***ORIGINAL RESEARCH ARTICLE***

**Analysis of Maize Area, Production and Productivity Trends: A Study of Kurnool District, Andhra Pradesh, India**

**ABSTRACT**

**Aim:** The present study was conducted on Trends of area, production and productivity of maize in Kurnool district of Andhra Pradesh. The was undertaken to analyse the Compound Growth Rates of area, production and productivity of maize for the last 20 (2001-2021) years’ time series data of both Andhra Pradesh state as well as Kurnool district. The time series data was taken up to 2021 as research was carried out in the year 2022.

**Place and Duration of Study:** The study was carried out in Kurnool district of Andhra Pradesh during 2022. The Kurnool district was selected as it is one of the highest producers of maize in Andhra Pradesh and no such research work was carried out during this period because of that research study on trend analysis on maize was taken purposively.

**Methodology:** For the study the secondary data and related information were collected from concerned departments, textbooks, handbooks, journals, reports. For secondary data analysis many statistical tools were tried but finally linear regression analysis was applied as its was suitable.

**Results:** The results from the study revealed that the compound growth rate (CGR) of Andhra Pradesh (2001-21) was negative in term of area but recorded positive for production and productivity but not-significant. The compound growth rate (CGR) of Kurnool (2001-21) was positive in terms of area, production and productivity and all were significant.

**Conclusion:** The study underscores the importance of continued research, farmer support programs, and efficient agricultural policies to optimize maize production and contribute to food security and economic stability in the region.

**Keywords**: *Kurnool, Maize, Production, Productivity, Trends*

**1. INTRODUCTION**

Maize (*Zea mays L.*) is one of the most important cereal crops in India, serving as a crucial component of food security, livestock feed, and industrial raw material. It is grown on 193.7 million hectares, producing 1147.7 million tonnes and producing 5.75 t/ha globally, with a wide range of soil, climate, biodiversity, and management techniques, and accounting for 37% of the world's grain production (Anonymous, 2019). India ranks fourth in area and seventh in production among nations that cultivate maize, accounting for around 4% of global maize area and 2% of total production. In India, the area cultivated to produce maize in 2018–19 was 9.2 million acres (DACNET, 2020). In 2020–2021, India produced 30 million tonnes across 9.9 million hectares (agricoop.nic.in).

Among the states contributing to India's maize production, Andhra Pradesh holds a significant position. The Guntur district saw the greatest maize output in 2019–20. Guntur (5.03 lakh tonnes), West Godavari (4.40 lakh tonnes), Srikakulam (2.61 lakh tonnes), Vizianagaram (2.45 lakh tonnes), and Kurnool are the leading districts in terms of maize production with 2.37 lakh tonnes (Anonymous, 2021). The district’s favourable agro-climatic conditions, improved hybrid varieties, and evolving agricultural practices have led to notable changes in the area, production, and productivity of maize over the years.

Maize requires optimal irrigation practices for enhancing productivity (Rukmni *et al*., 2025). Some studies also revealed that the rise in temperature accelerated maize plant phenology, reducing dry matter accumulation and crop yield (Koushal *et al*., 2024).

Understanding the trends in maize cultivation is essential for policymakers, farmers, and stakeholders to optimize resource allocation, improve yields, and ensure sustainable production. Several factors, including rainfall patterns, technological advancements, market dynamics, and government interventions, influence the growth trajectory of maize in the region. Analysing these trends can provide valuable insights into the effectiveness of existing agricultural policies and highlight areas requiring further attention. This study aims to examine the trends in maize area, production, and productivity in Kurnool district, Andhra Pradesh, over a specific period. The findings of this study will contribute to a better understanding of maize production dynamics, offering recommendations for enhancing productivity and ensuring food security in the region.

**2. METHODOLOGY**

The study was carried out using secondary data of maize area, production and productivity from Agricultural department, Commissionerate of Amaravathi, Andhra Pradesh for knowing the state trends on area, production and productivity and Agricultural Department, Collectorate Office, Kurnool for getting the information on trends of area, production and productivity of Kurnool district. A twenty years’ time series has been used to apply the exponential trend equation to get trends in area, production and productivity.

**Estimation of growth rates by exponential trend equation**

The compound growth rates (CGR) were calculated to estimate the growth pattern in area, production and productivity of maize by fitting the exponential trend equation of the following form:

Yt= abt

Or log Yt = log a + t log b

And r = (anti log ‘b’ -1) × 100

Where Y = area/production and productivity of maize in year ‘t’.

‘t’= time variable

‘a’ and ‘b’ are parameters to be estimated

r = Compound growth rate expressed in percentage

Compound growth rate ‘r’ was finally tested for significance in the present study by calculating t value as follows:

t =

Where, SE = Standard error

Calculated t value was compared with table value t to determine the level of significance.

