Economic Affairs, Vol. **70**(03), pp. 221-226, September 2025
DOI: 10.46852/0424-2513.3.2025.7

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RESEARCH PAPER

Decomposition and Instability Trends in Cumin Production: A Study of Rajasthan

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Received: 12-06-2025 **Revised:** 06-08-2025 **Accepted:** 27-08-2025

ABSTRACT

Cumin is an important seed spice crop, with significant medicinal properties. India, the leading producer of cumin, accounts for 70% of the world's production with Rajasthan and Gujarat contributing nearly 80% of the total area under cumin cultivation. This research addressed the growth instability and variability of Rajasthan's cumin production. Certain statistical methods, such as the compound growth rate, Cuddy-Della Valle Index, and Decomposition model were used in this research. Area, production, and productivity also revealed positive and significant growth rates, according to the statistics; Jaisalmer recorded the highest productivity growth (18.57%). Rajasthan's cumin production was primarily driven by the rise of cultivated area, contributing 67.70% to the overall growth, while yield improvements contributed for 11.23%. The interaction effect, representing increased yield on increased acreage, further improved production, especially in the study area. The study concludes that although area expansion significantly influenced cumin production growth, improvements in yield and interaction effects also played a crucial role. This research provides valuable guidance for policymakers and researchers to improve cumin production in Rajasthan under unstable environmental conditions like uneven rainfall, pest and disease etc.

HIGHLIGHTS

- The area revealed strong growth rates, cumin productivity and production with area expansion accounts for 67.70% of total production growth.
- There was significant variation in cumin production among the major five districts with Jaisalmer displaying a significant variation in productivity and Nagaur revealing the highest variability in both area and productivity.

Keywords: Cumin, Growth, Instability, Decomposition, Farm mechanization, Area expansion

Indian spices are widely known globally for their flavor and aroma. Every region in the nation produces at least one spice. India is known as the "house of spices" and production a large variety and quantity of spices. Around 80 % of the world's seed spice output comes from India, especially the semi-arid and desert districts of Rajasthan and Gujarat, which are known as the "spice bowl of India. (Bairwa *et al*. 2022) Cumin is becoming increasingly popular due to its profitability, quick growth cycle, and strong ability to survive in regions with limited rainfall. Its importance is heightened by its high

How to cite this article: Saran, V.K., Sharma, A., Mehra, J., Singh, P., Rath, P.K. and Sahu, A. (2025). Decomposition and Instability Trends in Cumin Production: A Study of Rajasthan. *Econ. Aff.*, **70**(03): 221-226.

Source of Support: None; **Conflict of Interest:** None

value in the international market. It's a winter season crop grown from mid-October to November. Cumin is treated as main ingredient in kitchen for its aroma and flavor in regular food items. And is also used in the preparation of seasonal bakery products like bread and biscuits. In addition to its culinary use, it has medicinal importance as an astringent, stimulant, and carminative that cures dyspepsia and stomachaches. (Bairwa *et al.* 2022) India produces 70% of the world's cumin, which makes it the foremost producer in the world. Following India are Syria, Turkey, and the USA, contributing 5%, 13%, and 3%, respectively. Together, these four countries produce approximately 91% of the world's cumin supply, with the remaining production coming from other regions (tropical and subtropical) in Asia and Africa. (FAOSTAT, 2022). Cumin is the most extensively grown seed spice in India, accounting for over 48% of the land use for seed spice production. In 2021–2022, 8.69 lakh hectares of land produced 5.55 lakh tonnes of cumin. Rajasthan and Gujarat are the top two producers of cumin, accounting for about 90% of the country's overall production. The state of Gujarat led in production during the same year, contributing 57.88%, while Rajasthan accounted for the biggest percentage of the cultivated area, at 58.85 %. (Anonymous, 2022) Rajasthan is India's top producer of cumin, contributing 70% of the country's total production. Together, Barmer, Jodhpur, Jalore, Jaisalmer, and Nagaur account for 85% of the state of Rajasthan's total area. The main focus of this study was to examine the acreage, production and productivity of cumin crop in study area. Cumin, a valuable spice crop, is primarily grown in the Indian states of Rajasthan and Gujarat. While holding a larger area under cultivation, Rajasthan has been producing less cumin in a larger area. Examining past trends in area, productivity, and production can help guide future research endeavors and assist policymakers in stabilizing growth in periods of instability.

