Economic Affairs, Vol. **70**(04), pp. 313-319, December 2025
DOI: 10.46852/0424-2513.4.2025.2

RESEARCH PAPER

Dynamics and Decomposition Analysis of Oilseed Production in India

Mahadeo S. Deshmukh[1*], Priyanka M. Kumbhar[1] and Amanuel A. Gebre[1,2]

[1]Department of Economics (*Autonomous*), Shivaji University, Kolhapur, India
[2]Department of Agricultural Economics, Wachemo University, Hossana, Ethiopia

*Corresponding author: msd_eco@unishivaji.ac.in (**ORCID ID:** 0000-0002-6408-5803)

Received: 11-09-2025 **Revised:** 06-11-2025 **Accepted:** 30-11-2025

ABSTRACT

The global oilseed industry has seen considerable shifts in output resulting from unfavorable weather patterns, market fluctuation, and climate change. India ranks as the fourth-largest oilseed producer globally, contributing 10% to the world's total productivity and utilizing 20.8% of all arable land globally. Since domestic oilseed production cannot keep up with demand, India has been compelled to import a lot of edible oils. This study provides a comprehensive analysis of the growth and decay of oilseed production in India. The study examines the level of development in the area, production, and yield of selected oilseed crops, focusing on their relative contributions to total crop yields. Compound annual and annual average growth rates are calculated, and the Cuddy-Della Valle index was used to assess changes in time-series data. Decomposition analysis reveals the role of regional and employment growth in determining productivity change, suggesting that employment growth, rather than regional expansion, is the primary factor that improves productivity. The study recommends enhancing oilseed productivity through improved agricultural practices to address challenges posed by climate change.

HIGHLIGHTS

- The oilseed sector in India contains a wide variety of crops, and 28% of the land used for oilseeds is irrigated.
- The variability in yield and declining cultivation of certain crops highlights the need for improved agronomic practices and technology to stabilize production.
- Addressing oilseed productivity gaps is crucial to improve efficiency, increase farmers' income, and enhance livelihood security.

Keywords: Decomposition analysis, Growth rate, Instability analysis, Oilseeds, Trend

Oilseed crops hold significant economic importance worldwide. In 2019-20, global oilseed production was approximately 584.3 million tons, down from a record-high in 2018-19, mainly due to poor yields and unfavorable weather, with declines in soybean and rapeseed production despite increases in groundnut and sunflower seed output (Thoenes & Yang, 2020). In India, Oilseeds rank second to food grains in terms of acreage and value, and approximately 70% of oilseeds are grown in rain-fed conditions, with 28% of the land irrigated (Bhatt *et al.,* 2022). Due to lower profitability, the area devoted to oilseeds has slowed (Kumar & Tiwari, 2020).

India's edible oil consumption has steadily increased, rising from about 6 MT in the early 1990s to around 12 MT recently (Dastagiri *et al.* 2022). The oilseed economy's current state reflects a declining trend in crop production from 2017/18 to 2019/20. Overall,

How to cite this article: Deshmukh, M.S., Kumbhar, P.M. and Gebre, A.A. (2025). Dynamics and Decomposition Analysis of Oilseed Production in India. *Econ. Aff.*, **70**(04): 313-319.

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

total production fell by 4.7% in 2019/20, decreasing from 600.5 MT to 572.5 MT due to significant drops in crop yields from adverse weather and other factors (Nations, 2024; Sangsefidi *et al.* 2015). However, soybeans increased by 7.6%, and rapeseed and copra saw rises of 5.2% and 8.2%, respectively. Groundnuts grew by 4.1%, while sunflower yield surged by 5.8% (Nations, 2024; Vinnichek *et al.* 2019). Despite the overall decline, successful crops like sunflowers and groundnuts underscore the need for improved agricultural practices to tackle production challenges (Darekar & Reddy, 2017; Vinnichek *et al.* 2019).

