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A Study on the Socioeconomic Implications of Geographical Patterns in Sugarcane Cultivation in Karnataka, India

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ABSTRACT

This study explores the socioeconomic impact of sugarcane cultivation in the Hyderabad-Karnataka and Bombay-Karnataka regions of Karnataka, India. It uses data analysis and a proposed research methodology to understand the dynamics of this vital agricultural sector. Geographical patterns reveal key contributors to the industry, with certain districts being key due to favourable agro-climatic conditions and irrigation facilities. Demographic insights reveal a diverse population of middle-aged farmers with varying landholding sizes and practices. The research methodology uses a cross-sectional design and stratified random sampling to capture the experiences of farmers across different age groups and landholding sizes. Ethical considerations are maintained throughout the research process. The study aims to inform evidence-based policy interventions and promote sustainable agricultural practices, enhancing the livelihoods of farming communities and fostering socio-economic development in the region.

Keywords: Sugarcane cultivation, Socioeconomic implications, Geographical patterns, Agricultural practices.

1. INTRODUCTION

Sugarcane is a major cash crop in India. The cultivation of sugarcane and the sugar industry have a longer history than agriculture and have expanded in step with the development of human society. Sugarcane and sugar are extensively utilized and play a key role in the nation's socioeconomic backdrop. These days, the cultivation of sugarcane and the sugar industry serve as the primary engines of socioeconomic development in rural areas, mobilizing resources, generating revenue and employment, and supplying infrastructure for communication and transportation. In addition to a substantial workforce of agricultural workers, the production of sugar cane and its byproducts employs almost 7 million sugarcane producers. Moreover, the sugar industry employs 5 lakhs trained and semi-skilled labourers in rural areas. India is one of the world's leading producers of sugarcane, with an annual production of over 300 million tons. The manufacturing of sugar is the country's second-largest agricultural processing industry, after cotton and textiles. Only India produces sugar from crops; other countries manufacture raw, refined, or both forms of sugar.

In India, sugarcane is the main raw material used to make gur and sugar. It is grown once a year, from January to March. It is the primary cause of the increase in sugar producing costs. Because it's an agricultural commodity, the unpredictability of nature's whims might result in either an abundant crop or a notable shortage in its production from year to year. Agroclimatic zones classified as subtropical and tropical may be used to generally classify sugarcane farming. The subtropical zone is made up of four states: 1) Punjab; 2) Bihar; and 3) Uttar Pradesh (UP); Haryana is the fourth. The tropical zones contain five States. Among them are: 1) Maharashtra 2. The Andhra Pradesh state 3) The Tamil Nadu state 4) Gujarat Let's start with Karnataka.

Ecological Factors

Climate, precipitation patterns, soil fertility, and other ecological factors all have a significant influence on the productivity and geographic dispersion of sugarcane production in Karnataka. Sugarcane need consistent and enough moisture to grow and flourish, particularly during the monsoon season. Karnataka's northern and central regions are perfect for cultivating sugarcane without extensively depending on irrigation due to their moderate to high rainfall. In addition, the typical growing season temperature in these regions is between 20°C and 30°C, which encourages vigorous vegetative growth and facilitates sucrose accumulation in sugarcane stalks, increasing sugar output. Additionally, the rich nutritional

substrate that these regions' excellent black soils give encourages sugarcane roots to flourish, leading to healthier and more productive harvests.

2. LITERATURE REVIEW

Farmers who were mulching and composting sugarcane waste were aware of the trash's nutritional value and how it increased crop output and soil fertility, according to Girijesh and Chandrasekhar (2001).

To increase the output of sugarcane and sugar, Cock (2003) looks at crop management strategies and plant type alterations. Because it skips important development phases, the crop can withstand some stress. The potential yield of improved cultivars can only be achieved with skilled agronomic management.

Poswal et al. (2005) conducted an overview among sugarcane ranchers in the Muzaffarnagar area of Uttar Pradesh, India, to ascertain the ranchers' knowledge levels on proposed practices in sugarcane development and the degree of reception of further developed sugarcane innovation. The review's findings indicated that 53.70 percent of respondents had a normal level of general knowledge.

