the average tractor power utilisation was 8.53 hours per hectare. The results are in accordance with the findings of Rao (1991).

On category II farms, Tractor power utilisation was inversely related with the farmsize with more number of hours (9.68 hours per hectare) on small farms, and 8.11 hours per hectare on large farms. On an average tractor power utilisation was 8.82 hours per hectare on combined farms.

Among small farms, small farms of category II utilised more number of tractor hours (9.68 hours per hectare) when compared to small farms of category I (6.89 hours per hectare). In the case of large farms, large farms of category I used more number of tractor hours compared to large farms of category II.

On an average, tractor power utilisation was higher (8.82 hours per hectare) on category II farms compared to category I farms (8.53 hours per hectare).

A further critical view into the Table 5.9 revealed that small farms of category I used more cattle labour and lower tractor power when compared to small farms of category II. In the case of large farms, category I farms used more cattle labour and more number of tractor hours compared to category II farms. On an average, category I farms utilised higher cattle labour and lower tractor power compared to category II farms.

5.2.4 Cost of production

5.2.4.1 Production costs are broadly classified into two viz. variable costs and fixed costs. Variable costs are also known as operational costs. The details of operational costs on the two category farms is presented in Table 5.10 (A) and 5.10 (B).

On category I farms, operational costs was directly related with farm size as evident from Table 5.10 (A). It was higher (Rs.18559.39 per hectare) on large farms compared to Rs.16004.17 on small farms. On both size group farms, cost of planting was the major cost, followed by harvesting. On an average planting cost accounted for 22.89 per cent of total operational cost, harvesting cost accounted for 16.37 per cent and transporting cost accounted for 13.8 per cent.

On categroy II farms, operational cost was inversely related with farm size and it was Rs.24027.4 on small farms and Rs.23011.61 on large farms.

TABLE - 5.10 (A) Operation wise cost of production of sugarcane on sugarcane supplying farms.

(Rupees per hectare)

operations	Small farms	Large farms	Combined farms
Land preparation	1306.67 (8.17)	1410.20 (7.60)	1386.55 (7.71)
Manuring	403.33 (2.52)	643.75 (3.47)	588.83 (3.28)
Planting	4344.44 (27.15)	4045.72 (21.80)	4113.96 (22.89)
Earthing up	577.78 (3.61)	796.05 (4.29)	746.19 (4.15)
Fertilizer application	1102.22 (6.89)	2118.42 (11.41)	1886.29 (10.49)
Weeding	816.67 (5.10)	784.05 (4.22)	791.49 (4.40)
Propping	489.72 (3.06)	520.72 (2.81)	513.64 (2.85)
Irrigation	1040.11 (6.50)	1197.78 (6.45)	1161.76 (6.46)
Harvesting	2466.67 (15.41)	3082.89 (16.61)	2942.13 (16.37)
Transporting	2282.22 (14.26)	2540.16 (13.69)	2481.24 (13.80)
Miscellaneous	16.66 (0.10)	13.32 (0.07)	14.09 (0.08)
Interest on variable cost	1157.67 (7.23)	1406.33 (7.58)	1349.53 (.7.51)
Total	16004.17 (100.00)	18559.39 (100.00)	17975.70 (100.00)

Note: Figures in parentheses indicate percentage to total

TABLE - 5.10 (B) Operation wise cost of production of jaggery on jaggery producing farms.

(Rupees per hectare)

operations	Small farms	Large farms	Combined farms
Land preparation	1589.02 (6.61)	1256.68 (5.46)	1406.67 (5.99)
Manuring	1097.48 (4.57)	1272.67 (5.53)	1193.60 (5.09)
Planting	3181.49 (13.24)	3739.91 (16.25)	3487.87 (14.86)
Earthing up	559.12 (2.33)	636.02 (2.76)	601.31 (2.56)
Fertilizer application	1883.12 (7.84)	1912.66 (8.31)	1899.32 (8.09)
Weeding	964.02 (4.01)	847.05 (3.68)	899.84 (3.83)
Propping	690.12 (2.87)	543.32 (2.36)	609.58 (2.60)
Irrigation	1521.30 (6.33)	1619.65 (7.04)	1575.26 (6.71)
Harvesting and jaggery making	9841.72 (40.96)	8606.99 (37.40)	9164.27 (39.05)
Transporting	627.64 (2.61)	563.04 (2.45)	592.20 (2.52)
Loading and unloading	164.56 (0.68)	186.46 (0.81)	176.57 (0.75)
Miscellaneous	-	-	-
Interest on variable cost	1907.81 (7.94)	1827.16 (7.94)	1863.56 (7.94)
Total	24027.4 (100.00)	23011.61 (100.00)	23470.05 (100.00)

Note: Figures in parentheses indicate percentage to total.

On all size group farms of this category jaggery making expenses together with harvesting expenses was the major operational cost followed by planting cost. On an average harvesting and jaggery making expenses accounted for 39.05 per cent of total operational cost, planting cost accounted for 14.86 per cent of operational cost.

A perusal of Table 5.10 (A) and 5.10 (B) reveal that in the case of category I farms, cost of planting was the major operational cost whereas in the case of category II farms, cost of operation of harvesting and jaggery making was the major cost. In the case of category I farms, harvesting cost was the second major operational cost against planting cost in the category II farms.

Additional operational cost on the farms of category II over category I ranged from Rs.8023.23 per hectare on small farms to Rs.4452.22 on large farms. This higher additional operational cost in case of large farms compared to small farms was a consequence of direct relation between farm size and operational cost in category I farms and inverse relation on category II farms.

5.2.4.2 Cost of production of sugarcane: Results of analysis of cost of production of sugarcane per hectare on category I farms presented in Table 5.11 (A) revealed that it is directly related with the farm size. On combined farms the cost of production amounted to Rs.26597.64 per hectare, out of which Rs.17975.71 was variable cost and Rs.8621.93 was fixed cost constituting 67.58 per cent and 32.42 per cent of the total cost respectively. Cost of human labour was the major variable cost (Rs.6469.17) constituting

TABLE-5.11(A) Cost of production of sugarcane on sugarcane supplying farms.

(Rupees per hectare)

	Small farms	Large farms	Combined farms
A. Variable cost			
Tractor power	688.89 (2.79)	901.32 (3.32)	852.79 (3.21)
Cattle power	693.33 (2.81)	698.68 (2.57)	697.46 (2.62)
Human labour	5589.33 (22.64)	6729.65 (24.78)	6469.17 (24.32)
Seed	4066.67 (16.47)	3628.62 (13.36)	3728.68 (14.02)
FYM	338.89 (1.37)	470.07 (1.73)	440.10 (1.65)
Fertilizers	1000.00 (4.05)	2030.26 (7.47)	1794.92 (6.75)
Electricity	170.50 (0.69)	140.99 (0.52)	147.73 (0.56)
Transporting	2282.22 (9.24)	2540.17 (9.35)	2481.24 (9.33)
Miscellaneous	16.67 (0.07)	13.32 (0.05)	14.09 (0.05)
Interest on variable cost	1157.67 (4.69)	1406.33 (5.18)	1349.53 (5.07)
Total variable cost	16004.16 (64.82)	18559.41 (68.33)	17975.71 (67.58)
B. Fixed cost			
Rental value of owned land	7000.00 (28.35)	7000.00 (25.77)	7000.00 (26.32)
Depreciation	751.91 (3.05)	534.91 (1.97)	584.48 (2.20)
Land revenue	40.11 (0.16)	36.11 (0.13)	37.02 (0.14)
Interest on fixed capital	893.85 (3.62)	1031.98 (3.80)	1000.43 (3.76)
Total fixed cost	8685.87 (35.18)	8603.00 (31.67)	8621.93 (32.42)
Total costs (A+B)	24690.03 (100.00)	27162.38 (100.00)	26597.64 (100.00)

Note: Figues in parentheses indicate percentage to total cost.

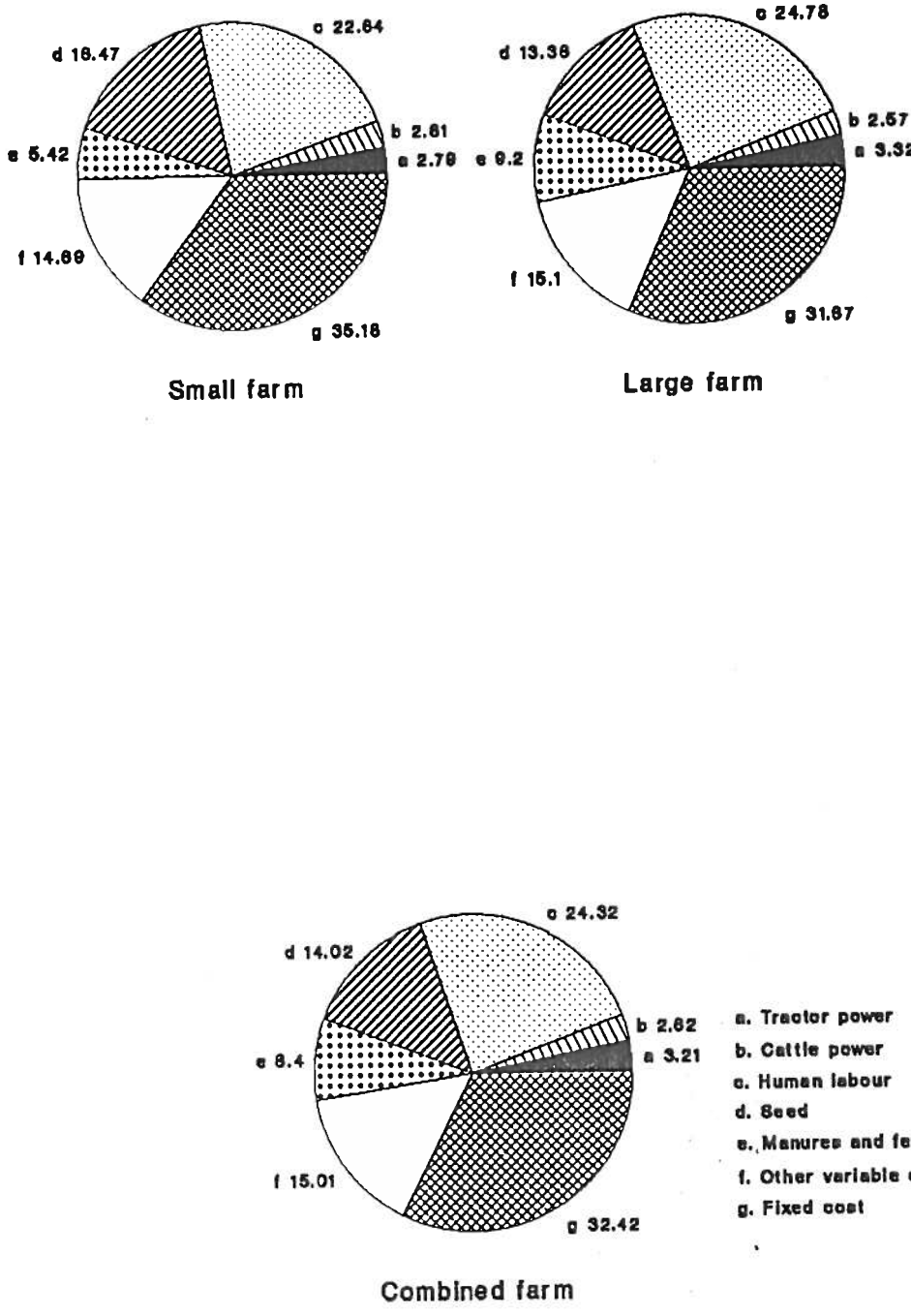


Fig.1: Component wise cost of production on sugarcane supplying farms (percentage)

24.32 per cent of the total cost of production, followed by seed cost (Rs.3728.68) and transporting cost (Rs.2481.24). Among fixed costs, Rental value of owned land (Rs7000) was the major cost, accounting for 26.32 per cent of the total cost of production followed by interest on fixed capital (Rs.1000.43).

Between size groups, on large farms, cost of production was Rs.27162.38 per hectare out of which variable cost was Rs.18559.41 (68.33%) and fixed cost was Rs.8603 (31.67%). On small farms, variable cost was Rs.16004.16 per hectare and fixed cost Rs.8685.87, thus making the total cost of production to Rs.24690.03. On both sizes of farms human, labour cost was the major variable cost component amounting to Rs.6729.65 on large farms and Rs.5589.33 on small farms. Seed cost was the next major variable cost amounting to Rs.4066.67 on large farms and Rs.3628.62 on small farms accounting for 13.37 per cent and 16.47 per cent of the total cost of production per hectare on respective farms. Among fixed costs rental value of land was the major cost in both size groups amounting to Rs.7000 per hectare.

The results revealed that on these two size group farms variable costs varied considerably when compared to fixed costs. Variation in cost of tractor power, cattle power, and human labour was in accordance with the variation in the levels of use of these resources.

Variation in seed cost might be due to the differential acreage composition under two varieties of cane, on the two size groups of farms. (Proportion of acreage under CO62175 and other varieties varied on two size

group farms). Difference in electricity charges might also be due to the same reason. A difference of Rs.1000.26 in fertilizer cost might be due to difference in quantum of fertilizers used.

The results of the present study are in accordance with the findings of Jayamma (1988) and Rao (1991).

5.2.4.3 Cost of production of jaggery:

In Table 5.11 (B) cost of production of jaggery on different size farms is presented. On combined farms, cost of production per hectare was Rs.32227.16, out of which variable cost was Rs.23470.05 accounting for 72.83 per cent of total cost of production. Among variable costs, human labour cost was the major cost component (Rs.9970.51) followed by seed cost (Rs.2954.17 per hectare).

Cost of production of Jaggery was inversely related with the farm size. On large farms, cost of production per hectare was Rs.31752.8 out of which Rs.23011.60 was variable costs. On small farms, cost of production was Rs.32803.88 out of which Rs.24027.40 accounted by variable cost. Between large farms and small farms, variation in total tractor power cost, total cattle power cost and human labour cost is due to the variation in the levels of use of these resources. Among fixed costs on both sizes of farms rental value of land was the major cost (R.7000) followed by interest on fixed capital.

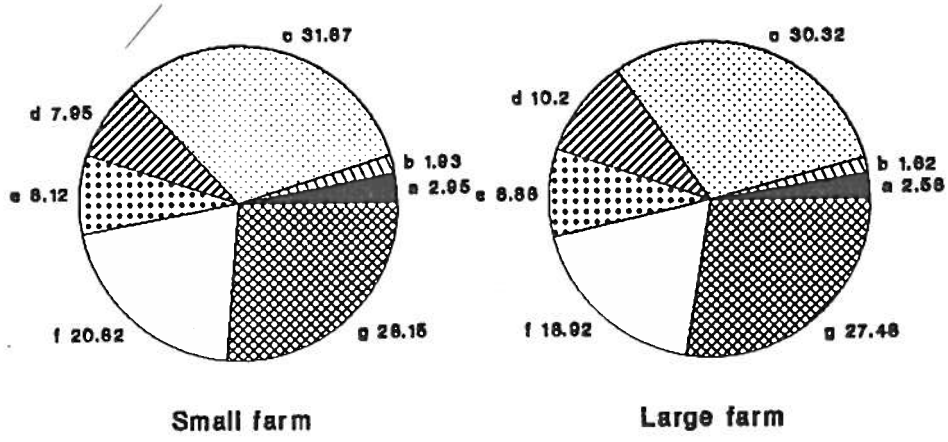
The comparison between the two categories of farms (Table 5.12) reveal that on the category I farms on an average, total cost of production

TABLE - 9.11 (B) Cost of production of jaggery on jaggery producing farms

(Rupees per hectare)

	Small farms	Large farms	Combined farms
A. Variable cost			
Tractor power	968.36 (2.95)	811.33 (2.56)	882.21 (2.74)
Cattle power	632.74 (1.93)	514.28 (1.62)	567.75 (1.76)
Human labour	10388.30 (31.67)	9626.82 (30.32)	9970.51 (30.94)
Seed	2607.78 (7.95)	3239.13 (10.20)	2954.17 (9.17)
FYM	896.63 (2.73)	961.49 (3.03)	932.21 (2.89)
Fertilizers	1769.11 (5.39)	1849.92 (5.83)	1813.44 (5.63)
Electricity	913.85 (2.79)	666.86 (2.10)	778.34 (2.42)
Rent for crusher	2570.03 (7.83)	2364.93 (7.45)	2457.49 (7.62)
Clarificants	745.15 (2.27)	586.64 (1.85)	658.18 (2.04)
Transporting	627.64 (1.91)	563.04 (1.77)	592.20 (1.84)
Interest on variable cost	1907.81 (5.82)	1827.16 (5.75)	1863.55 (5.78)
Total variable cost	24027.40 (73.25)	23011.60 (72.47)	23470.05 (72.83)
B. Fixed cost:			
Rental value of owned land	7000.00 (21.34)	7000.00 (22.05)	7000.00 (21.72)
Depreciation	815.20 (2.49)	678.71 (2.14)	740.31 (2.30)
Land revenue	36.28 (0.11)	36.80 (0.11)	36.56 (0.11)
Interest on fixed capital	925.00 (2.82)	1025.68 (3.23)	980.24 (3.04)
Total fixed costs	8776.48 (26.15)	8741.19 (27.52)	8757.11 (27.17)
Total costs	32803.88 (100.00)	31752.8 (100.00)	32227.16 (100.00)

Note: Figures in parentheses indicate percentage to total costs.



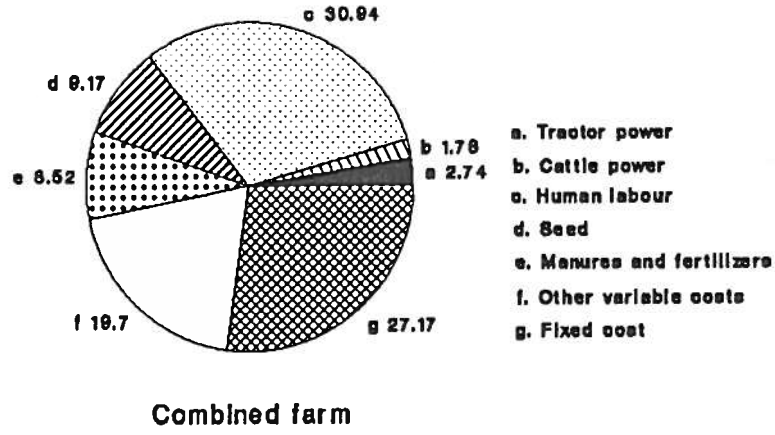


Fig.2: Component wise cost of production on jaggery making farms (percentages)

TABLE - 5.12 Distribution pattern of costs on sample farms

(Rupees per hectare)

		Category I			Category II		
		Small farms	Large farms	Combined fams	Small farms	Large farms	Combined farms
(1)	Total variable cost	16004.16 (64.82)	18559.41 (68.33)	17975.71 (67.58)	24027.40 (73.25)	23011.60 (72.47)	23470.05 (72.83)
(2)	Total fixed cost	8685.87 (35.18)	8603.00 (31.67)	8621.41 (32.42)	8776.48 (26.75)	8741.20 (27.53)	8757.11 (27.17)
(3)	Total cost	24690.03 (100.00)	27162.41 (100.00)	26597.64 (100.00)	32803.88 (100.00)	31752.80 (100.00)	32227.16 (100.00)

Note: Figures in parentheses indicate percentage to total costs.

was Rs.26597.64 as against Rs.32227.16 on category II farms which is nearly 1.21 times more than that of the farms supplying cane to sugarfactory. On category I farms the variable cost was Rs.17975.71 accounting for 67.58 per cent of cost of production as against Rs.23470.05 on category II farms which accounted for 72.83 per cent of the total cost of production. Fixed costs accounted for 32.42 per cent of the cost of production on category II farms it accounted for 27.17 per cent of total cost of production (Figures 1 and 2).

The variation in the cost of production between category I and category II farms might be due to the higher human labour cost in category II farms jaggery as preparation involves additional process involving more human labour when compared to harvesting and transporting of cane directly to the sugar factory. Further seed costs also varied from category I farms (Rs.3728.68) to category II farms (Rs.2954.17). It was 1.26 times more on category I farms when compared to category II farms. On category I, farms growing different varieties of cane with differential price might be one of the reasons for the highest seed cost. Another reason is that in the case of category I farms, seed was mostly purchased from factory in terms of tonnes. Later in preparing sets for planting certain wastage was involved necessiating purchase of additional quantity of seed than actually required, lack of knowledge on the part of farmers regarding recommended seed rate might have led to the additional cost. Unlike this, category II, farms used to grow only CO62175 variety of which the seed material was readily available locally in the form of sets, ready for planting by which the losses are minimised. The overall effect of these factor might have resulted in higher cost of seed on category I farms.

Electricity charges were higher on category II farms as compared to category I farms. This was due to the additional electricity charges on jaggery farms for the operation of sugarcane crushers for cane crushing.

