CHAPTER - II

REVIEW OF LITERATURE
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In this chapter, review of related works pertinent to the topic of research was made in order to know the present status of research in the area. The knowledge of these studies would help the researcher to proceed in an appropriate direction in the present study and to draw meaningful conclusions.

Rao I.V.Y. Rama (2012)\(^4\) in his study entitled that Efficiency, yield gap and constraints analysis in irrigated vis-à-vis rain fed sugarcane in north coastal zone of Andhra Pradesh. the economics of yield gap in irrigated and rain fed sugarcane cultivation have been studied in North Coastal Zone of Andhra Pradesh for the period 2008–09 by collecting data on various aspects of costs and returns. Budgeting techniques, cost concepts, benefit cost ratio (BCR), yield gap analysis and response priority index have been used for the analysis. The study has shown that the value of BCR is higher for plant crop in irrigated (1.49\%) than in rain fed (1.43\%) regions. The yield gap between irrigated and rain fed regions has been found to be 67.00\%, in which input usage had a higher (41.86\%) effect than cultural practices (25.93\%). The most important constraint in sugarcane cultivation is shortage of labour during crucial operations. Therefore, irrigated sugarcane is more remunerative and yields can be sustainable if constraints are addressed and a proper package of practices is followed.

Jaswanth Singh, R.D.Singh, S.I.Anwar and S.Solomon (2011)\(^5\) in their paper entitled that ‘Alternative Sweeteners Production from sugarcane in India: Lump Sugar (Jaggery)’. Importance of sweeteners has long been recognized in Indian diets. Sweetness and flavor are very important as regards


consumers’ acceptability. The sugar and jaggery are the main sweetening agents which are added to beverage and foods for increasing palatability. Over the years, food habits of human beings have been greatly influenced by research and developmental activities and also due to their health consciousness. Despite witnessing pressure of industrialization, the jaggery industry has flourished in different states of the country viz., Uttar Pradesh, Tamilnadu, Karnataka, Maharashtra and Andhra Pradesh. The increasing trend of their production is of much significance to learn about peoples’ liking towards jaggery in rural areas mainly due to it’s nutritional and medicinal values. About 25.30% of sugarcane produced in the country is utilized for production of jiggery and khandsari and this industry serves as very important means of subsistence and livelihood for masses. The technology and equipment for production of quality jaggery and its value added products have been developed. Due to its nutritional and medicinal values, the jiggery has great export potential in the world.

Murali P., Balakrishnan R. (2011) In the recent past, labour scarcity coupled with high labour wage rate has greatly affected the irrigation and harvesting of sugarcane crop in time. It has reduced sugarcane area from 3.91 lakh ha in 2006–07 to 3.14 lakh ha in 2009–10 in Tamil Nadu. Modern sugarcane machinery and labour-saving devices were introduced on a large scale to reduce dependency on labour, and finish different farm operations in time. The study has found the mechanical operations to be superior to manual operations in sugarcane cultivation. These have reduced cost of production and have enabled efficient utilization of resources with better work output. For example, furrow method of irrigation required about 320 person-hour, whereas drip irrigation required only 30 person-hour. Similarly, manual harvesting required about 1000 person-hour and cost of 55000 to harvest 100 tonne (550/t) against 32500 (325/t) with the labour engagement for 12 person-hour/ha.

The study has concluded that it has become inevitable to use modern sugarcane machinery, which is now available in the country. Although its initial cost is very high, the advantages accrued in their use are many. The study has suggested the use of drip irrigation and mechanical harvesters to mitigate the acute labour scarcity (farm operation and harvesting). It has also proposed to implement custom hiring system on co-operative basis/or owned and operated by the sugar factories for sugarcane harvesters in the state.

I.V.Y Rama Rao., G Sunil Kumar Babu (2011)⁷: The present study was an attempt to work-out costs and returns in value added products of Sugarcane viz., sugar, jaggery and sugarcane juice, in order to suggest the sugarcane growers the profitable and sustained way to deal with sugarcane. Multistage sampling technique was adopted in selecting the sampling units at various levels during 2010-11. Analytical tools like tabular analysis and Benefit Cost Ratio (BCR) were employed to achieve the objectives. The results revealed that cost of cultivation of sugarcane is the prime factor in the various value added products. Among the value added products, sugarcane juice production was found more profitable, which needs further study of technical and financial feasibility of keeping quality in order to produce on large scale.

K. Shrivastava, A. K. Srivastava, S. Solomon, A. Sawnani and S. P. Shukla (2011)⁸: In their study entitled that ‘Sugarcane cultivation and Sugar industry in India’. Sugarcane had been one of the most important and celebrated crops cultivated widely in India since time immemorial. Its cultivation and uses are mentioned in ancient Indian literature as well as in the descriptions in important books written during the reign of various kings as also in the descriptions given by various travelers who visited India during different periods. Ancient Indian literature (Puranas, etc.) mention about gur and sharkara made from sugarcane juice. The earliest record of establishment

of first sugar factories in India dates back to 1610 by Captain Hippon at Masulipatam and Petapoli on the Coromandel Coast, and subsequently one at Surat on the West Coast by Captains Best and Dowton in 1612. Sugarcane is grown by a large number of farmers its command area supply, marketing and payment to the farmers, etc., have been regulated by various Acts and Sugarcane Control orders promulgated and amended by the Government from time to time. Sugarcane development has received due importance both at the national level as well as at the state (Province) levels. The rapid developments in sugarcane cultivation and sugar industry in the country have earned India a prestigious position among sugar producing nations in the world. Today it maintains the second position, next to Brazil. The Sugar Industry has become a pivot for the socio economic transformation of rural India.

Imandi Venkata Yoga Ramarao (2011)⁹: The present study was conducted during 2008–2009 in Andhra Pradesh State of India, is an attempt to work-out various facets of economics involved in Jaggery manufacturing and marketing, constraints faced by jaggery manufacturers. Multistage sampling technique was adopted in selecting the sampling units. Averages, benefit–cost ratio (BCR), net present worth (NPW), internal rate of return (IRR), break even output (BEO), payback period (PBP), Garrets ranking technique and Kendall’s coefficient of concordance (W) test were employed as analytical tools. Cost of cultivation of sugarcane (68.22%) is the prime factor in jaggery manufacturing. Lack of infrastructural facilities in jaggery production and insufficient price dissemination in jaggery marketing were major constraints. Market concentration in whole sellers was moderately high (Gini coefficient = 0.59) and in commission agents was medium (Gini coefficient = 0.45). For profitable and sustained way of jaggery manufacturing and marketing these constraints should be addressed at war foot basis.

⁹Imandi Venkata Yoga Ramarao, An Economic Appraisal of Manufacturing and Marketing of Jaggery in Andhra Pradesh state, India Sugar Tech September 2011, Volume 13, Issue 3, pp 236-244
Amit Kumar Dwivedi (2010), in his study the entitiled that ‘An Empirical Study on Gur (Jaggery) Industry’. Gur (Jaggery) is a natural, traditional product of sugarcane. It can define as a honey brown coloured raw lump of sugar. Kushinagar1 district of Uttar-Pradesh has large number of Gur manufacturing units, mostly located in the rural areas and the manufacturers are following conventonal methods for producing this. In the district the major clusters which are having more numbers of manufacturing units are Sukraouli, Kasia, Hata and Padarauna. Around half of the rural population is employed in gur making industry in this region. Although, there is no R & D assistance and marketing institutions for support. It is found that the manufacturers are producing majorly for distilleries and local licker producers, not for the food plate or common man’s consumption.

The research study examines the cost-return analysis, profitability and operational efficiency of Gur manufacturing units in study area. The study revealed that units of medium and large sizes were able to cover their operating expenses with significant level of profit but small size units were earning marginal profit. The profit earned by this category was very low as compared to other two sizes. The manufacturers are not interested in any new product of Gur, they just want to earn more profit through Gur only. This research will urged the policymakers to streamline strategies that promote stabilization of sugarcane economy and make the nation credible supplier of Gur in the International market, benefiting Gur makers, sugarcane growers and related stakeholders.

Dharmawardene (2008) studied Trends in farm mechanization by sugarcane small land holders in Sri Lanka. He found that The mechanization of

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farm power is becoming extremely important day by day for the survival, efficiency and competitiveness of all field and plantation crops of the country. Sugarcane crop grown in the dry zone is no exception. In fact in these areas the available manpower is low due to low population densities and harsh climatic conditions and remoteness of locations from major cities. Thus scarcity of labour is common in sugarcane areas for manual work. Furthermore, labourer manual work get easily tired while working in the dry zone compared to the hills due to higher temperatures, harder soils, insolation and dry desiccating winds. Thus output of these workers is low compared to workers in the hills. In addition, cane fields tend to have a high population of poisonous snakes, which also make worker to be careful and slow in the cane fields. Thus timely agricultural operations get neglected causing crop losses while labour wages keep rising day by day especially during planting, weeding and harvesting/loading periods of sugarcane growing. Analysis of the cost components of sugarcane cultivation shows that harvesting of loading of cane comprise 35% of the costs followed by land preparation(21%), planting(16%), weeding(10%), fertilizer application(10%) and irrigation(8%). It is evident that harvesting and loading of cane is the highest cost component in sugarcane cultivation, while weeding fertilizer application, stubble shaving, earthling up, off baring in the ratoons are neglected by small land holder farmers as manual methods are labour intensive leading to considerable losses in crop production. Thus, small holder sugarcane farm mechanization to improve the productivity and ease strain on human labour has become crucial in order to improve sugarcane productivity in Sri Lanka.

