P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating (2025): 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 10; October 2025; Page No. 210-213

Received: 05-07-2025
Accepted: 08-08-2025

Indexed Journal
Peer Reviewed Journal

Trends and status of oilseed production in Rajasthan: A crop-wise analysis

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DOI: https://www.doi.org/10.33545/26180723.2025.v8.i10d.2534

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Abstract

The study examined the performance of annual oilseeds in Rajasthan by analyzing area, production, and yield over the period 1966-67 to 2018-19, which was divided into three sub-periods: pre-Technology Mission on Oilseeds (TMO) (Period I: 1966-67 to 1985-86), TMO implementation to liberalization (Period II: 1986-87 to 1999-2000), and post-liberalization (Period III: 2000-01 to 2018-19). The results revealed accelerated growth across all three parameters, with the highest growth rates recorded during Period II, coinciding with TMO implementation. Notably, growth momentum continued into Period III, despite the country's dependence on edible oil imports, reflecting the sustained oilseed production in the state, largely driven by technology diffusion, adoption of improved practices, and availability of high-yielding and hybrid seed varieties. A crop-wise trend analysis further highlighted the consistent contribution of rapeseed-mustard, soybean, and castor across the study periods, while groundnut showed steady progress, indicating its rising importance in Rajasthan's oilseed sector. In contrast, sesame displayed signs of mild improvement in Period III compared to earlier periods. Overall, the findings underscore Rajasthan's vital role in India's oilseed economy and point towards the need for continued technological and policy interventions to sustain growth.

Keywords: Rajasthan, oilseeds, growth trends, Technology Mission on Oilseeds (TMO)

Introduction

Rajasthan is one of the leading oilseed-producing states in India, with oilseeds forming an integral part of its agricultural economy. The state's arid and semi-arid climate, sandy soils, and vast cultivable land create favorable conditions for growing a wide range of oilseed crops. Among them, rapeseed-mustard dominates, making Rajasthan the largest producer of mustard in the country. Other important oilseeds grown in the state include groundnut, soybean, sesame, and castor, cultivated mainly under rainfed conditions in both kharif and rabi seasons. Oilseeds not only serve as a major source of edible oil and livestock feed but also provide livelihood opportunities to millions of farmers and support several agro-based industries. They contribute significantly to the state's economy through domestic consumption, value addition, and exports, particularly in the case of sesame and castor. However, oilseed cultivation in Rajasthan still faces challenges such as yield gaps, heavy dependence on monsoon rains, and pest and disease infestations. To address these issues and achieve self-sufficiency in edible oil production, government initiatives like the National Mission on Oilseeds and Oil Palm (NMOOP) and state-level programs are being implemented to enhance productivity, promote improved technologies, and raise farmers' incomes.

Materials and Methods

The study employed the time series data on different variables such as area, production and yield of oilseeds in significant oilseeds producing states through published reports (Department of Economics and Statistics, GOI, Ministry of agriculture, GOI and also from published reports from the state agriculture departments of various states) and USDA (United States Department of Agriculture). The trade data on import and export of vegetable oils were accessed from DGCIS (Directorate General of Commercial Intelligence Statistics). Ministry of Trade and Commerce, GOI and; Department of Food and Public Distribution, Ministry of Consumers Affairs, Food and Public Distribution, GOI.

The total period from 1966-67 to 2018-19 was divided into three sub-periods *viz.*, period I (1966-67 to 1985-86), period II (1986-87 to 1999-2000), period III (2000-01 to 2018-19) and overall period (1966-67 to 2018-19). The underlying principle of the time periods selected for the study were period I is Pre-Technology Mission on Oilseeds (TMO) period, period II is TMO implementation to liberalization and period III is Post-liberalization period.

Table 1: Time periods selected for the study

Time Periods	Significance	Selected years
Period I	Pre-Technology Mission on Oilseeds (TMO) period	1966-67 to 1985-86
Period II	TMO implementation to liberalization	1986-87 to 1999-2000
Period III	Post-liberalization period	2000-01 to 2018-19

Analytical tools and techniques used

a. Compound Annual Growth Rates (CAGR) analysis

In order to estimate the CAGR, the exponential time trend equation of the form

$$Y=a\ b^t \quad \text{----------(1)}$$

was used

It becomes linear when converted to log form, *i.e.*,

$$Ln\ Y=Ln\ a + t\ Ln\ b_1 \text{ where} \quad \text{----------(2)}$$

Y: Variable whose growth rate is being computed

t: Time trend (1, 2…n)

a and b are regression coefficients to be estimated.