The oilseed sector in India contains a wide variety of crops (Bhatt Param Jit *et al.* 2022; Mahto *et al.* 2021). According to data on the area, production, and productivity of oilseed crops in India, three crops, groundnut, rapeseed-mustard, and soybean, account for 87.58 percent of the area and 91.61 percent of the total oilseed production. Non-edible oilseeds account for only 4.67% of the total area and 5.53% of the total oilseed production, emphasizing the significance of edible oilseed agriculture in India (Dastagiri *et al.* 2022; Kachroo & Nazir, 2021). India's increasing population and stagnant crop yields may necessitate higher edible oil imports to satisfy demand. In response to rising edible oil prices following the Russia-Ukraine war, the Indian government lifted stock limits to allow more warehousing and stabilize prices. Over the years, the government has used various measures, including stock limits, revised import duties, and sudden export bans, to reduce oil price volatility while supporting local farmers (Bhatt *et al.* 2022; Dastagiri *et al.* 2022). Empirical studies indicate that the production of commercial crops and market participation among farmers help to raise income and ensure food security in developing countries (Gebre & Deshmukh, 2024). While previous studies have primarily focused on estimating variability within selected oilseed crops in specific regions, this research takes a comprehensive approach. By examining all oilseeds, this study offers a broader perspective on variability. Furthermore, this study emphasizes period-wise decomposition analysis of time series data, providing a more nuanced understanding of how these factors interact over time. Therefore, this study aimed to conduct the oilseed variability and decomposition analysis and contribute valuable insights for policymakers, scientific communities, farmers, traders, and other stakeholders involved in the field.

RESEARCH METHODOLOGY

Description of data sources and method of data analysis

The study focuses on a quantitative research methodology based on secondary data covering the period from 2000-01 to 2021-22. The data is sourced from credible sources, including the Ministry of Agriculture and Farmers Welfare, USDA-Oilseeds-World Markets and Trade, RBI, and various academic journals. The aim is to assess the growth patterns of oilseed crops in India, specifically the area, production, and yield. To analyze the growth rate, the study calculates the annual compound growth rate (Compound Annual Growth Rate) for these factors using regression analysis, where the logarithmic transformation of area, production, and yield is performed over time. The Cuddy-Della Valle index is employed to measure the variability and instability in the time series data, correcting the conventional coefficient of variation for long-term trends (Kwas *et al.* 2022; Roy *et al.* 2022). Finally, the study uses an additive decomposition approach to evaluate the relative contributions of area and yield in the total production change, thus providing a detailed understanding of the drivers behind oilseed production growth in India.

Analytical framework

Estimation of growth rates

The annual compound rate of growth in area, production, and yield of several oilseed crops was calculated using the equations below:

$$In\ Y = a + bt \qquad \ldots(1)$$

Where $ln\ Y$ is Area (million hectares)/ Production (million Tonnes)/ Yield of oilseeds (Kg/hectare) expressed in log form. t is the time trend denoting years, and b is the regression coefficient.

$$Compound\ growth\ rate\ (g) = Exp\ (b) - 1 \qquad \ldots(2)$$

Instability analysis

The Cuddy-Della Valle index, which is used to assess variability in time series data, quantifies the relative variability in oilseed area, production, and yield (Joseph & Karunakaran, 2022). In time series data with long-term trends, the simple coefficient of variation overestimates the degree of instability; in contrast, the Cuddy-Della Valle index corrects the coefficient of variation by:

$$CV = (CV^*)\sqrt{1 - Adj.R^2} \quad \ldots(3)$$

Where *CV* is the Cuddy-Della Valle index, i.e., corrected coefficient of variation (CV).

A low value of this index indicates low instability, and *vice versa*.

Decomposition analysis

The following additive system of decomposition can be used to determine the area, productivity, and interaction of the two in total production;

$$1 = [(Y_0\,\Delta A)/P] + [(A_0\,\Delta Y)/P] + [\Delta A\,\Delta Y)/P] \quad \ldots(4)$$

Where, P = Change in production; A_0 = Area in base year; A_n = Area in current year; Y_0 = Yield in base year; Y_n = Yield in current year; ΔA = Change in area ($A_n - A_0$); ΔY = Change in yield ($Y_n - Y_0$) (Joseph & Karunakaran, 2022).

RESULTS AND DISCUSSION

Growth rate in area, production, and yield of oilseeds in India

The growth in area, production, and productivity of nine oilseeds is presented in Table 1. India's area, production, and yield of oilseeds registered a positive growth rate over the study period. The production growth was mainly attributable to the growth in productivity (0.90 percent per annum) and was supplemented by production growth (0.28 percent per annum).