Transportation costs were higher on the farms of category I because of larger volume of produce as cane was directly transported to the factory when compared to category II farms. In accordance with variations in variable costs on the two categories of farms, interest on variable costs also varied.

Among fixed cost components, depreciation was higher in the case of category II farms on the whole, than on the category I farms which was due to the additional machinery i.e. cane crusher, pans etc owned on these farms.

On the whole the analysis of cost of production showed existance of direct relationship with the farm size on category I farms, where as an indirect relationship existed on category II farms. The contrasting behaviour of cost of production on the two categories farms further led to higher additional cost (Rs.8113.85) on small farms of category II over category I and an additional cost of Rs.4590.42 on large farms of category II over category I farms.

5.2.5 Costs and Returns of sample farms:

The Results of analysis of costs and returns on sample farms are presented in Table 5.13 and illustrated in Figues 3. and 4.

TABLE - 5.13 Costs and returns on sugarcane supplying and jaggery producing farms

(Rupees per hectare)

	Category I			Category II		
	Small farms	Large farms	Combined fams	Small farms	Large farms	Combined farms
Total costs	24690.02	27162.38	26597.64	32803.89	31752.79	32227.16
Gross returns	26680.00	28425.99	28028.55	34475.99	35797.36	35200.98
Net returns	1995.98	1263.61	1430.91	1672.10	4044.57	2973.82

As presented in Table 5.11 (A) and 5.13, on the category I farms, cost of production was directly related with the farm size, and on category II farms total cost of production was inversely related with the farm size.

5.2.5.1 Gross returns:

Gross returns on small farms of category I amounted to Rs.26686 per hectare and on large farms it amounted to Rs.28425.99 per hectare indicating a direct relationship between the farm size and gross returns. The results are in accordance with the findings of Balasubramanyam (1986), Jayamma (1988) and Rao (1991). The higher gross returns on large farms might be due to higher productivity on these farms compared to small farms as indicated in Table 5.6.

Incategory II farms, small farms obtained a gross returns of Rs.34475.99 per hectare and large farms obtained Rs.35797.36, indicating a direct relationship between farm size and gross returns. Inspite of lower productivity, on large farms, gross returns was higher compared to small farms. This might be due to the difference in price which is due to difference in quality of jaggery produced on large farms and small farms, difference in price received as the large farmers generally dispose their jaggery when the prices are high against the small farmers who due to pressing needs compelling them dispose it immediately after the jaggery preparation.

A comparison between category I and category II farms showed that on an average gross income was higher on farmsof category II (Rs.35200.98)

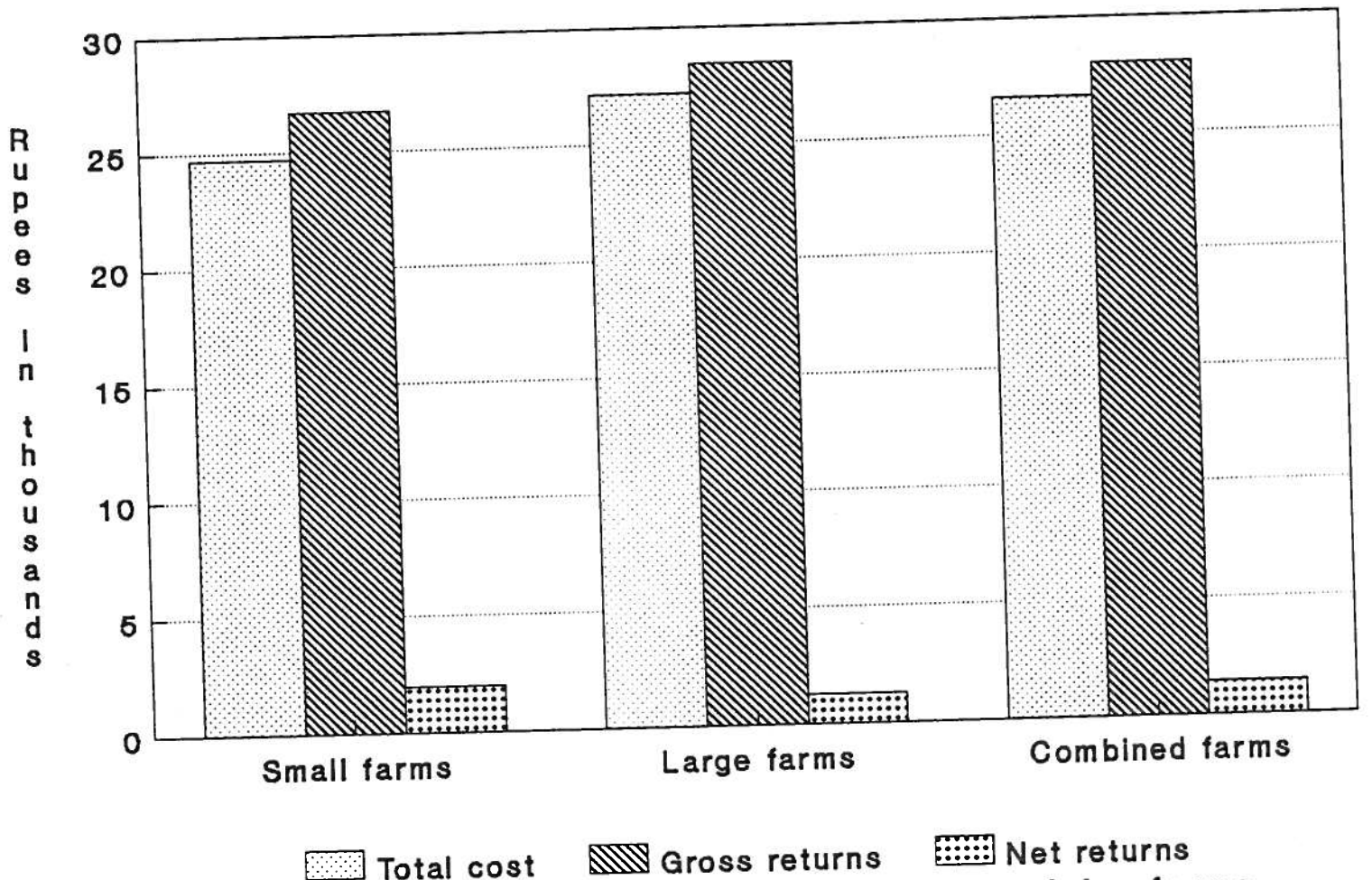


Fig.3: Costs and Returns on sugarcane supplying farms (Rupees per hectare)

as against Rs.28028.55 per hectare on category I farms. The same trend was observed on small farms and large farms also.

5.2.5.2 Netreturns: On category I farms, large farms were with lower net returns (Rs.1263.61 per hectare) compared to small farms (Rs.1995.98) indicating an inverse relationship between the farm size and net returns. The results are in confirmity with the findings of Jagdishlal (1980) and contradictory to the findings of Ramesh (1988), and Rao (1991). The trend might be due to the following reasons. On small farms of category I, 68.89 per cent of acreage was under 'other varieties' which received higher price compared to CO62175 variety. However, on large farms the area under this 'othervarieties' was only 66.45 percent of the total acreage. This resulted that in the case of large farms out of the total cane produced, only 65.75 per cent cane belonged to other varieties fetching higher price, where as on small farms 67.88 per cent of cane fetched higher price. Further lower cost of production on the small farms acted in a complementary way to the above explained fact, leading to higher net returns on these farms.

On category II farms, small farms were with lower netreturns of Rs.1672.10 per hectare and large farms were with higher netreturns of Rs.4044.57 per hectare, showing a direct relationship between farmsize and net returns. This is the net result of (1) direct relationship between farm size and gross income (2) inverse relationship between farm size and total cost of production, and 3) inverse relationship between farm size and productivity of jaggery.

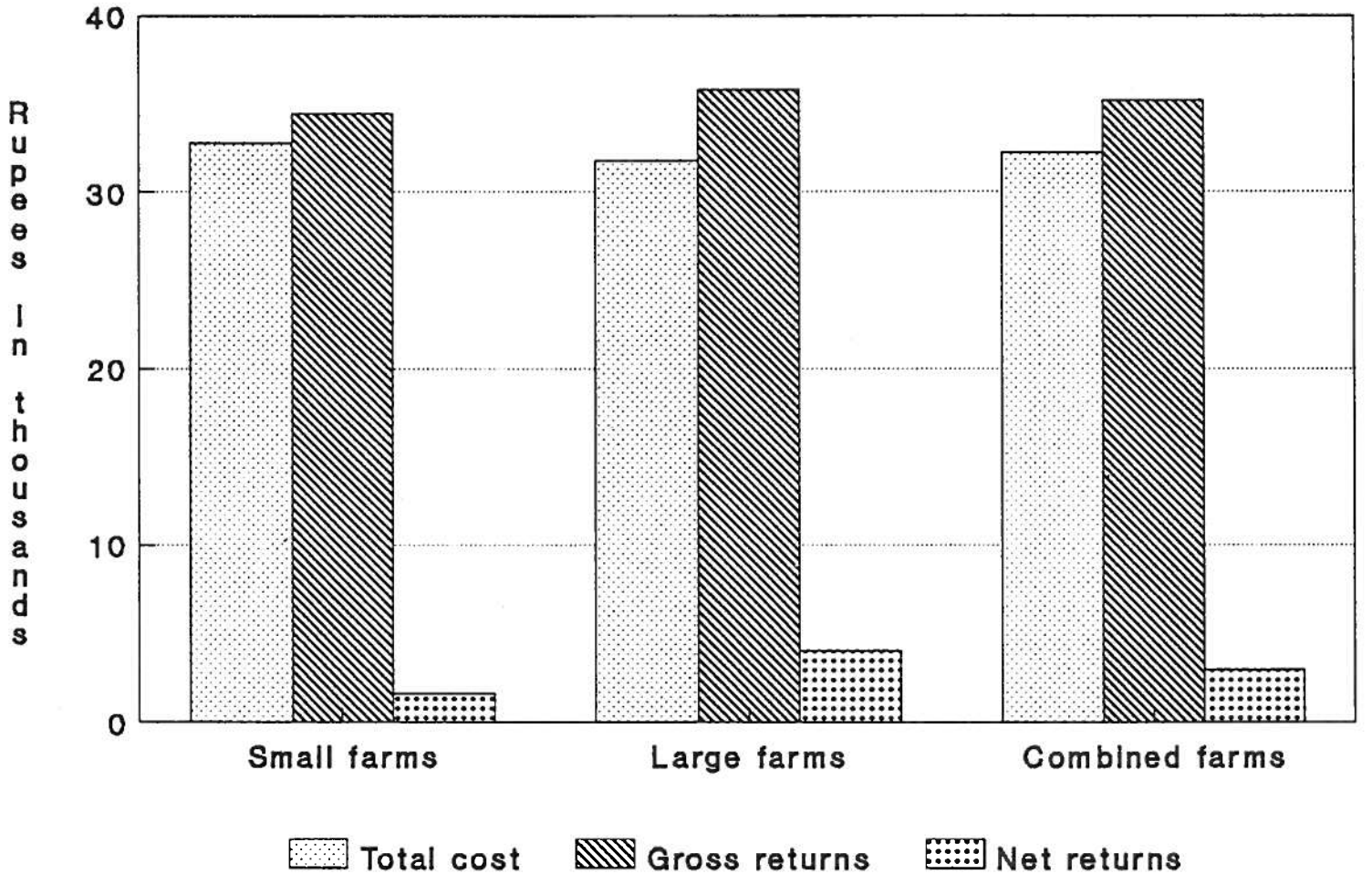


Fig.4: Costs and Returns on jaggery producing farms (Rupees per hectare)

A comparison between the two categories of farms showed that, small farms of category II were with lower net returns (Rs.1672 per hectare) compared to category I small farms (Rs.1995.98 per hectare). This was mainly due to varietal difference on these farms which inturn might led to higher cane price realisation on category I farms compared to lower Jaggery price on category II farms. Lower cost of production on category I farms might also led to higher net returns on these farms.

In the case of large farms, category II farms were with higher net returns (Rs.4044.57 per hectare) compared to category I farms (Rs.1263.61 per hectare). On an ,average combined farms of category II were with higher net returns (Rs.2973.82) compared to category I farms (Rs.1430.91). The trend might be due to higher price realisation per unit on these farms, This analysis is based on the minimum rate recovery of jaggery that is one tonne cane equals to one quintal jaggery. However, jaggery recovery in the study area is between 10.7 to 13 per cent as against a minimum 10 per cent recovery.

To probe further into the facts varietal-wise cost of production of sugarcane, costs and returns per unit of output were worked out and discussed.

Results of analysis of variety wise cost of production of sugarcane and returns on the sugarcane supplying farms are presented in Table 5.14. It is evident from the table that the net returns were higher on farms under CO62175, though the price realised by this variety was lower compared to other varieties. This might be due to higher productivity of this variety as

TABLE - 5.14 Variety wise cost of production of sugarcane and returns on sugarcane supplying farms

(Rupees per hectare)

	CO62175			Other varieties		
	Total cost	Gross returns	Net returns	Total cost	Gross returns	Net returns
Small farms	23348.83	26428.57	3079.74	25295.76	26802.42	1506.66
Large farms	26040.89	28000.00	1959.11	27728.68	28845.29	1116.61
Combined farms	25461.06	27661.54	2200.48	27157.31	28365.53	1208.22

indicated in Table 5.5 and the lower cost of production of this variety (Table 5.14).

Results of analysis of cost of production per unit of output and returns is presented in Table 5.15. From this table it is evident that in case of small farms of category I farms cost of production per tonne was lower (Rs.385.78) compared to large farms (Rs.396.01). This together with higher price realised on these small farms (Rs.416.97 per tonne) resulted in higher net returns (Rs.31.19) per tonne on these farms compared to large farms which realised a lower price (Rs.414.43 per tonne) and higher cost of production per tonne (Rs.396.01). Hence net returns were lower (Rs.18.42 per tonne) on these farms.

On category II farms cost of production per quintal was almost the same on the two size groups. This is due to, higher total cost of production on small farms (Rs.32803.89 per hectare) together with higher productivity (87.49 quintals per hectare) and on large farms lower total cost of production (Rs.31752.79 per hectare) with lower productivity (84.78 quintals per hectare).

Gross returns per quintal of jaggery was lower on small farms (Rs.394.04) compared to Rs.422.24 per quintal on large farms. This might be due to differences in quality of jaggery and time of sale etc.

Cost per unit remaining almost same on both small and large farms of category II, higher gross returns on large farms resulted in higher net returns (47.71) per quintal of jaggery on these farms.

TABLE - 5.15 Cost and returns per unit of output on sample farms

(Rupees per hectare)

Farms	Category I			Category II			Additional net returns due to jaggery production over cane supply (Rs)
	Cost/ tonne (Rs)	Gross returns per tonne (Rs)	Net returns per tonne (Rs)	Cost per Quintal (Rs)	Gross returns per quintal (Rs)	Net returns per quintal (Rs)	
Small farms	385.78	416.97	31.19	374.94	394.04	19.10	-12.09
Large farms	396.01	414.43	18.42	374.53	422.24	47.71	29.29
Combined farms	393.80	414.99	21.19	364.76	409.29	44.53	23.34

Note: The comparison is based on the fact that minimum jaggery recovery rate is 10% i.e. 1 tonne cane equals to 1 quintal jaggery.

Among small farms, small farms of category I were with higher net returns per unit of output (Rs.31.19) indicating that supplying cane to the factory was profitable on these farms, because of higher price realisation.

Among large farms, category II farms realised higher net returns per unit of output (Rs.47.71 per quintal) revealing profitability of jaggery making on these farms because of higher gross income per unit of output (Rs.422.24 per quintal) compared to the cane supplied to the factory.

On an average, net returns per unit of output was higher in category II farms (Rs.44.53) compared to Rs.21.19 per tonne on category I farms. Higher productivity on combined farms of Category II coupled with higher net returns per unit of output, revealed the profitability of jaggery making over cane supply to factory. This was further evident from the analysis of additional net returns due to conversion of one tonne cane into jaggery, presented in Table 5.15, on the basis of minimim 10% jaggery recovery. However, in the study area the recovery rate is ranging between 10.7 to 13 per cent indicating higher profits in jaggery making.

5.2.5.3 Varietal wise cost of production per tonne of sugarcane on category I farms:

The results of analysis of varietal wise costs and returns per tonne of sugarcane is presented in Table 5.16. From the table it is evident that though gross returns per tonne were lower (Rs.400) on farms under CO62175 variety, the net returns per tonne of cane were higher on these farms compared to farms growing other variety of cane, due to the lower cost of production per tonne on the former farms. On an average net returns per

TABLE - 5.16 Variety wise costs and returns of sugarcane on sugarcane supplying farms

(Rupees per tonne)

Farms	CO 62175			Other varieties		
	Costs	Gross returns	Net returns	Costs	Gross returns	Net returns
Small farms	353.39	400.00	46.61	401.14	425	23.86
Large farms	372.01	400.00	27.99	408.55	425	16.45
Combined farms	368.20	400.00	31.80	406.91	425	18.09

tonne of cane of CO62175 variety was Rs.31.80 and the same for other varieties was Rs.18.09 inspite of the price difference of Rs.25 per tonne realized by the farmers growing other varieties, due to the incentive price paid by the factory to 'other varieties'.

5.2.6 Cost concepts on sample farms:

Farm management cost concepts were worked out for both categories of farms and the results presented in Table 5.17. On both the categories of farms, on all size groups cost-A_1 and Cost A_2 were one and the same because no farmer in the sample studied, had leased in land.

On category I farms, cost A_1, was higher on large farms (Rs.19027.77 per hectare) and lower (Rs.15891) on small farms, there by showing a direct relationship between farm size and cost A_1, Cost B also showed a direct relationship with the farm size, with higher value of Rs.27059.75 per hectare on large farms and lower value on small farms (Rs.23784.85 per hectare). Cost C on large farms amounted to Rs.27162.38 and on small farms it was Rs.24690.03 per hectare.

On category II farms also, a direct relationship was observed between farm size and various costs. On large farms cost A_1, amounted to Rs.21764.55, cost B amounted to Rs.29790.23 and cost C amounted to Rs.31752.80 per hectare. On small farms cost A, cost B and Cost C amounted to Rs.21361.26, Rs.29286.26 and Rs.32803.89 respectively. A comparison between the two categories of farms showed that cost A_1/A_2 was higher on category II farms on all size groups indicating higher variable costs

TABLE - 5.17 Cost concepts on the sample farms

(Rupees per hectare)

Cost	Category I			Category II		
	Small farms	Large farms	Combined fams	Small farms	Large farms	Combined farms
Cost A_1	15891.00	19027.77	18311.25	21361.26	21764.55	21582.54
Cost A_2	15891.00	19027.77	18311.25	21361.26	21764.55	21582.54
Cost B	23784.85	27059.75	26311.68	29286.26	29790.23	29562.77
Cost C	24690.03	27162.38	26597.64	32803.89	31752.80	32227.16

on jaggery producing farms. Cost B and cost C were also higher on farms of category II.

Further critical analysis of these costs revealed that the difference between cost C and Cost B, indicating value of family labour was higher on small farms of category I compared to large farms of the same category. Similar trend was observed on category II farms also thereby indicating more family labour utilisation on small farms.

In between the two category farms, category II farms showed higher family labour utilisation by means of higher difference between cost C and cost B, compared to that of category I farms. This is in accordance with the results of analysis of human labour utilisation on the sample farms presented in Tables 5.7 and 5.8.

5.2.7 Farm income measures on sample farms:

The results of analysis of farm income measures are presented in Table 5.18.

On category I farms, gross income was directly related with the farm size as discussed earlier. Farm business income was Rs.10795 per hectare on small farms, and Rs.9398.22 per hectare on large farms. Thus farm business income exhibited an inverse relationship with the farm size. This is the net effect of interaction of direct relationship between farm size and gross income, and direct relationship between farm size and cost A_1/A_2.

TABLE - 5.18 Farm income measures

(Rupees per hectare)

	Category I			Category II		
	Small farms	Large farms	Combined farms	Small farms	Large farms	Combined farms
Gross income	26686.00	28425.99	28028.55	34475.99	35797.36	35200.98
Farm business income	10795.00	9398.22	9717.30	13114.73	14032.81	13618.44
Family labour income	2901.15	1,366.24	1716.87	5189.73	6007.13	5638.21
Net income	1995.98	1263.61	1430.91	1672.10	4044.57	2973.82
Farm investment income	9889.83	9295.59	9431.34	9597.10	12070.25	10954.06
Benefit cost ratio	0.08	0.05	0.05	0.05	0.13	0.09
Returns over variable cost	0.67	0.53	0.56	0.43	0.56	0.50

Family labour income was Rs.2901.15 per hectare on small farms of category I compared to family labour income of Rs.1366.24 per hectare on large farms of the same category thereby showing that family labour income also exhibited an inverse relationship with the farm size on category I farms. Netincome also exhibited an inverse relationship with the farm size.

Farm investment income was Rs.9889.83 per hectare on small farms of category I and it was Rs.9295.59 per hectare on large farms of same category indicating an inverse relationship with the farm size. This is mainly a consequence of inverse relationship of farmsize and net income.