K.G.Kshirsagar (2008)\textsuperscript{12} study entitled ‘Organic Sugarcane Farming for Enhancing Farmers Income and Reducing the Degradation of Land and Water Resource in Maharashtra’. The study points out that Maharashtra is the second largest sugarcane growing state in the country. It contributed 0.58

million hectares (13.53 per cent) to total area and 45.78 million tones (15.06) to total production of sugarcane in the country in TE 2002-03. Sugarcane, the second most important cash crop of the state covers less than three percent of the total cropped area but utilizes more than 60 per cent of the total water available for irrigation in the state. This has already exerted considerable strain on the limited water resources of the state. The demand of water for sugarcane irrigation has led to an increase in the number of wells and had resulted in to decrease of water table by more than four meters over the past decade in several districts, including the study districts, Jalgaon and Kolhapur (World Bank, 2003). Moreover, the excess use of water combined with higher doses of chemical fertilizers has resulted in enhanced degradation of land and water resources (Pachauri and Sridharan, 1998). This is reflected in the secular decline of sugarcane productivity in recent decades in Maharashtra (Samui et al., 2005).

Organic farming sustains and ameliorates the health of agro-ecosystem encompassing nutrient bio-cycles and soil microbial and bio-chemical activities. It forbids the use of chemo-synthetic fertilizers and pesticides and fosters socially and environmentally beneficial practices such as intercropping, green manuring, and use of organic manures, vermin-compost, bio-fertilizers and bio-pesticides. Recognizing the importance of organic farming, the Government of Maharashtra is promoting organic farming in the state since 2003-04 (Government of Maharashtra, 2007). This has helped in increasing the awareness about organic farming, reducing the use of chemicals, and enhancing the area under organic farming in the state.

R. N. S. Yadav, Sandeep Yadav and Raj Kumar Tejra (2008) the paper titled is Labour saving and cost reduction machinery for sugarcane cultivation. In this study they are studied Cultural operations for sugarcane production are very arduous especially planting, inter culture, plant protection

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and harvesting. Modern sugarcane machinery and labour saving devices reduce the cost of sugarcane production, help in completion of operation timely reduce human drudgery and enable efficient utilization of resources with better quality work output. It helps in increasing overall production and productivity. Sugarcane planting requires about 350 man-hour and 30.6-bullock pair-hour / ha with the cost of operation of Rs 3987 in conventional system of planting, as against mechanical planting requires Rs 2200 / ha with the engagement of 20 man hours. The cost involved in manual harvesting is about Rs. 9900 / ha (Rs 100 / tonne) with 990 man-hours as against Rs. 15700 per ha. with the labour engagement of 32 man-hours per ha. There is urgent need of introductions of modern sugarcane machinery, which are now available in the country like sugarcane cutter planters, inter culture and weeding machinery, sprayers and imported chopper harvesters are getting acceptance. Although their initial cost is very high but advantages accrued in their use are much more. There is a need for the design, development and commercialization of mechanical harvesters suitable for Indian conditions. Custom hiring system on co-operative basis sugarcane harvesters should also be popularized.

**Weidenmier, Davis, Roger Aliaga-Diaz (2008)**, the paper titled is ‘Is Sugar Sweeter at the Pump? The Macro economic Impact of Brazil's Alternative Energy Program, in their the recent world energy crisis raises serious questions about the extent to which the United States should increase domestic oil production and develop alternative sources of energy. We examine the energy developments in Brazil as an important experiment. Brazil has reduced its share of imported oil more than any other major economy in the world in the last 30 years, from 70 per cent in the 1970s to only 10 per cent today. Brazil has largely achieved this goal by: (1) increasing domestic oil production and, (2) developing one of the world's largest and most competitive

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sources of renewable energy - sugarcane ethanol - that now accounts for 50 per cent of Brazil's total gasoline consumption. A counterfactual analysis of economic growth in Brazil from 1980-2008 suggests that GDP is almost 35 per cent higher today because of increased domestic oil production and the development of sugarcane ethanol. We also find a notable reduction in business-cycle volatility as a result of Brazil's progression to a more diversified energy program. Nearly three-fourths of the welfare benefits have come from domestic oil drilling, however, as rents have been paid to domestic factors of production during a time of rising oil prices. We discuss the potential implications of Brazil's energy program for the U.S. economy by conducting historical counterfactual exercises on U.S. real GDP growth since the 1970s.

Maraddi and Hirevenkana gouda, etal., (2007)\(^\text{15}\) in their study on Analysis of Farmer's Knowledge about Selected Sustainable Cultivation Practices (SCP) in Sugarcane. The research study was conducted in Belgaum and Bagalkot District of Karnataka during 2005-2006, with the sample size of 180 respondents. The ex post-facto research design was used for the study. The findings revealed that, more than half of respondents (53.33\%) had medium knowledge level of selected SCP. Higher knowledge was observed in land preparation planting related SCP, and FYM, Mulching, Inorganic manures (N.P.K.). Whereas least knowledge noticed in bio fertilizer, Vermi compost and micro nutrients. Education, Farming experience, Risk orientation, Attitude towards SCP, management orientation, Achievement motivation, Innovative proneness and Extension contact of respondents had positive and significant relationship with the knowledge level of selected SCP, Multiple regression analysis indicated that, the seventeen independent variables put together had contributed to 39.42 per cent (R\(^2\)=0.3942) variation in knowledge level of selected SCP.

Dr. Adya Prasad Pandey (2007) has studied on ‘Indian sugar industry - a strong industrial base for rural India, in his study Indian sugar industry’, second largest agro-based processing industry after cotton textiles industry in country, has a lion's share in accelerating industrialization process and bringing socio-economic changes in under developed rural areas. Sugar industry covers around 7.5% of total rural population and provides employment to 5 lakh rural people. About 4.5 crore farmers are engaged in sugarcane cultivation in India. Sugar mills (cooperative, private, and public) have been instrumental in initiating a number of entrepreneurial activities in rural India. Present paper is an attempt as to review progress of sugar industry in India, understand it's problems and challenges in context of ongoing liberalization process. Indian sugar industry can be a global leader provided it comes out of the vicious cycle of shortage and surplus of sugarcane, lower sugarcane yield, lower sugar recovery, ever increasing production costs and mounting losses. It needs quality management at all levels of activity to enhance productivity and production. Attention is required on cost minimization and undertaking by product processing activities.

Vijaya Sankar and Mastan, etc, (2007) in their research study entitled Effect of integrated use of organic and inorganic fertilizers on soil properties and yield of sugarcane, The results of a field experiment conducted on alluvial soils to study the effect of different organic manures along with inorganic fertilizers on physical, physico-chemical and chemical properties of alluvial soil and yield of sugarcane during 1994–96 in farmers’ fields of Kovur Sugar Factory area of Nellore district, Andhra Pradesh revealed that sugarcane responded to organic manures when used in integration with inorganic

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16 Dr. Adya Prasad Pandey, Indian sugar industry - a strong industrial base for rural India, MPRA, Banaras Hindu University Dec 2007.

fertilizers. An additional cane yield of 14–27 t ha\(^{-1}\) was realized with different organic manures + inorganic fertilizers over inorganic fertilizers alone. Among different organic sources, FYM, press mud and poultry manure proved superior in terms of cane yield whereas press mud followed by poultry manure proved superior in terms of sugar yield. There was a slight reduction in soil pH and increase in electrical conductivity with the application of organic manures. At the end of ratoon crop, the increase in available N and Ca was maximum (38.2% and 24.4%) with the application of FYM whereas the application of poultry manure resulted in the highest increase in available P (122.2%), K (23.6%) and magnesium (47.4%) over the initial soil values. Application of poultry manure along with inorganic fertilizers resulted in higher cane yield in plant crop whereas, FYM along with inorganic fertilizers resulted in the highest cane yield in ratoon crop.

Judice, Griffin, Jones, Etheredge and Salassi (2006)\(^{18}\) studied ‘Weed Control and Economics Using Reduced Tillage Programs in Sugarcane’. In their study they observed, tillage is used in sugarcane to control weeds, eliminate ruts caused by harvest, destroy residue from the previous crop, and incorporate fertilizer. The effect of weed control and tillage programs on sugarcane growth and yield and on economics was evaluated over two growing seasons. In the first study, weeds were effectively controlled with a March application of hexazinone at 0.59 kg ai/ha plus diuron at 2.10 kg ai/ha either banded or broadcast. When tillage of row shoulders and middles in March was eliminated, soil temperature in the sugarcane drill early in the season was equal to that where March tillage was performed. Sugarcane early and late season stalk population and sugarcane and sugar yield were each equivalent for the full season tillage (tillage of row shoulders and middles in March and in May) and the no-till programs. Elimination of a single tillage operation reduced cost $16.28/ha, and herbicide applied as a band rather than broadcast reduced cost

$30.49/ha. For the no-till program, with herbicide banded in March, net return was increased $32.56/ha. In a subsequent study conducted at five locations, weed control was excellent when either pendimethalin at 2.77 kg ai/ha plus metribuzin at 1.26 kg ai/ha or hexazinone plus diuron at 0.59 kg/ha and 2.10 kg/ha was used. When the March tillage was eliminated, sugar yield was increased 8.6% (620 kg/ha), and net return was increased $152.68/ha compared with March tillage. When the May tillage was eliminated sugar yield was increased 8% (580 kg/ha), and net return was increased $143.88/ha compared with May tillage. A reduction in tillage cost accounted for only $16.28 of the increase in net return per hectare, with the remainder due to increased yield with the elimination of the tillage operation.