Table 1 shows the trends in the growth of selected oilseeds, which shows the mixed performance across different oilseeds. Groundnut has a decline in cultivation area (-1.40% Compound Annual Growth Rate), but production (2.50% Compound Annual Growth Rate) and yield (3.95% Compound Annual Growth Rate) surged significantly, indicating enhanced efficiency of production. Linseed, on the other hand, shows a sharp decline in area (-5.81% Compound Annual Growth Rate) and production (-2.08% Compound Annual Growth Rate), although yield shows significant growth (4.01% Compound Annual Growth Rate) and depicts better utilization of resources. Castor shows moderate growth in area (3.72% Compound Annual Growth Rate), production (2.20% Compound Annual Growth Rate), and yield (1.46% Compound Annual Growth Rate), making it a relatively stable oilseed crop.

Table 1: Growth Rate in area, production, and productivity of oilseed crops (2000-01 to 2019-20) in India

Oilseeds	Area		Production		Yield	
	AAGR (%)	CAGR (%)	AAGR (%)	CAGR (%)	AAGR(%)	CAGR (%)
Groundnut	-1.41	-1.40	2.47	2.50	3.87	3.95
Linseeds	-5.98	-5.81	-2.10	-2.08	3.93	4.01
Castor	3.65	3.72	2.18	2.20	1.44	1.46
Niger	-10.37	-9.85	-9.97	-9.49	0.48	0.48
Rapeseeds and Mustard	-0.29	-0.29	2.23	2.26	2.52	2.55
Safflower	-18.64	-17.01	-16.91	-15.56	1.68	1.69
Sesame	-2.78	-2.74	-1.96	-1.94	0.80	0.81
Soybean	1.47	1.48	-1.16	-1.15	-2.63	-2.60
Sunflower	-16.13	-14.90	-13.83	-12.92	2.14	2.17
Oilseeds	-0.62	-0.61	0.28	0.28	0.89	0.90

Source: *Computed by Authors (2025).*

Note: *AAGR stands for Average Annual Growth Rate, and CAGR stands for Compound Annual Growth Rate.*

Table 2: Growth rate in area, production, and productivity of oilseed crop for period I (2000-01 to 2010-11) and period II (2011-12 to 2021-22) in India

Oilseeds	Area				Production				Yield			
	Period I (2000-01 to 2010-11)		Period II (2011-12 to 2021-22)		Period I (2000-01 to 2010-11)		Period II (2011-12 to 2021-22)		Period I (2000-01 to 2010-11)		Period II (2011-12 to 2021-22)	
	AAGR (%)	CAGR (%)	AAGR (%)	CAGR (%)	AAGR (%)	CAGR (%)	AAGR (%)	CAGR (%)	AAGR (%)	CAGR (%)	AAGR (%)	CAGR (%)
Groundnut	-0.95	-0.94	-1.21	-1.20	1.64	1.66	4.72	4.83	2.59	2.63	3.97	4.05
Niger	-1.78	-1.76	-8.80	-8.43	-0.09	-0.09	-12.16	-11.45	1.68	1.69	0.67	0.67
Rapeseeds and Mustard	3.27	3.33	0.85	0.85	5.53	5.68	4.88	5.00	2.25	2.28	2.47	2.51
Safflower	-4.57	-4.46	-23.20	-20.70	-0.62	-0.62	-13.17	-12.34	3.91	3.99	2.43	2.46
Soybean	5.23	5.37	1.75	1.76	8.78	9.18	0.25	0.25	3.54	3.60	-0.55	-0.55
Sunflower	0.37	0.37	-22.31	-19.99	2.45	2.48	-10.30	-9.79	2.10	2.12	2.56	2.60

