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Original Article

Evaluating the Agricultural Potential of Maize through Five-Year Cultivation Trends

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Abstract

This study assesses the agricultural potential of maize in Nandurbar District by analyzing taluka-wise area under maize cultivation over a continuous five-year period (2020–21 to 2024–25). Using secondary data obtained from district agricultural records, the research examines temporal dynamics and spatial variations in maize-cultivated area across the six talukas of the district. Findings reveal an overall upward trend in the total maize-area, with marked inter-taluka differences: certain talukas record sustained or increasing areas while others show stagnation or decline. The study computes annual growth rates and coefficient of variation to highlight stability or volatility in cultivation patterns. Spatially, talukas with better connectivity, irrigation access and market linkages show higher growth, suggesting latent agricultural potential for maize. On the other hand, declining or erratic cultivation in other talukas points to constraints such as water scarcity, land fragmentation or weak infrastructure. While climatic variables could not be incorporated due to data limitations, the trends analyzed provide a sound baseline for evaluating the maize-sector's development scope in the district. The paper concludes with policy implications: targeted extension services, infrastructure improvement, credit support and crop diversification strategies could enhance maize cultivation potential in weaker zones. The study contributes to geographical agrarian research by offering a focused temporal–spatial assessment of maize cultivation trends in a marginal district context, thereby informing both academic discourse and regional agricultural planning.

Keywords- *Maize cultivation, Agricultural potential, Spatio temporal analysis, Trend analysis Growth Rate (CAGR), Instability Index, Agricultural Economics.*

Introduction

Maize (Zea mays L.) functions as one of the world's most versatile and foundational cereals, fulfilling a diverse range of purposes that extend far beyond its role as a staple food crop. It forms the backbone of livestock feed systems, supports a wide array of agro-based industries, and increasingly serves as a critical raw material in food processing, starch and sweetener production, biofuel generation, and pharmaceutical applications. Within the Indian agricultural landscape, maize has gained strategic prominence due to its high-yield potential, adaptability to varied agro-ecological zones, and capacity for cultivation during the Rabi (winter) season under assured irrigation. This seasonal advantage enables farmers to obtain higher and more stable yields compared to Kharif maize, which remains heavily dependent on the monsoon. Consequently, Rabi maize has emerged as a profitable diversification alternative, offering farmers an opportunity to shift away from traditional Kharif-dominated cropping patterns and reduce vulnerability to climatic uncertainties.

Understanding long-term changes in maize cultivation area has therefore become essential for agricultural policymakers, planners, and development agencies. Multi-year acreage analysis provides valuable insights into farm-level resilience, economic motivations, technological adoption, and the broader structural transformation of regional agriculture. Such trend assessments help identify regions with high production potential, evaluate market-driven expansion or contraction, and pinpoint areas where interventions are required to stabilize farmer income and enhance productivity.

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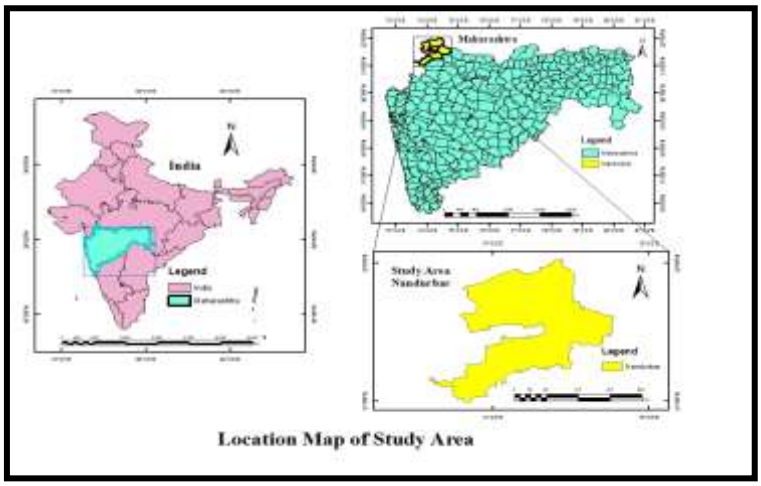
Moreover, analyzing temporal fluctuations supports evidence-based decision-making by revealing the socio-economic and environmental drivers that shape farmer crop-choice behavior.