On category II farms, as indicated already, gross income was directly related with the farm size. Farm business income was Rs.13114.73 per hectare on small farms and Rs.14032.81 per hectare on large farms. This indicated a direct relationship between farm business income and farmsize. This is the consequence of direct relationship between farm size and gross income, and direct relationship between farm size and cost A_1. Net income on category II farms, directly related with the farm size (Table 5.13). Farm investment income amounted to Rs.12070.25 per hectare on large farms and Rs.9597.1 per hectare on small farms indicating a direct relationship between farm size and farm investment income.

A critical analysis of results presented in Table 5.18 reveal that except gross income, all other incomes on category I farms were related with farm size inversely and on category II farms they exhibited direct relationship with the farm size.

Among small farms of category I and category II, small farms of category II were with higher gross income of Rs.34475.99 per hectare. Farm business income was also higher on small farms of category II (Rs.13114.73) compared to small farms of category I (Rs.10795) indicating that earnings of a farmer and his family for their capital investment, labour and managerial work were higher on small farms of category II. Family labour income was also higher on category II small farms (Rs. 5189.73) compared to category I (Rs.2901.15). However, net income and farm investment income were higher on small farms of category I (Rs.1995.98 and Rs.9889.83 respectively) compared to small farms of category II (Rs. 1672.10 and Rs.9597.10 respectively). This indicated that returns to fixed capital investment was higher on small farms of category I compared to category II small farms. This higher farm investment income was due to higher net returns (Rs.1995.98) on these farms.

Among large farms, large farms of category II were with higher incomes compared to category I farms. On the whole also, farm business income, a measure of the earnings of a farmer and his family for their capital investment, labour and managerial work was higher on category II farms (Rs. 13618.44 per hectare) compared to category I farms (Rs.9717.30 per hectare). On similar lines farm family income was also higher on category II farms (Rs.5638.21 per hectare) compared to category I farms (Rs.1716.87 per hectare). Further farm investment income, a measure of returns to fixed capital investment on farm, was also higher on category II farms (Rs.10954.06 hectare) compared to category I farms (Rs.9431.34 per hectare).

Returns over variable cost:

Reults of analysis of returns over variable costs is presented in Table 5.18. Ratio of returns over variable cost on category I farm was 0.56, on combined farms, higher on small farms (0.67) and lower farms (0.53) on large farms. On category II farms the ratio was 0.50, on combined farms with lower value on small farms (0.43) and higher value on large farms (0.56).

A perusal of the observations indicated that returns over variable cost was higher on category I small farms compared to category II small farms. However on large farms a reverse trend is observed. But in case of combined farms, ratio of returns over variable cost was higher on category I farms compared to category II farms.

Benefit-cost Ratio:

On category I farms, benefit-cost ratio was higher on small farms (0.08) compared to large farms (00.05). On the average in category I farms benefit-cost ratio was 0.05.

On category II farms, benefit cost ratio was higher on large farms (0.13) compared to small farms (0.05). On an average, on category II farms benefit-cost ratio was 0.09.

Among small farms, farms of category I were with higher benefit-cost ratio of 0.08 compared to category II farms (0.05) indicating profitability of cane supply over jaggery preparation on these farms.

TABLE- 5.19 Additional costs and additional returns on category II farms over category I farms

(Rupees per hectare)

	Small farms	Large farms	Combined farms
Additional cost (Rs/hectare)	8113.86	4590.42	5629.52
Additional gross returns (Rs/hectare)	7789.99	7371.37	7172.43
Additional net returns (Rs/hectare)	-323.87	2780.95	1542.91
Benefit cost ratio	-0.04	0.61	0.27

Among large farms, large farms of category II were with higher benefit-cost ratio of 0.13. The results indicate the profitability of jaggery preparation over cane supply on large farms. Further higher benefit-cost ratio on combined farms of category II (0.09) compared to category I farms (0.05) indicate that on an average, jaggery preparation was profitable over cane supply. The results are in accordance with the findings of Krishnaiah (1981).

Similar results obtained by working out benefit cost ratio, taking into consideration the additional costs and additional returns on category II farms over category I farms, are presented in Table 5.19. From the table it can be seen that benefit cost ratio based on additional cost and additional returns was negative (-0.04) on small farms indicating unprofitable nature of jaggery preparation on these farms. On large farms and combined farms it was positive (0.61 and 0.27 respectively) indicating profitability of jaggery preparation over cane supply on these farms. The trend is due to the reason that, additional costs were higher than additional gross returns on small farms (Rs.8113.86 and Rs.7789.99 per hectare respectively). On large farms and combined farms additional costs were lower than additional returns (Table 5.19).

5.2.8 Break even analysis:

The results of break even analysis on sample farms are presented in Table 5.20. Breakeven output is that output level, at which, there is neither profit nor loss i.e. total costs equals to toal returns.

TABLE - 5.20 Break-even analysis per hectare

	Category	Total fixed cost (Rs)	Total variable cost (Rs)	Variable cost per unit output (Rs)	Total returns (Rs)	Price (Rs)	Break-even output	Average yield	Percentage of BEO to average yield
I.	Cane Suppliers								
(1)	Small farms	8685.87	16004.16	250.07	26686.00	416.97	52.04	64.00	81.31
(2)	Large farms	8603.00	18559.41	270.62	28425.99	414.43	59.82	68.59	87.21
(3)	Combined farms	8621.93	17975.71	266.15	28028.55	414.99	57.93	67.54	85.77
II.	Jaggery producer								
(1)	Small farms	8776.48	24027.40	274.63	34475.99	394.04	73.52	87.49	84.03
(2)	Large farms	8741.19	23001.60	271.43	35797.36	422.24	57.96	84.78	68.36
(3)	Combined farms	8757.11	23470.05	272.90	35200.98	409.29	64.21	86.00	74.66

Note: Output in the case of Category I farms is in tonnes
Output in the case of Category II farms is in quintals.

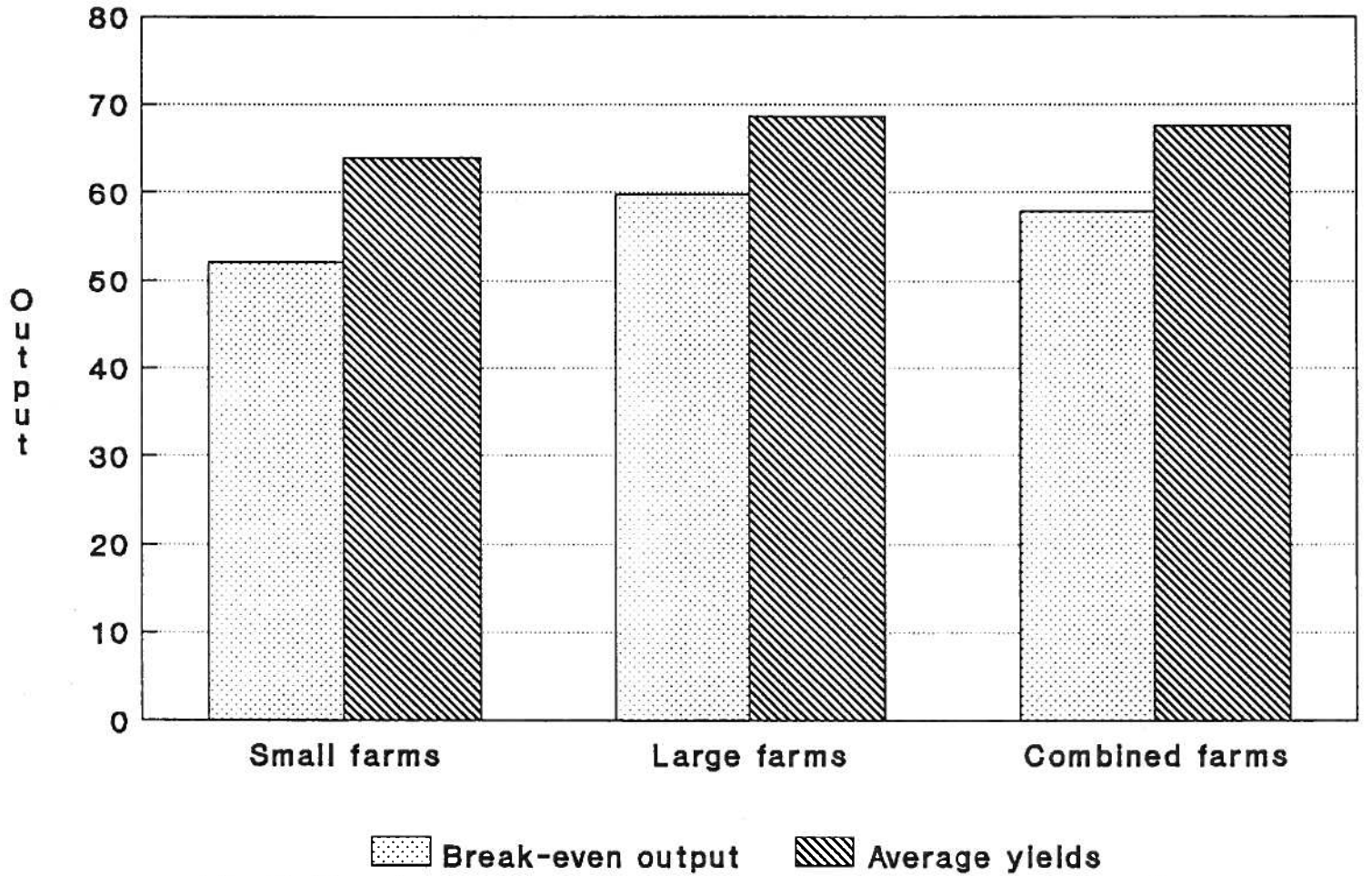


Fig.5: Break-even analysis on sugarcane supplying farms (Tonnes/hectare)

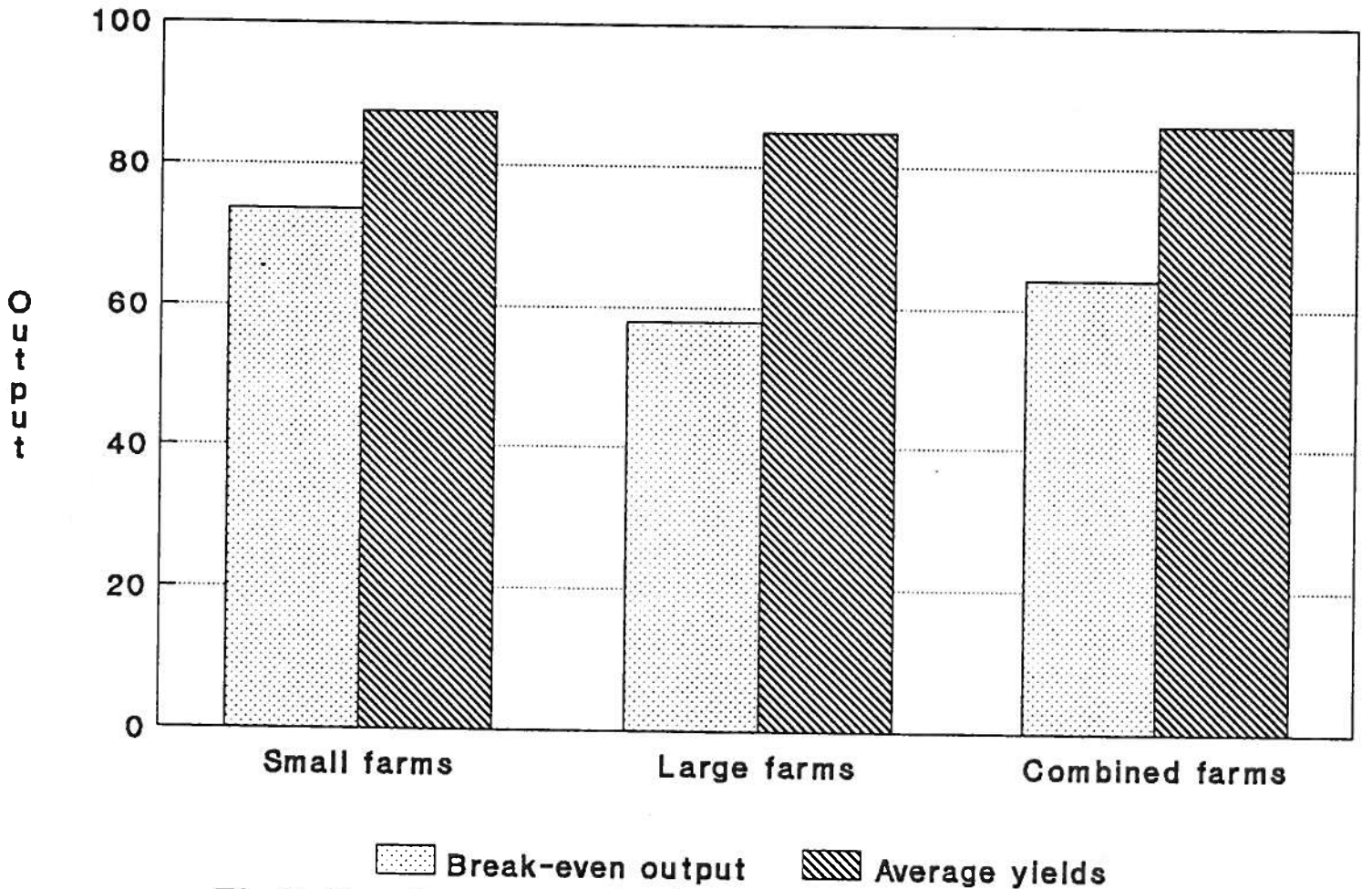


Fig.6: Break-even analysis on jaggery producing farms (Quintals/hectare)

From Table 5.20 it is evident that break-even output on small farms of category I was 52.04 tonnes per hectare against average yields of 64 tonnes indicating that these farms were operating in profit zone and can continue in the business. The small farmers were obtaining nearly 18.69% over and above the break-even output levels and hence are in profit zone.

On large farms of category I break-even output was 59.82 tonnes per hectare while the average yields was 68.59 tonnes per hectare. Thus average yields were nearly 8.77 per cent over and above Break-even output, and indicated that these farms were also operating in profit zone.

Among size groups of category I farms, small farms were operating their farms more safely as the percent of break-even output to actual yields was less (81.31%) compared to 87.21 per cent on large farms. Thus small farms were operating better than large farms of the same category. However, actual profits on both size group farms were lower than expected profits which might be because of increase in variable costs with the increase in production level, at an increasing rate.

On category II farms, small farms were with a Break-even output of 73.5 quintals per hectare, achieved an average yield of 87.49 quintals per hectare and the corresponding figures for large farms were 57.96 quintals and 84.78 quintals per hectare indicating that both size group farms were in the profit zone as they were able to produce above the Break-even output levels. Unlike that of category I farms, in category II farms, large farms were in more saferzone as the per cent of break-even output over average yields on large farms was less (68.36) when compared to small farms (84.03).

However, on these farms also, actual profits were lower than expected, which might be due to increase in variable cost with the increase in production level, at an increasing rate.

On category I farms, Break-even output was directly related with the farm size. On category II farms, Break-even output was inversely related with farm the size. The per cent of Break-even outputy to average yield was lower (74.66 per cent) on combined farms of category II compared to combined farms of category I (85.77) indicating that category II farms were operating in safe zone.

5.2.9 Production function analysis:

In the present study, both multiple linear regression, Cobb-Douglas type production function were used. However, Cobb-Douglas production function was found to be better fit for the sample data on the basis of R^2 value as well as number of variables significant. Hence the results of the analysis obtained by using Cobb-Douglas production function are presented here in Tables 5.21 and 5.22.

5.2.91. Production function analysis on category I farms:

A total of seven independent variables viz, land in acres per farm (X_1), tractor hours used per farm (X_2), bullock labour (X_3) per farm in terms of cattle pair days, human labour per farm (X_4) in terms of manworking days, seed cost per farm (X_5), manures and fertilizer cost per farm (X_6) and other cash expenses (X_7) were included in the analysis. Dependent variable was considered in terms of physical units viz., tonnes per farm.

TABLE - 5.21 Production elasticities on sugarcane supplying farms

	Small farms	Large farms	Combined farms
Intercept	-0.2018	-2.2906	-2.2276
Land (X_1)	0.6405**	0.1255**	0.1701***
	(0.2208)	(0.0671)	(0.0680)
Tractor hours (X_2)	-0.1459	-0.0037	-0.0184
	(.1494)	(0.0804)	(0.0573)
Bullock labour (X_3)	-0.3603**	-0.0010	-0.0839*
	(0.1555)	(0.0634)	(0.0596)
Human labour (X_4)	0.2494	0.1329	0.2846**
	(0.3486)	(0.1417)	(0.1179)
Seed cost (X_5)	0.1353	0.1131*	0.1196*
	(0.2121)	(0.0833)	(0.0712)
Manures and fertilizers (X_6)	-0.0120	-0.0097	-0.01834
	(0.0498)	(0.0838)	(0.0229)
Other cash expenses (X_7)	0.2289	0.6068***	0.5072***
	(0.1840)	(0.1181)	(0.0834)
Sum of elasticity coefficients	0.7359	0.9639	0.9975
R^2	0.827	0.9428	0.9084
R^2 0.654	0.9605	0.8910	

*** Significant at 0.01 level of probability
** Significant at 0.05 level of probability
* Significant at 0.10 level of probability

Note: Figures in parentheses are standard error.

The results presented in the Table 5.21 revealed that on small farms two variables were found to be significant. They were land and bullock labour with elesticity coefficients of 0.6405 and -0.3603 respectively. The elasticity coefficient of a explanatory variable measures the responsiveness of dependent variable in percentage terms, for one percentage increase or decrease in the respective explanatory variable, under ceteris paribus assumption. Elasticity coefficient of land for small farms was 0.6405 which indicates that for one per cent increase in the acreage under sugarcane, keeping other resources at constant level, increase in the yield was 0.64 per cent over its geometric mean level. The positive sign associated with the elasticity coefficient indicates a direct relation between the variable and the dependent variable, on the contrary negative sign indicates inverse relation between the two. Adjusted coefficient of multiple determination ($\bar{R}^2$) in the case of small farms of category I was 0.654 indicating that 65.4 percent of the variation in the yield on small farms was explained by the seven explanatory variables included in the analysis.

On large farms of category I, land, seed costs and other expenses were found to be significant with elasticity coefficients of 0.1255, 0.1131 and 0.6068 respectively. Adjusted coefficient of multiple determination on these farms was 0.9605. On combined farms of category I, the variables found to be significant were land, bullock labour, human labour, seed and other expenses. Adjusted R^2 value for these farms was 0.8910.

5.2.9.2 Production functional analysis on category II farms: On jaggery producer farms also the same seven variables mentioned earlier were included, for analysis. Dependent variable was in quintals per farm. On

TABLE - 5.22 Production elasticities on jaggery producing farms

	Small farms	Large farms	Combined farms
Intercept	-5.2345	-3.1681	-4.6252
Land (X_1)	0.014 (0.2435)	0.4347*** (0.1432)	-0.0115 (0.1560)
Tractor hours (X_2)	0.2201** (0.1122)	-0.4693*** (0.1293)	0.1777** (0.0856)
Bullock labour (X_3)	-0.3283** (0.1651)	0.0210 (0.0877)	-0.2366** (0.1016)
Human labour (X_4)	0.2115 (0.2554)	0.1596 (0.1713)	0.2574* (0.1861)
Seed cost (X_5)	-0.1008 (0.1624)	0.0432 (0.0772)	-0.0633 (0.0982)
Manures and fertilizers (X_6)	-0.0368 (0.1353)	-0.2274*** (0.0659)	-0.0870 (0.0845)
Other cash expenses (X_7)	1.1482*** (0.2161)	1.0311*** (0.1035)	1.0413*** (0.1392)
Sum of elasticity coefficients	1.128	0.9929	0.0632
R^2	0.6766	0.9758	0.8310
R^2	0.6227	0.9658	0.8133

*** Significant at 0.01 level of probability
** Significant at 0.05 level of probability
* Significant at 0.10 level of probability

Note: Figures in parentheses are standard error.

small farms of category II three variables viz., tractor hours, bullock labour, other expenses were found to be significant with elasticity coefficients of -0.2201, -0.3283 and -1.1482 respectively. On large farms land, tractor hours, manures, fertilizers and other cash expenses were found to be significant with elasticity coefficients of 0.4347, -0.4693, -0.2274 and 1.0311 respectively. On combined farms of category II tractor hours, bullock labour, human labour and other expenses were significant with elasticity coefficients value 0.1777, -0.2366, 0.2574 and 1.0413 respectively.

5.2.9.3 Comparision between category I farms and category II farms:

On small farms of category I two variables viz land and bullock labour were significant with elasticity coefficients of 0.6405 and -0.3603 whereas on small farms of category II, variables viz., tractor hours, bullock labour, other expenses were found to be significant with elasticity coefficients of 0.2201, -0.3283 and 1.1482 respectively. The significant variable common to both categories of small farms was bullock labour.