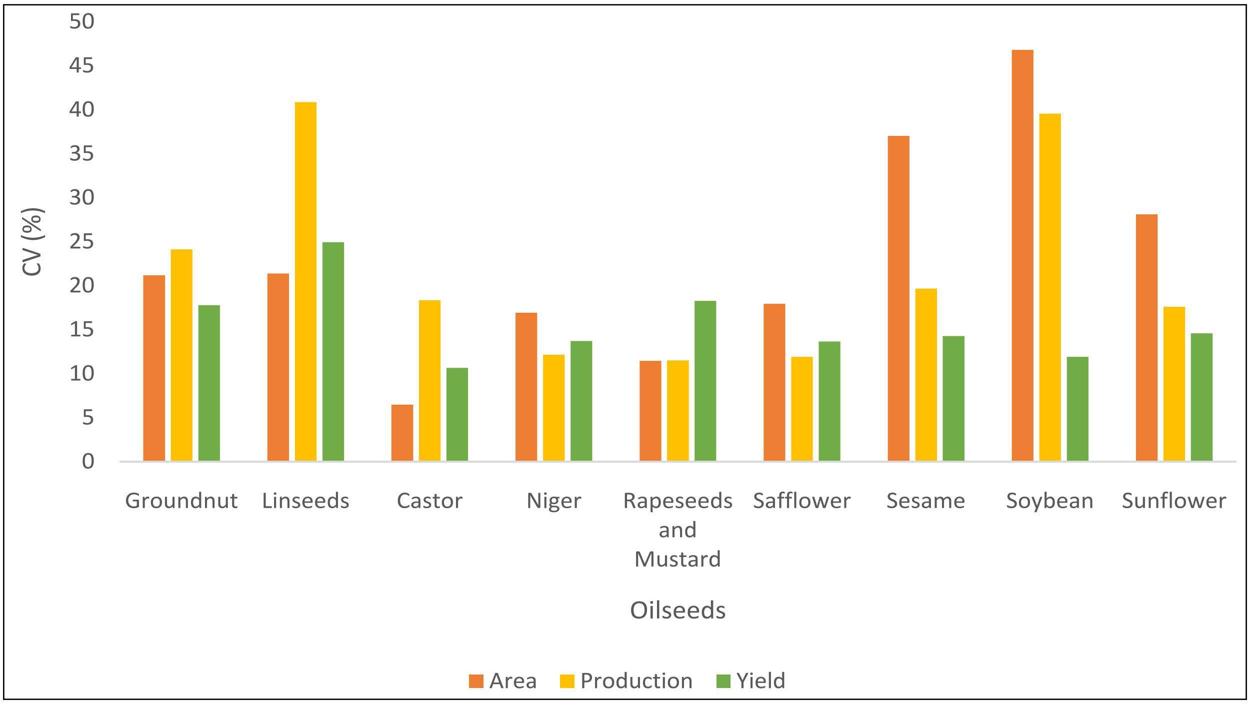
Source: *Computed by the Authors (2025).*

Niger and safflower showed a sharp decline in area and production (Niger: -9.85% Compound Annual Growth Rate, Safflower: -17.01% Compound Annual Growth Rate), while their yield growth remains very low. Rapeseeds and mustard, despite stagnant area growth (-0.29% Compound Annual Growth Rate), show a significant flow in production (2.26% Compound Annual Growth Rate) and yield (2.55% Compound Annual Growth Rate), depicting their potential for further improvement. Sesame and sunflower showed a decline in area and production, with little improvement in yield (0.81% Compound Annual Growth Rate and 2.17% Compound Annual Growth Rate, respectively). Soybean, despite a surge in the area under cultivation (1.48% Compound Annual Growth Rate), showed a moderate decline in production (-1.15% Compound Annual Growth Rate) and yield (-2.60% Compound Annual Growth Rate), indicating significant changes in adverse climatic conditions and crop management. Overall, the oilseed crops in the study period showed a slight decline in area (-0.61% Compound Annual Growth Rate), stagnation in production (0.28% Compound Annual Growth Rate), and little yield improvements (0.90% Compound Annual Growth Rate).

The analysis of oilseed cultivation from 2000–01 to 2021–22 reveals notable shifts in patterns and economic viability. Groundnut cultivation declined in area but improved in production and yield, indicating better farming practices. Conversely, Niger saw significant drops in both area and production without yield improvements, suggesting declining viability. Rapeseed and mustard production grew despite a slowdown in area expansion, reflecting their ongoing significance. Safflower's area and production sharply declined, indicating reduced importance. Soybean showed increased area and production initially, but faced stagnation and yield decline later, possibly due to soil erosion or pest issues. Sunflower exhibited a similar pattern, thriving initially but declining in later years. The overall trends reflect a shift away from economically unviable crops such as Niger and Safflower, while rapeseed & mustard and groundnut continue to thrive, with best practices and supportive policies notwithstanding soil health, pest control and industrial use due to standing soybean and sunflower seed. Continued research and development are essential to reduce crop production viability and ensure long-term productivity.