Rajula et al. conducted research in 2005 on the limitations and pattern of adoption of moisture stress management solutions. The study indicates that farmers with and without registration know very little about the recommended protocols.

Devi et al. (2011) focused on the effects of sett size, seed rate, and sett treatment on sugarcane formation and quality over the course of three consecutive years, from 2008–09 to 2010–11, at the provincial agricultural exploration station in Anakapalle, Andhra Pradesh. The results of the experiment suggested that two bud setts (86.3 tonnes per hectare) or three bud setts (84.9 tonnes per hectare) can be used as seed material for sugarcane cultivation in order to achieve higher yields of both sugarcane and sugar. Single bud setts (77.9 tonnes per hectare) were found to be inferior in terms of both sugarcane and sugar yields. Sugarcane increased in 3 and 2 bud setts by 10.8% and 8.9%, respectively, compared to single bud setts. Lowering the seed rate to 25% of the regular rate of Rs. 80,000 buds per hectare instead of the customary seed rate of 1,20,000 buds per hectare was shown to result in reduced yields of sugarcane and sugar, regardless of sett size.

Shukla and Singh (2011) studied the tillering example, development, and yield of three promising genotypes of sugarcane (CoS 96269, CoPant 97222, and Colk 9616) under three ripeness levels (112.5, 45, 45; 150, 60, 60 and 187.5, 75, 75 kg N, P2O5 and K2O per hectare) at the Indian Establishment of Sugarcane Exploration, Lucknow. Sugarcane genotypes adhered to a polynomial example in turning crises. CoLk 9616 produced much more sugarcane (78.84 tonnes per hectare) than CoPant 97222 (63.79 tons per hectare) and C0S 96269 (62.68 tons per hectare). Genotype CoLk 9616 demonstrated the greatest sugar output among the fertility levels, with 9.29 tonnes per hectare, whereas the highest sugarcane yield was 70.48 tonnes per hectare. 150, 60, and 60 kg of N, P2O5, and K2O tonnes per hectare were applied to produce sugar yields of 8.59 tons per hectare.

Rao and Babu (2011) conducted a thorough analysis of various consumables produced in Andhra Pradesh with the main goal of adding value to sugarcane. A multistage sample technique was used by the study in 2010–11 to choose 60 farmers at various phases for sampling. The results demonstrated that the price of cultivating sugarcane is the main factor impacting the various value-added goods. Production of sugarcane juice was shown to be more feasible; nevertheless, further study is needed to determine if it would be financially and technically feasible to produce this product on a big scale while preserving quality.

Mandla and Cliff (2012) not only looked at sugarcane output at the national, continental, and worldwide levels but also looked at general statistics on sugarcane production in connection to sustainability. The challenges that the South African sugarcane producing area faces are discussed; they arise from the poor quality of farming that the region's commercial farmers conduct and the industry's lack of global competitiveness. It then frames and illustrates in

detail the five pillars of reasonable horticulture as they apply to sugarcane creation by highlighting the corporate social obligation and social acknowledgment of the sugarcane business in South Africa, which includes preparing and limiting working of local people in rudimentary and proficient abilities in sugarcane creation.

Priya et al. (2014) focused on the use of principal component analysis for data reduction in their study. Sugarcane data spanning 40 years was used in the study. To avoid multicollinearity, yield predictions are created using the principal component regression model. The results are compared using the linear regression model. The new model yields excellent performance.

Priya et al. (2015) conducted research on the importance of sub-national forecasting in the present environment. A connection between the auto backward integrated moving normal (ARIMA) model and the twofold dramatic smoothing model is completed for the Coimbatore sugarcane yield data. Using the Akaike data measure and the Bayesian data rules, the optimal ARIMA model is found. Calculating the upsides of root mean square, mean blatant error, and mean square mistake allows the outcome of the ARIMA model to be compared with that of the Twofold Remarkable Smoothing model and the ideal to be rather flexible. ARIMA outperforms the other model in sugarcane yield forecasting and is thus the better appropriate model for the Coimbatore sugarcane yield data, according to the previously cited results.