Location Map of Study Area

Location Of Study Region

Nandurbar District is located in the northwestern part of Maharashtra as a newly formed administrative district after bifurcating Dhule on 1 July 1998. On the geographical frame, it is located between 21° 00' to 22° 03' North latitude and 73° 31' to 74° 32' East longitudes. The total area of the district is about 5,955 square kilometers and occupies the major part of Khandesh region. The Narmada River and the state of Madhya Pradesh form the northern and north-eastern boundaries of this district. The state of Gujarat borders Dhule district on the south and south-east, and Nandurbar on the east and north-west.

The landforms of Nandurbar are considerably different in two respects: to the north, which consists of Dhadgaon and Akkalkuwa talukas, the region has the rugged and mostly tribal Satpura hills, while to the south of Nandurbar, which is composed of Shahada and the Nandurbar talukas, is located in the productive alluvial plains of the Tapi River basin. This physical geography creates two natural agro-regions of importance in the district, which affect cropping decisions and contribute differently to the agricultural variability patterns discussed in this paper. The district is divided administratively into six talukas (Nandurbar, Shahada, Taloda, Akkalkuwa, Navapur and Dhadgaon).

Objective:

- To analyse and quantify the year-over-year changes (2021–2025) in average maize yield across Nandurbar district to determine the overall cultivation productivity trend.

Research Methods and Materials

This study analyzes secondary time-series data regarding the area (in hectares) under chilli cultivation in the Nandurbar district. The data was prepared on the basis of a compilation of official documents and reliable government reports, including:

- District Statistical Abstract of Nandurbar.
- Directorate of Economics and statistics, Government of Maharashtra.
- Government of Maharashtra, Directorate of Agriculture.
- Agricultural Statistics at a Glance issued by the Ministry of Agriculture and farmers Welfare, Government of India.
- Using GIS Software (Arc GIS).

Result And Discussion

The five-year analysis of maize cultivation in Nandurbar district (2020–21 to 2024–25) reveals significant spatial and temporal variations across the six talukas. The trends indicate that maize has emerged as a promising Rabi-season crop, particularly in regions with assured irrigation and favorable market linkages.

Table-1: Maize (Rabbi Season) Area under the Cultivation of Chill (2020–2025)

Taluka	Area Under Cultivation (Hectare) 2020-21	Area Under Cultivation (Hectare) 2021-22	Area Under Cultivation (Hectare) 2022-23	Area Under Cultivation (Hectare) 2023-24	Area Under Cultivation (Hectare) 2024-25
Akkalkuwa	7771.5	7985	8714.53	8915.25	9370.53
Dhadgaon	4330	6212	4998	4710	4750
Taloda	654	474	435	714	834
Shahada	780	7900	6150	6282	10914
Nandurbar	4780.5	2179	2693.5	2911	5864
Navapur	6283	3240	3427	5885	574
Total	**24599**	**27990**	**26418.03**	**29417.25**	**32306.53**

Source: District Statistics Abstract Nandurbar and compiled by researcher

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Methodology for Analysis:

Compound Annual Growth Rate (CAGR): To determine the annual growth over the 5-year period.

$$CAGR = \left(\frac{A_n}{A_1}\right)^{\frac{1}{n-1}} - 1$$

(Where n = 4, representing the intervals between the 5 years)

Coefficient of Variation (CV): To measure instability (volatility). A higher CV indicates higher instability.

$$CV = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$$

Table No 2: District-Level Analysis

Year	Total Area (Hectares)	Change from Previous Year
2020-21	24,599	—
2021-22	27,990	+3,391 (Significant Increase)
2022-23	26,418.03	-1,571.97 (Slight Decrease)
2023-24	29,417.25	+2,999.22 (Moderate Increase)
2024-25	32,306.53	+2,889.28 (Significant Increase)

Table No 3: Growth and Instability by Taluka (2020–2025)