Instability analysis

In this study, oilseed production instability was analyzed using the CV Method as shown in Fig. 1. The CV analysis revealed variation in area, production, and yield of sesame seed varieties over time. Soybean and sesame exhibited high variability, with 46.79% and 37.01% CV in area, 39.53% and 19.66% in production, respectively. This indicates that these crops are more sensitive to external factors such as market demand, weather conditions, or policy changes. In contrast, rapeseeds & mustard exhibited relatively little variation, with area and



Source: *Computed by the authors (2025)*

Fig. 1: Variability in area, production, and yield of oilseed crops in India (2000-01 to 2021-22)

Table 3: Area effect, yield effect, and interaction effect on production growth of oilseed crops for period I (2000-01 to 2010-11) and period II (2011-12 to 2021-22) in India

Oilseeds	Area Effect		Yield Effect		Interaction Effect	
	Period I (2000-01 to 2010-11)	Period II (2011-12 to 2021-22)	Period I (2000-01 to 2010-11)	Period II (2011-12 to 2021-22)	Period I (2000-01 to 2010-11)	Period II (2011-12 to 2021-22)
Groundnut	-15852.6	-14232.4	33654.2	34982.3	-5623.3	-6324.1
Niger	-496.164	-456.856	35.621	33.562	-32.65	-29.62
Rapeseeds & Mustard	-1358	-1494	10685	10523	-185	-199
Safflower	1526.3	1352.2	335.6	333.65	-426.28	-422.65
Soybean	26354.72	28064.65	-42631.55	-43658.62	-9583.1	-9825.3
Sunflower	-5235.6	-5563.5	1035.6	1120	-1354.6	-1285.6
Castor	2465.6	2635.66	2155.6	2180.6	375.65	370.61
Linseeds	-960.5	-966.5	708.2	705.3	-450.26	470.23
Sesame	-2015.6	-1985.6	-425.6	-443.6	109.6	110.2

Source: *Computed by the Authors (2025).*

production CVs of less than 20%, indicative of stable agricultural systems and constant production levels. Variation in yield for most crops is small relative to location and production. For example, soybean shows a relatively robust yield with a CV of 11.90% despite high regional and production variability. Similarly, sesame and sunflower have achieved yield CV of 14.26% and 14.58%, respectively, indicating that improvements in agricultural practices or technologies may have contributed to sustainable production within any one area. In other words, collectively, the analysis highlights considerable regional and production variability for several crops, especially soybean and sesame, while crop variability ranges from moderate to low. Similar findings were obtained by a previous study (Mahto *et al.* 2021).

Decomposition analysis

The decomposition of oilseed production growth from 2000-01 to 2010-11 and 2011-12 to 2021-22 focuses on area, yield, and interaction effects. Groundnut and Rapeseed & Mustard show declining area effects but strong yield improvements, indicating better productivity with less cultivation. In contrast, the increased area is accompanied by a significant yield drop, raising efficiency concerns. Safflower and Castor exhibit positive trends in both area and yield, while niger, sunflower, linseed, and sesame face negative area effects, with linseed and sesame also showing reduced yields. Most crops have negative interaction effects, suggesting that combined area and yield changes are not boosting production growth. These insights underline the need for strategic measures to improve oilseed productivity and optimize land use. Table 3 gives detailed information about factors impacting production changes of selected oilseeds, focusing on the area effect, yield effect, and interaction effect. These effects help untangle the contributions of cultivation area, productivity (yield), and their combined effect on production levels.