This form implies a constant growth rate over time. There will be a constant deceleration if b < 0. A value of b=0 indicates absence of any trend and a positive value for b indicates a constantly accelerating growth. In the context of CAGR estimation through the exponential time trend equation, Dandekar (1980) [1] observed that when the exponential form is used, taking the parameter B (=Ln b) as the annual growth rate was not correct. Instead, the formula for finding growth rate (e^B-1) is derived using the compounding formula. Thus, the CAGR (per cent) is given by (e^B-1) X 100

Using the compounding formula,

$$Y_t=Y_0\ (1+r)^t \quad \text{----------(3a)}$$

or

$$Ln\ Y_t=Ln\ Y_0 + t\ Ln\ (1+r) \quad \text{----------(3b)}$$

or

$$Ln\ Y_t=A + tb \text{ where} \quad \text{----------(3c)}$$

$$A = Ln\ Y_0 \text{ and } B = Ln\ (1+r) \quad \text{----------(4)}$$

This equation is the log linear form of the exponential function and gives CAGR when differentiated with respect to t as follows:

$$1/Y_t.dY_t/dt = Ln(1+r) \quad \text{----------(5)}$$

$$e^B = 1 + r \quad \text{----------(6)}$$

$$r = e^B-1 \quad \text{----------(7)}$$

Thus, the CAGR (per cent) is given by (e^B-1) X 100

In this study, Y represents the area or production or productivity of the crop.

Results and Discussion

Compound Annual Growth Rate of annual oilseeds in Rajasthan

Compound Annual Growth Rate in area, production and yield of annual oilseeds in Rajasthan were calculated and presented in Table 2.

The CAGR for the annual oilseed crops with respect to area, production and yield across all the periods at the state level were found to be positive and significant at one per cent level of significance. During period I, the CAGR was 7.22, 4.98 and 2.14 per cent for production, yield and area respectively. The CAGR during period II, was 9.33, 6.89 and 2.28 per cent, respectively for production, area and yield, while during period III; the CAGR was 5.16, 2.67 and 2.43 per cent for production, yield and area respectively. With respect to the overall period, the CAGR was 7.43, 3.74 and 3.56 per cent respectively for production, area and yield.

It can be deciphered from the table that the state had made rapid strides under oilseeds as evidenced by the acceleration in growth of area, production and yield in all the periods. It was observed that the highest growth rate in area and production was evidenced during Period II which coincides with the implementation of the TMOP. The growth rate of all the three parameters did not loose momentum even in Period III which coincided with the country importing huge quantities of edible oils. This reflects on the sustained production of oilseeds in the state perhaps on account of a host of factors involving technology diffusion and adoption, availability of quality HYV/hybrid seeds to name a few.

Table 2: Compound Annual Growth Rate in area, production and yield of annual oilseeds in Rajasthan

Time Periods	Area (per cent)	Production (per cent)	Yield (per cent)
Period I	2.14 ***	7.22 ***	4.98 ***
Period II	6.89 ***	9.33 ***	2.28 ***
Period III	2.43 ***	5.16 ***	2.67 ***
Overall Period	3.74 ***	7.43 ***	3.56 ***

***Significant at one per cent level.

Compound Annual Growth Rate in area, production and yield of individual oilseeds in Rajasthan

The results of CAGR for the important annual oilseeds crops in the state *viz.*, groundnut, rapeseed-mustard, soybean, sesame, linseed and castor are presented in Table 3.

The results of the CAGR during period I, revealed that in rapeseed-mustard, the coefficients were positive and significant at one per cent level for production, area and yield (13.00, 8.56 and 4.10 per cent respectively). In sesame, the CAGR with respect to area was negative (-2.03 per cent) and significant at one per cent level; while the coefficients for production and yield were non-significant (-0.96 and 1.09 per cent respectively). In groundnut, the coefficients were non-significant for all the parameters (-0.59, 2.13 and 1.52 per cent for area, yield and production respectively). In soybean, the newly introduced crop to the country, the growth analysis revealed that for all the three parameters *viz.*, area, production and yield, the CAGR was found to be positive. The CAGR for production and area were 53.47 and 66.26 per cent respectively and were significant at one per cent level; while the coefficient of yield revealed 8.33 per cent growth and was found to be significant at five per cent level. In castor, the CAGR was positive and significant at one per cent level for area and production (11.34 and 8.89 per cent respectively); while it was negative and significant at ten per cent level for yield (-2.21 per cent).

During period II, in rapeseed-mustard, the CAGR was positive and significant at one per cent level for production and area (8.29 and 8.00 per cent respectively) while the growth rate of yield was positive (0.26 per cent) but non-significant. With regard to sesame, the growth rate was positive but not significant for yield and production (3.30 and 0.85 per cent respectively) while for area, the coefficient was negative but not significant (-2.38 per cent). The CAGR in groundnut revealed positive growth rate for area and production (5.19 and 2.27 per cent respectively) significant at one per cent level, while the coefficient for yield was positive (2.85 per cent) and significant at five per cent level. Soybean registered a positive and significant growth rate at one per cent for all the parameters (CAGR of production, area and yield being 23.62, 19.61 and 3.35 per cent respectively). Positive and significant growth rate was evidenced in castor for production, area and yield. The estimates for production, area and yield were significant (34.40, 21.81 and 10.34 per cent respectively) at one per cent level.

