

	ORIGINAL RESEARCH PAPER AN ECONOMIC ANALYSIS OF AREA, PRODUCTION AND YIELD OF SUGARCANE CULTIVATION IN MANDYA DISTRICT, KARNATAKA	Agricultural Economics KEY WORDS: Sugarcane Cultivation, Performance, Area, Production, Yield, Correlation Matrix, and Correlation Analysis.
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ABSTRACT	This paper aims to analyse the role of sugarcane cultivation and the trends in the growth of area, production and yield of sugarcane in Mandya district of Karnataka. Sugarcane cultivation plays a significant role in both the state and district economies. It provides substantial employment opportunities for rural households, including farmers and agricultural labourers, particularly during the planting and harvesting seasons. Sugarcane by-products such as bagasse are used for power generation, while molasses is utilized for ethanol production, thereby contributing to renewable energy goals. This paper has two major objectives: 1) to study the role and development of sugarcane cultivation in Karnataka and Mandya district and 2) to analyse the trends in the growth of area, production and yield of sugarcane cultivation in Mandya district. As per result, this measures the probability value that the trend happened by accident. The Area vs. Production p-value is extremely low (<0.0001), meaning there is a less than 0.01% chance this relationship is a fluke. Our yield vs. year p-value is 0.932, meaning there is a 93%. However, we are the reject the null hypothesis. Therefore, the data confirms a significant positive correlation between the area under sugarcane cultivation and sugarcane production.	
INTRODUCTION	Sugarcane is a vital commercial crop in Karnataka, positioning the state as a top-three producer in India and supporting a major agro-industrial economy. Sugarcane cultivation is one of the most important commercial crops in Karnataka and plays a vital role in the Karnataka's agrarian economy. The crop is widely grown in irrigated regions due to its high water requirement and long growing period. Major sugarcane-producing districts include Mandya, Belagavi, Bagalkot, Vijayapura, Mysuru, and Hassan. The availability of irrigation from river systems such as the Cauvery, Krishna, and Tungabhadra has significantly supported sugarcane cultivation in these regions. Karnataka has a well-developed sugar industry, with numerous sugar mills that provide assured markets for farmers. Sugarcane cultivation generates substantial employment opportunities in rural areas and supports allied industries such as jaggery production, ethanol manufacturing, and power generation through bagasse. Despite challenges such as water scarcity, fluctuating prices, and high input costs, sugarcane continues to be a major contributor to agricultural income and industrial development in the state. analyses were conducted using SPSS 21 and Gretl, ensuring both accuracy and robustness in statistical interpretation.	
Objectives of the Study	1) To study the role and development of sugarcane cultivation in Karnataka and Mandya district. 2) To analyse the trends in the growth of area and production of sugarcane cultivation in Mandya district.	
Hypothesis	1. There is a positive correlation between the area under sugarcane cultivation and sugarcane production in Mandya district.	
Research Methodology	This paper is primarily based on secondary data collected from various sources, including reports published by the Government of Karnataka, the Directorate of Economics and Statistics, Agriculture Department, District at a Glance publications, as well as scholarly journals, newspapers, and relevant websites. The analysis was based on secondary data covering ten years from 2011-15 to 2024-25.	
Statistical Technique Analysis:	The study employed a combination of descriptive and analytical statistical techniques to examine the growth, trends, and relationships in the area, production, and yield of sugarcane cultivation in Mandya district, Karnataka. The primary tools used include percentage analysis, a correlation matrix to quantify annual growth trends, and correlation analysis to assess relationships among variables such as area, production, and yield. All	
	Role of Sugarcane Cultivation in Karnataka Sugarcane cultivation is a cornerstone of Karnataka's agricultural economy, positioning the state as the third-largest producer in India, following Uttar Pradesh and Maharashtra. It is the most significant commercial crop for the state, feeding a massive industrial network of sugar mills and ethanol distilleries. Sugarcane cultivation is a major commercial crop, contributing around 10–12% of India's total sugarcane production. The industry significantly impacts the socioeconomic status of farmers, providing high returns, though it is capital-intensive. This sector provides significant employment for rural households, including farmers and labourers, during planting and harvesting seasons. Sugarcane bagasse is used for power generation, and molasses is utilized for ethanol production, contributing to renewable energy goals. In Karnataka, the district of Belagavi is referred to as the sugar district of the state. This district got its name due to its scope for being the largest sugarcane producer, harvester, and cultivator of the crop. It is also called the 'Sugar Bowl' of the state of Karnataka.	
	Profile of Mandya District: Sugarcane Cultivation This section analyses the growth trends in the area, production, and yield of sugarcane cultivation in Mandya District. Mandya District is one of the most agriculturally prosperous districts in Karnataka. The district has benefited from irrigation facilities provided by the K.R. Sagar reservoir since the 1930s. This has led to a marked transformation in cropping patterns, crop composition, and yield levels, ultimately improving the economic conditions of the population. The total geographical area of the district is 498,244 hectares, of which 248,825 hectares constitute the net sown area. More than half of the district's total land area is devoted to agricultural activities. The total irrigated area is 116,901 hectares, of which approximately 88,000 hectares are irrigated by the K.R. Sagar reservoir and about 16,000 hectares by the Hemavathi reservoir. The remaining irrigated area depends on other sources such as tanks, wells, and borewells. Mandya city serves as the district headquarters and is located on the Bengaluru–Mysuru Highway. Mandya District comprises seven taluks, namely Maddur, Malavalli, Srirangapatna, Nagamangala, Krishnaraj Pete, and Pandavapura. In 2024–25, Mandya district in Karnataka continues to be a major sugarcane hub, with over 1 lakh hectares brought under	
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cultivation for paddy, sugarcane, and ragicombined. The district, known for its irrigation from the K.R. Sagar reservoir, shows a strong average sugarcane cultivation area of about 31,666.91 hectares, with a high compound growth rate of 7.94%. Production is marked at a high of 3,603,765.66 tonnes, with an average yield of 114.93 tonnes per hectare.