Dharmawardene (2006) this study relates to ‘Trends in farm mechanization by sugarcane small land holders in Sri Lanka’. In his study the mechanization of farm power is becoming extremely important day by day for the survival, efficiency and competitiveness of all field and plantation crops of the country. Sugarcane crop grown in the dry zone is no exception. In fact in these areas the available manpower is low due to low population densities and harsh climatic conditions and remoteness of locations from major cities. Thus scarcity of labour is common in sugarcane areas for manual work. Furthermore, labourer manual work get easily tired while working in the dry zone compared to the hills due to higher temperatures, harder soils, insolation and dry desiccating winds. Thus output of these workers is low compared to workers in the hills. In addition, cane fields tend to have a high population of poisonous snakes, which also make worker to be careful and slow in the cane fields. Thus timely agricultural operations get neglected causing crop losses while labour wages keep rising day by day especially during planting, weeding and harvesting/loading periods of sugarcane growing. Analysis of the cost components of sugarcane cultivation shows that harvesting of loading of cane

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comprise 35% of the costs followed by land preparation (21%), planting (16%), weeding (10%), fertilizer application (10%) and irrigation (8%). It is evident that harvesting and loading of cane is the highest cost component in sugarcane cultivation, while weeding, fertilizer application, stubble shaving, earthing up, off baring in the ratoons are neglected by small land holder farmers as manual methods are labour intensive leading to considerable losses in crop production. Thus, small holder sugarcane farm mechanization to improve the productivity and ease strain on human labour has become crucial in order to improve sugarcane productivity in Sri Lanka.

Some of the small holder farm tools and implements developed by the Sugarcane Research Institute which can be powered by a two-wheeled tractor such as the SRI type cultivator, Fertilizer applicator, Disc ratooner, Furrow opener, and the new design sugarcane harvesting knife as well as the implements for animal drought technology are described in this review.
Mandal and Tudu Etc (2006)\textsuperscript{20} in their study on Effect of common packing materials on keeping quality of sugarcane Jaggary during monsoon season, they conducted in the Research Laboratory of Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati during 2002 and 2003, it was revealed that the best packing material for storing Gur during monsoon season was heat-sealed LDPE (Low Density Polyethylene) packet of 150 gauge followed by glass jars. LDPE packets prevented moisture ingress, fall in pH and inversion of sucrose in the stored Gur to the maximum extent. However, colour of Gur in LDPE packets was darker as compared to Gur stored in glass jars. PET (Poly Ethylene Terephthalate) jars were as good as glass jars but the stored Gur darkened more in PET jars. Canisters were better in comparison to painted earthen pots provided those were with airtight lid.

Patil, (2005)\textsuperscript{21}, study relates to ‘An Inquiry into the Economic Aspects of Cane Cultivation in the Princely State of Kolhapur’, the study noticed that despite ecological constraints sugarcane cultivation in Kolhapur was largely possible due to the informal cooperation among the cane farmers. In the informal cooperative known as Phad, the small farmers of Kolhapur pooled their limited quantity of land, labour and capital to irrigate cane land and make 'jaggery'. The traditional sugarcane cultivation and jaggery industry in Kolhapur was closely tied to the inner dynamics of the group of small cane producers within a context, which in the twentieth century was increasingly determined by market and monetary relationships, by the capitalist organization of trade in 'jaggery' and advances in agricultural technology. The changes in techniques of sugar production that took place in the first half of the 20th century - the use of high yield cane varieties and chemical fertilizers, technological advances in sugar mills and jaggery furnaces, and use of oil


engines for irrigation had a profound impact on the cane farmer of Kolhapur. While these changes resulted in high productivity, they also entailed a large investment in working capital. The small cane farmer in Kolhapur had to look towards the money lenders and jaggery traders for financing the valuable crop. The present paper tries to abstract the conditions that influenced the informal cooperation among the cane farmers of Kolhapur. By taking a micro-historical viewpoint, it attempts to know the impact of the 'market' and 'technological improvement in cane cultivation' on the small cane farmer.

Peter Griggs (2004)\textsuperscript{22} the paper titled ‘Improving Agricultural Practices: Science and the Australian Sugarcane Grower, 1864-1915’, in his study Sugarcane emerged by 1884 as the most favored crop cultivated in the coastal lands of Eastern Australia between Cairns and Grafton. Initially, Australian cane growers invested as little labor and capital as possible. Contemporary commentators, however, were very critical of the agricultural practices adopted by the country's first cane growers, noting a lack of careful cultivation and plowing, fertilizer use, drainage, and paddock design. Various reasons for the use of these "inadequate techniques" are discussed in this essay, with the conclusion being offered that the most important factor was a lack of scientific knowledge about farming under Australian conditions. By 1891 cane-growing techniques were reported to be "on the upgrade," with improved cane and sugar yields. Such a transformation had commenced due to the introduction of some mechanization and the dissemination of research findings and technical information about scientific cultivation methods under Australian conditions. This detail had been assembled during the 1890s and 1900s mainly by the Colonial Sugar Refining Company and the Queensland government Sugar Experiment Stations, which had been established following pressure from cane growers who increasingly sought advice on the correct farming methods.

Nain et al. (2002)\(^{23}\) reported that the irregularity in the distribution of sugar cane purchase indent, delay in payments of sugar cane to the farmers, delay in unloading, lack of transportation facilities etc., were the major problems reported by the selected respondents in marketing of sugar cane to the sugar mills. The review revealed that jaggery production was a major traditional enterprise in sugar cane producing areas. At times, jaggery making was profitable to cane producers than supply to sugar factory. The cost of sugar cane was the major cost item in jaggery production. The investment in jaggery processing units was found to be profitable.

Vijayan and Pati (2002)\(^{24}\) in their study focused on the Impact of Changing Cropping Patterns on Man-Animal Conflicts Around Gir Protected Area with Specific Reference to Talala Sub-District, Gujarat, India, they were analyzed the escalating man-animal conflict due to changing cropping pattern in Talala sub-district on the periphery of Gir National Park and Sanctuary (GNPS), Gujarat, India. Sugarcane and mango cultivation has increased by 87% and 103% respectively within eight years from 1992 to 1999. Straying of lions (Panthera leo persica) and leopards (Panthera pardus) increased to 55% and 46% respectively from 1997 to 1999. Significant correlations between the increases in sugarcane cultivation and mango orchard with straying of lions ($r = +0.827$, df 2) and leopards ($r = +0.981$, df 2) were observed. From 1990 to 1998, of the total of 11 lions rescued, eight (72%) were from farmlands and of 32 leopards rescued, ten (31%) were from farmland. Ten lions (91%) and five leopards (41%) were found dead in farmlands. Thirteen lion attacks (72%) took place in farmlands, of which 10 were specifically reported, from sugarcane and mango cultivation. Fifty-nine percent of the leopard attacks (resulting in four deaths) were recorded from farmlands. Livestock kills taking place in farmland


have increased by 150% within two years from 1998 to 1999. Sugarcane and
groundnut cultivation in the adjoining areas also suffer from damage due to
increased movement of wild ungulates and wildboar.

**Abhijit Banerjee, Dilip Mookherjee, Kaivan Munshi and Debraj Ray (2001)** their study on ‘Inequality, Control Rights, and Rent Seeking: Sugar Cooperatives in Maharashtra’. This paper presents a theory of rent seeking within farmer cooperatives in which inequality of asset ownership affects relative control rights of different groups of members. The two key assumptions are constraints on lump-sum transfers from poorer members and disproportionate control rights wielded by wealthier members. Transfers of rents to the latter are achieved by depressing prices paid for inputs supplied by members and diverting resulting retained earnings. The theory predicts that increased heterogeneity of land holdings in the local area causes increased inefficiency by inducing a lower input price and a lower level of installed crushing capacity. Predictions concerning the effect of the distribution of local landownership on sugarcane price, capacity levels, and participation rates of different classes of farmers are confirmed by data from nearly 100 sugar cooperatives in the Indian state of Maharashtra over the period 1971–93.

**B. W. Higman (2000)** in his study the paper entitled “The Sugar Revolution”. The 'sugar revolution' concept is commonly used to characterize the transformation of society and economy that occurred in the English and French West Indies in the middle of the seventeenth century. This transformation was marked by an abrupt shift to mono culture, plantation agriculture, and dense populations of enslaved Africans, producing great wealth. Larger claims have been made for sugar's impact on the Atlantic world, and sugar revolutions have been identified in other places and other


times. A critical review of the subject literature reveals a general agreement that the concept does identify a genuine historical discontinuity.

Moore (2000)\textsuperscript{27} in his study the paper entitled “Sugar and the Expansion of the Early Modern World-Economy: Commodity Frontiers, Ecological Transformation, and Industrialization”. In this study, This article contends that the ecologically destructive nature of capitalism was operative from the very beginning of the modern world-system, and was a major force in the geographic expansion of the system. The case of the "sugar frontier" demonstrates that early modern capitalism was both highly "industrial" and profoundly destructive of the natural environment. The ecological devastation caused by sugar cultivation and processing, in combination with booming European demand, was a major force behind the geographic expansion of the world-economy in the early modern period. The article shows the interconnections between the sugar frontier, the world-economy, and such socio ecological issues as: deforestation, soil erosion, livestock overpopulation, delocalization of food supply, hydraulic systems, worker health and safety, monocultures, species extinction, and climate change.