However magnitude difference in elasticity coefficients value indicates that, one percent increase in bullock labour leads to 0.36 percent decrease in yield on category I farms and it leads to 0.33 per cent decrease in yield on category II farms.

On small farms tractor power was significant on jaggery farms only, whereas it was non-significant on category I small farms, with negative coefficient of elasticity. But bullock labour was significant on both categories of farms. This trend might be due to varied combination of cattle labour and tractor power on these farms as is evident from Table 5.9. On

small farms of category I on an average, tractor hours used was 6.89 hr in combination with 8.67 cattle pair days per hectare where as on small farms of category II tractor hours used was 9.68 hr per hectare coupled with 7.91 cattle pair days per hectare.

On large farms of category I significant variables were three viz., land, seed cost and other expenses. On large farms of category II significant variables were land, tractor power, manures and fertilizers and other expenses. Thus significant variables common to both categories of farms were land, and other expenses.

Tractor power was significant with elasticity coefficient of -0.4693 on category II large farms, but was not significant on category I large farms.

Seed costs was significant only on category I farms because it constituted 13.36 per cent of cost of production on category I farm compared to (10.20 per cent) on category II farms. Manures and fertilizers was significant only on category II farms because it constituted 2.89 per cent of cost of production against 1.65 per cent on category I farms.

On combined farms of category I, Land, bullock labour, human labour, seed cost and other expenses were significant. On the other hand on category II farms tractor power, bullock labour, Human labour and other expenses were significant. Thus significant variables common to both farms were bullock labour, human labour and other expenses.

Bullock labour was significant with negative sign on both category of farms, with coefficient value of -0.0839 and -0.2366 for category I and category II farms respectively. Human labour was significant with elasticity coefficient of 0.2846 on category I farms, with elasticity coefficient of 0.2574 on category II farms. Similarly other expenses were significant on both the farms with varied magnitude.

Seed cost was significant on category I farms, but was not significant on category II farms. This was due to the fact that seed cost on category I farms constituted 14.02 per cent of total cost of production [Table 5.11 (A)] whereas it constituted only 9.17 per cent of total cost of production [Table 5.11 (B)] on category II farms.

On category I farms the $\bar{R}^2$ was 0.654, 0.9605 and 0.8910 on small farms, large farms and combined farms respectively. This indicated that percentage of explained variation was higher on large farms. On category II farms $\bar{R}^2$ was 0.6227 on small farms, 0.9658 on large farms and 0.8133 on combined farms. Hence percentage of explained variation was higher on large farms.

On small farms of category I, $\bar{R}^2$ was 0.654 and was 0.6227 on category II farms indicating that explained variation percentage was higher on sugarcane supplying small farms.

On large farms of category I, $\bar{R}^2$ was 0.9605, and on category II farms $\bar{R}^2$ was 0.9658. Hence explained variation was more or less of the same magnitude in both category large farms.

Between combined farms, category I farms were with $\bar{R}^2$ 0.8910 and category II farms were with $\bar{R}^2$ 0.8133. Thus it indicated that explained variation was higher on sugarcane supplying farms indicating controlability was higher on sugarcane supplying farms.

Marginal value product:

As mentioned earlier production function analysis is also useful in deriving marginal value products for evaluating resource use efficiency of a factor by comparing marginal value product (MVP) and marginal factor cost (MFC) of the resource.

In cobb-Douglas production function the elasticity coefficients are helpful in measuring the MVP at geometric mean level. The results of resource use efficiency analysis are presented in Tables 5.23 and 5.24.

On small farms of category I, MVP of land was Rs.6665.68 and MFC was Rs.2800. Resource use efficiency of the land hence worked out to be 2.38. On similar lines resource use efficiency of bullock labour was found to be -16.30.

On large farms resource use efficiency of land, seed cost and other cash expenses were found to be 0.52, 0.95 and 6.49 respectively. On combined farms also resource use efficiency was evaluated. The evaluation showed that serveral resources were being inefficiently used.

On jaggery making farms also the resource use efficiency study was taken up which also showed the existence of several resource use

TABLE - 5.23 Resource use efficiency on sugarcane supplying farms

Factor	Geometric mean	Marginal value product (MVP) (Rs)	Marginal factor cost (MFC) (Rs)	MVP/MVC Ratio
Small farms				
Yield	36.19			
Land (X_1)	1.45	6665.68	2800	2.38
Bullock labour (X_3)	4.17	-1303.83	80	-16.30
Large farms				
Yield	60.51			
Land (X_1)	2.16	1457.02	2800	0.52
Seed cost (X_5)	2996.63	0.95	1	0.95
Other cash expenses (X_7)	2344.28	6.49	1	6.49
Combined farms				
Yield	50.98			
Land (X_1)	1.89	1904.06	2800	0.68
Bullock labour (X_3)	5.44	-326.29	80	-4.08
Human labour (X_4)	443.34	13.58	20	0.68
Seed cost (X_5)	2677.66	0.94	1	0.94
Other cash expenses (X_7)	1959.75	5.47	1	5.47

TABLE - 5.24 Resource use efficiency on jaggery producing farms

Factor	Geometric mean	Marginal value product (MVP) (Rs)	Marginal factor cost (MFC) (Rs)	Resource use efficiency (MVP/MFC)
Small farms				
Yield	41.47			
Tractor hrs (X_2)	4.26	844.29	100	8.44
Bullcok labour (X_3)	3.73	-1438.27	80	-17.98
Other cash expenses (X_7)	169.04	110.10	1	110.10
Large farms				
Yield	93.2			
Land (X_1)	2.849	6004.30	2800	2.14
Tractor hrs (X_2)	8.27	-2233.11	100	-22.33
Manures and fertilizers (X_6)	3070.01	-2.72	1	-2.72
Other cash expenses (X_7)	4761.63	8.52	1	8.52
Combined farms				
Yield	54.32			
Tractor hours (X_2)	5.32	742.62	100	7.42
bullock labour (X_3)	4.67	-1126.39	80	-14.08
human labour (X_4)	316.47	1225.41	20	61.27
Other cash (X_7)	3018.10	7.67	1	7.67

inefficiencies. On small farms tractor power and other cash expenses were underutilised. On large farms, land and other cash expenses revealed a resource efficiency of greater than one there by revealing potentialities for further use of resources. Similar trend was observed with tractor power, human labour and other cash expenses on combined farms.

While comparing category-wise resource use efficiency, resource use efficiency of bullock labour was negative on small farms of both categories.

On large farms of category I resource use efficiency of land was 0.52, whereas on the large farms of category II it was 2.14 revealing that land was relatively efficiently used on category I farms. Resource use efficiency of other cash expenses was relatively more in the case of category I farms, on category II farms high degree of under utilisation was observed. Similarly variations in resource use efficiency on two categories of farms i.e. combined farms was also observed.

5.2.10 COST FUNCTIONS

The general assumption of economic theory is that the total cost function describes a non-linear relationship. Robinson (1933) assumed in general that total cost functions have certain amount of curvature and are not straight lines. The same was also opined by Vinear (1937). The theortical short-run marginal and average cost curves are assumed to decrease first, reach a minimum point and then increase. This gives rise to the traditional 'U' shaped marginal cost and average cost curves. This is the first hypothesis describing the behaviour of the short-run cost curve and spells out the nature and behaviour of cost-output relationship. The

statistical cost function for this is the form of a third degree polynomial i.e. cubic function.

A second hypothesis about the nature of the cost-output relationship was deduced by Davis (1949). It is the case where the total cost curve does not cut the range of marginal cost. In such a case the marginal cost always rises but average cost may first fall and then rise. This form of cost function assumes second degree polynomial i.e. quadratic function.

The third hypothesis depicting the behaviour and nature of the cost-output relation, mainly found in the works of Andrews (1949) is that the average cost tends to fall upto a point and then remain constant over a wide range of output. The marginal cost is simply a horizontal straight line. The total cost function in this case is a linear type.

Assumptions of cost functions:

Cost functions assume constant technology and constant prices of inputs. Changes in these factors lead to shift of the cost curves. Short run cost curves are obtained from the time series data of single farm whose farm size remained constant over the study period. But cross-section data on different farm sizes are used for the estimation of long run cost curves. Under such situation the assumption of constant technology is not necessary because some farms may use advanced methods of production while others use obsolete methods of production. Hence the problem of differences in technology is brushed away.

The longrun cost functions estimated through cross section data are thought to avoid problem of price change, since prices are given at one time. Cost-output relationship analysis in the present study was carried out upto third degree polynomial for both size group farms of each category. Best fit form of cost function for each size group farm was determined by adopting the criteria of number of significant coefficients, value of coefficient of multiple determination (R^2) and expected signs of coefficients. Results of this analysis are presented in Table 5.25.

On small farms of category I, the best fit form of cost function was of linear nature, on large farms of the same category, best fit cost function was quadratic form and on combined farms also quadratic cost function was observed to be the best suited form.

On small farms of category II linear cost function was found to be best fit. On large farms of the same category linear cost function was observed to be the best fit. On combined farms of the category II also linear cost function was found to be the best fit.

A perusal of the Table 5.25 further revealed that linear cost function was found to be best fit on small farms of both category I and category II. However on large farms, quadratic form was found to be the best fit for category I farms, where as linear form was found to be the best fit for category II farms. On combined farms the best fit model was quadratic form on category I farms, and linear form on category II farms.

TABLE - 5.25 Cost functions on the sample farms

(per farm)

	Best fit form	a	b	c	R^2
I. Cane suppliers					
Small farms	Linear	2792.38	313.06***		0.62
			(67.83)		
Large farms	Quadratic	6997.49	191.877***	1.3398***	0.92
			(75.76)	(0.34)	
Combined farms	Quadratic	5637.94	211.34***	1.0765***	0.91
			(56.42)	(0.27)	
II. Jaggery producers					
Small farms	Linear	7730.576	208.33***		0.62
			(23.6179)		
Large farms	Linear	15623.48	231.44***		0.53
			(45.08)		
Combined farms	Linear	6128.59	283.77***		0.72
			(20.72)		

*** 0.01 level of probability
** 0.05 level of probability
* 0.10 level of probability

TABLE - 5.26 Evaluation of optimality of output on sample farms existing level of productivity

	Average productivity	MC (Rs)	MR (Rs)
I. Sugarcane suppliers			
Small farms	64	313.06	416.97
Large farms	68.59	347.44	414.43
Combined farms	67.54	356.08	414.99
II. Jaggery producers			
Small farms	87.49	208.33	394.045
Large farms	84.78	231.44	422.24
Combined farms	86.00	283.77	409.29

Note: Productivity is in tonnes on category I farms and in quintals on category II farms.

By taking best fit form of cost function for each size group (Category wise), marginal cost was computed by differentiation. Later it is compared with marginal revenue (Price per unit output) on the respective size group farms to evaluate the optimality of output on these farms. The results are presented in Table 5.26.

From the Table 5.26 it is evident that on all size group farms of both category I and category II marginal revenue was greater than marginal cost indicating suboptimal level of output on these farms, under ceteris paribus assumption.

From Table 5.25 it can be seen that on small farms of category I marginal cost was a constant, however on large farms as well as combined farms, marginal cost is increasing with output level as is revealed by positive value of derivative of marginal cost. Hence optimal output levels worked out on these farms yield maximum profit. On category II farms, all size group farms had a constant marginal cost.

5.3 MARKETING OF SUGARCANE AND JAGGERY

Marketing is a process of selling or buying of the produce spreading between assembling and distribution activities which include the work of a wholesaler, retailer, middlemen, trader and transport agency.

In initial farm-costs and returns studies, the stress was laid on high productivity for enabling the farmers to realise higher income from any given enterprise. However it was later realised that the quantum of

marketable surplus together with price, is the main determinent factor of farmer's income.

At this juncture it is worth noting that the price of a product in the modern complex world is not only determined by determinents like demand for the product, but also by the method of marketing of the product. In the present business world most of the products are marketed through several market intermediaries who are profit seeking functionaries and who influence final consumer price and also affect producer's share in consumer's rupee. Thus to evaluate profitability of an enterprise, knowledge of not only production aspects but also knowledge of marketing aspects is necessary. Thus the present study on marketing was undertaken to probe into the methods of marketing, marketing channels, different intermediaries involved in marketing, marketing costs at different stages of marketing in the case of sugarcane as well as jaggery. The results of the field investigation carried out are discussed here.

5.3.1 Marketing of sugarcane:

As all of the respondent farms of category I were supplying sugarcane to Chittoor co-operative sugar factory, the price paid by the factory and subsidy facilities extended by the factory in marketing of cane were considered in the study.

Main marketing costs in the marketing of sugarcane in the study area were transporting costs, other marketing charges like cost of getting permit, cost of cheque collection etc were included under the item of miscellaneous expenses. Here transportation costs includes harvesting, loading and

unloading costs of cane to the factory. Marketing cost of different size group farms are presented in Table 5.27.

A perusal of the Table 5.27 revealed that transporting cost was the major marketing cost on both size groups of farms. It was lowest on small farms (Rs.35.66 per tonne) constituting 99.28 per cent of total cost of marketing and highest on large farms (Rs.37.04 per tonne) accounting for 99.49 per cent of the total cost of marketing. Transporting cost showed a direct relationship with farm size and the results are in confirmity with the findings of Sreedevi (1989).

Miscellaneous expenses were higher on small farms (Rs.0.26 per tonne) and lower on large farms (Rs.0.19). Hence miscellaneous expenses were inversely related with the farm size. This might be due to the fact that small farmers, especially those growing CO62175 were facing more problem in obtaining cutting permit, whereas large farmers because of their social status and acquiantance with field officials were getting cutting permits easily.

Total marketing costs presented in the Table 5.27 revealed that they were higher (Rs.37.23 per tonne) in the case of large farms and lower (Rs.35.92 per tonne) on small farms, indicating a direct relationship with the farm size. This is mainly due to the higher transportation costs (which was the major marketing costs) on these farms.

TABLE - 5.27 Marketing costs per tonne of sugarcane

(Rupees)

	Small farms	Large farms	Combined farms
Transportation cost	35.66 (99.28)	37.04 (99.49)	36.73 (99.43)
Miscellaneous expenses	0.26 (0.72)	0.19 (0.51)	0.21 (0.57)
Total costs	35.92 (100.00)	37.23 (100.00)	36.94 (100.00)

Note: Figures in parentheses indicate percentage to total costs

5.3.2 Marketing of jaggery:

5.3.2.1 Marketing pattern: For the present study chittoor jaggery market was selected purposively, as majority of respondents of category II were selling their produce in chittoor market. There is no regulated market yard in chittoor. Therefore the marketing was done in the premises of licenced 'mandies' under the supervision of Agricultural market committee, chittoor. The marketing committee has a jurisdiction of 6 revenue mandals, within a radius of 16 km. Notified commodities under this committee are jaggery, Groundnut, mangoes, Paddy, Rice, mesta and Tamarind.

Under the supervision of marketing committee open auction system of marketing came into operation from 24-10-1975. Under this, producers bring their produce (jaggery) to licenced mandies where open auction of the produce takes place the presence of officials of Agricultural market committee. The process will enter into the committee's Record by a form known as "Tak patti", which contains details about producer, commission agent through whom produce sold his produce, purchaser's addres, quantity marketed, price etc. In this process the purchaser will pay purchase tax and market cess to the market committee. As this process operates through a commission agent this process is known as commission sales. Here commission agent is defined as the person who disposes the commodity to wholesalers on behalf of producers and inturn get the commission charges as per rules laid out by the marketing committee and it is 2 percent of the turnover in the case of jaggery.

There is another type of market activity operating in chittoor viz, consignment sales where in the producer sells his produce to wholesalers in the

other states at prices fixed by phone contacts through commission agents. Here the central sales tax is exempted. These are the prominent marketing methods of jaggery in the district. Another less prominent marketing method is 'direct purchases' by other state personnel or distant wholesaler from the producer in the village itself. Mostly this was limited to off seasonal sales.

The marketing pattern existing in chittoor jaggery market revealed the operation of following types of intermediaries.

Commission agent: As per market committee rules he is authorised to sell produce to wholesalers on behalf of the producer and to take commission charges.

Exporter: He is also a licence holder. He purchases produce from the producer, later sells the produce in other states either through commission agents or directly to the wholesalers or to the retailers at the other point.

Wholesaler: Here wholesaler is defined as a person who purchases produce from producer in wholesale lots either directly or through commission agent in the market or at villages.

Retailer: A person who purchases a produce from producer or wholesaler and sells it to consumer.

5.3.2.2 Marketing costs: These are the marketing charges that are incurred by different agencies during the process of marketing like packing on the

farm, loading and unloading charges, market fee, weightment charges and storage charges. While considering total marketing costs of jaggery as entity margins of middlemen were included as costs.

5.3.2.2.1 Marketing costs incurred by Producer: Marketing costs incurred by producer were loading charges, transporting costs, unloading charges (Hamali charges) and weighing charges. The particulars of these are presented in Table 5.28.

As per market committees rules commission charges to be incurred by a jaggery producer was only 2 per cent, but in the study area it was observed that commission agents were collecting a higher commission charge at the rate of 4.5 per cent from the producers who took a loan from them, besides an interest rate of 24 per cent on the loan amount. However from a non-borrower producer, the commission agents charged only 2 percent on their sales. In the study area majority of farmers have taken credit from commission agent, hence incurred high expenses towards payment of commission charges. Thus in the present study farm-wise data regarding rate of commission was collected and was considered in working out commission charges.

From the Table 5.28 it can be seen that the small farms incurred higher marketing charges with Rs.24.95 per quintal than the large farms who incurred Rs.22.40 per quintal. Loading charges were higher on large farms compared to small farms with Rs.1.88 per quintal. The other costs viz, transportation costs and commission charges were higher on small farms Rs.7.17 and Rs.15.84 respectively, whereas the large farms incurred only

TABLE - 5.28 Marketing costs per quintal of jaggery

(Rupees)

	Small farms	Large farms	Combined farms
Loading and unloading	1.88 (7.54)	2.20 (9.82)	2.05 (8.70)
Transporting charges	7.17 (28.74)	6.64 (29.64)	6.89 (29.23)
Commission	15.84 (63.49)	13.40 (59.83)	14.52 (61.60)
Miscellaneous	0.06 (0.24)	0.16 (0.71)	0.11 (0.47)
Total cost	24.95 (100.00)	22.40 (100.00)	23.57 (100.00)

Note: Figures in parentheses indicate percentage to total cost

TABLE - 5.29 Marketing costs for commission agent

(Rs/year)

	(Rs)
Rent for building	6130
Licence renewal fee	100
Electricity and phone bills	7952
Staff charges	5365.7

Rs.6.64 and Rs.13.40 per quintal on transportation and commission respectively.

The higher loading and unloading charges on large farms was due to the reason that, most of them were using tractors in transport of produce in which they have to engage extra labour exclusively for the purpose of loading. On the other hand on small farms mostly bullock carts were used in transporting, where in the same person driving the bullock cart, undertake loading also.

Transport charges were higher on small farms because of use of bullock carts in transport there by increasing number of trips, or underutilisation of tractor transporting because of lower output on these farms compared to large farms.

Commission charges were higher in the case of small farms inspite of the fact that commission is charged on advalorem basis, average price realised by the small farms was lower and also higher productivity on these farms. This is due to the fact that almost all small farms were credit takers from the commission agent. The commission charged was at a rate of 4.5 per cent of the value of the output, whereas most of large farms incur a commission of 2 per cent only.

On the average, total marketing costs were higher in the case of small farms, there by showing an inverse relationship with the farm size.

5.3.2.2.2 Marketing costs of commission agents:

Commission agents were classified based on their annual turnover and accordingly licence fee differed from one class to another. However, the renewal fee is Rs.100 per year, irrespective of the class. Besides this they also incurred expenses on rent for mandi building, phone and electricity bills, salaries of the staff and other miscellaneous charges. The details of these costs are presented in Table 5.29.

Further it is observed that in the study area most of the commission agents are not only dealing with sale of jaggery, but also with the sale of other commodities like paddy, groundnut etc depending on seasons.

5.3.2.2.3 Marketing expenses incurred by Exporter:

Exporters incurred charges of packing, charges on transport the quantum of which was determined by the distance of the State to which he is transporting . Later according to the marketing pattern in the respective State, exporter incurs charges of commission payment etc.

At this juncture it is worth mentioning that 90-95 per cent of jaggery produced and marketed in chittoor market was going for consumption in other States. For this 40 licenced exporters are operating in chittoor market.

5.3.2.2.4 Marketing expenses of wholesalers: Wholesalers were of two types. Local wholeslers were mainly exporters and marketing costs incurred by them are mentioned earlier. Distant Wholesalers were mainly from the districts like Nellore. They incurred expenses on packing and transporting.

Irrespective of the fact whether a wholesaler was local or of distant one has to pay purchase tax of 9.1 per cent and market cess of 1 per cent.

5.3.2.2.5 Marketing Expenses of Local retailers: These intermediaries were purchasing jaggery from local wholesalers and selling to consumers. They incurred expenses on packing material, transporting etc which are discussed while presenting price spread for jaggery.