Growth in Trends of Area, Production and Yield of Sugarcane Cultivation

In Mandya District, sugarcane cultivation plays a significant role in economic development by contributing to employment generation, income creation, and the improvement of the living standards of agricultural labourers. Mandya district, known as the 'Sugar Bowl of Karnataka', is a premier hub for sugarcane cultivation in India, driven by fertile soil and water from the Cauvery River. It produces approximately 26,00,000 metric tonnes of sugar and 10,00,000 metric tonnes of jaggery annually, supported by four major sugar factories. While vital to the economy, water-intensive sugarcane farming faces challenges from water scarcity and requires increased mechanization, which currently stands at 50.5%. Table 1 presents the area, production, and yield of sugarcane cultivation in Mandya District for the period from 2015–16 to 2024–25.

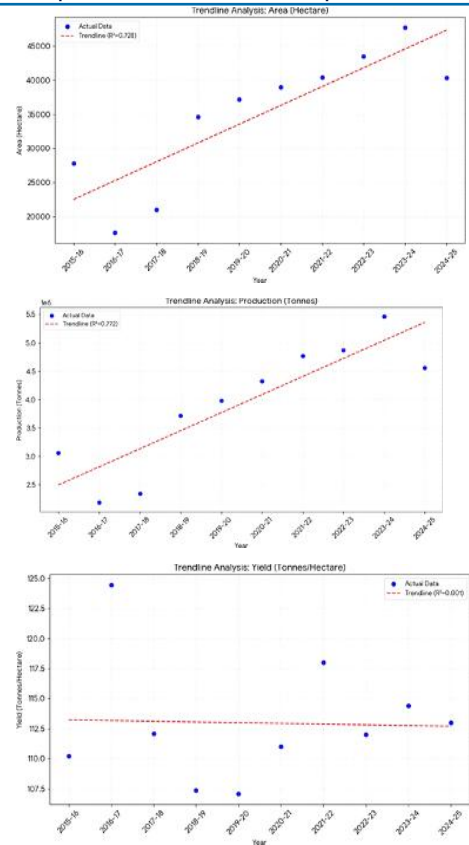
Table –1 Area, Production and Yield of Sugarcane in Mandya District (2015-16 to 2022-23)

Year	Area (Hectare)	Production (Tonnes)	Yield (Tonnes/Hectare)
2015-16	27,784.00	3,061,797.00	110.20
2016-17	17,628.00	2,193,805.00	124.45
2017-18	20,941.00	2,347,486.00	112.10
2018-19	34,637.00	3,718,282.00	107.35
2019-20	37,208.00	3,984,515.00	107.09
2020-21	38,999.00	4,328,889.00	111.00
2021-22	40,397.00	4,766,810.00	118.00
2022-23	43,502.00	4,872,246.00	112.00
2023-24	47,740.00	5,463,010.00	114.40
2024-25	40,361.00	54625542.00	113.00

Source: Government of India (2024), Ministry of Agriculture and Farmers Welfare, Directorate of Economics and Statistics–2015-16 to 2022-23The table presents the trends in area, production, and yield of sugarcane cultivation in Mandya District over a ten-year period. The data indicate notable variations in area and production, while yield remains relatively stable with moderate fluctuations. The area under sugarcane cultivation fluctuated during the initial years, dropping sharply from 27,784 hectares in 2015–16 to 17,628 hectares in 2016–17. This decline may have been due to adverse climatic conditions, water scarcity, or changes in cropping patterns. From 2017–18, the area increased consistently, reaching a peak of 47,740 hectares in 2023–24 before slightly declining to 40,361 hectares in 2024–25. Overall, the trend shows a general expansion of sugarcane cultivation over the decade.