Jason W. Moore (2000)\textsuperscript{28} has studied on ‘Sugar and the Expansion of the Early Modern World-Economy’: Commodity Frontiers, Ecological Transformation, and Industrialization. In this, he observed contends that the ecologically destructive nature of capitalism was operative from the very beginning of the modern world-system, and was a major force in the geographic expansion of the system. The case of the "sugar frontier" demonstrates that early modern capitalism was both highly "industrial" and profoundly destructive of the natural environment. The ecological devastation


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Singh (2000)\textsuperscript{29} revealed that sugar cane, jute, cotton, tea, coffee and tobacco were major commercial crops grown in India and had made remarkable progress in production of these crops. The production of sugar cane was 289.70 million tonnes in 1998-99. More than 50 per cent sugar cane was estimated to be processed by sugar mills and the balance by Gur and Khandstari industries. He also stated that, though the efficiency of Gur and Khandstari sector is low compared to sugar mills, these units provided more employment opportunities to rural work force and therefore cannot be ignored and requires special attention.

Balishter et al. (2000)\textsuperscript{30} found that tillage, threshing and transportation of sugarcane were the major operations for which tractor was utilized which together accounted for about 88 per cent of the tractor use. About 41 per cent for tillage, 25 per cent for threshing and 22 per cent for transportation of farm produce. The overall per hour total cost of tractor operation was Rs. 102. Size wise it was about Rs. 85 for 25 HP tractor, Rs. 100 for 35 HP tractor and Rs. 126 for tractor above 35 HP.

Kayar Kanni (2000)\textsuperscript{31} analyzed the factors affecting the yield of sugar cane by fitting multiple linear regression model. The independent variables selected were hired labour, fertilizer, pesticides, capital, seed cost, dummy

\textsuperscript{29} Singh G, Modernization of agriculture in India. Agricultural Situation in India 55(10) : 583-592.

\textsuperscript{30} Balishter, Singh R and Mithlesh K M, Tractor use in agriculture – A study in Agra Division of Uttar Pradesh. Agricultural Situation in India 51(2) : 687-693.

\textsuperscript{31} Kayar Kanni S, Fertilizer use on three major crops in Madurai district of Tamil Nadu – An economic analysis. Agricultural Situation in India 52(8): 441-446.
variables for variety and irrigation systems. About 74 per cent variation in the yield of sugar cane was caused by these seven explanatory variables. The regression coefficient values were 77.84, 26.29, 4.95, 47.01, -0.12, 292.01 and -1311.05 respectively in the above order. All independent variables except seed cost were found to be statistically significant at 5 per cent level. The overall regression model was also statistically significant.

*Singh et al. (2000)* studied the trend and seasonal variations in arrivals and prices of rape seed and mustard in Haryana by using linear regression model and moving average method. The analysis of the time series trend showed that the prices of rape seed and mustard increased significantly over time in all the markets. There existed definite seasonality in the arrivals and prices of rapeseed and mustard. More than 80 per cent of the total arrivals arrived in peak season when prices were quite low. The price indices were below hundred from February to June when the arrivals were the maximum. The review highlighted the high fluctuations in arrivals and prices of jaggery at regulated markets. There existed inverse relationship between these two factors. There was glut of jaggery during cane harvesting season resulting in low prices. Lack of credit facilities, storage structures and low price paid by the sugar factories were some of the reasons identified by the researchers for above situation.

*Suhaag et al. (2000)* analyzed the factors effecting production instability in principal crops of Haryana. In case of sugar cane the Cuddy Della Valle Instability Index (CDI) measured to be 3.19, 1.50 and 3.04 per cent for area, yield and production respectively. The reason for the less fluctuation in the above factors was due to assured supply of irrigation water.

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33 *Suhaag K S, Masresha T and Kundu K K*, Factors affecting production instability in Principal crops of Haryana. Agricultural Situation in India 55(4) : 201-204.
The growth rate of area, production and productivity of sugar cane showed varying trends over years in different part of the country. In the present study, compound growth rates were worked out to assess the direction of growth and reasons for the same for above three components in Andhra Pradesh and selected regions for the period 1970-2002.

Hui-wen Koo and Chun-chieh Wang (1999)\(^{34}\) the paper entitled "Indexed Pricing: Sugarcane Price Guarantees in Colonial Taiwan, 1930-1940". In their study, In Taiwan during the Japanese colonial period, sugarcane was typically purchased by Japanese-owned sugar mills at prices guaranteed long in advance of delivery. In some places, the future price was indexed to the price of rice in the following year. This study points out that indexing served to insure farmers' real incomes. But as an insurance against an aggregate risk, this arrangement threatened the mill's profits. We investigate why mills nevertheless offered the insurance.

Kalim Siddiqui (1999)\(^{35}\) has studied on 'New Technology and Process of Differentiation: Two Sugarcane Cultivating Villages in UP'. The study examines empirically the 'new technology' and the process of differentiation of peasant households in Muzaffarnagar district, in western Uttar Pradesh, India. High-yielding varieties (HYVs) of sugarcane were introduced to certain parts of the district in the late 1970s and early 1980s which has dramatically increased yields of cane per acre. The empirical study is focused on a region which is generally associated with the development of capitalist farming, on the assumption that any proposition which could be proved for these areas is likely to hold for other regions undergoing similar processes of change. We analyse the various impacts of 'new technology' on two different villages and examine


the resultant changes at the household level. The study examines the effects of the 'new technology' on process of differentiation of the 120 sample households. A clear picture emerges that capitalist farming is expanding and economic differentiation is increasing.

Malik (1999)\textsuperscript{36} analyzed the costs and returns of sugar cane production in Hardwar district of Western Uttar Pradesh. In case of reserve area (< 10 kms from sugar mill) cost $A_1$, $A_2$, $B_1$, $B_2$, $C_1$, $C_2$, gross income from main product and by product were Rs. 21605, 21605, 24724, 33908, 28231, 37415, 45002 and Rs. 4491 respectively. In free area (> 10 kms from sugar mill) the above costs in the same order were Rs. 21366, 21366, 24498, 33293, 28009, 36806, 42785 and Rs. 4416 respectively.

Rama Swamy et al. (1999)\textsuperscript{37} stated that jaggery making is a traditional enterprise in Tamilnadu and is more profitable to cane producers than supply to the factory. But, higher profitability is counter veiled by price risk in jaggery. Traditionally, jaggery making is under taken by cane growers in their own farm. The trend has changed with the entry of new enterprisers who venture jaggery manufacturing as a pure enterprise by procuring cane from the cane growers. The substantially higher price, immediate disbursements for the sale of cane, missing the registration in time with factory, delays in cutting order and complex procedure of transactions with the factory make the cane growers favour cane supply to jaggery making. Absence of price risk, labour shortage in the case of own jaggery making, financial and technical assistance extended by the factory are the major factors attracting supply of cane to factory. Linear probability model was estimated to identify the determinants of sugar cane supply to sugar factory. A two stage procedure was employed to estimate the equation. Profitability in opting for jaggery production emerges as a significant variable in influencing the farmer not to be in favour of cane supply to the

\textsuperscript{36} Malik S K and Singh R P, Break-up of costs and returns of sugarcane production in Reserve and Free areas of sugar mills. Agricultural Situation in India 55(12) : 749-751.

factory. The education and farm size were no significant variables in influencing the cane growers decision to supply cane to the factory. The insignificance of farm size indicates sugar cane supply to factory is neutral to scale. The experience in jaggery making has negative influence on the cane supply to the factory. Labour shortage had significant influence in encouraging farmers to supply the cane to the sugar mills. Distance of factory appears less significant in the decision process as the modern transport system such as tractor had made transport of cane a non-issue. Therefore the dummy variable, owner ship of tractor had no influence on cane supply decision to factory.

Shaik (1999) found that the application of nitrogen in sugar cane crop was higher (248 kg/ha) in North Coastal than in Northern Telangana (205 kg/ha). The deviations revealed to be 121 per cent excess use in case of the former and 18 per cent under use in the latter. Although P and K use were not at all recommended, farmers took up the application of these nutrients which was considered to be a colossal wastage.

Chinnappa (1998) analyzed the resource use and cost structure in sugar cane crop in Bhadra command area of Karnataka state. On an average the sugar cane crop required 98.46 man days per acre. The most labour consuming operations were planting, manuring, weeding, inter culture and harvesting. Harvesting of sugar cane consumed more labour than any other operation. Bullock labour to an extent of 7.59 cattle pair days was utilized in preparatory cultivation and inter culture operations. 6.60 hours of machine labour was used mainly for land preparation to ensure deep ploughing. The variable costs constituted 76.06 per cent of total cost and fixed costs accounted for remaining 23.94 per cent. Among variable costs, seed material was the highest expenditure item accounting for 23.24 per cent of total cost followed by fertilizer and human labour accounting for 17.51 per cent and 11.45 per cent of

total cost of cultivation. The total cost of cultivation was Rs. 21,505.93 per acre.

Maheshwarappa et al. (1998) studied economics of production of sugar cane in Karnataka state. Human labour, bullock labour and tractor power was employed to an account of 386.90 man days, 15.57 pair days and 6.34 hours per hectare respectively. The average total cost of cultivation per hectare was Rs. 40,266.59. The variable cost and fixed cost accounted for 87.68 and 12.32 per cent of total cost of cultivation respectively. The variable cost mainly comprised cost of human labour, seed material and chemical fertilizers accounting for 24.02, 17.19 and 14.10 per cent of the total cost of cultivation respectively. Among the fixed costs, the rental value of owned land was major cost accounting for 12.28 per cent of total cost of cultivation.