**3. RESULTS AND DISCUSSION**

**3.1 Trends in area, production and productivity of maize in the state**

The study of trends in area, production, and productivity of maize in Andhra Pradesh was based on secondary data collected for the period *i.e*., 2001-02 to 2020-21. In 2001-2002, the area under maize was 4,28,000 ha. in Andhra Pradesh with a production of 14,57,000 tons and a productivity of 3,401 kg/ha. Although the area was decreased in 2015-16, the production and productivity increased during the same period. This decrease in area was due to the suggestions the respondents received from the government regarding MSP and projections of climate conditions for the year. However, this downward trend was not regular, and in 2020-21, the area increased to 9,89,196 ha, with a production of 31,64,691 tons and a productivity of 3,199 kg/ha. The findings are in consistent with the finding of Kumar *et al.* (2014), Ayalew & Sekar (2016), Sharma & Mehta (2016).

**Table 1. Trends in area, production and productivity of maize in Andhra Pradesh (2001- 2021)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. no** | **Years** | **Area (ha)** | **Production (MT)** | **Productivity** |
| **(kg/ha)** |
| 1 | 2001-02 | 4,28,000 | 14,57,000 | 3,401 |
| 2 | 2002-03 | 5,26,000 | 14,86,000 | 2,827 |
| 3 | 2003-04 | 7,21,000 | 24,77,000 | 3,437 |
| 4 | 2004-05 | 6,57,000 | 20,64,000 | 3,142 |
| 5 | 2005-06 | 7,58,000 | 30,87,000 | 4,073 |
| 6 | 2006-07 | 7,25,000 | 24,62,000 | 3,391 |
| 7 | 2007-08 | 7,86,000 | 41,35,000 | 5,263 |
| 8 | 2008-09 | 8,52,000 | 41,52,000 | 4,874 |
| 9 | 2009-10 | 7,83,000 | 27,61,000 | 3,528 |
| 10 | 2010-11 | 7,44,000 | 39,53,000 | 5,317 |
| 11 | 2011-12 | 8,64,000 | 36,56,000 | 4,232 |
| 12 | 2012-13 | 9,72,000 | 48,55,000 | 4,994 |
| 13 | 2013-14 | 9,06,000 | 24,25,950 | 2,676 |
| 14 | 2014-15 | 9,18,540 | 24,17,270 | 2,632 |
| 15 | 2015-16 | 2,33,000 | 17,79,000 | 6,369 |
| 16 | 2016-17 | 9,63,320 | 25,89,987 | 2,689 |
| 17 | 2017-18 | 3,36,000 | 23,26,000 | 6,911 |
| 18 | 2018-19 | 2,66,000 | 15,63,000 | 5,872 |
| 19 | 2019-20 | 9,56,906 | 28,76,586 | 3,006 |
| 20 | 2020-21 | 9,89,196 | 31,64,691 | 3,199 |

*(Source: Indianstat.com)*

Fig. 1. Trends in area, production and productivity of maize in Andhra Pradesh

**3.2 Compound Growth Rate (CGR) of area, production and productivity of maize for 20 years’ time series data of Andhra Pradesh state**

The entire period was further sub divided into 1) period-1 (2001-11), 2) period-2 (2011-21) and period-3 (2001-21) to study decade wise growth in area, production and productivity of maize in Andhra Pradesh. Table 2 reveals the compound growth rates (CGRs) for period-1, period-2 and period-3. In period-1 (2001-11) the compound growth rate recorded positive for area (5.66 %) and productivity (5.40 %) but non-significant. The compound growth rate in period-2 (2011-21) recorded negative growth rates for area (-3.93 %) production (-4.09 %) and productivity (-0.06 %) but non-significant. The area, production and productivity recorded negative growth rate as well as non-significant during period-2 (2011-21). The compound growth rate in entire period (2001-21) recorded negative for area (-0.22 %), but recorded positive for production (0.83 %) and productivity (0.92 %) but non-significant. However, production showed significant growth rate (11.36 %) during the same period.