MATERIALS AND METHODS

The major cumin-producing districts of Rajasthan, including Jodhpur, Barmer, Jalore, Jaisalmer, and Nagaur, were the sites of this research. Secondary data on cumin cultivation, including area, production and productivity has been collected for the selected districts over the 20-year period from 2002-03 to 2021-22. The websites such as Directorate of Agriculture, Rajasthan; DASD Calicut; FAO; and the NRCSS Ministry of Agriculture were among the public sources from which the data were gathered. Several statistical and economic approaches, including the Decomposition Model, CDVI, and Compound Growth Rate, were used for the analysis of data. The brief about the analytical techniques are presented below:

Trend Analysis & Compound Growth rates

(a) Trend

Linear equation, $Y = a + bx$

$$a = \overline{Y} - b\overline{X}$$

$$b = \frac{\Sigma XY - (\Sigma X)(\Sigma Y)/n}{\Sigma X_2 - (\Sigma X)_2/n}$$

Where,

Y = Dependent Variable

X = Independent variable

a = Intercept

b = Regression coefficient

$\overline{Y}$ = Mean of Y

$\overline{X}$ = Mean of X

(b) Compound Growth Rate

The Compound Growth Rates were analyzed by using log linear functions which is a convenient functional form described by Gujarati, 1988. The function was applied in many other studies for the enumeration of CAGR. Equation to evaluate CAGR is: (Joshi *et al.* (2021).

$$Y_t = ab^t u^t$$

Where.

Y_t = Dependent Variable (area/production/ productivity) in the time period t.

a = intercept

b^t = Regression Coefficient (1 + r)

t = Years 1, 2, … …, n (which takes value)

u_t = error term

Taking logarithm of both sides, the equation is transformed into log-linear form for estimation:

$$logY = loga + logb$$

The compound growth rate (r) of area, production and productivity in percentage was computed by using the function:

$$CAGR\ (r)\ (\%) = \{Antilog\ of\ (ln\ b) - 1\}\ *100$$

(c) Cuddy-Della Valle Index will be used to determine instability of in area, production, and productivity of cumin;

$$Instability\ index = CV \times \frac{1}{\sqrt{(1-R^2)}}$$

Where,

R^2 is the coefficient of determination obtained from a time trend regression adjusted for the degree of freedom.

$$CV = \frac{\sigma}{\overline{y}} \times 100$$

Where,

CV = Coefficient of variation

σ = Standard deviation

$\overline{y}$ = Mean of the y

(d) Decomposition model

This model (Narula and Vidyasagar, 1973) was used to estimate the impact of area, yield and their interaction on the increase or decrease in cumin production in the research area.

Area effect: display percentage share of area in the total production.

$$AE = \frac{(A_t - A_0)Y_0}{(P_t - P_0)} \times 100$$

Yield effect: display percentage share of yield in the total production.

$$YE = \frac{(Y_t - Y_0)A_0}{(P_t - P_0)} \times 100$$

Interaction effect: display percentage share of area and yield in the total production.

$$IE = \frac{(Y_t - Y_0)(A_t - A_0)}{(P_t - P_0)} \times 100$$

Where,

A_t, P_t and Y_t = Triennium average for area, production and productivity calculated from 2019-20 to 2021-22 (the current year).

A_0, P_0 and Y_0 = Triennium average for area, production and productivity calculated from 2019-20 to 2021-22 (the base year).