Singh and Kishore (1998) studied marketable surplus, disposable pattern and marketing of sugar cane in Sitapur district of U.P. The average production of sugar cane on the selected farms was 346.70 quintals per farm of which 30.84 quintals was utilized for seed purpose and family consumption. The average marketable surplus of sugar cane on the selected farms was 315.86 quintals (91.10 %) per farm. Three marketing channels for sugar cane have been identified. They are:

Channel I : Producer -> Sugar factory
Channel II : Producer -> Khandsari unit
Channel III : Producer -> Processor (Gur) -> Wholesaler -> Retailer -> Consumer

On an average 59.92, 24.35 and 15.73 per cent marketable surplus moved through channel I, III and II respectively. The total marketing cost of Gur in channel III was Rs. 154.22 which included Rs.94.22 processing cost per quintal.

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borne by processor of Gur. The marketing cost paid by the producer – cum – processor, wholesaler and retailer was Rs. 108.22, Rs. 33.50 and Rs. 12.50 per quintal respectively. The producer’s share in consumers price was 62.68 per cent. The marketing margins of wholesaler and retailer were 6.64 and 6.00 per cent respectively. This study pointed out the existence of more than one marketing channel of jaggery in traditional jaggery producing areas. The producer’s share in consumer’s rupee was considerably high in all channels. The produce was disposed immediately due to lack of funds and storage facilities.

Ravi Kumar et al. (1998) studied the factors influencing market arrivals of jaggery at regulated market Anakapalli by using multiple linear regression model. The regression coefficient of average price and production of jaggery were statistically significant where as the regression coefficient of rainfall and area under sugar cane had no effect on market arrivals. The R² value showed that the regression model was statistically significant at 5 per cent level.

Teggi et al. (1998) studied the costs involved in jaggery production in Bijapur district. The investment required for establishing jaggery processing unit with a capacity of one ton per day was around Rs. 97.000. The share of the shed in the total investment was maximum (29 %) followed by investment on land (21 %) and cane crusher (20 %). The cost of raw material was the prime variable cost accounting for 88 per cent of the total cost. Labour charges and chemicals accounted for 4.6 per cent and 3.5 per cent respectively. The share of the fixed cost in the total cost was only about 1.5 per cent. The cost of sugar cane played a major role in determining the cost and returns structure of jaggery processing units. The net returns realized in jaggery processing were


Rs.1,93,865 per year. A rupee investment in jaggery processing resulted in a return of Rs. 1.175. On an average 8.7 tonnes of sugar cane was used to produce one ton of jaggery and the recovery percentage was 11.50 per cent. The total cost of processing including the cost of raw material was Rs. 7,935 per ton of jaggery produced. The processors, on an average realized Rs. 9,331 per ton of jaggery and the net margin was Rs. 1396 per ton. The net present value of jaggery processing unit at 15 per cent discount factor was Rs. 9,07,374. These results showed that jaggery processing was profitable. The investment made on jaggery processing unit was repaid within a short span of one year.

Teggi et al. (1996) studied the pace and pattern of jaggery prices and arrivals at Jamakhandi and Mahalingapur markets. The explanatory power of the fitted function was appealing in the polynomial form. The linear function of time period explained 63 per cent variation in jaggery arrivals in Mahalingapur and 72 per cent variation in prices of jaggery in Jamakhandi. Fourth degree polynomial explained 97 per cent variation in jaggery prices in Mahalingapur while third degree polynomial explained 59 per cent variation in arrivals of Jamakhandi. The prices in Jamakhandi and arrivals in Mahalingapur showed a constant increasing trend over the reference period. The jaggery arrivals in Jamakhandi market exhibited an increasing trend in the beginning part and a decreasing trend in next part and again showed increasing trend thereafter. In general, the prices and arrivals of jaggery in the sample market did not show a consistent pattern. This was due to inconsistency in processing of jaggery in the study area over a period of time. The processing of sugar cane into jaggery depended on the cane price offered by the sugar mills operating in the area and the prices of jaggery. The processors preferred to crush cane into jaggery at times of attractive jaggery prices coupled with low prices offered by sugar mills. Seasonal pattern was observed only in prices and arrivals in

Mahalingapur market. There was inverse relationship between prices and arrivals of jaggery in Mahalingapur market.

_Teggi et al. (1996)_45 analyzed the marketing of jaggery in Ghataprabha command area of Karnataka. Mudhol and Jamakhandi jaggery markets were selected. The jaggery processors were selling jaggery immediately after manufacturing due to need of funds or due to lack of storage facility. Three major marketing channels were identified.

Channel I : Producer -> Commission agent -> Wholesaler -> Retailer -> Consumer

Channel II -> Producer -> Wholesaler -> Retailer -> Consumer

Channel III : Producer -> Retailer -> Consumer

In case of Jamakhandi market, 62 per cent of the processors sold 77 per cent of their produce through channel II and in Mudhol market, 25 per cent of the processors disposed 76 per cent of the produce through channel II. This was due to high price realized by processors in respective channels. The producers share in consumer’s rupee in channel I at Mudhol and Jamakhandi markets was Rs. 86.55 and 87.36 per quintal respectively. In channel II it was Rs. 88.69 and Rs. 89.04 in the above order of markets.

_Babar and Lohar (1994)_46 examined the trends in arrivals and prices of jaggery in Sangli regulated market. Least squares method was used to estimate the linear trend in arrivals and prices. The arrivals and prices showed increasing tendencies over the period of 12 years. The seasonal indices of arrivals of jaggery were higher during the months of August to January, while the indices of prices were higher during the months of September and October, respectively.

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Thakur and Shandil (1993)\textsuperscript{47} studied the regulated market arrivals in Himachal Pradesh. Lack of efficient regulated markets which are poorly equipped both in terms of infrastructure and personnel and marketing problems faced by the farmers prohibited the increased quantum of arrivals in the regulated market. The strategy of training of farmers, large scale investment in providing requisite marketing facilities, control over the scruptulous trading practices of traders and strict implementation of the regulated markets act would increase market arrivals in the regulated markets. The involvement and competition of three groups i.e., private traders, co-operative and govt. agencies in the regulated market will eliminate the mal practices of traders and middle men and help the free market economy to function more efficiently and to attract more volume of market arrivals.

Daniels and Daniels (1993)\textsuperscript{48} in their study the paper entitled “Sugarcane in Pre history”. In this paper they suggested that, sugarcane (Saccharum officinarum L.) was a major food for pigs (Sus scrofa) in the New Guinea Highlands prior to the introduction of the sweet potato (Ipomea batatas) about 250 years ago. Taro (Colocasia esculenta) has been favored in the literature, but pigs do not like raw taro and will only eat most varieties when cooked. Pigs consume sugarcane avidly and it provides a high calorie diet combined with suitable fiber roughage. Evidence is provided to show that large fields of sugarcane were grown in mono culture in the highlands at the time of European contact. Humans consumed sugarcane as a major food in some areas in the early 20th century. S. officinarum is usually recorded as having evolved in New Guinea and Indonesia east of the Wallace line, from the wild cane Saccharum robustum Brandes & Jeswiet ex Grassl. An alternate theory that S. officinarum was derived from the Chinese sugarcane, Saccharum sinense, transported east of the Huxley line by Austronesian speakers is mentioned as a


\textsuperscript{48} John Daniels and Christian Daniels in their study the paper entitled “Sugarcane in Prehistory”, Archaeology in Oceania, Vol. 28, No. 1 (Apr., 1993), pp. 1-7
serious possibility. Both hypotheses are compatible with sugarcane being available for human and pig food from about 6000 years ago.

Rohal et al. (1990)\textsuperscript{49} identified two marketing channels of Gur at Muzaffar Nagar regulated market, U.P. They are:

Channel I : Producer -> Processor -> Primary wholesaler -> Secondary wholesaler -> Retailer -> consumer

Channel II : Producer -> Primary wholesaler -> Secondary wholesaler -> Retailer -> consumer

In channel I, the producers share in consumers rupee was 66.96 per cent. The marketing expenses incurred by the producer, processor, secondary wholesaler and retailer were 2.55, 12.50, 11.35 and 0.40 per cent respectively. The marketing margins of processor, secondary wholesaler and retailer were 4.03, 1.04, 0.94 per cent respectively. The processing cost incurred by the processor was Rs. 41.75 per quintal. In channel II, the producers share in consumers rupee was 73 per cent. The expenses incurred by the producer, secondary wholesaler and retailer were 12.92, 11.54, 0.40 per cent respectively. The marketing margins of secondary wholesaler and retailers were 1.14 and 1.00 per cent respectively. The processing cost of Gur was Rs. 43.00 per quintal. Channel II was more efficient than channel I as the producer’s share in consumers rupee was high.

Galloway (1989)\textsuperscript{50}, the history of sugar is linked with a trio of institutions which were anything but sweet. These are plantation, slavery and slave trade.


\textsuperscript{50}Galloway, J.H, The Sugarcane Industry: An Historical Geography from its origins to 1914, Cambridge, Cambridge University Press, 1989, pp. 266.
Verma (1989)\textsuperscript{51}’s study found that the average cost of processing of sugar cane under power-kohlu units of Gur was Rs. 6.80 per quintal in Indore district of M.P. It varied from mill to mill according to the level of capital investment, power and sugar cane crushed during the year by the mill. In Gur marketing the producers share in consumer’s rupee was 60 per cent. The study indicated that the provision of adequate facilities for quick and cheaper transport and timely supply of cheaper credit by the financing institutions to the producers, processors and traders will help in increasing the productivity and efficiency of marketing of the produce.