**Table 2. Compound Growth Rate (CGR) of area, production and productivity of maize for 20 years’ time series data of Andhra Pradesh**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. no** | **Years/Period** | **Area** | | **Production** | | **Productivity** | |
|  |  | **CGR (%)** | **R2** | **CGR (%)** | **R2** | **CGR (%)** | **R2** |
| 1 | Period-1 (2001-11) | 5.66 (0.01) | 0.62 | 11.36\*  (0.02) | 0.70 | 5.40  (0.02) | 0.50 |
| 2 | Period-2 (2011-21) | -3.93 (0.07) | 0.04 | -4.09  (0.03) | 0.14 | -0.06  (0.40) | 2.67 |
| 3 | Period -3 (2001-21) | -0.22  (0.01) | 0.0009 | 0.83  (0.01) | 0.02 | 0.92  (0.01) | 0.03 |

***(Figures in parenthesis indicates standard error)***

\* Significant at 5% level

**3.3 Trends in area, production and productivity of maize in Kurnool district**

The study of trends in area, production and productivity of maize in Kurnool district of Andhra Pradesh was based on secondary data during the study period i.e., 2001-02 to 2020-21. In 2001-02 the area was 21,202 ha, production was 53,153 T and productivity was 3,625 kg /ha in Kurnool district and decreased in the area (26,000 ha), production (96,000T) and productivity (4,083 kg/ha) in 2015-16. However, this decreasing trend was not regular and area increased to 59,000 ha, production 2,38,000 T and productivity 4,026 kg/ha in 2020-21. The findings are in consistent with the finding of Sharma *et al.* (2005), Dhakre & Sharma (2010), Saraswathi *et al.* (2012), Singha and Chakravarthy (2013), Baba *et al.* (2019).

**Table 3. Trends in maize area, production and productivity in Kurnool district**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. no** | **Years** | **Area (ha)** | **Production (MT)** | **Productivity** |
| **(kg/ha)** |
| 1 | 2001-02 | 21,202 | 53,153 | 3,625 |
| 2 | 2002-03 | 25,378 | 1,04,227 | 4,107 |
| 3 | 2003-04 | 28,977 | 1,31,848 | 3,776 |
| 4 | 2004-05 | 30,193 | 1,12,000 | 2,981 |
| 5 | 2005-06 | 39,800 | 1,35,300 | 3,781 |
| 6 | 2006-07 | 31,399 | 1,68,000 | 4,018 |
| 7 | 2007-08 | 33,730 | 1,89,000 | 3,813 |
| 8 | 2008-09 | 40,623 | 1,84,649 | 4,265 |
| 9 | 2009-10 | 27,450 | 1,41,420 | 4,876 |
| 10 | 2010-11 | 47,000 | 2,15,400 | 4,270 |
| 11 | 2011-12 | 27,650 | 1,20,450 | 4,760 |
| 12 | 2012-13 | 39,000 | 1,97,000 | 5,640 |
| 13 | 2013-14 | 44,000 | 1,79,650 | 4,200 |
| 14 | 2014-15 | 46,000 | 1,86,000 | 4,030 |
| 15 | 2015-16 | 24,000 | 96,000 | 4,083 |
| 16 | 2016-17 | 36,000 | 1,95,000 | 5,445 |
| 17 | 2017-18 | 53,000 | 2,87,000 | 5,446 |
| 18 | 2018-19 | 48,000 | 2,23,000 | 4,606 |
| 19 | 2019-20 | 45,000 | 2,37,000 | 5,297 |
| 20 | 2020-21 | 59,000 | 2,38,000 | 4,026 |

*(Source: Agricultural Department, Collectorate Office, Kurnool)*

Fig. 2. Trends in area, production and productivity of maize in Kurnool district

**3.4 Compound Growth Rate (CGR) of area, production and productivity of maize for 20 years’ time series data of Kurnool district**

Table 4 reveals the compound growth rate of area, production and productivity of maize during the entire period (2001-21). This entire period was further sub divided into 1) period-1 (2001-11), 2) period-2 (2011-21) and period-3 (2001-21) to study decade wise growth in area, production and productivity in Kurnool district. In period-1 (2001-11), area productivity showed positive growth rate but non-significant. However, production showed positive as well as significant growth rate during the same period. In case of period-2 (2011-21) area (5.66 %) & production (6.58 %) recorded positive growth rate but non-significant, but Productivity (-0.18 %) recorded negative. In the entire period (2001-21) compound growth rate recorded positive in area (3.33 %), production (4.74 %) and productivity (1.67 %) and all were significant. Similar finding was reported by Jahnavi *et al.* (2016).