Tehsils	Mean Area (Ha)	CAGR (%)	CV (%)	Interpretation of Trend and Instability
Navapur	3,881.80	-45.02	59.5	Extreme Contraction & Highest Instability. Severe decline in Maize area driven by drastic year-to-year changes, indicating a major shift away from the crop due to constraints or superior alternatives.
Shahada	6,405.20	93.41	57.52	Explosive Expansion & Very High Instability. Dominant source of district growth. The high volatility is due to an initial, massive shift in area, suggesting a recent structural change (e.g., irrigation expansion or new market access).
Nandurbar	3,685.60	5.24	42.47	Modest Growth & High Instability. Area decisions are highly volatile, swinging significantly around the mean, implying high sensitivity to short-term factors like price fluctuations or localized weather events.
Taloda	622.2	6.27	26.81	Moderate Growth & Moderate Instability. Typical fluctuation for a minor crop area, indicating reasonable responsiveness to market while maintaining a modest upward trend.
Dhadgaon	5,000.00	2.34	14.37	Slow Growth & Low Instability. The area is relatively consistent over time, suggesting established farming practices and a low dependency on Maize for rapid expansion.
Akkalkuwa	8,551.36	4.79	7.75	Highest Average Area & Lowest Instability. Represents the most consistently cultivated Maize area with the highest degree of reliability and predictability in farmer decisions.
Total (District)	28,146.16	7.05	10.44	Strong Aggregated Growth & Low District Instability. The overall positive trend is sustained, but the low instability is a statistical aggregation that masks the extreme volatility of individual Talukas.

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The temporal dynamics of Rabbi Maize acreage were analyzed using the Compound Annual Growth Rate (CAGR) and the Coefficient of Variation (CV) across the six Talukas of Nandurbar District. This analysis revealed a complex pattern where overall district stability masks significant and highly polarized localized instability.

District-Level Aggregated Trend:

The aggregated data for Nandurbar District shows that the area under Rabbi Maize cultivation experienced a robust annual expansion rate, reflected by a CAGR of 7.05% over the five-year period. This indicates a strong, sustained preference for Maize cultivation during the winter season across the region. Crucially, this growth occurred with a low Coefficient of Variation (CV) of 10.44%. In agricultural economics, a CV below 15% typically signifies low instability and high predictability in planting decisions. This low district-level volatility suggests that, in aggregate, Maize area is a statistically reliable component of the district's cropping pattern.

Tehsil-Level Polarization and Instability:

While the district average is stable, the Taluka-level statistics highlight extreme divergences, classifying the Talukas into three distinct groups:

Group 1: Extreme Volatility and Structural Shifts (CV > 40%)

Three Talukas exhibit area dynamics that are highly erratic, indicating underlying structural changes or high sensitivity to localized factors.

Shahada (CAGR: 93.41%; CV: 57.52%): Shahada is the primary engine of growth, exhibiting an extraordinary compounded growth rate. This rate is unsustainable in normal circumstances, signifying a recent, massive shift in land use, likely driven by major investment in irrigation infrastructure or highly favorable output prices that encouraged substantial area diversion from other crops. The corresponding high CV confirms the instability caused by this rapid, non-linear adoption.

Navapur (CAGR: -45.02%; CV: 59.50%): Conversely, Navapur represents a case of severe contraction. This substantial negative CAGR, paired with the district's highest CV, points to a crisis or a successful crop substitution. Farmers in Navapur are rapidly abandoning Maize, likely due to localized resource constraints (e.g., specific water stress in the Rabi season) or the emergence of a significantly more profitable competing crop, rendering Maize cultivation economically unviable.

Nandurbar (CAGR: 5.24%; CV: 42.47%): While achieving a modest positive growth, Nandurbar's high CV indicates that farmer area decisions are highly reactive. The acreage swings dramatically year-on-year, suggesting deep sensitivity to short-term market signals, localized pest or disease pressure, or immediate antecedent weather conditions that influence the subsequent Rabi planting.

Group 2: Moderate Responsiveness (CV: approx. 27 %)

Taloda (CAGR: 6.27%; CV: 26.81%): Taloda demonstrates moderate instability, a common finding for minor crop areas where acreage is highly dependent on residual resources and fluctuating market demand. The steady growth trend suggests that when resources are available, Maize remains a viable, secondary option.