Azad et al. (1989)\textsuperscript{52} revealed that the net returns per quintal were significantly higher in crystal sugar than in Khandsari sugar and Gur in U.P. The share of sugar cane growers in the price paid by the consumers price was found to be highest for Khandsari sugar (58.6 \%) followed by Gur (53 \%), levy sugar (44 \%), and free sale of crystal sugar (38 \%). The profit of the manufactures of crystal sugar, Gur and Khandsari sugar was 23, 13 and 5 per cent of the consumer’s price respectively.

Raju and Ramesh (1989)\textsuperscript{53} analyzed the costs and returns of jaggery production and marketing in East Godavari district of Andhra Pradesh. The cost of production of jaggery per hectare of sugar cane was Rs. 28,497. Among this, the cost of production of sugar cane accounted for 70 per cent cost followed by human labour cost, crusher rent charges, chemical ingredient charges etc. The average physical returns of jaggery was 93.28 quintals from one hectare of sugar cane amounting to Rs. 33,724. The net returns were Rs. 5,227 per hectare. Two marketing channels were identified


Channel I: Farmers -> commission agents at regulated markets -> wholesalers -> retailers -> consumers.
Channel II: Farmers -> village merchants -> wholesalers at unregulated markets -> retailers -> consumers.

The producer’s share in consumers rupee was more in channel I i.e., 87 per cent. The input-output ratio, when cane was sent to sugar factory and converted to jaggery was 1:1.10 and 1:1.8 respectively. The study concluded that the jaggery preparation was more profitable than selling cane to sugar factory.

Padmanabhan (1988) analyzed the structure of jaggery market by using firm concentration and gini concentration ratio. The estimation of concentration of producer sellers and buyers in Vellore and Tirupatur markets showed that the share of individual producer sellers was less than one per cent during the study year. The findings confirmed the atomistic nature of the market for producer sellers. The degree of concentration of jaggery buyers showed that the assembling market for jaggery was oligosporic in nature. The organizational structure, though exploitative to some extent, provided requisite man power and capital to carry on the business. The regulation of whole sale trade of jaggery by the Government was suggested in order to prevent male practices and to promote free competition and growth.

Rajayan and Aruputhraj (1988) studied the marketing problems of sugar cane growers of Tamilnadu. The non-registered growers were spending 31 per cent of cost C-2 on jaggery manufacturing and marketing. In jaggery marketing, ten per cent of the gross sale proceeds was taken away by traders/commission agents. There was a mutual agreement to sell the entire produce to them or through them at the time of drawing loans. The producers were exploited in grading and weighing as the marketing cannot be delayed due to late ripening.

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to lack of storage facilities, short production period, heavy arrivals and disorderly marketing. The share of the producer in consumers rupee was only 67 paise.

**Rohal et al. (1985)**\(^{56}\) studied the processing and marketing of Gur in Muzaffar Nagar district of U.P. The average cost of processing of sugar cane per quintal was Rs. 4.20. The producer’s share in the consumer’s price in channel I (producers to processors) and channel II (producers processed channel) was 65.79 and 73.57 per cent respectively. The middle men’s margin was high in channel I, being 8.20 per cent and in channel II it was only 2.93 per cent. Channel II was found to be more efficient than channel I because of high producer’s share in consumer’s rupee and also low consumer’s price.

**Rupa Kumar (1984)**\(^{57}\) ‘s study entitled ‘Yield response of sugarcane to weather variations in Northeast Andhra Pradesh, India’. In their study The influence of the meteorological parameters: maximum and minimum temperatures, relative humidity, rainfall and duration of sunshine, on sugarcane yield, is studied by fitting third-degree response function models using the long-period experimental data at the Regional Agricultural Research Station at Anakapalle (17°38’N, 83°01’E), Andhra Pradesh, India. These models give the quantitative response in the yield brought about by a unit change in the meteorological parameters at each stage of the crop growth. The maximum and minimum temperatures and relative humidity during the first three months of the crop (germination and tillering phases), are found to have a profound influence on the yield. Above normal temperatures and drier conditions at this time seem to be favorable for good yields. Presuming that the year-to-year variations of the meteorological parameters are largely the reflections of the


broad synoptic systems prevailing over and around the area of study, an attempt has been made to identify the macro meteorological situations that critically affect the sugarcane yield. This is accomplished through selected case studies of weather situations during the critical periods obtained above, for some poor-yield and good-yield years. This study helps in fixing the favorable and unfavorable macro meteorological systems, which could be useful for issuing special agro meteorological forecasts for sugarcane growers and crop-outlook statements.

Amin (1984)\textsuperscript{58} focuses attention on the cultivation of sugarcane by small farmers in Gorakhpur region. He analyses the socio-economic and cultural conditions, under which these small farmers became dependent upon traders, landlords and other intermediaries for marketing sugarcane for the production of crystal sugar.

Attwood Donald (1984)\textsuperscript{59} study entitled "Capital and the Transformation of Agrarian Class System. A Case Study of Sugar Production in India". This study has raised two issues: (i) Why do some agrarian systems generate more economic growth than others" and (ii) Why do some undergo structural transformation leading to further growth, while others stagnate? These issues have been discussed in terms of different kinds of agrarian class systems which either promote or inhibit economic innovations, and economic forces in terms of different levels of capital investment and managerial skills required for different levels of production and distribution systems. His conclusion is that ownership control of land is not relevant to the productivity of sugarcane farm in Maharashtra while R.K. Gupta (1963)\textsuperscript{60} feels that it is the

\textsuperscript{58}Amin, S, Sugarcane and Sugar in Gorakhpur : An Inquiry into peasant Production for Capitalist Enterprises in Colonial India, Delhi, OUP, 1984, pp. XXII, 336.


\textsuperscript{60}Gupta, R.K. The Sugar Industry in a Bengal District Birbhum from the last decade of the Eighteen Century to Mid-Nineteenth Century, Ph.D. Thesis, 1963
landed interest which could increase sugarcane cultivation and in turn sugar production in Birbhorn district of West Bengal.

Grewal and Rangi (1983)\textsuperscript{61} conducted an analytical study of growth of Punjab agriculture during the period 1960-61 to 1982-83. They reported a 3.48 per cent decrease in area, 3.67 per cent increase in productivity and 0.01 per cent decrease in production of sugar cane. The negative growth rate of production had primarily resulted from decrease in acreage of sugar cane.

Nandal et al. (1983)\textsuperscript{62} studied the changes in cropping pattern of Haryana agriculture. The study revealed that there was an increase in area under sugar cane cultivation from 115.20 thousand hectares in 1957 to 158.33 thousand hectares in 1967. However, it decreased to 155.33 thousand hectares in 1980. The percentage share of sugar cane in the total gross cropped area during the above period was 3.28, 4.06 and 3.35 respectively. The cereals had attained added importance after the release of high yielding varieties compared to pulses and non-food grain crops in respect to area-allocation as well as share in food grain production.

Chandrahas et al. (1983)\textsuperscript{63} examined the relationship between the yield of sugar cane and different morphological characters measured at various stages of crop growth, with a view to forecast the yield of sugar cane before harvest. Among the various models tested for forecasting, multiple linear regression model was found to be better based on its simplicity and ease for computation.

Pudasaini (1983)\textsuperscript{64} studied the contribution of education to allocative and technical efficiency in sugarcane production in Nepal by using production


\textsuperscript{63} Chandrahas, Bapat S R and Singh B H, Pre-harvest for casting of yield of sugar cane. Agricultural Situation in India 38(3) : 291-292, 1983.

function and profit function. Most of the estimates from the production function were reasonable in terms of their sign and significance. Land, labour, capital and fertilizers had significant contribution to sugar cane production indicating that those were the crucial inputs in sugar cane cultivation. Operator’s age (a proxy for experience) had no significant impact on sugar cane output. Bullock labour and extension, on the other hand, had negative but non-significant influence on sugar cane production. Education had positive influence on the sugar cane output. From the profit function analysis it was found that the educated farmers were able to attain higher economic efficiency relative to the illiterates and it resulted from being more efficient in allocative efficiency than the illiterates. However, the educated and illiterates were not significantly different in terms of technical efficiency.

**Singh (1983)**[^65] identified the major reasons for low productivity of sugar cane in Northern states compared to the Indian tropical belt. The poor yield was due to the ratoon crop which occupied about 50 per cent of the total cane area, inadequate plant nutrient applications, lack of adequate plant protection measures, shortage of irrigation facilities including supply of electricity for pump sets, paucity of good seed and nonpayment of cane price arrears. All the above factors are needed to be addressed to improve the cane production in Northern states.

**Naidu and Reddy (1981)**[^66] examined jaggery marketing at Anakapalli regulated market. Immediately after manufacturing of jaggery, the cultivator brings it to the market due to need of money or lack of storage facilities. The commodity is entrusted to a commission agent. The jaggery brought to each shop in the market is differentiated into three qualities and graded as No. 1, 2, 3 by the experienced Hamal based on colour, hardness and crystalline texture. The retailers or the commission agents of wholesalers gather at each shop where auction is being held under the supervision of a marketing committee.

[^65]: Singh H., Crop production in India. Agricultural Situation in India 38(9) : 635-639, 1983.

official. The highest bidder purchases the stocks and the bidding is done in terms of 10 kgs of jaggery. The producer’s share in the consumer’s rupee was 82.72 per cent. The wholesalers margin, brokerage and commission agent’s margin was 5.82, 2.74 and 2.64 per cent respectively.