**Table 4. Compound Growth rate (CGR) of area, production and productivity of maize for 20 years’ time series data of Kurnool district**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl. No** | **Years** | **Area** | | **Production** | | **Productivity** | |
|  |  | **CGR (%)** | **R2** | **CGR (%)** | **R2** | **CGR (%)** | **R2** |
| 1 | Period-1 (2001-11) | 5.92 (0.02) | 0.53 | 11.66\*  (0.02) | 0.69 | 2.51  (0.01) | 0.34 |
| 2 | Period-2 (2011-21) | 5.66  (0.02) | 0.35 | 6.58  (0.03) | 0.34 | -0.18  (0.01) | 0.001 |
| 3 | Period-3 (2001-21) | 3.33\* (0.008) | 0.46 | 4.74\*  (0.01) | 0.48 | 1.67\*  (0.005) | 0.38 |

*(Figures in parenthesis indicates standard error)*

\* Significant at 5% level

**4. CONCLUSION**

The study revealed that while Andhra Pradesh as a whole experienced a decline in maize cultivation area, production and productivity showed a positive but non-significant growth. However, in Kurnool district, all three parameters—area, production, and productivity—demonstrated a significant positive growth trend, indicating a more favourable scenario for maize cultivation in the region. The compound growth rate (CGR) analysis further highlighted variations across different periods. These trends emphasize the need for targeted policy interventions, improved agronomic practices, and sustainable resource management to enhance maize productivity further. Factors such as improved hybrid varieties, technological advancements, favourable agro-climatic conditions, and supportive policies have contributed to the observed growth in Kurnool. However, challenges like climate variability, market fluctuations, and input costs must be addressed to ensure sustained growth in maize cultivation. The study underscores the importance of continued research, farmer support programs, and efficient agricultural policies to optimize maize production and contribute to food security and economic stability in the region.

**ACKNOWLEDGMENTS**

The authors express their sincere gratitude to School of Agricultural Sciences, Nagaland University, Medziphema Campus, Medziphema, Nagaland for providing the research platform and resources required for the study.

**AUTHORS’ CONTRIBUTION**

Author 1 and 2 designed the study and performed the statistical analysis. Author 1 and 3 wrote the first draft of the manuscript, managed the analyses of the study and all authors managed the literature searches. All the authors read and approved the final manuscript.

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**REFERENCES**

Anonymous, 2019, Food and Agriculture Organization annual report 2019.

Anonymous, 2021, Angrau's Maize Outlook Report, January to May 2021.

Ayalew, B., & Sekar, I. (2016). Trends and regional disparity of maize production in India. *Journal of Development and Agricultural Economics*, *8*(9), 193-199.

Baba, S. H., Zargar, B. A., Husain, N., Malik, I., & Bhat, I. F. (2019). Trends of maize production in Jammu & Kashmir. *Journal of Pharmacognosy and Phytochemistry*, *8*(3), 4558-4561.

Dhakre, D. S., & Sharma, A. (2010). Growth analysis of area, production and productivity of maize in Nagaland. *Agricultural Science Digest*, *30*(2), 142-147.

https://eands.dacnet.nic.in/

https://kurnool.ap.gov.in/agriculture-department/

<https://www.indiastat.com/>

Jahnavi, K. P., Aparna, B. & Sumath, P. (2016). Analyzing compound growth rates and marketing efficiency in transacting maize in Kurnool district of Andhra Pradesh. *Andhra Pradesh Journal Agricultural Science*. *2*(1): 62-67.

Koushal, S., G M, R., Kambale, J. B., Sarma, H. H., Singh, B., Devi, O. R., & Laishram, B. (2024). Assessing Maize Yield Variability under Climate Change Using DSSAT Model. *Journal of Scientific Research and Reports*, *30*(9), 84–91.

Kumar, R. K., Srinivas, N. K. B. & Pravin, C., Gedam. (2014). Production performance of Maize in India: Approaching an inflection point. *International Journal of Agricultural and Statistical Sciences*. *10*(1): 241-248.

Rukmni, R., Halidoddi, R. R., Rajesh, G. M., Ramthal, M., & Rao, P. S. (2025). Effect of deficit irrigation and drip emitter spacing on soil moisture, yield and water use efficiency of maize (zea mays) under semi-arid condition. *Plant Archives*, *25*(1), 680-692.

Saraswathi, P. A., Basavaraj, H., Kunnal, L. B., Mahajanashetti, S. B. & Bhat, A. R. S. (2012). Growth in area, production and productivity of major crops in Karnataka. *Karnataka Journal of Agricultural Sciences*. *25*(4): 431-436.

Sharma, G., & Mehta, S. (2016). Trends, Growth and Instability in Area, Production and Productivity of Maize Crop across Regions in India. *Productivity*, 56(4).

Sharma, M., Gill, J. K., Prakash, S., & Rizvi, S. E. H. (2005). Growth trends in area and productivity affecting maize production in Jammu & Kashmir. *Progressive Agriculture*, *5*(1and2), 13-18.

Singha, K. & Chakravarthy, A. (2013). Crop diversification in India: a study of maize cultivation in Karnataka*. Scientific Journal of Review*. *2*(1): 1-10.