5.3.2.3 Marketing channels: Various marketing channels that are in operation in chittoor jaggery market are as follows.

1. Producer ---> Commission agent ---> local wholesaler --->Local retalier ---> consumer.
2. Producer ---> Commission agent ---> Distant wholesaler ---> Retailer ---> Consumer.
3. Producer ---> Commission agent ---> wholesaler cum exporter ---------- -------> Consumer.
4. Producer ---> Distant whole saler ---------- --------> consumer.
5. Consignment sales.

Bulk of the jaggery marketed in chittoor market is being marketed through channel 3. Channel 4 is mostly confined to off seasonal sales. Through channel 1 only 1-2 per cent of produce in the market was marketed. However within the constraint of time limit during the study, price spread was studied in this channel I only, due to the accessibility of different intermediaries in the channel. The results of the study are presented in Table 5.30.

TABLE - 5.30 Price spread for jaggery

	Rs/quintal	Percentage
Producer's net selling price	381.82	78.59
Expenses of producer		
1) Transport charges	6.89	1.42
2) Commission charges	18.42	3.79
3) Hamali charges	2.05	0.42
4) Miscellaneous expenses	0.11	0.02
Producers selling price (or) whole salers purchase price	409.29	
Expenses for wholesale purchasers:		
Market cess	4.09	0.84
Purchase tax	37.25	7.67
Weighing charges	1.30	0.27
Wholesaler's margin	20.46	4.21
Wholesalers sale price (or) retailers purchase price	472.39	
Expenses for retailer packing material	4.00	0.82
Retailer's margin	9.45	1.95
Retailer's sale price (or) consumer price	485.84.	100.00

Note: Commission charges are worked out at 4.5% rate.

From the Table 5.30 it is evident that though the producers selling price was Rs.409.29 per quintal accounting for 84.24 per cent of consumer price, producer actually realised a net selling price of Rs.381.82 only which accounted for 78.59 per cent of consumer's price. Further among expenses incurred by producer, commission charges were the major one (Rs.18.42 per quintal) constituting 3.79 percent of consumers price. This indicate that nearly 3.8 per cent of price paid by consumer is being received by commission agent as commission charges, reducing producer's share in consumer's rupee.

Wholesaler was incurring expenses on market cess (Rs.4.09 per quintal), purchase tax (Rs.37.25 per quintal) and weighing charges (Rs.1.30 per quintal), these three together constituting 8.78 per cent of consumer's price. He is realising a margin of Rs.20.46 per quintal accounting for 4.21 per cent of consumers price. This lower margin might be one reason for the preference of wholesalers to become exporters for distant sales.

A retailer incurred expenses on packing material amounting Rs.4 per quintal accounting for 0.82 per cent of consumer's price. However he realised a margin of Rs.9.45 per quintal accounting for 1.95 per cent of consumer's price.

A critical observation of the results showed that producer's share in consumer's rupee was reduced to a greater extent because of operation of number of intermediaries in between producer and consumer. Further as given in Table 5.30, in chittoor market area a higher rate commission charges are collected from the producers than the prescribed charges as

specified by the market committee and was also a cause for lower share of producer in consumer rupee.

The results are in accordance with the findings of Jagdishlal (1979), Krishnaiah and Subbarama Raju (1989), and Padmanabhan (1991).

5.3.3 Comparison of cost of marketing at producer's level in sugarcane and jaggery

From Tables 5.27 and 5.28 it is evident that marketing costs per unit output on average was higher in the case of sugarcane, (Rs. 36.94 per tonne) even after excluding loading charges, as against marketing charges of Rs. 23.57 per quintal in jaggery marketing.

Transportation charges constituted higher percentage of cost of marketing (nearly 99 per cent). Further from Tables 5.11A and 5.11B it is evident that in the case of sugarcane supply, transporting costs constituted 9.33 per cent of total cost of production, and in the case of jaggery production it constituted only 1.84 per cent of the total cost of production. This higher transportation cost in cane supply was the one reason, which led to farmers preference for taking up jaggery production.

5.3.4 Bulkline cost analysis

Analysis of bulkline cost, a test to decide whether a particular price is remunerative or not was carried out on both categories farms and the results are presented in Table 5.31.

TABLE - 5.31 Evaluation of remunerative price on sample farms

Category	Bulkline cost (Rs)	Average price (Rs)	Average cost (Rs)
I. Sugarcane suppliers			
Small farms	480.00	416.97	385.78
Large farms	477.50	414.43	396.01
Combined farms	467.50	414.99	393.80
II. Jaggery producer			
Small farms	455.00	394.045	374.94
Large farms	480.00	422.24	374.53
Combined farms	455.00	409.29	364.76

Note: Output is considered in terms of tonne on category I farms and in quintals on category II farms.

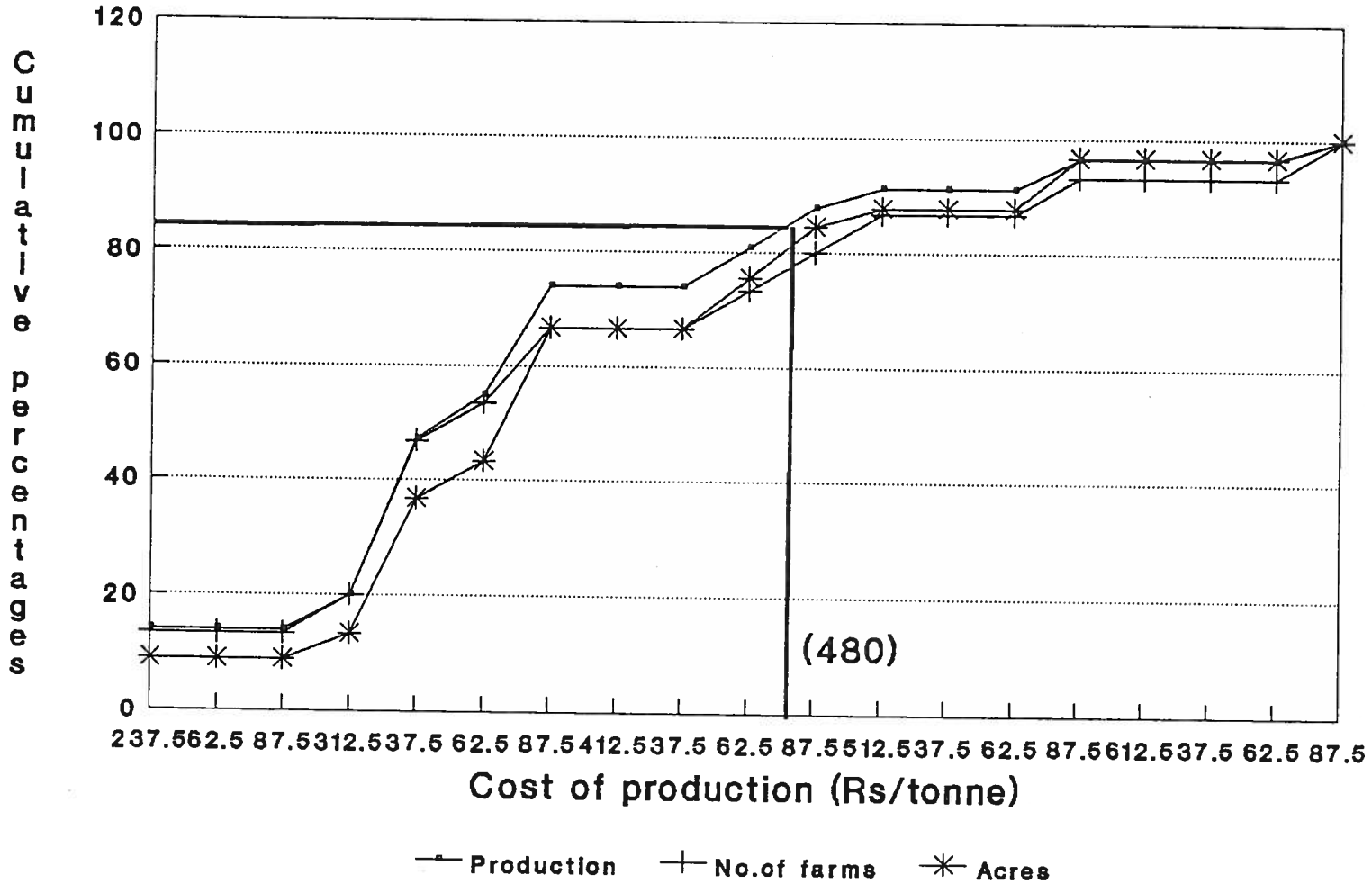


Fig.7: Bulkline cost of sugarcane supplying small farms

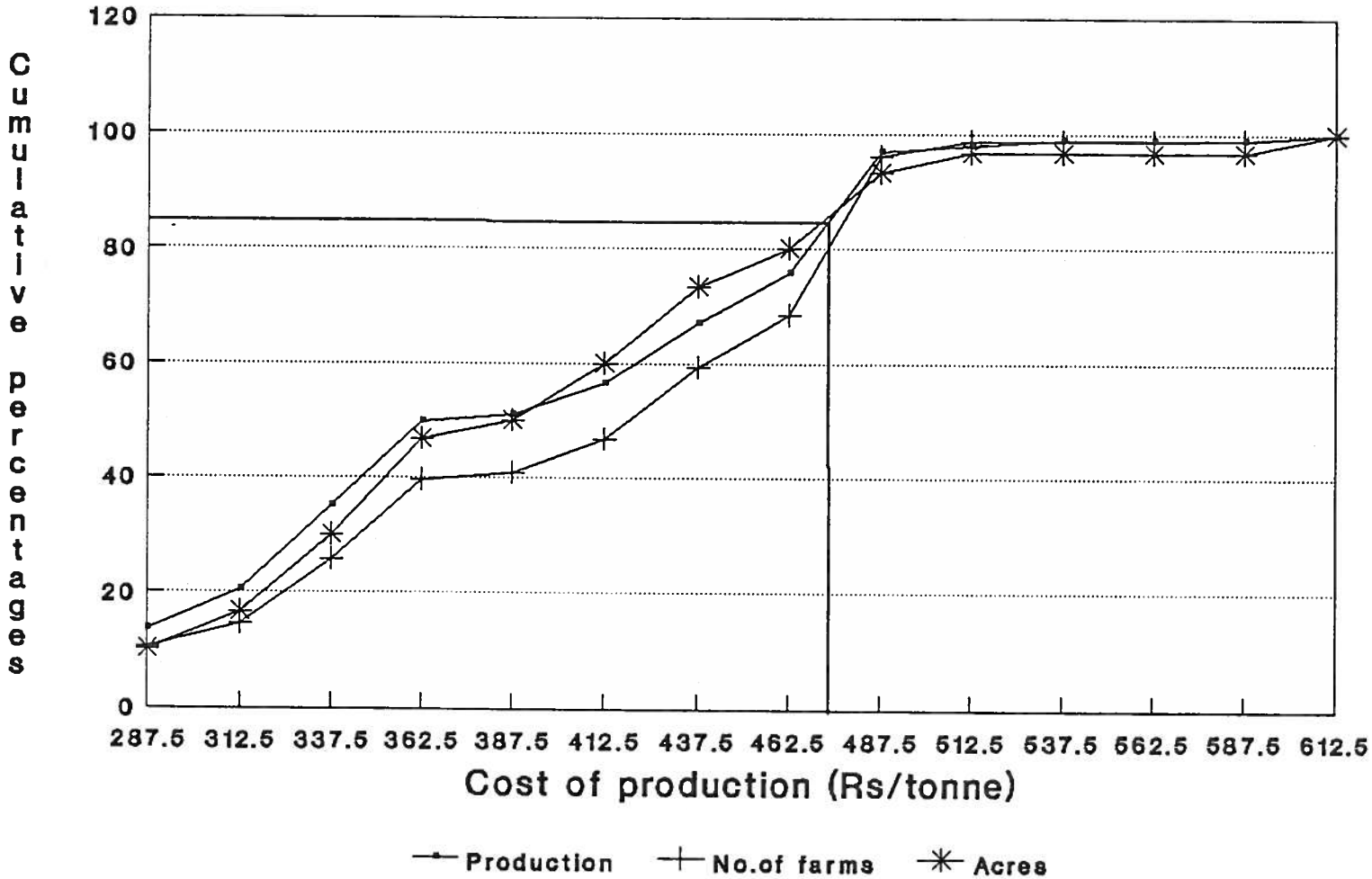


Fig.8: Bulkline cost of sugarcane supplying large farms

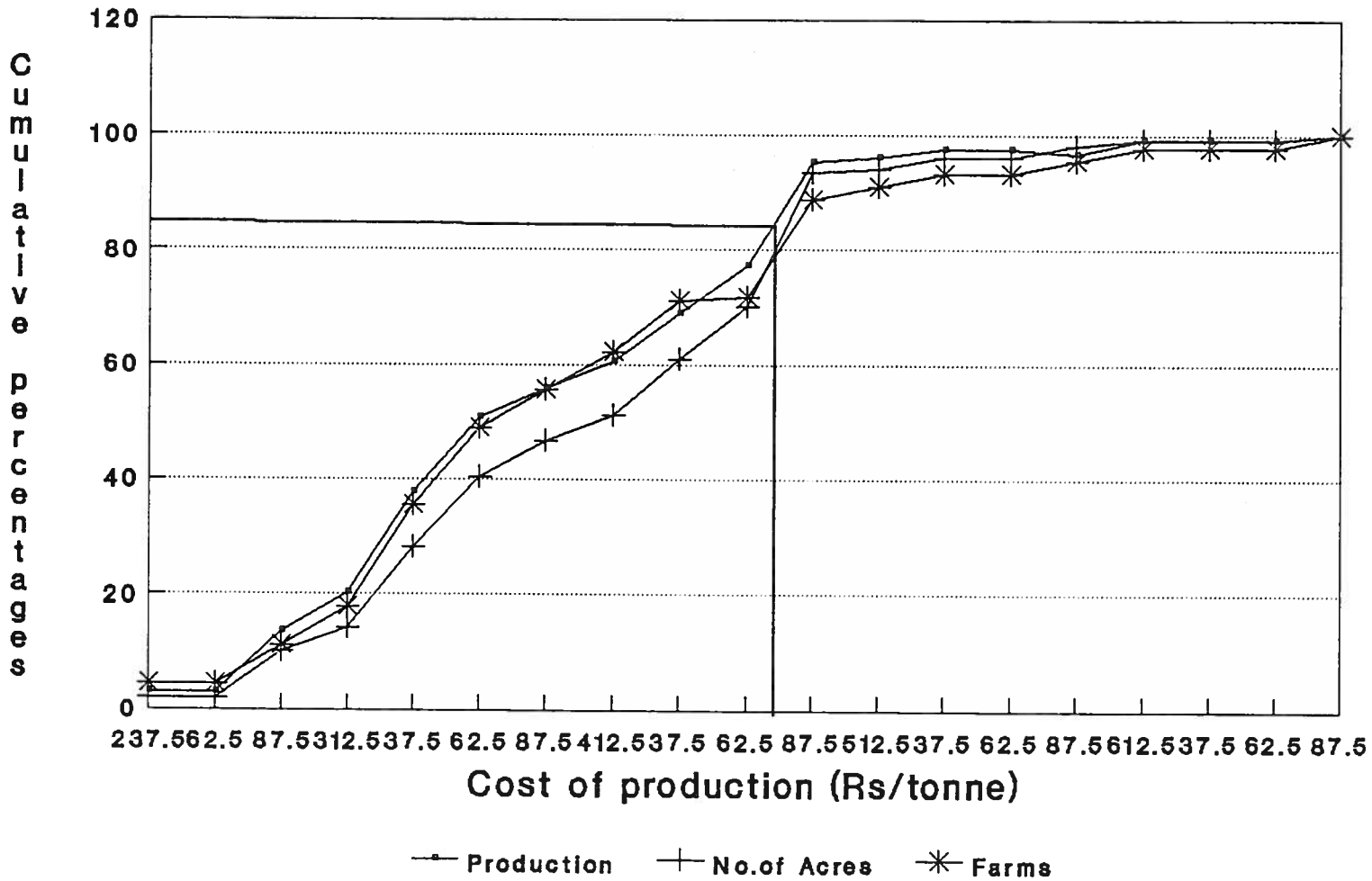


Fig.9: Bulkline cost of sugarcane supplying combined farms

Bulkline cost for small farms of category I was Rs. 480 per tonne and was covering 78 per cent of the total number of farms and 82 per cent of acreage under sugarcane. Bulkline cost of large farmers of category I was Rs. 477.50 per tonne, covering 88 per cent of farms and 85 per cent of acreage under sugarcane. For combined farms of category I, Bulkline cost was Rs. 467.5 per tonne covering 85 per cent of farms and 75 per cent of acreage under sugarcane.

From Table 5.31 it is evident that when bulkline cost of each size group farms of category I was compared with their respective average cost of production it was observed that in all the cases average cost of production was lower than bulkline cost. On similar lines on all the size group farms average price realised was lower than bulkline cost indicating that price paid for sugarcane by the factory was not remunerative. The results are in accordance with the findings of parthasarathy (1974) Rao (1991), and contradictory to findings of Jayamma (1988).

On category II farms, bulkline cost for small farms was Rs. 455 per quintal covering 79 per cent of farms and 79 per cent of acreage under sugarcane on large farms bulkline cost was Rs. 480 per quintal covering 82 per cent of farms and 75 per cent of acrege under sugarcane. For combined farms bulkline cost was Rs. 455 per quintal covering 80 per cent of farms and 76 per cent of acreage under sugarcane.

On this category farms also, bulkline cost was higher than average cost of production. Average price realised on each size group farm was lower than the bulkline cost indicating that there is need for remunerative price in