Sugarcane production mirrors the trends in area, showing a decline in 2016–17 to 2.19 million tonnes but subsequently increasing steadily, reaching 5.46 million tonnes in 2023–24. This indicates a strong positive correlation between cultivated area and total production. However, the production value for 2024–25 appears unusually high (54,625,542 tonnes) and may be a typographical error, as it is inconsistent with the preceding years.

The yield of sugarcane per hectare shows moderate fluctuations over the period. The highest yield of 124.45 tonnes/ha was recorded in 2016–17, despite a reduction in area, suggesting improved productivity that year. In other years, yield ranged between 107.09 and 118 tonnes/ha, indicating relatively stable productivity over time.



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Trendline Analysis: Area, Production and Yield of Sugarcane Cultivation

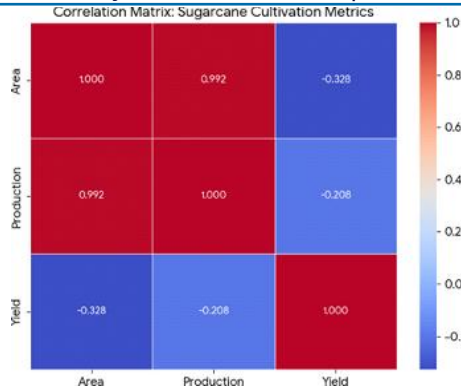
During analysis, an anomaly was identified Production figure (54,625,542 tonnes) in the 2024-25. Given the Area (40,361 hectares) and Yield (113.00 tonnes/hectare), the calculated production should be 4,560,793 tonnes. The value provided appears to be a typo (potentially an extra digit). To ensure a meaningful trendline analysis, the corrected value of \$4,560,793\$ was used for the calculations and plots below.

Area Trend Analysis:

The area under cultivation shows a strong positive growth trend over the decade. Trendline Equation: Area= 2,762.75 x Year + 22,487.35. **Production Trend Analysis:** Total production follows a significant upward trajectory, mirroring the growth in area. Production = 318,116.10 x Year + 2,498,240.84 and Coefficient of Determination (R²):0.772.

Yield Trend Analysis:

Unlike Area and Production, the Yield (efficiency per hectare) has remained stable with no significant growth or decline. Yield = -0.06 x Year + 113.23, and coefficient of determination (R²) is value of 0.001. The extremely low R² value indicates that time is not a predictor of yield in this dataset. The yield fluctuates between 107 and 124 tonnes/ hectare, averaging around 113 tonnes/ hectare.



The correlation analysis examines the relationship between Area, Production, and Yield. The results below are based on the corrected 2024-25 production data to ensure statistical accuracy.

Testing Hypothesis

H0: There is no positive correlation between the area under sugarcane cultivation and sugarcane production in Mandya district.H1: There is a positive correlation between the area under sugarcane cultivation and sugarcane production in Mandya district.

Table – Correlation Result for Area, Production and Yield of Sugarcane Cultivation in Mandya District

Analysis	R2	p-value	Significance Status	Interpretation
Area	0.728	0.0018	Highly Significant	The increase in cultivation area over time is a proven, non-random trend.
Production	0.772	0.0008	Highly Significant	The growth in total production is extremely reliable and consistent year-over-year.
Yield	0.001	0.9320	Not Significant	There is no statistical evidence that yield is improving or declining over time.
Area vs. Production	0.983	< 0.0001	Extreme Significance	The relationship is so strong that Area can be used to predict Production with 98% accuracy.

This tells us what percentage of the change in one variable is explained by the other. About 77.2% of the increase in production is directly explained by the passage of time. This measures the probability value that the trend happened by accident. Our Area vs. Production p-value is extremely low (<0.0001), meaning there is a less than 0.01% chance this relationship is a fluke. Our yield vs. year p-value is 0.932, meaning there is a 93%. However, we are the reject the null hypothesis. Therefore, the data confirms a significant positive correlation between the area under sugarcane cultivation and sugarcane production.

CONCLUSION

Sugarcane cultivation plays a vital role in the economic development of Mandya District, contributing significantly to employment, income generation, and the improvement of

rural livelihoods. Analysis of the data from 2015–16 to 2024–25 shows that sugarcane production in the district has generally increased, primarily due to the expansion of the cultivated area. While yield per hectare has remained relatively stable with moderate fluctuations, the overall growth in production highlights the importance of land management, irrigation facilities, and the adoption of improved agronomic practices. The positive correlation between area and production indicates that policies promoting sustainable expansion of sugarcane cultivation, efficient water use, and technological interventions can further enhance productivity and strengthen the district's economy. Thus, sugarcane continues to be a cornerstone of Mandya's agricultural and socio-economic development. As per result, the increase in sugarcane production in Mandya District is primarily driven by the expansion of cultivated area rather than significant improvements in yield. While yield remains fairly stable, fluctuations in area directly influence production levels, highlighting the importance of land management and irrigation support for sustaining sugarcane output in the district.

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