RESULTS AND DISCUSSION

Instability Analysis

The data provided in Table 1 demonstrates the fluctuations and growth rates of cumin production across the leading cumin-producing districts of Rajasthan. In Rajasthan, there was a 22.79% total variability in cumin area, production, and productivity, and 35.70% overall productivity. With 33.69% of the area variability, Nagaur displayed the highest level of variability, followed by Jalore (24.57%) and Barmer (18.41%). Again, with 46.79% production variability, Nagaur led in the area, followed by Jodhpur (42.69%), Barmer (36.62%), Jalore (36.52%), and Jaisalmer (31.59%). Jaisalmer has the most variation in productivity (18.57%), followed by Jodhpur (15.43%). Nagaur (8.97%) had the least variation in production, followed by Barmer (5.79%) and Jalore (5.21%). Simlar outcomes were observed in previous studies Dhakre *et al*. (2009).

Table 1: Variability of cumin in major cumin growing districts of Rajasthan (2002-03 to 2021-22)

Districts	CDVI (%)		
	Area	Production	Productivity
Barmer	17.01	36.62	23.24
Jodhpur	23.22	42.69	31.43
Jalore	24.57	36.52	27.19
Jaisalmer	18.41	31.59	23.22
Nagaur	33.69	46.79	23.92
Rajasthan	22.79	35.70	24.41

Source: *Directorate of Agriculture, Rajasthan.*

Growth Rate Analysis

The statistics reveal a notable increase in the acreage, productivity, and overall production of cumin in Rajasthan over the years. The growth rates for cumin are positive and significant, noticed at 8.86%, 12.40%, and 3.25% per annum. The area cultivated with cumin showed a noticeable positive and statistically significant compound growth rate in Nagaur (11.85%), Barmer (9.30%), and Jalore (7.02%). Jaisalmer has the greatest growth rate in terms of output, at 39.82%; it was followed by Jodhpur (30.80%), Nagaur (21.89%), Barmer (15.88%), and Jalore (12.60%). In the same vein, Jaisalmer led the way in productivity growth at 18.57%, followed by Jodhpur (15.43%), Nagaur (8.97%), Barmer (5.79%), and Jalore (5.21%). Similar results were reported for fenugreek by Boyal *et al*. (2015) The outcomes show that the scarcity of water and climate change, which are unsuitable for cumin cultivation, adversely impact the variability and growth of cumin in Rajasthan's major districts. In addition, the crop frequently experiences disease incidence, which lowers cumin production.

Table 2: Compound Growth Rates of cumin in major cumin growing districts of Rajasthan (2002-03 to 2021-22)

CGR (%)		
Area	**Production**	**Productivity**
9.30**	15.88**	5.79**
13.31**	30.80**	15.43**
7.02**	12.60**	5.21**
17.91**	39.82**	18.57**
11.85**	21.89**	8.97**
8.86**	12.40**	3.25**

** Significant at 5% level of probability ** Significant at 1% level of probability.*

Decomposition Method

A simple decomposition model was employed for computing the area and yield impact to rise in cumin production. In this model, the share of production is attributed to the increased in cumin acreage compared to the base year's productivity. The interaction component refers to the portion of production that result from the increase in yield on the expanded cumin acreage. Table 3 presents the analyzed data for different districts shows that the area under cultivation contributed significantly to the rise in cumin production (67.70% of the overall growth in Rajasthan). The interaction effect, which made a 23.05% contribution, occurred following them. Over time, the expansion of cumin acreage had a greater impact on production growth than yield improvements or their combined interaction. The yield effect accounted for just 11.23% of the overall increases in production.