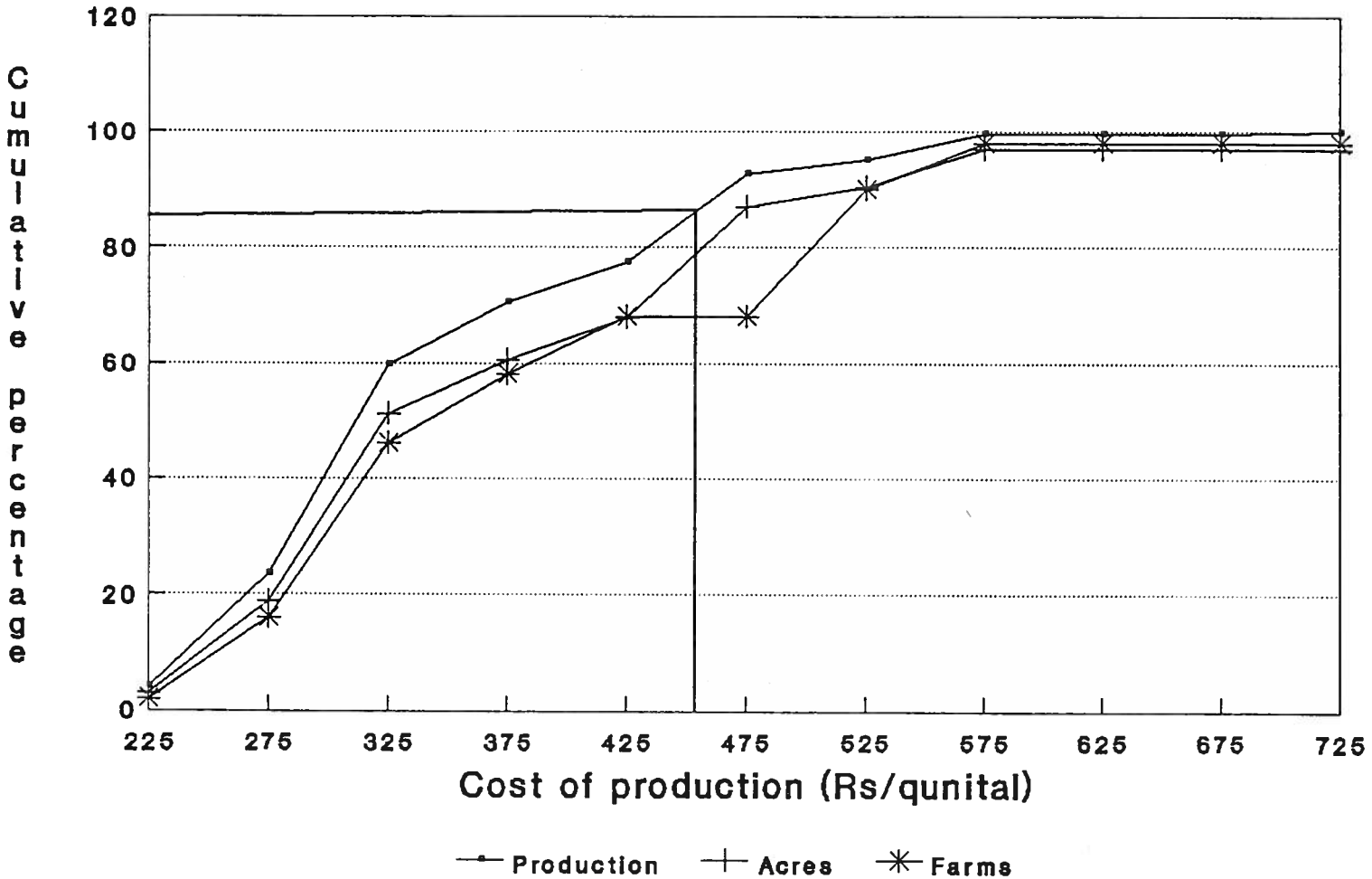


Fig.10: Bulkline cost of jaggery making small farms

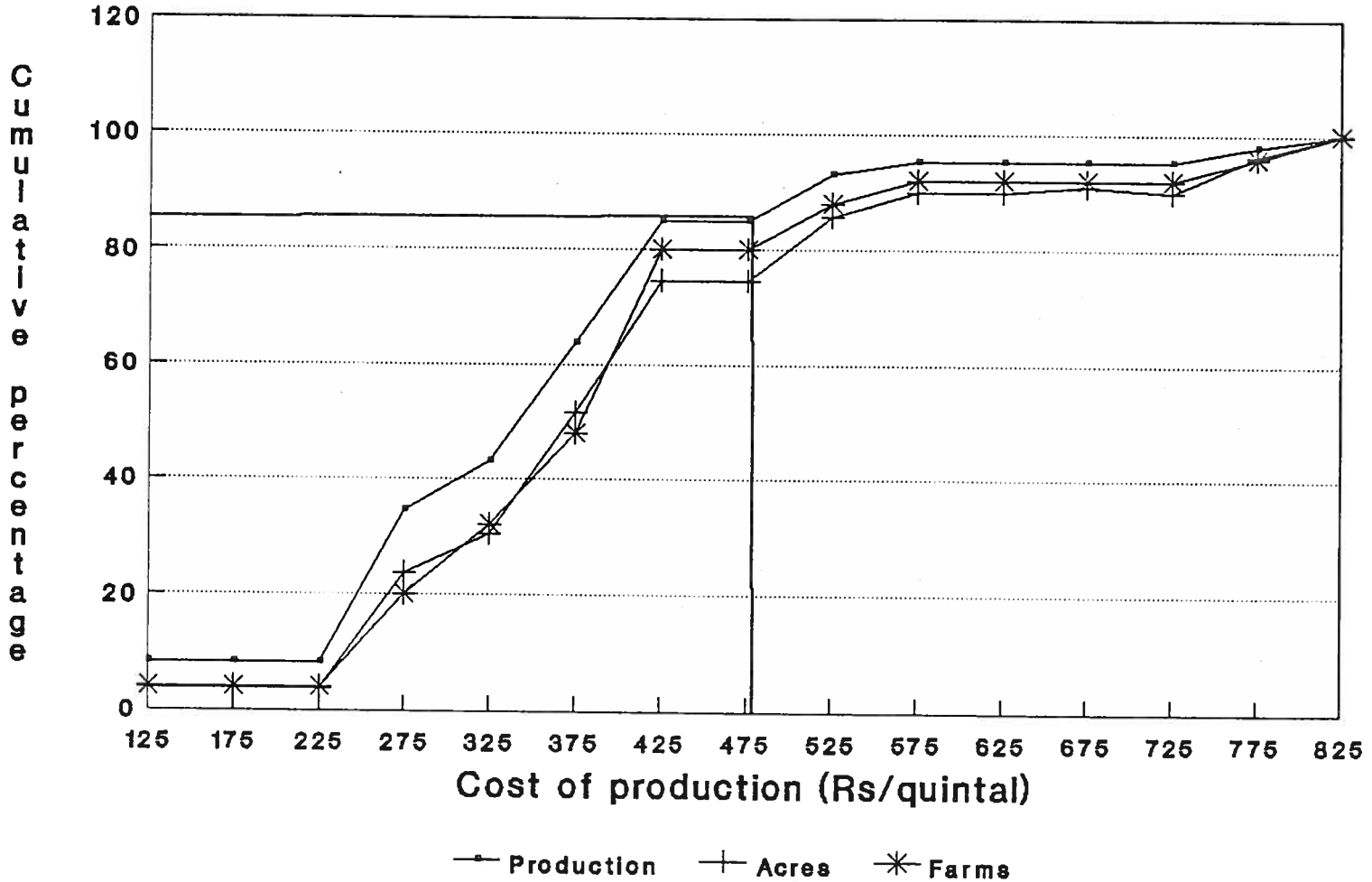


Fig.11: Bulkline cost of jaggery making large farms

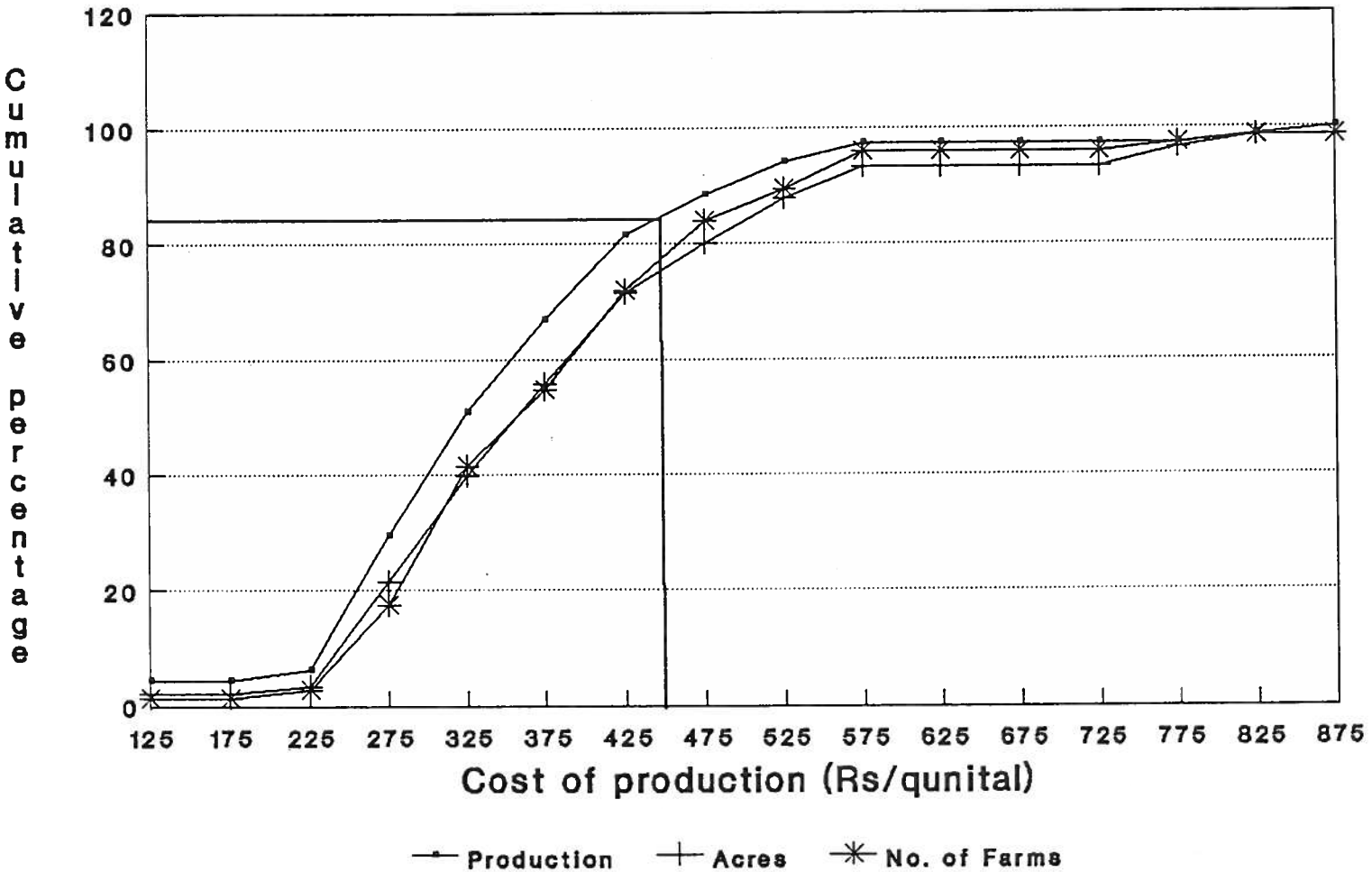


Fig.12: Bulkline cost of jaggery making combined farms

the case of jaggery also. However, when a comparison was made between category I and category II farms in terms of combined farms it was observed that the difference between the bulkline cost and average price realised was (Rs. 45.71) lower in the case of jaggery when compared to sugarcane supply to factory (52.51). This also further suggests that jaggery production was relatively profitable when compared to supplying sugarcane to factory.

5.4.4 Price variation in the case of sugarcane and jaggery

During every year, Central Government announces the statutory minimum support price for sugarcane. Then State Government announces support price. Taking this into consideration together with sugar recovery percentage a sugar factory announces price for the sugarcane.

This clearly shows that variation in price of sugarcane is effected only once for a crushing season. During a season there will be no price change, except for some changes in incentives which appear as price change. Further in the case of sugarcane supplied to Chittoor Cooperative factory, price differentiation with respect to varieties was observed, which was actually an incentive to induce and encourage the farmers to take to 'other varieties'. This was due to higher sugar recovery from these varieties.

Hence in the case of sugarcane, except for these incentive difference between varieties, difference between incentives given during various months of a crushing season, no actual price changes are observed, with in a year.

In the case of jaggery marketed in Chittoor district, where grading is done upto 3rd sort, price differentiation with reference to the grade was a

TABLE - 5.32 Price of sugarcane and jaggery in the year 2000-2001

Month	Cane price (Rs/T)	Jaggery price (Rs/quintal)					
		I Sort		II Sort		III Sort	
		Min	Max	Min	Max	Min	Max
April	367	480	550	415	460	380	405
May	367	490	600	420	485	380	405
June	367	530	638	425	525	380	404
July	367	-	-	450	517	355	425
August	367	523	523	425	495	-	-
September	367	500	515	450	492	375	420
October	367	-	-	-	-	350	415
November	367	600	430	480	595	400	450
December	367	550	620	450	540	370	430
January	367	500	580	425	495	370	420
February	367	470	510	400	350	350	390
March	367	455	500	440	330	330	385

Note: Cane price given is price excluding incentives.

prominently observed feature, from the Table 5.32. Further for the same quality of jaggery different prices prevailed in different years.

A given quality of jaggery in Chittoor market fetched different prices in different months of the same year. For example I sort jaggery price in April 90 was Rs. 480 (minimum to Rs. 550 (maximum) per quintal. The same quality jaggery fetched a price of Rs. 490 (minimum) to Rs. 600 (maximum) per quintal in May. The peak season in Chittoor market was from December to May, with large arrivals. The arrival of different sorts of jaggery in different quantities in different months, interacting with the demand factor, resulted in different prices for jaggery in different months.

As against this, in the case of sugarcane supplied to factory, what ever may be the quantity of sugarcane supplied to factory, the price was the same, except for some minor changes in incentives in different months of a crushing season. Hence it is observed that in the case of sugarcane supply to the factory, price fluctuations are less frequent compared to jaggery price.

However in time series studies, fluctuations will be more clear only when trends are worked out. Hence in the present study trend is traced out by fitting linear as well as exponential equation to cane price data as well as jaggery price data. The results are presented in Table 5.33 (A) and 5.33 (B). From the table it was evident that, with advancement of the year, the rise in price of sugarcane was of the magnitude of Rs. 34.7 and in case of jaggery it was Rs. 32.039, on the other hand compound growth rate in price of sugarcane was 12 per cent to 9 per cent in case of jaggery. Further coefficient of variation in the case of cane price was 18.24 per

TABLE - 5.33 (A) Trend of cane price and jaggery price

Year	Cane price (Rs/t)	Percentage of trend of cane price	Deviation	Jaggery price (Rs/Q)	Percentage of trend of jaggery price	Deviation
1986	254	109.77	9.77	299.47	101.52	1.52
1987	247	92.82	7.18	335.69	102.65	2.65
1988	268	89.10	10.90	331.90	92.43	7.57
1989	368	109.69	9.69	401.48	102.65	2.65
1990	367	99.14	0.86	426.77	100.86	0.86

TABLE - 5.33 (B) Price variations in case of cane and jaggery ~~over years~~ from 1986 to 1990.

	Cane price	Jaggery price
Coefficient of Variation	18.24%	13.19%
Linear trend	300.8 + 34.7 x	359.06 + 32.04 x
Compound growth rate	12%	9%

cent, against 13.19 per cent in the case of jaggery price, indicating that price variation was more in case of cane. However in case of jaggery, seasonal variations in price were also observed as indicated earlier and is clear from the table 5.33 (C). From the table it is evident that highet percentage of trend of price of jaggery was recorded in November and minimum in March.

As specified earlier, sugarcane price is mostly under Government's control, on the other hand jaggery price is not under Government control. Hence the variations in price of jaggery can be attributed to changes in supply of jaggery and quality of jaggery, and demand for jaggery etc.

Changes in supply of jaggery, in other words production of jaggery might be due to changes in quantity of cane diverted to factory and jaggery under ceteris paribus condition. Further the changes in quantity of cane diverted to factory or jaggery might depend on cane price, jaggery price, lagged jaggery price etc. Hence all possible combinations of these variables were used to analyse any possible association between them. The results are presented in Table 5.34.

Generally statutory price for sugarcane is announced in advance of a year, and hence it will have its influence in determining cane supply to the factory in the area. This is analysed by correlating cane price and cane supply. The correlation coefficient was positive (0.44) but non significant.

Correlation between cane price and jaggery supply was found to be -0.92 and was significant implying that rise in the cane price leads to

Table 5.33 (C) Seasonal variation in price of Jaggery in 1990-1991

Month	Price (Rs./Q)	Trend value	Percentage of Trend
April	448.11	457.49	97.95
May	462.95	459.61	100.73
June	484.45	461.73	104.92
July	433.73	463.85	93.51
August	489.79	465.97	105.11
September	458.57	468.09	97.97
October	383.78	470.21	81.62
November	499.01	472.33	105.64
December	493.08	474.45	103.92
January	464.99	476.57	97.57
February	429.98	478.69	89.82
March	415.99	480.81	86.52

TABLE - 5.34 Correlation coefficients

Variables	'r' value
Cane price Vs. Cane supply	0.44
Cane price Vs. Jaggery supply	-0.92**
Jaggery price Vs. Cane supply	-0.20
Jaggery price Vs. Jaggery supply	-0.063**
Lagged jaggery price Vs. Cane supply	0.82***
Lagged jaggery price Vs. Jaggery supply	-0.20
Cane price Vs. Jaggery price	0.995***
Cane supply Vs. Jaggery supply	0.1959

*** 1 per cent level of significance

** 5 per cent level of significance

decrease in supply of jaggery and vice versa. This trend was once again confirmed by negative correlation between jaggery price and cane supply to factory (-0.20). This is in confirmity with expectation as sugarcane supply to factory and jaggery preparation are the competing alternatives depending on the same agricultural product viz sugarcane.

Correlation between lagged jaggery price and cane supply was positive (0.82) and significant. This might be due to farmers expectation that as previous years jaggery price will influence jaggery price in this season inversely and accordingly they effect changes in cane supply to factory.

Correlation between lagged jaggery price and jaggery supply was negative, for this also, the reason might be the same as discussed above. The same reason might be the cause of negative correlation between jaggery price and jaggery supply, as jaggery prices change from month to month as indicated earlier.

Correlation between cane price and jaggery price was 0.995 and significant indicating that price of cane and jaggery move in the same direction and is evident from the trend also. However correlation between cane supply and jaggery supply was 0.1959 and non significant indicating very weak associatioon between them.

5.5 PROBLEMS AND PROSPECTS OF SUGARCANE SUPPLY AND JAGGERY PRODUCTION

Opinion survey of the farms was carried out to identify problems and prospects of sugarcane supply and jaggery production in Chittoor district.

5.5.1 Causes for adopting the practice of sugarcane supply to factory

Lower labour requirement: 44.44 per cent of the total respondents expressed that they were adopting the practice of supplying sugarcane to factory because of lower labour requirement in this practice compared to jaggery production.

Less cumbersome nature: 37.77 per cent of the respondents revealed that less cumbersome nature of sugarcane supply to factory led to their preference for this practice instead of jaggery preparation.

Frequent fluctuations in the prices of jaggery: 20 per cent of respondents revealed that of less stability in the prices of jaggery compared to cane prices, motivated them to go for sugarcane supply.

Another reason expressed by respondents mostly small farmers was lower capital availability with them. In their view profit making from jaggery preparation was possible only when the farmers were able to invest some capital on sugarcane crusher, pans etc. Farmers inability in this aspect, led them to go in for supply sugarcane to factory. Further farmers expressed that they were forced invariably to go for sugarcane supply as per their pre-agreement as they have to pay fine in case they fail to supply cane as per agreement. Profitability of cane supply was the cause, for which respondents responding in positive way was least.

5.5.2 Causes for going to jaggery preparation:

Varietal Problem: 70.67 per cent of total respondents revealed that they preferred growing Co 62175 variety cane to other varieties because of

TABLE - 5.35 (A) Reasons for adopting the paractice of supplying sugarcane to factory in 1990-91.

Reasons	Number of respondents	Percentage to total sample size
Lower labour requirement	20	44.44
Less cumbersome nature	17	37.77
Frequent fluctuations in jaggery price	9	20.00
Lower capital requirement	4	8.88
Profitability of cane supply	3	6.66

TABLE - 5.35 (B) Reasons for adopting the paractice of jaggery making in 1990-91.

Reasons	Number of respondents	Percentage to total sample size
Varietal problem	53	70.67
Profitability of jaggery making	27	36.00
Transport problem	24	32.00
Need for higher hired labour	12	16.00
Preharvest contract	10	13.33

(1) Suitability of the variety in the area

(2) Higher productivity

(3) Ability to withstand water stress during dry spells.

But sugar recovery of this variety is very low when compared to 'other varieties'. Hence sugar factory is encouraging the farmers to take up 'other varieties' (early varieties) by providing some incentives. On the other hand they were discouraging the farmers taking up Co 62175 variety by paying lower price and also by, delaying the issue of cutting permits. Hence the farmers especially small farmers growing this Co 62175 variety faced many problems in supplying cane to factory. On the other hand this variety was giving good yield in terms of jaggery. Thus most of the farmers preferring this variety, resorted to preparation of jaggery. This is in accordnace with the findings of Jain (1990)

Profitability of jaggery production:

36 per cent of respondents attributed the profitability of jaggery production over cane supply as the principal cause behind their adoption of practice of jaggery preparation.

Transport problem: 32 per cent of respondents stated that their fields are located in such a way that thery lack accessibility to vehicles like tractors or lorries etc. used in transporting cane to factory. In this case they have to engage extra labour in transporting the cane from fields. On the other hand by taking up jaggery preparation they were able to prepare jaggery at the field itself, later transported jaggery to their homes by utilising the same

labour engaged in jaggery preparation, hence incurred no additional labour charges for this. Therefore they adopted the practice of jaggery preparation.

Further farmers expressed their inability to hire human labour needed for harvesting cane at a time for cane supply. Hence they went for jaggery preparation in which cane harvesting was done in phased manner mostly by utilising family labour.

Some respondents stated that they had entered into preagreement with commission agents by taking credit from them. Hence they were forced to going for jaggery production. Some respondents expressed that absence of shares in the factory as the cause for jaggery preparation.

5.5.3 Problems in production and marketing of sugarcane:

Labour shortage was the major problem in sugarcane production as expressed by 22.22 per cent of total cane suppliers in the study. This is mainly due to the fact that sugarcane is a labour intensive crop and seasonality of operations in the crop.

Limited water availability was another major problem in sugarcane producted as opined by 17.78 per cent of total cane suppliers. Other problems were credit availability and obtaining of cutting permits. Nearly 11 per cent of total cane suppliers in the study opined that the credit available to them from credit institutions on the basis of their shares in the sugar factory, was untimely and also it was expensive. They further expressed that obtaining credit from the credit institution was a problem, because of the still persistant disputes about "adopted area" of credit institutions. Further

TABLE - 5.36 (A) Problems in cane production and marketing

	Number of respondents	Percentage to total
Labour shortage	10	22.22
Limited water availability	8	17.78
Credit shortage	5	11.11
Problem in getting permit	5	11.11
Lower price	19	42.22
Transport problem	3	6.67

TABLE - 5.36 (B) Problems in jaggery production and marketing

	Number of respondents	Percentage to total sample size
Credit shortage	40	53.33
Labour shortage	30	40.00
Lack of regulated marked yard	53	70.66
Fluctuations in the price of jaggery	50	66.66
Storage problem	10	13.33
Transport problem	4	5.33

the scale of finance fixed for sugarcane was not adequate due to the escalations in the cost of various inputs.