Lal (1980)\(^67\) analyzed costs, margins and price spread of Gur and Khandasari in three different markets of U.P. The investigation revealed three important channels of trade.

**Channel I**: Sugar cane producers -> Gur & Khandasari producers -> Retailers in villages -> Consumers in villages

**Channel II**: Sugar cane producers -> Gur/Khandsari producers -> Wholesalers in Lucknow market -> Retailers in Lucknow market -> Consumers in Lucknow market

**Channel III**: Sugar cane producers -> Gur/Khandsari producers -> Wholesalers in Lucknow market -> Wholesalers in Calcutta market -> Retailers in Calcutta -> Consumers in Calcutta

Due to difficulty in obtaining factory purchasing slip, urgent cash needs, late payments by factories and transportation problems, the farmers were selling their produce to either Gur or Khandasari unit at a lesser price than that paid by the factories.

The producer’s share in consumers rupee in channel I, II & III for Gur and Khandasari were 71.11, 60.00, 52.32, 75.00, 67.41, 60.00 per cent respectively. The share of manufacturing costs of Gur and Khandasari in the above channels were 9.99, 10.46, 9.13, 7.98, 8.58 and 7.63 per cent respectively in the same order. The margins of Gur and Khandasir producers were 8.11, 7.05, 6.15, 8.30, 7.60, 6.76 per cent respectively in the above order of channels.

Naidu and Reddy (1980)\(^68\) observed that the arrivals and price of jaggery at Anakapalli market showed, high variations. The arrivals of jaggery increased

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\(^{68}\) Naidu and Reddy (1980)
from September to May, the period during which the freshly manufactured jaggery is brought into the market. Thereafter the arrivals started decreasing with the commencement of rainy season. The seasonal index of arrivals of jaggery start increasing from the month of September (28.90 %) and reach the peak by April (256.48 %). The seasonal index of average prices of jaggery reached the peak in the month of June (123.20) as the stored jaggery alone came into the market.

**Jan Breman (1978)** has studied on ‘Seasonal Migration and Co-operative Capitalism’ Crushing of Cane and of Labour by Sugar Factories of Bardoli the study is Seasonal migration of labour is nothing new to India, but its present character and scale are indicative of a far-reaching transformation in the countryside: a change to new production relationships. This account, the result of the author's fieldwork in and around Bardoli taluka in Gujarat during February-June 1977 and part of a more extensive study of migratory labour in South Gujarat, examines the intra-rural circulation and the seasonal movement of landless labourers and small peasants, mostly from the Khandesh in western Maharashtra, to sugar factories in the vicinity of Bardoli. Describing in detail the beginnings of sugarcane cultivation in South Gujarat and the organization of sugar co-operatives, the highly organized methods of recruitment of migrant labour from western Maharashtra, the conditions in which the migrant labourers live and work, the author shows that this type of seasonal migration is most closely bound up with the capitalist development of rural production in this area - a process in which the organization of the dominant class of farmers into agricultural co-operatives has played an important part.

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Sharma (1977)\textsuperscript{70} analyzed by using decomposition analysis and found that, during the study period i.e., 1960-61 to 1970-71, the total increase in the value of sugar cane crop production in India was Rs. 4,207 million of which 8.08 per cent and 70.76 per cent were due to increases in the yield, area and prices, while the remaining 12.34 per cent was due to interaction of area, yield and prices. It was inferred that the price was most powerful factor in causing change in value of sugar cane production followed by area and yield.

Acharya et al. (1976)\textsuperscript{71} carried out a study in Kolhapur district of Mahararastra to analyze whether the introduction of tractor had resulted in reduction of labour use in sugar cane cultivation and also whether there is any increase in the level of profitability. It was observed that the total human labour days on owned tractor farms was slightly less (373.95 days) than that on the non-tractor use farms (398.95 days). Bullock labour days on owned tractor farms were very low (37.32 days) as compared to the hired tractor use farms (67.48 days) and non tractor use farms (85.79 days). The efficiency of employment of energy was compared with that of employment of labour by working out input-output ratios. The input-output ratio on owned tractor use farms was relatively high (2.16) followed by hired tractor use farms and non-tractor use farms where the ratio was 2.06 and 2.00 respectively.

Acharya et al. (1976)\textsuperscript{72} studied the economics of different sources of irrigation in sugar cane crop. The per hectare total irrigation cost worked out to be as high as Rs. 2,058.50 under well irrigation with oil engine pump and as low as Rs. 856.78 under canal irrigation. It was Rs. 1414.93 and Rs. 1832.99

\textsuperscript{70} Sharma K L, Measurement of the effects of area, yield and prices in the increase of value of crop output in India. Agricultural Situation in India 32(6) : 349-351, 1977.

\textsuperscript{71} Acharya T K T, Patil R T and Waghmare R E, Economics of different sources of irrigation and it’s impact on cropping pattern on irrigated farms of Poona district (Maharashtra). Indian Journal of Agricultural Economics 31(3) : 235-236, 1976.

under well irrigation with electric motor pump and lift irrigation (on river) respectively. The per hectare per irrigation costs calculated to Rs. 30.10, 33.94, 52.57 and Rs. 62.00 under canal, well (with electric motor pump), lift (on river) and well irrigation with oil engine pump respectively.

**Singh and Singh (1976)** observed that the level of energy use per hectare was higher on the tractor operated farms (1218.36 HP hours) than on the bullock operated farms (910.08 HP hours). The mechanical energy use in land preparation constituted a significant part of total energy use on the tractor operated farms (751.60 HP hours). The mechanical energy use constituted 68.73 and 57.21 per cent of the total energy use on the tractor operated and bullock operated farms respectively. The tractor operated farms did not make matching reduction in animal and manual energy through use of mechanical energy in tillage operations. But, the high doses of fertilizer application had helped the tractor operated farms to achieve higher yields than that on the bullock operated farms.

**Rebello, Chandra Sekhar, Shankaramurthy and Hiremath (1976)** in their primary study on the impact of the increase in the prices of inputs on the profitability and production of sugarcane and paddy in Mandya district of Karnataka, they were analyzed the prices have been increasing at a relatively high rate during the period covering the three years ending with 1975. This is apparent from the study of the price index. The general price index has risen from 132 in 1973 (base year 1961) to 143 in 1975. Thus, the prices have increased by 12 points in two years in this period, as against 32 points in the eleven years prior to it. However, the increase in the price of all commodities as not been of the same dimension in all sectors of the economy. Agricultural

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74 N.S.P.Rebello, G.S.Chandra Sekhar, H.G.Shankaramurthy And K.C.Hiremath, 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 Economy, Vol:XXXI, No:3, 1976.
prices, both of products and factors, especially of fertilizers and labour, have increased in greater proportion than of other commodities. In general hypothesis that farmers at least the present time when the prices of factors increases substantially, their inputs should be decreased on the other hand when the prices of products increases, the input of factors would be increased.

Agrawal and Pal (1975)\textsuperscript{75} reported that the area under sugar cane in Uttar Pradesh had tripled during the period 1901-1975. The average productivity increased from 24.36 tonnes to 35.22 tonnes per hectare during the same period. The main causes of stagnation of productivity were the extension of area under sugar cane to poor and unsuitable lands, small and fragmented land holdings, inadequate capital, lack of adequate and timely irrigation, inadequate supply and application of modern inputs, low yielding new varieties and deterioration in soil fertility in the sugar cane tracts of U.P.

Panse (1975)\textsuperscript{76} 's research study on Problems on techniques, and the cost of production in agriculture, he revealed that the objective of farm cost studies is the analysis of one or more classes of farms rather than of individual units, it is essential that the farms selected for study should be truly representative of the respective classes. Representativeness can be secured only through random selection of a sample of adequate size. Examples of such selection and of the precision of results obtained have been quoted from Indian surveys. Two methods of ascertaining primary data, cost accounting and survey, have been discussed on the background of Indian conditions. In their case, the task has to be assigned to a specially employed field agency and the cost of the first method is appreciably higher than that of the second. It has, however, been established that by the use of the survey method even in the hands of the qualified staff the input factors tend to get exaggerated and outputs under estimated.


Some of the important questions that arise in the recording and analysis of data on various components of cost are imputation of values to unpaid labour, rental on own land and interest on own capital, rates of depreciation on farm assets and apportionment of common overheads to specific enterprises. In regard to the composition of cost, several alternatives are available, but it would seem that direct expenditure incurred on cultivation weighs most with the Indian peasant and this together with the value of his own and his family’s labour on cultivation should form the basic cost. Agreement on approach to these questions will be a distinct step in the promotion of farm cost studies. Apart from their relation to price policies, farm cost studies can provide a variety of results of practical value for improving farming efficiency and increasing production. Some of these are indicated in this study.

Patil and Acharya (1974)\(^7\) in their study titled A comparative study of resource productivities and resource allocation on a sample of sugarcane and banana firms in Nasik and Jalgaon districts of Maharashtra state. The objectives of the study are to estimate and compare the cost of cultivation and resource productivities of, and optimum allocation of resources to sugarcane and banana. A random sample of 60 cultivators from two villages in Malegaon taluka of Nasik district in Maharashtra for adsali sugarcane and Bhadgaon taluka of Jalgaon district for basarai banana on area proportionate basis for each were selected. Both the area in Girna Valley are fed by Girna canals. Rainfall, climate, soil type, are similar even though distance between these areas of crops are 30km. Besides, these crops being wet land crops, their duration, manorial and cultural requirement, water requirement, are also the same. The variations minimized for comparison. The data pertained to the two year period 1970-71 and 1971-72 and were collected by survey method by personally

contacting the banana and sugarcane growers during the period. Following conclusions emerge from the study

1. The per hectare labour utilization is more or less same and heavy in both the crops.

2. The yield of both the crops decreased in 1971-72 and between 1970-71 and 1971-72 the cost per ton of sugarcane and banana has increased by Rs.16.41 and by Rs.140 respectively. But the net profits are more in the case of sugarcane than in banana, because of higher and stable prices in sugarcane and low and fluctuating prices in banana.