Jagatpal et al. (2017) looked at the socioeconomic profile of the sugarcane growers in the Sitapur area of Uttar Pradesh, India. This study was conducted utilizing in-person interviews with 100 respondents in the Khaira bad block of the Sitapur district of Uttar Pradesh. The respondents were selected using a random selection technique based on the majority of sugarcane growers from five sample villages. The study, which included 100 respondents, discovered that the majority, or 60%, were in the middle age ranges (38–59), were literate, were Hindus, members of other backward castes, were from nuclear families (54%), were from medium-sized families (67%), had marginal land holding sizes (47%), worked as agricultural labourers in secondary occupations (67%), had a medium annual income (45001–172000), lived in mixed houses (41%), and had a medium amount of material possessions overall (71%).

Pal et al. (2017) investigated the socioeconomic traits of sugarcane growers in the Moradabad region of the Indian state of Uttar Pradesh. Exponential equations were fitted with consideration to the socioeconomic character of the study area in order to estimate the arithmetic mean. When compared to other districts in the state of Uttar Pradesh, Moradabad district has the most area under sugarcane farming, according the data. For the study, 200 participants were randomly selected from the Moradabad region. It was found that the respondents' major source of income was agriculture, with 75% of them being marginal farmers, 73.68% being small farmers, and 63.74% being medium farmers. The study found that 52.63% of small farmers, 58.03 percent of marginal growers, and 58.06 percent of medium growers belonged to the backward caste, which comprised the majority of sugarcane producers.

Nandhini and Padmavathy (2017) looked at the variables that affected the variability in sugarcane yield in India from 2000 to 2010 on a state-by-state basis. The study is based on secondary data, and sugarcane growth rates are taken into consideration during data analysis. The amount of sugarcane produced in India demonstrates the disparities in production methods. The trend equations demonstrated that there were fluctuations in India's sugarcane yield and that no discernible pattern of steady expansion was seen. The main reason for low production and low productivity is the unpredictable monsoon season.

The Kallakurichi Cooperative sugar mill in the Indian state of Tamil Nadu functioned as the research field experiment for Chelvi (2017). This research investigates the effects of microbial consortia functioning as biofertilizers on sugarcane output. 75 percent NPK liquid and 75 percent NPK biofertilizers were used as treatments. The results demonstrated that

using liquid bio-fertilizers would preserve soil fertility and boost sugarcane yield, both of which will boost farmers' incomes.

3. RESEARCH METHODOLOGY

Based on the presented data analysis, the study technique that has been developed to investigate the socioeconomic repercussions of sugarcane production in the Karnataka areas of Hyderabad-Karnataka and Bombay-Karnataka includes many essential elements.

A cross-sectional strategy will be used in the study design to enable data gathering at a particular moment in time. This strategy makes it easier to examine different agricultural and demographic characteristics among the sugarcane growers in the chosen locations. Because the research is quantitative in character, numerical data from organized surveys may be rigorously analysed.

To guarantee representation across all age groups and landholding sizes, a stratified random sampling approach will be used as part of the sampling strategy. This strategy will improve the generalizability of the research results by capturing the variety among sugarcane producers in the target locations. The agricultural community will be encouraged to participate more widely and with more inclusiveness if both online and offline data gathering techniques are included.

The main method of gathering data will be surveying sugarcane farmers, with an emphasis on agricultural techniques including the use of different tools and demographic data like landholding size and age composition. The project attempts to give a detailed knowledge of the socioeconomic environment surrounding sugarcane agriculture in Karnataka by collecting extensive data on these topics.

Descriptive statistics will be used for data analysis in order to look at how respondents are distributed across various categories, including landholding sizes and age groups. To clarify patterns and trends in the data, percentages and frequencies will be computed. Furthermore, possible correlations between variables may be investigated using cross-tabulations and chi-square tests, which can provide insight into the interactions between socioeconomic results, agricultural methods, and demographic features among sugarcane producers.

Throughout the study process, ethical concerns will be of utmost importance, and strict protocols will be implemented to guarantee the preservation of participants' rights and privacy. Every participant will be asked for their informed permission, and measures will be taken to protect their identity and confidentiality. The study will protect the validity and integrity of the research findings by adhering to the ethical standards and laws regulating research with human subjects.