Regarding marketing, obtaining cutting permit in time was a problem as revealed by nearly 11 per cent of total cane growers. This was mainly due to the farmers preference to grow Co 62175 which was not preferred by sugar factory as its sugar recovery was very low. Thus the farmers growing this variety, except some of the large farmers, faced the problem of getting cutting permits in time and more over they received lower price for this variety.

Lower price for the sugarcane was the problem felt by 42 per cent of cane suppliers. They opined that on one hand price paid for Co 62175 variety cane was lower compared to other varieties, on the other hand, even the price paid for other varieties was not enough to leave the reasonable profits to the farmers and thus shadows of frustation appears among cane growers in the study area.

Another problems in sugarcane marketing as revealed by the farmers was transport problem, because of lack of proper road facilities to their fields as well as village roads were not usable during rainy season.

5.5.4 Problems in production and marketing of jaggery:

Problems associated with jaggery production and marketing as per the opinion survey were identified and presented in Table 5.36 (B). Credit constraint was the major problem in producing jaggery according to 53.33 per cent of the jaggery producers in the study area. Lack of timely and

adequate credit from credit institutions led the farmers to go for loans from jaggery commission agents. The commission agents charged a high rate of interest i.e. 24 per cent besides higher commission.

Nearly 40 per cent of total respondents expressed the problem of labour shortage during the peak operations like planting, weeding, harvesting and jaggery preparation.

Absence of the regulated market yard in Chittoor was, the major problem in marketing of jaggery according to nearly 70 per cent of jaggery producer respondents. Further due to lack of knowledge about actual consumers of jaggery and also due to absence of good storage facility farmers were invariably to the commission agents. Further the farmers are entering into agreement with commission agents by taking credit from them. For every Rs. 1000 loan, they have to sell 2 cart loads (1500 kgs) of jaggery through them. This type of agreement with commission agents led to exploitation of the farmers especially small farmers in the study area due to a high rate of interest (24%) being collected from them, together with a high rate of (4.5%) commission charges. Further if the producer fails to supply jaggery (in quantity) as per agreement due to several reasons like crop failure etc, even then he is incurring high commission charges charged based on quantum of jaggery in agreement. Thus the problem of credit together with absence of regulated market yard in Chittoor is leading to several other problems in marketing of jaggery.

Fluctuations in the price of jaggery was another problem, according to 67 per cent of jaggery producers selected in the study. Government

regulation of price is, existing in the case of cane supplied to factories but not in the case of jaggery. This is one reason for frequent fluctuations in the price of jaggery. Further 80-90 per cent of jaggery produced in the study area is being marketed in other states, which also is contributing for fluctuations in jaggery price.

Transportation was another important problem in marketing of jaggery as per the views of nearly 5 per cent of respondents. This is because of the fact that most of the roads connecting the village to the main road are "Kaccha Roads'.

SUMMARY AND CONCLUSIONS

CHAPTER VI

SUMMARY AND CONCLUSIONS

Sugarcane is one of the important cash crops grown in India. Two major sugarcane based industries in our country are sugar industry and jaggery industry. Further, there prevails a sort of dichotomy in pricing of sugarcane used in these two industries. Under this circumstance, sugarcane farmers have their own reasons in their option of going either for sugarcane supply to factory or jaggery preparation. Keeping this in view, this study has been undertaken with the following specific objectives.

1. To evaluate costs, returns and profits of jaggery production and sugarcane supply to factories in chittoor district,
2. to analyse the input-use efficiency in jaggery production vis-a-vis cane production,
3. to study the cost-output relationship through cost functions,
4. to study the marketing aspects of jaggery in chittoor District,
5. to analyse price variations in jaggery and sugarcane over a period of time and
6. to identify production and marketing problems associated with cane production and jaggery making in chittoor district and to suggest suitable measures to overcome them.

For the present study Chittoor district was purposively selected as it is a major sugarcane cultivating district in Andhra Pradesh constituting nearly 16 per cent of area under sugarcane in the State (1990-91). Thavanampalli and Bangarupalem mandals were selected purposively as they stood first and second respectively in terms of acreage under sugarcane in Chittoor district in 1990-91. Prevalence of both the practices of cane supply and jaggery preparation was another point considered in selecting these two

mandals. Totally four villages were selected from these two mandals to constitute a sample size of 120 respondents for the present study, 45 cane suppliers i.e. category I farms (15 small and 30 large farmers) and 75 jaggery producers i.e. category II farms (50 small and 25 large farmers) in the four villages together.

Interview method was used in collecting data through the pre-tested, suitably structured schedules regarding cane cultivation (Plant crop only) and marketing of cane as well as preparation and marketing of jaggery.

Both conventional and functional analyses were used in the present study to arrive at valid conclusions.

Summary:

Family size and percentage of family labour available for farm work, were found to be higher on category II farms (4.21 members and 43.94 per cent respectively) compared to 3.73 members and 29.75 per cent respectively in category I farms. The same trend was observed on both size group farms. Percentage of family labour available to family size was higher on small farms compared to large farms, on both category farms.

Average size of operational holding was higher on category I farms (4.44 hectares) compared to category II farms (2.22 hectares). The same trend was observed with size groups also. Area under sugarcane was higher on combined farms of category I (0.88 hectares) compared to combined farms of category II (0.78 hectares). The same trend was observed with small farms also but reverse trend was observed with large farms. However

percentage of area under sugarcane to total operational holding was higher on category II farms in both size groups as well as combined farms.

The value of total assets possessed by the category II farms was higher (Rs.227199.63 per hectare) compared to Rs.224808.87 per hectare on category I farms. The same trend was observed with size groups also. Further on both categories of farms, assets value increased with increase in the size of farm, exhibiting direct relationship.

Productivity on category I farms was directly related with farmsize, with values of 64 and 68.59 tonnes per hectare on small and large farms respectively. Average productivity on these farms was 67.54 tonnes per hectare. Further varietal-wise productivity analysis on these category farms, showed higher productivity on farms under the variety CO 62175 (69.15 tonnes per hectare) compared to farms under 'other varieties' (66.74 tonnes per hectare). The same trend was observed with size groups also.

Productivity on category II farms i.e. jaggery producing farms was inversely related with farmsize, with 87.49 quintals of jaggery per hectare on small and 84.78 quintals per hectare on large farms. Average productivity on these category farms was 86 quintals of jaggery per hectare.

Human labour utilisation was directly related with farm size on category I farms, with 279.46 mandays per hectare on small farms and 336.05 mandays per hectare on large farms. However, on category II farms human labour utilisation was inversely related to farmsize with 519.42 mandays per hectare on small farms and 481.33 mandays per hectare on

large farms. On an average labour utilisation was higher on category II farms (498.51 mandays per hectare) compared to category I farms (323.12 mandays per hectare).

Percentage of family labour to the total labour utilisation was inversely related to farmsize on both categories of farms. On an average percentage of family labour to the total labour utilisation was higher on category II farms (27.01 per cent) compared to category I farms (15.90 per cent).

Cattle labour utilisation was directly related with farmsize on category I farms, with higher value (8.74 cattle pairdays per hectare) on large farms compared to small farms which utilized 8.67 cattle pair days per hectare. On category II farms it was inversely related with farm size 7.91 and 6.42 cattle pair days per hectare on small and large farms respectively. On an average cattle power utilisation was higher on category I farms (8.72 cattle pair days per hectare) compared to category II farms (7.09 cattle pair days per hectare).

Tractor power utilisation in sugarcane cultivation was directly related with farmsize on category I farms, it being 6.89 and 9.01 hrs per hectare on small and large farms respectively while it was inversely related to farmsize on category II farms with 9.68 hrs on small farms compared to 8.11 hours on large farms. On an average tractor power utilisation was higher on category II farms (8.82 hours per hectare) compared to 8.53 hrs per hectare on category I farms.

Cost of production per hectare was directly related with farmsize on category I farms with higher value of Rs.27162.38 on large farms compared to Rs.24690.03 per hectare on small farms. Cost of production was inversely related with farm size on category II farms, with Rs.32803.88 per hectare on small farms and Rs.31752.8 per hectare on large farms. On an average per hectare cost of production was higher on category II farms (Rs.32227.16) compared to category I farms (Rs.26597.64). Further variable cost accounted for 72.83 per cent of the total cost of production on category II farms compared to 67.58 per cent on category I farms.

Among category I farms, farms under CO 62175 incurred lower cost of production (Rs.25461.06 per hectare) compared to farms under 'other varieties' (Rs.27157.31 per hectare).

Cost of production per unit output was directly related with farm size on category I farms with Rs.385.78 and Rs.396.01 per tonne on small farms and large farms respectively. On category II farms, it was almost the same on both size group farms (Rs.374.94 and Rs.374.53 per quintal of jaggery on small and large farms respectively). On an average, cost of production per unit output was higher (Rs.393.80 per tonne) on category I farms compared to category II farms (Rs.364.76 per quintal).

Gross returns per unit of output was inversely related with farm size on category I farms with higher value on small farms (Rs. 416.97 per tonne) compared to Rs.414.43 per tonne on large farms. On category II farms, it was directly related with farm size with Rs.394.04 per quintal of jaggery on small farms and Rs.422.24 per quintal on large farms. On an average gross

returns per unit was higher on category I farms (Rs.414.99 per tonne) compared to category II farms (Rs.409.29 per quintal).

Net returns per unit of output was inversely related with farmsize on category I farms with Rs.31.19 per tonne on small and Rs.18.42 per tonne on large farms. On category II farms, netreturns per unit of output was Rs.19.10 per quintal on small farms and Rs.47.71 per quintal on large farms. On an average net returns per unit of output was higher on category II farms with Rs.44.53 per quintal of jaggery compared to Rs.21.19 per tonne of cane on category I farms.

On category I farms, gross returns per unit of output was lower (Rs.400 per tonne) on farms under CO 62175 compared to farms under other varieties (Rs.425 per tonne). However, cost of production per tonne was also lower on the CO 62175 variety farms (Rs.368.20 per tonne) compared to 'other variety' farms (Rs.406.91 per tonne). Hence net returns per tonne was higher (31.80) on farms under CO62175 variety compared to farms under other variety cane (Rs.18.09).

Cost A_1/A_2 was directly related with farm size on category I farms with Rs.15891.00 per hectare on small farms and Rs.19027.77 per hectare on large farms. On category II farms also it was directly related with farmsize, with Rs.21361.26 per hectare on small farms and Rs.21764.55 per hectare on large farms. On an average cost A_1/A_2 was higher on category II farms with Rs.21582.54 per hectare compared to Rs.18311.25 per hectare on category I farms.

Cost B also showed a direct relationship with farmsize on both categories of farms. It was higher on category II farms (Rs.29562.77 per hectare) compared to category I farms (Rs.26311.68 per hectare). Similarly cost C was also directly related with farmsize on category I farms, but was inversely related with farmsize on category II farms. It was higher (Rs.32227.16 per hectare) on category II farms compared to Rs.26597.64 per hectare on category I farms.

Among income measures, gross income was directly related with farmsize on category I farms with Rs.26686 per hectare on small and Rs.28425.99 per hectare on large farms. On category II farms also it was directly related with farmsize with Rs.34475.99 per hectare on small and Rs.35797.36 per hectare on large farms. On an average it was higher on category II farms (Rs.35200.98 per hectare) compared to category I farms (Rs.28028.55 per hectare).

Farm business income showed an inverse trend with an increase in farmsize on category I farms, whereas it was directly related with farm size on category II farms. On an average it amounted to Rs.13618.44 per hectare on category II farms and Rs.9717.30 per hectare on category I farms.

Family labour income was inversely related with farmsize on category I farms, whereas it showed a direct relationship with farmsize on category II farms (Rs.5638.21 per hectare) compared to category I farms.

Net income amounted to Rs.1995.98 per hectare on small farms and Rs.1263.61 per hectare on large farms on category I farms exhibiting an

inverse relationship, on category II farms it amounted to Rs.1672.10 per hectare on small and Rs.4044.57 per hectare on large farms. On an average it amounted to Rs.1430.92 per hectare on category I and Rs.2973.82 per hectare on category II farms.

Farm investment income was inversely related with farmsize on category I farms and on category II farms it was directly related. On an average it was higher (Rs.10954.06 per hectare) on category II farms. Farm investment income was inversely related with farmsize on category II farms compared to category I farms (Rs.9597.1 per hectare).

Benefit cost ratio was higher on small farms of category I (0.08) compared to large farms of same category (0.05). On category II farms, it was higher on large farms (0.13) compared to small farms (0.05). On an average benefit cost ratio was higher on category II farms (0.09) compared to category I farms (0.05).

From the break-even analysis it is observed that all farms were operating in profit zone, as the average yields realised on each size group of farm in both categories were higher than the break even output. On an average break even output was 57.93 tonnes per hectare on category I farms compared to 64.21 quintals of jaggery per hectare on category II farms. Break even output was directly related with farmsize on category I farms and was inversely related with farmsize on category II farms.

In the production function analysis seven independent variables included in the Cobb-Douglas model explained 89 per cent of variation in the output

levels on category I farms whereas on category II farms they explained variation upto 81 per cent. Highest per cent of explained variation was recorded on large farms of category II (96.58) and the lowest was on small farms of category II. On an average, five variables viz., land, bullock labour, human labour, seed cost and other expenses were statistically significant on category I farms, out of these bullock labour was negatively significant. On category II farms tractor hours, bullock labour, human labour and other expenses were found to be statistically significant, out of which bullock labour was negatively significant. Further resource use efficiency analysis on these farms revealed resource use inefficiency and hence need for changes in resource allocation and level of use.

Cost-output analysis revealed the existance of linear or quadratic trend on different size group farms of both category. On the average quadratic cost function was observed to be the best fit on category I farms compared to linear function on category II farms with R^2 values of 0.91 and 0.72 respectively.

In the marketing of sugarcane, trsnsporation cost was the major marketing cost. Total marketing cost was higher on large farms (Rs.37.23 per tonne) and lower on small farms (Rs.35.92 per tonne).

In the marketing of jaggery, marketing was done mainly in three ways viz commission sales (through open auction), consignment sales and direct sales. Different intermediaries operating in jaggery marketing were found to be commission agents, exporters, wholesalers and retailers.

Costs in marketing of jaggery was higher on small farms (Rs.24.95 per quintal) compared to Rs.22.4 per quintal on large farms with an average of Rs.23.57 per quintal on combined farms. On both size group farms commission charges were the major marketing cost followed by transporting charges. Higher per cent (4.5%) of commission charges were collected from farmers who took credit from commission agents compared to 2 per cent rate prescribed by Agricultural Market Committee, Chittoor.

Among the channels of marketing of jaggery operating in the district, operations exporting (channel 3) and consignment sales were predominent. Price spread study in channel I revealed that producer's share in consumer,s rupee was only 78.59 per cent.

Marketing costs were higher on both size group farms of category I as compared to category II because of higher transportation costs on category I farms.

Bulk line cost analysis revealed that on all size group farms of both categories, average price realised was lower than bulkline cost indicating that the price received is not remunerative. Bulk line cost on an average was Rs.467.50 per tonne on category I farms compared to Rs.455 per quintal on category II farms. Bulk line cost was inversely related with farmsize on category I farms compared to a direct relationship on category II farms.

Variations in price of cane supplied to factory was observed to be of greater magnitude (12 per cent) compared to 9 per cent in case of price of jaggery. However, frequency of variations in price (Price fluctuations) was

more in the case of jaggery compared to cane, as revealed by seasonal changes in price of jaggery.

Labour shortage, lower cane price were the main problems in production and marketing of cane. Lack of regulated market yard, fluctuations in the price of jaggery, credit and labour shortage were the major problems faced by the jaggery producers as per the opinion survey.

Conclusions:

The following important conclusions were drawn from the present study.

Family size and percentage of family labour available for farm work were higher on category II farms as compared to category I farms.

Percentage of area under sugarcane to the total operational holding was higher on category II farms compared to category I farms.

Value of assets per hectare was higher on category II farms.

Productivity was directly related with farmsize on category I farms and it was inversely related to farmsize on category II farms.

Human labour utilisation was higher on category II farms indicating higher labour intensive nature of jaggery preparation compared to cane supply.

Percentage of family labour to total labour decreased with increase in size of farm on both categories of farms.

Cost of production was higher on category II farms and was inversely related with farmsize. It was directly related to farmsize on category I farms.

Cost of production per unit of output was higher on category I farms.

Gross returns per unit of output was inversely related with farmsize on category I farms and it was directly related on category II farms. The same trend was observed with respect to net returns per unit of output also.

Cost A, was higher on category II farms and directly related to farmsize on both categories of farms. Similar trend was observed with cost B also.

Gross income was directly related to farmsize on category I farms, as well as on category II farms, with higher values on category II farms.

Farm business income and family labour income were inversely related with farmsize on category I farms and directly related with farmsize on category II farms. Both the income measures were higher on category II farms.

Net income was higher on category II farms, and was inversely related with farm size on category I farms and directly related to farmsize on category II farms. Similar trend was observed with Farm investment income also.

Profits were higher on category II farms as incated by higher Benefit cost Ratio and lower percentage of breakeven output to average yield.

Production functional analysis together with resource use efficiency analysis revealed that out of five inputs significant on category I farms, bullock labour was excessively used and other inputs viz., land, humanlabour seed cost and other expenses were under utilised. On category II farms land and bullock labour were excessively used and, tractor power, human labour and other expenses were under utilised.

Cost function analysis revealed the operation of increasing cost function of linear nature on category II farms and quadratic nature on category I farms.

Marketing costs were higher and directly related to farmsize on category I farms and on category II farms they were inversely related to farmsize.

Producer's share in consumer rupee in jaggery marketing was considerably reduced due to the operation of intermediaries in between producer and consumer.

Price received by category I as well as category II farms was not remunerative as per the results of the present study.

Magnitude of price variation was more in the case of cane, but frequency of price variation was more in the case of jaggery.

From the present study following suggestions are made

Yield gaps in sugarcane need to be allieviated by integrating efforts of farm community, extension personnel and farm scientist community.

Excessive stress laid on 'other (early) varieties' must be relieved in order to encourage farmers to supply cane to factory by issuing timely cutting permits.

Price policy changes have to be effected to provide remunerative price to cane suppliers.

Farmers must be educated about scientific method of jaggery preparation to improve the quality of jaggery and there by enable farmers to realise higher price.

Regulated market yard for jaggery need to be provided as soon as possible to reduce intermediaries in between producer and consumer. Till then strict enforcement of rules controlling the powers of different intermediaries need to be taken up to check exploitation of jaggery producers.

Jaggery producers cooperatives may be an alternative to check exploitation of jaggery producers.

Adequate crop finance and market finance must be extended to farming community in time by credit institutions at lower rates of interest to enable them to take up cane or jaggery production and market efficiently and to save them from the clutches of money lenders. At least 2/3rd of Present Cost of cultivation must be fixed as scale of finance. Infrastructural development such as proper transport facilities and storage facilities are to be provided to reduce transportation costs and to enable

jaggery producers to sell their produce in proper time instead of selling in glut market.

A mechanism of jaggery price regulation need to be effected to check violent and frequent fluctuations in jaggery price.

Parity between jaggery price and cane price is to be effected through suitable measures to facilitate healthy competition between these two sugarcane based industries and there by stabilise cane supply to the factory.

LITERATURE CITED

LITERATURE CITED

Acharya TKT 1965 Resource productivity and optimum resource allocation on a sample of Queensland sugarcane farms. Indian Journal of Agricultural Economics 20(2): 20-31.

Acharya TKT, Patel R T and Waghmare R E 1976 Economics of different sources of irrigation and its impact on cropping pattern on irrigated farms of Poona District (Maharashtra). Indian Journal of Agricultural Economics 31(3): 235-236.

Acharya TKT, Waghmare R E and Gore S K 1976 Impact of mechanization on capital investment and resource use pattern on sugarcane farms of Kolhapur District (Maharashtra). Indian Journal of Agricultural Economics 31(3): 234.

Agarwal 1954 Prices and Production trends in Agriculture. Indian Journal of Agricultural Economics 9(1): 42-43.

Agarwal G D and Foreman W J 1959 Farm resource productivity in west Uttar Pradesh. Indian Journal of Agricultural Economics 14(4): 115-128.

Agarwal G D and Pal P S 1975 Sugarcane Productivity in U.P. during 1901 to 1975. Agricultural Situation in India 30(5): 361-364.

Anang Nath and Mohd Ishtiyaq Ali 1978 Utilization of inter row spaces on autumn planted sugarcane for higher returns. Co-operative sugar 9(9): 466-467.

Ananth Ram Verma 1981 Employment of far-holding in district Unnao, Uttar Pradesh. Indian Journal of Agricultural Economics 36(4): 47.

Arjuna Rao B 1966 Cost studies in sugarcane in Krishna District, Andhra Pradesh. M.Sc.(Ag.) Thesis, Andhra Pradesh Agricultural University.

Ashok Chamotra Moorthi T V and Bhim Singh 1976. Bullock energy input for selected crops in paonta valley of Himachal Pradesh. Indian Journal of Agricultural Economics 31(3): 241-242.