3. The regression coefficients of land and labour in banana are more than those in sugarcane but they are less for manures and fertilizers and seed in banana than in sugarcane.

4. In no case the individual coefficient is greater than unity and hence diminishing marginal returns to individual factors of production are indicated.

5. Even though the sums of regression coefficients, for both the crops and for both the years (1970-71 and 1971-72) are greater than one, they are found to be non significant when tested with Tintner’s t-test and hence the hypothesis of constant returns to scale is accepted and increasing returns rejected.

6. On the basis of ‘F’ test, all values of $R^2$ were found to be highly significant at 1 per cent level and hence the coefficient of multiple determination explained highest percentage of variation for the variables included in the study.

7. The marginal productivity of land in sugarcane is the highest while it is comparatively low in banana, indicating the superiority of sugarcane enterprise over banana.
8. Optimum resource allocation with limited capital and land being fixed indicated that resource allocation on human labour and seed should be increased and on manures and fertilizers should be decreased.

9. If both criteria of MVP and elasticity are applied, the results show that resource allocations do not always coincide. But irrespective of the criterion used, it is questionable as to whether in all cases resource shifts could be carried out in practice or would result in increasing future net profits.

10. On the whole, optimum resource allocation indicated that resource allocation on inputs like land and labour have already attained the optimum level in the sample studied.

Parthasarathy, Suryanarayana (1974) in their study paper entitled Regional Variations in Resource Productivity of Sugarcane Farms in Andhra Pradesh. The main objective is to study the regional variations in resource productivity and scale returns in sugarcane farming in Andhra Pradesh by size of sugarcane farms. The study relates to a single production year 1964-65 and provides inter farm comparison of input output data. For this study, a 212 registered sugarcane growers were randomly selected from 18 villages (6 each) in the three agro climatic regions of Andhra Pradesh, viz., North Circars, South Circars and Telangana representing small (up to 1.5 acres) medium(1.5 to 3 acres) and large farms (3 acres and above) on the basis of sugarcane area. In this study only sugarcane plant crop was considered and 177 growers raised this crop (66 each in North Circars and Telangana and 45 in South Circars). Cobb-Douglas type of production was fitted to the input and output data of sugarcane to estimate the resource productivity and returns to scale. Five causal variables, viz., land (sugarcane plant area), human labour (man days of eight

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hours), cattle labour (pair days of eight hours), seed and manures and fertilizers (in Rupees). All possible combinations of input variables were taken and 360 production functions were fitted by using the IBM 1620 of the Delhi University. Only production functions with five variables were considered here for detailed discussion.

The coefficient of adjusted multiple determination ($R^2$) was highly significant in all the regions and indicated that 94 to 99 per cent of variations in output were associated with the variables included in the functions. Significant diminishing returns were found to exist for land in all the regions. Besides this, only human labour in North Circars, cattle labour in South Circars and cattle labour and seed in Telangana showed significant diminishing returns. In all the regions the contribution of fertilizers in sugarcane production in Andhra Pradesh was practically nil. In all the regions constant returns to scale were prevailing in sugarcane production. The use of more land and seed in all the regions, cattle labour in South Circars and Telangana and less of human labour, and manures and fertilizers in all the regions and also cattle labour in North Circars would increase the profitability of the planted sugarcane crop in Andhra Pradesh.

It was found that diminishing factor returns were found to exist for all the inputs in sugarcane farming in all the size group of farms. It was interesting to note that the production elasticity of land which was significant in North Circars for the totality of farms turned out to be non significant in sugarcane farms in all the three regions except on the small farms in North Circars, where diminishing returns to scale were found to exist. The marginal value product to opportunity cost ratios in different size groups indicated gross inefficiency in resource use in sugarcane farming in Andhra Pradesh. A decrease in the use of fertilizers and human labour and an increase in the use of land and cattle labour might contribute to achieve profitability in sugarcane production among different farm size groups. This there exist opportunities for attaining optimal efficiency in sugarcane production through the substitution of resources.
Brijendra Singh, Raj Vir Singh, and L.R.Singh (1974)\textsuperscript{79} their study on Economics of Sugarcane Vis-à-vis its competing crops. In their study they examine the economics of sugarcane crop in comparison to its competing crops on different size of farms the data were used from a survey of 30 farms randomly selected from Rudrapur block of Nainital district in Uttar Pradesh. Out of these 30 farms, ten farms were taken from each group representing small (below 3 hectares), medium (3 to 6 hectares) and large (6 to below 12 hectares) farms. The input-output data were collected from the sample farms pertaining to the agricultural year 1973-74. The intensity of cropping showed an inverse relationship with the size of farm because of increase in the proportionate area under sugarcane crop and limitation of the labour availability on larger farms in peak times. The proportionate area under high-yielding varieties of paddy wheat also showed an increasing trend with the farm size. The increase in the proportionate area under sugarcane and high-yielding varieties of paddy and wheat with size of farms supply and owning of tractor which helped in timely accomplishment of the farm operations. The yield per hectare of sugarcane crop showed an increasing trend with the farm size because of increasing expenditure on fertilizer, irrigation and inter culture operations. The yield per hectare of high significantly higher on the large farms due to higher use of fertilizer and timely irrigation through their own source on this category of farms. The comparison of sugarcane and paddy-wheat rotation indicated that sugarcane is profitable as compared to paddy-wheat rotation on the medium and large farms. On the small farms the paddy-wheat rotation turned out to be profitable because of the depressed yield of sugarcane crop on account of lower level of irrigation application as these farms were handicapped with respect to their own source of irrigation.

Goutam K. Sarkar (1972)\textsuperscript{80} has studied on ‘India's Sugar Exports: Re-Assessment of Rationale’, in the study India first undertook sugar exports in 1957. From the latter half of 1961, government has been sharing the rupee losses on account of sugar exports. Over the years 1961-62 to 1967-68, these subsidies for sugar export amounted to as much as 60 per cent of the foreign exchange earned thereby. And in certain years - 1962-63, 1965-66 and 1966-67 – the subsidies either equaled or substantially exceeded the exchange earnings from sugar. The fact is that we clearly do not have a comparative costs advantage in sugar. The cost structure of the industry is far too high to warrant export - without losses being incurred by the industry or without official subsidy. And the extent of reorganization of cane and sugar production that would be required for Indian sugar to become significantly cheaper puts viable sugar exports beyond the pale of the practically possible. Moreover, the developed countries have in sugar-beet a perfect substitute for sugarcane which they, therefore, try to protect. Sugar also has a low income elasticity in the affluent sugar-importing countries. Although all these adverse factors exports of sugar continue to be susidiised, reflecting our misplaced investment decisions flowing from the ill-conceived notion that exports have to be promoted at any price. [The views expressed in this article are author's own.]

Dhawan (1968)\textsuperscript{81} ’s entitled ‘Comparative Advantage of UP in Sugarcane’. In his study, The Sen Commission's pioneering attempt to estimate the comparative inter-State advantages in growing sugarcane as compared to other competing crops could be improved upon. If the crops which are compared with cane in assessing the comparative advantage among States are not irrigated to the same extent as in a given State, inter-State comparison is vitiated by the irrigation factor. Moreover, with the recent introduction of high-yielding varieties of food grains, the relative advantage of cane vis-a-vis these

\textsuperscript{80} Sarkar has studied on India's Sugar Exports: Re-Assessment of Rationale, Economic and Political Weekly, Vol. 7, No. 18 (Apr. 29, 1972), pp. 893-895-897

\textsuperscript{81} B. D. Dhawan, Comparative Advantage of UP in Sugarcane. In his study, Economic and Political Weekly, Vol. 3, No. 44 (Nov. 2, 1968), pp. 1697-1698
crops within each State is in flux. One firm conclusion that can be drawn is that UP does not appear to have suffered till recently from any comparative disadvantage in growing cane.

Bokil (1959) \(^{82}\) in his study entitled Index of cost of cultivation. In his study cost of cultivation of crops is an important factor in the consideration of agricultural price policies. Under the conditions existing in our country detailed enquiries into cost of cultivation tend to become very costly and cannot generally be conducted as an annual routine. This explains how information collected in such comprehensive surveys conducted over a period of, say 3 years could be used to construct a cost index, the numerical value of which could be calculated from year to year on the basis of data regarding wages, prices and production collected annually. Such an index would reflect adequately the trend of cost of cultivation from year to year.

The index involves the calculation of wage and price relative of labour and materials (such as seed, manure, etc.) utilized in cultivation from the data collected in the base period and then annually. The weights to be given to various wage and price relatives depend on the composition of cost as determined by the initial survey. Both the constructions as well as the numerical calculation of the index have been illustrated in the paper.

Where the price of a crop is fixed by the government in advance of the season as in the case of sugarcane, one way to use the index would be that a minimum price may be declared by the government in the beginning of the season on the basis of the previous year’s index of cost. The payments made may be adjusted later, if necessary, on the basis of the index of cost of cultivation calculated from complete data at the end of that season. Where an

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index is required in the middle of the season for price policies, calculation of a mid-season cost index on the basis of crop forecasts is suggested.