During period III, rapeseed-mustard registered a positive and significant growth rate at one per cent level for production and yield (3.86 and 2.43 per cent) while for area, the estimates were positive but not significant (1.39 per cent). In sesame, the coefficients were positive but not significant for production, yield and area (3.55, 3.18 and 0.36 per cent respectively). With regard to groundnut, the CAGR was positive and significant at one per cent level for all the three parameters (production 10.98, area 6.53 and yield 4.17 per cent respectively). Soybean crop evidenced a positive and significant growth rate at one per cent level for production and area (5.13 and 3.92 per cent). The growth rate was positive for yield (1.17 per cent) but not significant. In case of castor, positive growth rate was evidenced for production and area which were significant at one per cent level (10.74 and 7.45 per cent respectively). For yield, the growth rate was positive (3.06 per cent) and significant at five per cent level for yield.

For the overall period, rapeseed-mustard evidenced positive and significant growth rate at one per cent level for area, production and yield respectively (5.97, 8.67 and 2.55 per cent respectively). In sesame, growth rate was positive and significant at one per cent for yield and production (2.86 and 1.99 per cent); while the growth rate in area was negative (-0.84 per cent) and significant at one per cent level. Groundnut registered a positive and significant growth rate at one per cent for production, yield and area (4.57, 3.18 and 1.34 per cent respectively). Soybean evidenced positive and significant growth rate at one per cent level for production, area and yield (13.80, 12.13 and 1.50 per cent respectively). In case of castor, the coefficients were positive and significant at one per cent level for all the three parameters. Castor crop registered a CAGR of 11.06, 15.84 and 4.30 per cent in production, area and yield respectively.

The above analysis suggests that the contribution of rapeseed-mustard, soybean and castor has been consistent across the different periods considering the healthy positive growth rates. This reflects on the concerted efforts made by the R&D agencies in ensuring adoption of the proven technologies developed under NARES. With regard to groundnut, it was interesting to observe that there has been steady progress with the corresponding periods indicating the increasing contribution of groundnut to the state. This is perhaps on account of adoption of the technologies developed under the AICRP on groundnut specific to the agro eco region of Rajasthan be it for table purpose or for export purpose. In sesame, signs of mild improvement in the growth was observed from period I through period III. This is could be attributed to the gradual increase in adoption of the technologies adopted from period I to period III. Further increase in adoption of technologies would ensure higher growth in area and production of sesame in the state.

Table 3: Compound Annual Growth Rate in area, production and yield of individual oilseeds in Rajasthan

Crops	Area (per cent)	Production (per cent)	Yield (per cent)
Period I			
Rapeseed-Mustard	8.56 ***	13.00 ***	4.10 ***
Sesame	-2.03 ***	-0.96 NS	1.09 NS
Groundnut	-0.59 NS	1.52 NS	2.13 NS
Soybean	53.47 ***	66.26 ***	8.33 **
Castor	11.34 ***	8.89 ***	-2.21 *
Period II			
Rapeseed-Mustard	8.00 ***	8.29 ***	0.26 NS
Sesame	-2.38 NS	0.85 NS	3.30 NS
Groundnut	2.27 ***	5.19 ***	2.85 **
Soybean	19.61 ***	23.62 ***	3.35 ***
Castor	21.81 ***	34.40 ***	10.34 ***
Period III			
Rapeseed-Mustard	1.39 NS	3.86 ***	2.43 ***
Sesame	0.36 NS	3.55 NS	3.18 NS
Groundnut	6.53 ***	10.98 ***	4.17 ***
Soybean	3.92 ***	5.13 ***	1.17 NS
Castor	7.45 ***	10.74 ***	3.06 **
Overall Period			
Rapeseed-Mustard	5.97 ***	8.67 ***	2.55 ***
Sesame	-0.84 ***	1.99 ***	2.86 ***
Groundnut	1.34 ***	4.57 ***	3.18 ***
Soybean	12.13 ***	13.80 ***	1.50 ***
Castor	11.06 ***	15.84 ***	4.30 ***

***Significant at one per cent level, **Significant at five per cent level, *Significant at 10 per cent level, NS-non-significant.

Summary and Conclusion

Rajasthan-Annual oilseeds

In Rajasthan, the study revealed that across all the annual oilseed crops and for the respective periods, accelerated growth was evidenced in area, production and yield. It was observed that the highest growth rate in area and production was evidenced during period II which coincides with the implementation of the TMOP. The growth rate of all the three parameters did not lose momentum even in period III which evidenced the country importing huge quantities of edible oils. This reflects on the sustained production of oilseeds in the state perhaps on account of a host of factors involving technology diffusion and adoption, availability of Quality HYV/ Hybrid seeds to name a few.

Rajasthan-Crop-wise

Inter-alia, the crops and periods, the analysis indicated that the contribution of rapeseed-mustard, soybean and castor has been consistent across the different periods considering the healthy positive growth rates. With regard to groundnut, it was interesting to observe that there has been steady

progress with the corresponding periods indicating the increasing contribution of groundnut to the state. In sesame, a sign of mild improvement in the growth of area, production and yield was observed in period III as against the previous periods I and II.

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