4. DATA ANALYSIS

In the Karnataka regions of Hyderabad and Bombay, the total area under cultivation for sugar can be estimated to be approximately 4.8 lakh hectares, or 480,000 hectares. Some districts within these areas are notable for having made substantial contributions to the production of sugarcane. Districts with the highest concentration of sugarcane growing are Belagavi, Bagalkot, Mandya, Vijayapura, and Bidar. These areas are well-known in the sugar business because of their ideal agroclimatic conditions, plentiful irrigation resources, and sugarcane-growing atmosphere. These districts have large areas of land dedicated to sugarcane farming, which is essential to maintaining the state's sugar output and the livelihoods of many sugarcane farmers.

Socio-Economic Background

Table.1: Age Composition of Respondents

Age	Frequency	Percentage
25 - 40	40	15.4
41 - 55	150	57.6
55 - 70	70	27
Total	**260**	**100.0**

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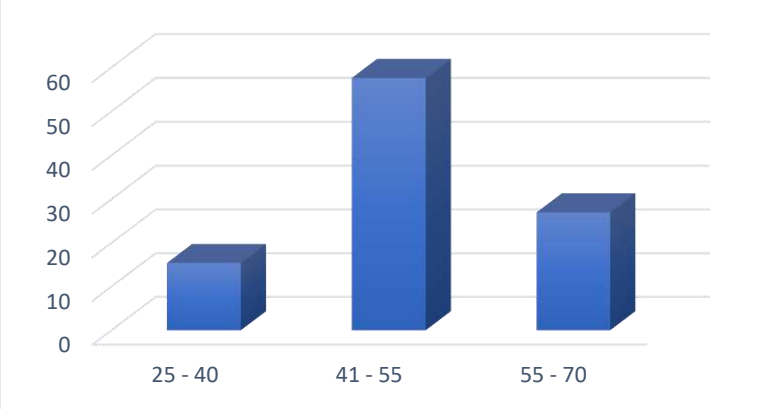

Figure 1: Age Composition of Respondents

The age distribution of study participants is shown in Table 1. Three age groups—25–40, 41–55, and 55–70—are represented in the variable about the respondents. 150 respondents, or around 57.6% of the sample as a whole, are in the 41–55 age range, which comprises the bulk of respondents within these groups. This suggests that a significant fraction of the population polled are middle-aged people. Moreover, the 55–70 age group makes up a significant component of the sample as well, with 70 responders accounting for over 27% of the sample as a whole. However, 40 respondents fall into the youngest age group of 25–40 years, making up around 15.4% of the sample as a whole.

Table 2: Size of Land Holding

Size of Land Holding	Frequency	Percentage
Marginal (<1) hectares	80	30.7
Small (1-2) hectares	100	38.5
Medium (4-10) hectares	60	23
Large (>10) hectares	20	7.7
Total	**260**	**100.0**