Azad M P and Garg J S 1974 Productivity and Optimization of resource use in sugarcane in Uttar Pradesh (A case study). Indian Journal of Agricultural Economics 29(3): 170-171.

Azad M P, Tewari S P and Nigam H K 1981 Determination of sugarcane price (A case study). Indian Journal of Agricultural Economics 36(4): 112.

Balasubramanyam 1986 An economic analysis of yield gaps and constraints in Paddy and Sugarcane production in Chandragiri Taluk of Chittoor District - A.P. M.Sc.(Ag.) Thesis Andhra Pradesh Agricultural University.

Balasubramaniam 1991 Pricing policy anaomalies distort sugar economy - The Hindu dated February 21, 1991.

Behl K K, and Narwal S S 1977 To study the feasibility of intercropping of rabi crop in autumn planted sugarcane. Indian Sugar 27(1): 23-26.

Behl K K Chhabra K L and Surinder Singh 1980 Intercropping in autumn planted sugarcane cooperative sugar 11(8): 401-403.

Bhagat Singh 1966 Cost of cultivation to the size of holding. Indian Journal of Agricultural Economics 21(3): 71-74.

Bhalerao and Singh 1972 Economics of sugarcane cultivation in Basti District (Uttar Pradesh). Cooperative sugar 3(5): 233-241.

Bhutada J C and Parashar K S 1981 Studies on the effect of intercropping and nitrogen fertilization on the yield and quality of sugarcane first ratoon. Indiah Sugar 31(4): 273-279.

Bose P.K. and Thakur K. 1980. A study on cropping pattern of sugarcane and wheat for efficient use of land resource Indian Sugar 29(12): 771-776.

Brijendra Singh, Rajvir Singh and Singh LR 1974 Economics of sugarcane vis-a-vis its competing crops. Indian Journal of Agricultural Economics 29(3): 175.

Chougule J D and Patil B R 1982 Cultivation of sugarcane ratoon is economics than plant cane in medium black soils of Maharashtra. Maharashtra Sugar 7(6): 43-45.

Chougule J D 1982 Resource productivities in sugarcane and other crops and selected cultivators farms in Kolhapur District of Maharashtra. Maharashtra Sugar 7(7): 69-71.

Chougule J D and Patil B R 1983 Resource productivity in sugarcane in selected cultivator farms in Kolhapur District of Maharashtra. Co-operative Sugar 14(12): 625.

Croxton and Cowden 1964 Applied general statistics.

Das F C and Krishen Singh 1988 Need of mechanisation for increasing production and productivity of cane in India - Agricultural Situation in India - XLIII (9): 757-760.

Dayanatha Jha 1970 Acreage response of sugarcane in factory areas of North Bihar. Indian Journal of Agricultural Economics 25(1): 79.

Dhawan 1967 Productivity of factory operated sugarcane farms in India. Indian Journal of Agricultural Economics 22(3): 28.

Dhawan K C and Kahlon 1974 Impact of yield increasing food grain technology on the cultivation of commercial crops - Indian Journal of Agricultural Economics - Vol. 29(3): 92.

Dhoble M V and Khuspe V S 1983 Studies on intercropping in sugarcane. Indian Sugar 33(4): 255-258.

Ethirajan A S, Arvindmisra and Maikulal 1981 Intercropping bengalgram with sugarcane. Indiah Sugar 31(8): 525-528.

Gangadharamma K 1982 Resource productivity of sugarcane and jaggery enterpricse in Tuni Taluk of East Godavari District (Andhra Pradesh). M.Sc.(Ag.) Thesis, Andhra Pradesh Agricultural University.

Garg J S and Raghuvanshi N S 1960 Economic study of sugarcane in Uttar Pradesh. Rural India 23(5): 185-186.

Garg J S 1975 Resource mobilization in the agricultural sector tax on agricultural income -An appraisal. Indian Journal of Agricultural Economics 30(2): 62.

Garg J S, Singh G N and Pandey K N 1976 An estimation of energy requirements of mechanised farms in district Muzoffarnagar (Uttar Pradesh). Indian Journal of Agricultural Economics 31(3): 247.

Gawhahe B H and Patil R S 1976 Intercropping cereals in sugarcane. Indian Sugar (7): 493-500.

George M V, Kurian N J and Chandra Mohan C 1983 Factor shares in Indian Agricultural - Temporal and Spatial Variations and their implications. Indian Journal of Agricultural Economics 38(3): 399-406.

Grewal S S and Kahlon A S 1966 Implications of the disturbance of Gur and Sugarcane price parity Agricultural Situation in India. 21(2&3): 77-84.

Gundu Rao 1969 Stabilising sugar production. Indian Sugar 19(2): 105.

Gupta and Mahavir Prasad 1982 Correlation study among sugarcane area, average sugarcane yield and sugar recovery percent in Uttar Pradesh. Cooperative Sugar 14(2): 65-68.

Gupta B K and Sharma A N 1985 Comparative economics of mentha, sugarcane and mentha sugarcane mixed cropping Agricultural Situation in India 40(4): 261-264.

Hanumantha Rao C H 1965 Agricultural production functions, costs and returns in India Asia Publishing House.

Hasan Md. and Parthasarathy P B 1980 Economics of mechanised sugarcane farming - A case study in Bodhan Taluk, Nizamabad district, Andhra Pradesh. The Andhra Agricultural Journal 27(5&6): 281-285.

Hasan Md. and Parthasarathy P B 1981 Resource productivity variation in mechanised farms. The Andhra Agricultural Journal 28(1&2): 63-66.

Jadhav M G 1984 Productivity of sugarcane. Sugarcane Cultivation. A Regional Survey 83-89.

Jagdish Lal, Singh L R and Singh R V 1976 Resource productivity in relation to farm mechanization. Indian Journal of Agricultural Economics 31(4): 145-151.

Jagdish Lal 1979 Price spread of Gur and Khandasari in central U.P. - comparative analysis. Indian Journal of Agricultural Economics 34(4): 209.

Jagdish Lal 1980 A study on cost and returns of sugarcane under different sizes of farms in Uttar Pradesh. Indian Sugar 39(6): 305-307.

Jagdish Lal and Kartar Singh 1980 Trends and variability in area, production and productivity of cane in U.P. Agricutlural Situation in India 35(2): 91-94.

Jagadish Lal 1987 Response of sugarcane producers to prices and non-price factors. Agricultural situation in India 817-822.

Jain R P (1990) Fluctuations in sugar production. Cooperative Sugar 21(5): 333-336.

Jayamma 1988 Resource productivity, returns to scale and scale of finance in sugarcane crop (plant and ratoon) in Medak district of Andhra Pradesh M.S.(Ag.) Thesis, Andhra Pradesh Agricultural University.

Kahlon A S and John Kurien 1984 Trneds in the share of rental value of land in cost of cultivation of major in India. Agricultural situation in India 34(1): 3-7.

Kanoriat 1966 Some suggestions to growers for improved methods of cane plantations in Northern India - Indian Sugar 16(2): 93-94.

Kedarnath 1991 Increasing income and employment through optimal cropping pattern in Chandragiri Mandal of Chittoor district in A.P. - M.Sc.(Ag.) Thesis. Andhra Pradesh Agricultural University.

Kirtikar Dixit R S and Jai Singh Saroj 1975 Intercropping with autumn planted sugarcane in the Taraitract of Uttar Pradesh Indian Sugar 25(1): 27-30.

Krishnaiah J 1981 Comparative economics of sugarcane converted into sugar and jaggery. Co-operative sugar 12(7): 355.

Krishnaiah J and Subba Rama Raju K 1989 Price spread in Marketing of jaggery at Anakapalle Jaggery market in A.P. - 1980 Andhra Agricultural Journal 36(2&3): 131.

Lala Bansidhar 1965 Problems of sugar industry in west Uttar Pradesh. Indian Sugar 15(5): 277-281.

Latchumibaty 1977 A study on the pattern of growth of sugar farm in factory area. M.Sc.(Ag.) Thesis, Tamil Nadu Agricultural University, Coimbattore.

Lavania G S, Bhalerao M M and Panduranga Rao A 1978 Impact of commercial bank finance on costs and returns in sugarcane. Co-operative Sugar 9(8): 405-410.

Majumdar N A 1963 Crop pattern, production targets and strategic intervention. Indian Journal of Agricultural Economics 18(1): 44-53.

Malya 1963 Urbanisation and cropping pattern. Indian Journal of Agricultural Economics 18(1): 90-96.

Manohar Rao 1989 Preparation index and mill extraction in Indian sugar factories Vs sugar factories of Australia and South Africa. Cooperative Sugar 20(5) 387-346.

Mathur B S 1975 Intercropping of autumn planted sugarcane with wheat. Indian Sugar 25(5): 405-414.

Mathur B S 1980 Intensive rotation and intercropping of sugarcane. Indian Sugar 30(7): 353-358.

Mehta 1969 Problems and Prospectus of the sugar industry. Indian Sugar 19(5): 393-400.

Meenakshi K 1987 Economics of crop rotation in Tottambedu taluk of Chittoor district under irrigated conditions. M.Sc.(Ag.) Thesis, Andhra Pradesh Agricultural University.

Muniraj R 1968 Crisis of sugar industry solutions. Indian sugar 17(10): 735-738.

Nagabhushanam T D J 1970 Capital resource productivity and credit limits on farm firms in Krishna and Guntur district of A.P. Ph.D. Thesis Indian Agiruclture Research Institute.

Naidu M R 1975 Economics of jaggery production in the selected villages of Anakapalle area (Andhra Pradesh). Food farming and Agriculture 7(5):1-2.

Naidu M R and Chennarayudu K C 1976 Towards bettern sugarcane production in Tuni taluk of East Godavari. Indian Sugar 26(8): 553-556.

Naidu M R and Hota B C 1977 Functional analysis of sugarcane farms in Anakapalle area of Andhra Pradesh Co-operative Sugar 8(10): 485-488.

Naidu M R and Gupta S B 1983 Resource use efficiency in farms of East Godavati. The Andhra Agricultural Journal 29(1): 14-18.

Naidu M R and Krishna Rao 1986 "The coexistance of sugar industry and the jaggery market". Cooperative sugar 18(2): 87-88.

Narwal S S and Behl K K 1978 Effect of intercropping on the yield of spring planted sugarcane. Indian Sugar 28(1): 27-30.

Narwal S S and Malik D S 1981 Effect of intercropping on the growth and yield of sugarcane varieties. Indian Sugar 31(3): 193-198.

Nirmal Singh and Bal 1974. Economics of commercial crops in Punjab. Indian Journal of Agricultural Economics 29(3): 164-165.

Padmanabhan K 1991 Performance efficiency of cane jaggery marketing and the scope for cooperative marketing. Indian Cooperative review 29(1): 13-17.

Parashar K S, Arora P N and Sharma R P 1979 Effect of short duration winter vegetables as intercrops grown in autumn planted cane on the yield of milleable canes, juice quality and economics. Indian Sugar 29(4): 217-223.

Parthasarathy P B 1974 The cost structure of sugarcane an emperical study in regional variations. Ph.D. Thesis, Osmania University.

Parthasarathy P B and Suryanarayana K S 1974 Regional variations in resource productivity of sugarcane farms in Andhra Pradesh. Indian Journal of Agricultural Economics 29(3): 188-189.

Parthasarathy P B and Suryanarayana K S 1975 Statistical cost functions and emperical study in Agriculture. Paper presented to the 14th All India Econometric Conference, Delhi January 1974.

Parthasarathy P B and Suryanarayana K S 1976 Impact of input prices on profitability in sugarcane production. Application of break-even analysis. Indian Journal of Agricultural Economics 31(4): 122.

Patel I S, Patel M L and Bhatt J P 1981 Intercropping in autumn planted sugarcane. Sugar News 13(8): 11-14.

Patil N P 1966 Input costs and returns of major irrigated crops in Mandya district. Indian Journal of Agricultural Economics 21(2): 78-83.

Patil S M and Acharya T K T 1974 A comparative study of resource productivities and resource allocation on a sample of sugarcane and banana farms in Nasik and Jalgaon district of Maharashtra state. Indian Journal of Agricultural Economics 29(3): 186-187.

Patil S J, Dhongade M P and Kasar D V 1979 Economics of sugarcane cultivation in Rahuri region of Ahmednagar district in Western Maharashtra. A case study by size of farm. Indian Sugar 29(9): 585-590.

Pitamber Sethi and Parashar K S 1981 Studies on the effect of intercropping and nitrogen levels on the yield of spring planted sugarcane. Indian Sugar 31(2): 95-100.

Pitamber Sethi and Parashar K S 1981 Studies on the effect of intercropping and nitrogen levels on the yield of spring planted sugarcane. Indian Sugar 31(2): 95-100.

Porwal N K and Kumpawat B S 1985 Studies on the effect of intercropping with and without fertilizer on the yield of spring planted sugarcane. Indian Sugar 35(5): 309-313.

Praduman Kumar 1984 Price policy model of sugarcane and its products. Indian Journal of Agricultural Economics 39(4): 595-613.

Raghuram P and Darsi V S Rao 1986 An economic analysis of sugarcane vis-a-vis its competing crops. Bharatiya Sugar December' 1986: 31-35.

Raghuram P and Darsi V S Rao 1987 Economics of rainfed and irrigated sugarcane cultivation in Andhra Pradesh. Indian Sugar 36(12): 621.

Rahman M M and Islam M M 1987 A study of economics of intercropping with sugarcane in selected arears of Bangladesh Economic affairs 32(1): 38-43.

Rajeswhar Tiwari and Singh D K 1981 Relative profitability of autumn Vs spring planted sugarcane grown alone or with intercrops and their competing cereal rotations. Indian Sugar 30(11): 685-689.

Rajeswhar Tiwari and Singh D K 1982 Intercropping with sugarcane helps in the reduction of per quintal cost of production of sugarcane. A case study - Indian Sugar 30(1): 813-818.

Rajeswhar Tiwari 1989 Causes of fluctuations in acreage and productivity of sugarcane in North Bihar. Cooperative Sugar 20(8): 557-562.

Ramachandra Murthy 1965 Gur making leaves you more profits. Sugarcane Herald 7(11): 5-6.

Rama Kumar P 1985 Profitability of sugarcane farming in Anantapur district an empirical analysis M.Sc.(Ag.) Thesis, Andhra Pradesh Agricultural University.

Rambabu L R 1980 Economics of sugarcane cultivation in Nizamabad district (Andhra Pradesh). M.Sc.(Ag.) Thesis, Andhra Pradesh Agricultural University.

Ram Dhan Singh and Dulip singh Lohan 1960 Economics of production of irrigated crops of sugarcane potato and wheat in some villages of the sonepat community project area, Rohtak district (Punjab). Indian Journal of Agricultural Economics 15(3): 34.

Ramesh M V 1988 Economics of production and marketing of sugarcane in East Godavari district of Andhra Pradesh. M.Sc.(Ag.) Thesis, Andhra Pradesh Agricultural University.

Rao D V S, Raghuram R and Chowdary N A 1986 Sugarcane (rainfed) based cropping system. Seeds and farms 12(9): 42.

Rathi K S and Tripathi H N 1975 Intercropping with autumn planted sugarcane III. Cultivation of mustard with sugarcane in Scientific way. Co-operative sugar 6(1): 7-10.

Rathi K S and Tripathi H N 1975 Intercropping with autumn planted sugarcane IV. Cultivation of late variety of potato with sugarcane in scientific way. Co-operative sugar (6(4): 163-165.

Rathi K S, Tripathi H N and Tripathi H S 1979 Agro Technique for higher production of wheat in the ratoon of autumn harvested sugarcane. Co-operative Sugar 10(4): 185-186.

Rathod 1973 Response of sugarcane producers to prices a case study of western Uttar Pradesh. Agriricultural Situation in India 28(6): 795-801.

Rebello N S P, Chandrasekhar G S Shankaramurthy H G and Hiremath K C 1976 The impact of the increase in the prices of inputs on the profitability and production of sugarcane and paddy in Mandya district of Karnataka. Indian Journal of Agricultural Economics 31(3): 71-81.

Sastry K N R and Ramana R 1978 Economics of growing planted and ratoon crops of sugarcane in Krishna Raja Sugar area (Karnataka State). Financing Agriculture 9(4): 10-13.

Satyanarayana Y 1967 Factors affecting acreage under sugarcane in India. Indian Journal of Agricultural Economics 22(2).

Sethi A S and Kanwa R S 1987 Trend analysis and Relative contribution of the factors affecting sugarcane and sugar productivity in India. Agricultural Situation in India Nov. 1987 (8) 707-710.

Shakuntla Mehra 1976 Some aspects of labour use in Indian agriculture. Indian Journal of Agricultural Economics 31(4): 95-121.

Shanmugam K S 1974 Sugarcane crop and its response to fertilizer application. Farmer and Parliament 9(6): 11.

Sharma R K and Chauhan D V S 1974 Sugar production and profit per hectare from sugarcane and sugar beet. Sugar News 6(8): 19-20.

Shukla B D and Pandey H K 1969 Study of costs and returns on sugarcane farms. Agricultural Situation in India 23(12): 1253-1256.

Shukla D S, Sharma P K, Shri Ram Yadav and Chauhan Y S 1976 Pattern of energy use per hectare in different areas of district bareilly (Uttar Pradesh). Indian Journal of Agricultural Economics 31(3): 245-246.

Singh R and Patel R K 1973 Returns to scale, farm size and producivity in Meerut district. Indian Journal of Agricultural Economics 28(2): 43.

SSingh L R and Sirohi A S 1973 Capital structure and productivity of farms in Shajanpur and Meerut district of western Uttar Pradesh. Indian Journal of Agricultural Economics 28(1): 90-96.

Singh I J, Gangwar A C, Chikkara O P and Singh P 1974 Production function for commercial crops in Haryana. Indian Journal of Agricultural Economics 29(3): 143-147.

Singh G N and Srivatsava H L 1974 Economics of resource use and productivity of sugarcane (Uttar Pradesh) Indian Journal of Agricultural Economics 29(3): 174-175.

Singh L R and Brijendra Singh 1976. Level and pattern of energy consumption in an agriculturally advanced area of Uttar Pradesh. Indian Journal of Agricultural Economics 31(3): 157-165.

Singh A J and Dhawan K C 1976 Energy requirements at different levels of technology in Punjab. Indian Journal of Agricultural Economics 31(3): 243-244.

Singh R K, Singh R I, Singh G N and Singh D S 1976 Importance of purchased inputs in the cost structure and their productivity in farming. Indian Journal of Agricultural Economics 31(3): 131-132.

Singh G B 1983 Sugarcane productivity-constraints and remedies. Indian farming 32(12): 28-31.

Sinha S S, Jha K C and Singh V P 1985 Studies on intercropping in autumn planted sugarcane Maharashtra Sugar 19(5): 13-16.

Sohani D K and Pawar J R 1977 Resource productivity on sugarcane farms in Sangli district of Maharashtra. Co-operative sugar 8(7): 367-371.

Soham S M and Rathore B S 1976 Level and pattern of energy consumption in agriculture. Indian Journal of Agricultural Economics 31(3): 245.

Som P Pudasaini 1983 The contribution of education to allocative and technical efficiency in sugarcane production in Nepal. Indian Journal of Agricultural Economics 30(1): 48-45.

Sreedevi 1989 Marketing of sugarcane in Chittoor M.Sc.(Ag) Thesis. Andhra Pradesh Agricultural University.

Subba Rao 1969 Farm supply response a case study of sugarcane in A.P. Indian Journal of Agricultural Economics 24(1): 84-88.

Subba Reddy S, Eswara Prasad Y, Naidu M R and Shareef S M 1983 Input use efficiency on sugarcane farms in Chittoor district of Andhra Pradesh Co-operative sugar 14(9): 461-463.

Sur A K 1956 Why Indian sugar is so costly. Indian Sugar 5(4): 7-9.

Tambad S B and Hiregoudar S L 1969 Optimum utilisation of resources in sugarcane - Mandhya District - Mysotre State. Agricultural Situation in India 24(2): 99-106.

Thakur D R, Yadav R P, and Nadda A L 1976 Energy requirements of commercial crops in Himachal Pradesh. Indian Journal of Agricultural Economics 31(3): 242-243.

Thuljaram Rao 1986 Stabilisation of sugarcane production in India- Cooperative Sugar 17(5): 383-387.

Tripathi R L and Ajit Singh 1977 Observations on the assessment of the scope of intercropping in autumn planted sugarcane in Dhuri mill area. Indian Sugar 26(11): 753-758.

Venkata Ramana Rao S 1991 Regional variations in the cost structure and profitability of sugarcane in A.P. An economical analysis Ph.D. Thesis. Andhra Pradesh Agricultural University.

Verma R A, Motiwala M P, Chauhan R S and Tewari R K 1971 Studies in intercropping of spices and tobacco with autumn sugarcane. Indian Sugar 31(7): 451-456.

Wankhede N P and Parashar K S 1975 Studies on intercropping of cotton in spring planted sugarcane. Indian Sugar 24(11): 951-954.