Group 3: Low Instability and Predictability (CV < 15 %)

Akkalkuwa (CAGR: 4.79%; CV: 7.75%): Akkalkuwa is the exemplar of stability. It has the largest average area under cultivation and the lowest CV, indicating a reliable and established cropping pattern. This predictability suggests assured access to resources, well-integrated market supply chains, or a strong local tradition of Maize farming that buffers against short-term shocks.

Dhadgaon (CAGR: 2.34%; CV: 14.37%): Dhadgaon also exhibits low instability, but with the lowest growth rate, suggesting the area allocation is near its resource capacity, leading to consistent but non-expansive farming practices.

Conclusion

The five-year assessment of Rabi maize cultivation in Nandurbar district reveals a dynamic agricultural landscape shaped by varying levels of growth, stability, and farmer responsiveness across talukas. The overall district trend shows strong aggregated growth (CAGR 7.05%) with relatively low instability**,** indicating that maize continues to gain importance as a reliable Rabi crop. However, taluka-level patterns expose substantial internal disparities. Akkalkuwa demonstrates the most consistent and stable cultivation**,** reflecting well-established maize practices, while Shahada shows explosive expansion but with very high instability, suggesting rapid structural changes in irrigation or market access. Dhadgaon maintains steady but slow growth, whereas Taloda and Nandurbar exhibit moderate improvements coupled with greater sensitivity to short-term economic conditions. Navapur stands out for its severe contraction and highest instability, indicating a decisive shift away from maize, possibly due to competing crops or agro-economic constraints.

Overall, the district possesses considerable potential for strengthening maize-based agriculture, but targeted interventions must address localized volatility, infrastructure gaps, and farmer decision constraints. Recognizing these spatial differences is essential for designing sustainable maize development strategies tailored to the unique agro-climatic and socio-economic contexts of each taluka.

Abbreviation

CAGR: Compound Annual Growth Rate.
CDI: Cuddy- Della Valle Index
CV: Coefficient of Variation
Ha: Hectare

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

References

1. Chauhan R.S., J.N.Singh and D.R.Thakur, 1998, Producer's share in vegetables in Azomgarh District of Uttarpradesh. Indian Journal of Agricultural Marketing,12(3): 104—105.
2. RACHHAPAL.S AND S. DARSHAN, 1996, Performance of co-operative sec- tor infrastructure in agro-processing – A case of Punjab market canneries. Indian Journal of Agricultural Marketing,10: 145-161.
3. MAHESH.N, T.R. KESHAVA REDDY AND LALITHA ACHOTH, 2000, An Empirical Analysis of Growth and Instability of Indian Tea Industry. Agricultural Banker, 24(2): 25-27.
4. Prof. S. Sabaritnathan, 2016, PARIPEX - Indian Journal Of Research, A Study on the Marketing of Chilles Shivgangai District 5(12) : 427-428.
5. Department of Agriculture, Government of Maharashtra: District Level Agricultural Statistics: Area, Production and Productivity of Horticultural Crops (2020–2025). Office of the District Superintending Agriculture Officer, Nandurbar.
6. Cuddy, J. D. A., & Della Valle, P. A. (1978). Measuring the instability of time series data. *Oxford Bulletin of Economics and Statistics*, 40(1), 79–85.
7. Boyce, J. K. (1987). Agrarian Impasse in Bengal: Institutional Constraints to Technological Change. Oxford University Press. (Standard citation for exponential growth rate/CAGR methodology).
8. Chattopadhyay, A., & Das, S. (2021). Dynamics of Crop Diversification in Tribal Dominated Districts of Maharashtra: A Case Study of Nandurbar. *Journal of Rural Development*, 40(2), 112-125.
9. Spices Board of India. (2024). Spice Market Weekly Reports and Crop Estimates. Ministry of Commerce and Industry, Government of India.
10. Kumar, S., & Kumar, S. (2021). Growth and instability of chilli cultivation in Maharashtra. International Journal of Agriculture Sciences, 13(5), 106-110.