To estimate the share of acreage and yield to a rise or reduction in cumin production, where yield contribution is the share of production owing to enhanced cumin area throughout the productivity of base year. The part of production resulting from higher yield on more cumin crop area is the contribution of interaction effect. The data analyzed for major districts are shows in given table 2. It is adhered to from the data that the acreage impact positively in boosting the production of cumin, hence the total cumin area in the state of Rajasthan was 67.70 per cent and the Interaction effect was 23.05 percent. The impact of yield effect toward enhanced cumin production was 11.23 percent exhibition that throughout the period the increase in area of cumin impacted much as compared to increase in yield and their interactions. The impact of acreage among the districts was absolute in Jalore (33.35%),

Table 3: Decomposition analysis is cumin yield growth in major producing districts of Rajasthan in India (2002-03 to 2021-22)

Sl. No.	Districts	AC Production (thousand tons)	Area effect (thousand Tones)	Yield effect (thousand Tones)	Interaction effect (thousand Tones)
1	Barmer	474.73	136.35 (28.50)	67.24 (16.57)	271.14 (54.91)
2	Jodhpur	481.04	80.11 (5.07)	34.88 (16.04)	366.05 (78.87)
3	Jalore	333.56	72.91 (33.35)	38.74 (23.22)	221.91 (43.42)
4	Jaisalmer	843.82	136.5 (5.98)	105.68 (7.65)	601.64 (86.36)
5	Nagaur	601.41	50.33 (19.85)	40.29 (15.69)	510.79 (64.44)
6	Rajasthan	876.15	438.91 (67.70)	298.83 (11.23)	138.41 (23.05)

Note: *Figures in brackets shows proportion to the total production in each state.*