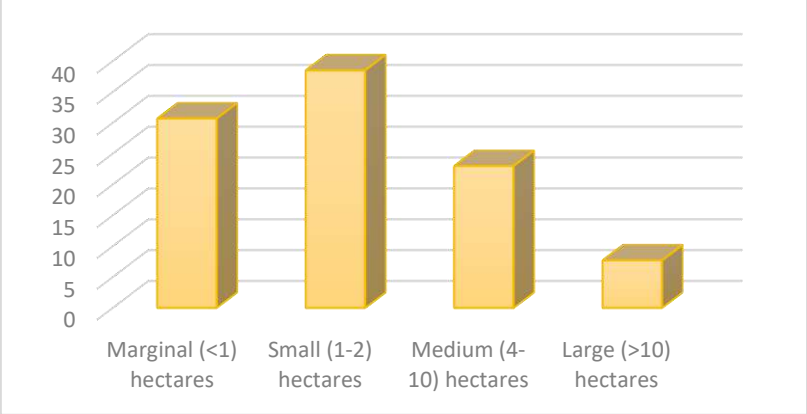

Figure 2: Graphical representation Size of Land Holding of respondents

The distribution of respondents according to the amount of land they own is shown in Table 2. The data shows that the population under study has a wide variety of landholding sizes. With 100 responses, small landholdings is the most prevalent type, accounting for around 38.5% of the sample as a whole. This suggests that a significant proportion of the participants own property with an area between one and two hectares. Then, marginal landholdings—which are defined as less than one hectare—are represented by 80 respondents, or around thirty-seven percent of the sample as a whole. Additionally, 60 respondents, or around 23% of the sample as a whole, own medium-sized landholdings that range in size from 4 to 10 hectares. Respondents with significant landholdings over 10 hectares form the smallest group, including 20 persons and accounting for around 7.7% of the sample as a whole.\

Table 3: Agricultural Implements usage

Agricultural Implements usage	Frequency	Percentage
Tractors	60	23
Harrows	40	15.4
Cultivators	30	11.5
Thrashers	50	19.2
Rotavators	30	11.5
Tillers	20	7.7
Sprayers	10	3.8
Sowing Machines	10	3.8
Wooden Ploughs	10	3.8
Total	**260**	**100.0**

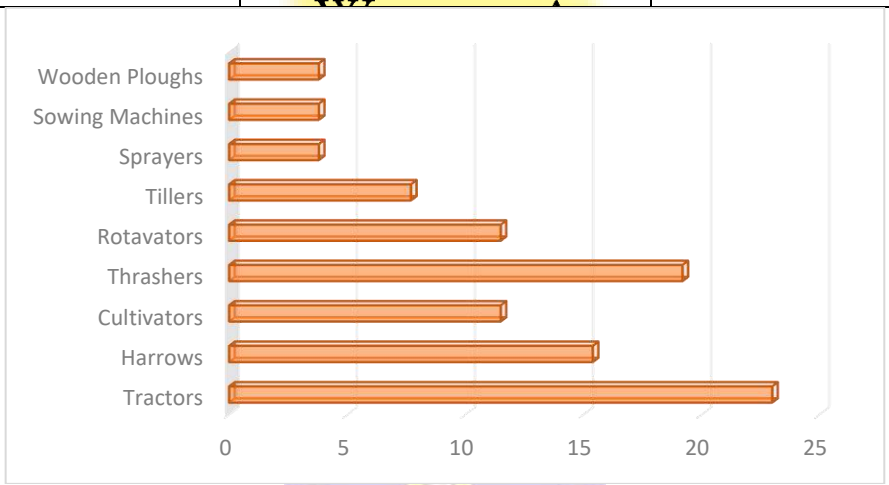

Figure 3: Graphical representation of Agricultural Implements usage

Table 3 offers information on how different agricultural tools are used by the people that were polled. According to the statistics, farmers use a wide variety of equipment in their agricultural methods. Among the 60 responses, or around 23% of the sample, tractors are the most often utilized agricultural tool. This shows that among the farmers polled, tractors are a major factor in the mechanization of agricultural activities. After tractors, thrashers (50 respondents, or about 19.2% of the sample total) and harrows (40 respondents, or roughly 15.4% of the sample total) are other often used devices. Wooden ploughs, tillers, rotavators, sprayers, cultivators, and sowing machines are also used, but less often and with frequencies range from 10 to 30 responses each.

5. CONCLUSION

The study analysed data on sugarcane cultivation in the Hyderabad-Karnataka and Bombay-Karnataka regions of Karnataka, providing insights into the socioeconomic dynamics of the sector. The research revealed significant trends in geographical distribution, with districts like Belagavi, Bagalkot, Mandya, Vijayapura, and Bidar being key contributors. The study also revealed a predominance of middle-aged individuals with varying landholding sizes and agricultural practices. The proposed research methodology uses a cross-sectional design and stratified random sampling to explore the socioeconomic implications of sugarcane cultivation. The study adheres to ethical guidelines, upholding participant rights and data confidentiality. The findings aim to inform evidence-based policy interventions and promote sustainable agricultural practices, enhancing the livelihoods of farming communities and contributing to the region's socio-economic development.

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