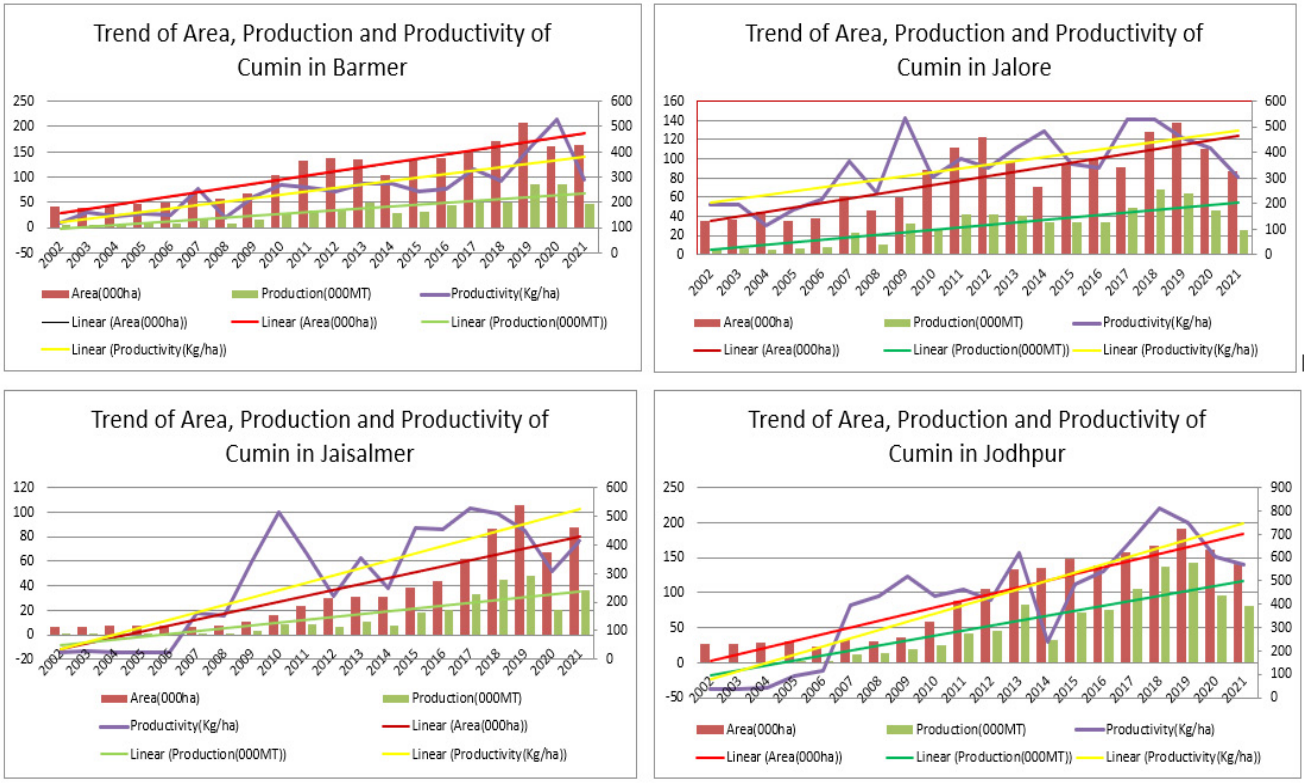

Fig. 1: Trend of area, production and productivity of cumin in different districts of rajasthan for periods of 2002-2021

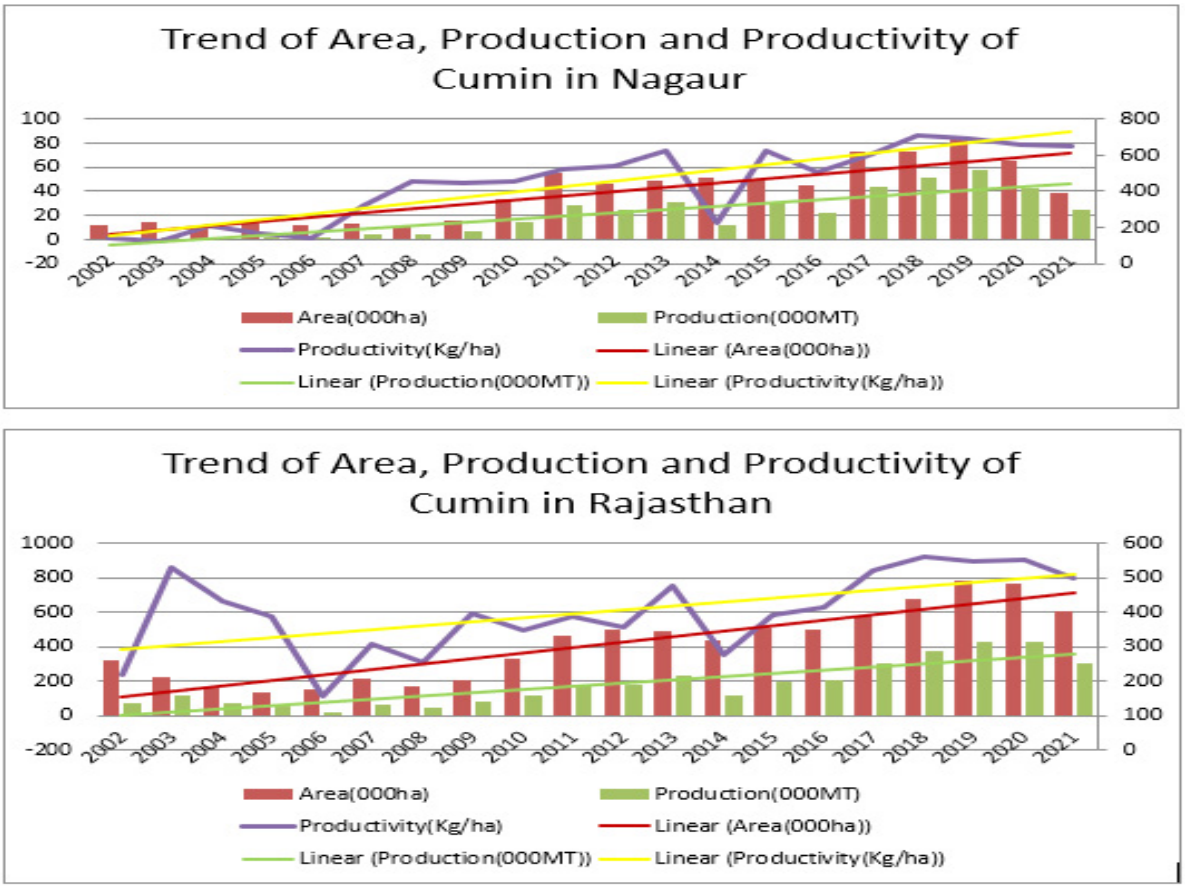

Fig. 2: Trend of area, prodcution and productivity of cumin in different districts of rajasthan for periods of 2002-2021

followed by Barmer (28.50%), Nagaur (19.85%), Jaisalmer (5.98%) and Jodhpur district (5.07%). On the other way yield effect was also highest in Jalore district (23.22%), followed by Barmer (16.57%), Jodhpur (16.04%), Nagaur (15.69%) and Jaisalmer district (7.65%). The maximum interaction effect was seen in Jaisalmer district (86.36%) as compared to other major cumin producing districts of state of Rajasthan. The Jaisalmer district also observed a major relative change in production i.e., 843.82th tons have enhanced overall production over the years by 105.68th tons.

CONCLUSION

The analysis of Rajasthan's cumin production from 2002–03 to 2021–22 indicates notable fluctuations and positive development patterns in the state's major cumin-producing districts. Cumin production, productivity, and area have all indicated positive and significant compound growth rates districts such as Jaisalmer, Jodhpur, and Nagaur make significant contributions to this growth. The state's entire growth was mostly driven by the area under cultivation, which accounted for 67.70% of the increase in cumin production. Improvements in yield, however, had a less but still significant effect, especially in regions like Jalore. Production was further enhanced by the interaction effect, which showed yield gains on increased cumin acreage, particularly in Jaisalmer, which had the highest relative rise.

REFERENCES

Akula, M., Bandumula, N. and Rathod, S. 2022. Rice production in Telangana: Growth, instability, and decomposition analysis.

Ansari, S., Ali, N. and Rashid, M. 2022. Growth and instability of pulses production in Uttar Pradesh: A decomposition analysis. *Asian Journal of Multidimensional Research,* **11**(1): 71-81.

Bairwa, K.C., Meena, G.L., Balai, H.K., Singh, H., Yadav, A., Meena, M.L. and Barmer, R.I. 2022. Performance of major seed spice crops in Rajasthan during pre- and post-Agri Export Zone periods in context of growth, instability, and decomposition analysis. *AMA, Agricultural Mechanization in Asia, Africa, and Latin America,* **53**(2): 6067-6081.

Directorate of Arecanut & Spices Development. 2022. Retrieved from https://www.dasd.gov.in

Food and Agriculture Organization. (n.d.). Retrieved from https://www.fao.org.in

Joshi, P., Gautam, P. and Wagle, P. 2021. Growth and instability analysis of major crops in Nepal. *Journal of Agriculture and Food Research, 6*, 100236.

Kumar, M., Sahoo, P.K., Kushwaha, D.K., Gudi, S., Singh, G., Mahore, A. and Rahimi, M. 2023. Tackling the constraints of cumin cultivation and management practices. *Annals of Agricultural & Crop Sciences,* **8**(3): 1134.

More, S.S., Deshmukh, K.V. and Chavan, R.V. 2020. Has production of cotton in Maharashtra shown stable growth over the years? *Current Agriculture Research Journal,* **8**(3).

Reddy, V.K. and Immanuelraj, K.T. 2017. Area, production, yield trends, and pattern of oilseeds growth in India. *Economic Affairs,* **62**(2): 327.

Rowniyar, A.K. and Yadav, H. 2021. Production performance of cumin in Rajasthan. *Jamshedpur Research Review,* **44**(1): 7-13.

Sahu, A., Nahatkar, S. and Kolar, P. 2020. Variability and growth in production of wheat in India. *Economic Affairs,* **65**(2): 255-260.

Sectorial Agriculture, Rajasthan. 2023. Retrieved from https://agriculture.rajasthan.gov.in

Sharma, H., Parihar, T.B. and Kapadia, K. 2017. Growth rates and decomposition analysis of onion production in Rajasthan state of India. *Economic Affairs,* **62**(1): 157-161.