Table 4: Overall area effect, yield effect, and interaction effect on production growth of oilseed crops

Oilseeds	Area Effect	Yield Effect	Interaction effect
Castor	2734.85	2186.01	376.82
Groundnut	-16858.6	35152.5	-6343.8
Linseeds	-965.705	708.785	-470.77
Niger	-696.775	32.955	-30.55
Rapeseeds	-1518	10944	-192
Safflower	-1401.6	334.48	-433.92
Sesame	-1918.2	-444.72	110.4
Soybean	28074.75	-43271.55	-9935.1
Sunflower	-5485.5	1123.2	-1324.8

Source: *Computed by the Author (2025).*

The effects on the production growth of oilseed crops are summarized in Table 4. Castor oilseeds demonstrate a positive area effect (2734.85) and yield effect (2186.01), leading to overall production growth, aided by a positive interaction effect (376.82). Groundnut has reduced area and production (-16858.6), but increased yield (35152.5) partly offsets this, despite a negative interaction effect (-6343.8). Linseeds and niger also faced production declines from reduced cultivation area (-965.705 and -696.775, respectively), with minor yield improvements offering limited compensation. For rapeseeds, yield growth (10944) increased production, though a decrease in area (-1518) hampered potential gains. Safflower and sesame experienced declines in both area and yield, resulting in overall production losses. Although sesame had a better interaction effect (110.4), it couldn't counteract the larger negative effects from area (-1918.2) and yield (-444.72).

Soybean production increased due to expanded cultivated area, but a loss in yield offset this gain, resulting in a negative net impact, further affected by an interaction effect (-9935.1). Sunflower cultivation decreased, leading to reduced production despite a slight yield increase (1123.2). Castor and rapeseed saw production rise due to yield improvements, while sesame, safflower, and sunflower experienced declines from area reductions. Interaction effects varied, often worsening the impact of area and yield reductions. This highlights the need for interventions to improve productivity and reverse declining oilseed production trends.

CONCLUSION

India's oilseed subsector includes nine major crops, with groundnut, rapeseed-mustard, and soybean making up over 87% of the area and 91.6% of production. Although these crops have shown positive yield growth, the overall oilseed area has stagnated, with a compound annual growth rate (Compound Annual Growth Rate) of -0.61% for area and 0.28% for production. Soybean, despite leading in area, has a negative yield growth of -2.60% Compound Annual Growth Rate due to management challenges and adverse weather. In contrast, groundnut and rapeseed mustard have seen yield growth rates of approximately 3.95% and 2.55%, respectively. Minor crops like safflower and linseed are declining in area, though yields have slightly improved. The average yield for oilseed crops in India is 1,224 kg per hectare, emphasizing the need for better agronomic practices and technology. Enhancing productivity in low-performing crops can strengthen India's oilseed economy, reduce import dependency, and promote underutilized crops like safflower and sesame to improve nutrition. This requires investment in research and market awareness to create a more resilient agricultural system beneficial to producers and consumers.

REFERENCES

Bhatt Param Jit, Y., Negi, N. and Asghar Ali Himanshu Pramod Kumar Abbas Hasan Raj Kumar Gopal, M. (2022). Estimating and Bridging the Yield Gaps in Oilseeds for Atma Nirbhar Bharat. Library and editing support Administrative and general support.

Bhatt, Y., Jain, V., Yadav, U. and Sain, R. 2022. Estimating and Bridging the Yield Gaps in Oilseeds for Atma Nirbhar Bharat.

Dastagiri, M., Kareemulla, K., Venkateshwarlu, G. and Sujatha, M. (2022). Self-Sufficiency in Edible Oilseeds in India: Strategies and Policies.

Gebre, A.A. and Deshmukh, M.S. 2024. Drivers of vegetable market participation in southcentral Ethiopia: Heckman two-stage model approach. *Discover Food*, **4**(1).

Joseph, J.V. and Karunakaran, N. 2022. Growth and Instability in Area, Production and Productivity of Oilseed Crops in India. Agriculture Situation In India, 79.

Kachroo, M.M. and Nazir, N. 2021. Trend and Seasonality Analysis in Prices and Arrivals of Selected Agricultural Commodities in India. *Madras Agricultural Journal*, **108**: 1–5.

Kumar, V. and Tiwari, A. 2020. Rural Pulse (Sparking Yellow Revolution in India Again).

Kwas, M., Paccagnini, A. and Rubaszek, M. 2022. Common factors and the dynamics of cereal prices. A forecasting perspective. *Journal of Commodity Markets*, **28**. https://doi.org/10.1016/j.jcomm.2021.100240

Mahto, A.K., Alam, M.A., Biswas, R., Ahmad, J. and Alam, S.I. 2021. Short-Term Forecasting of Agriculture Commodities in Context of Indian Market for Sustainable Agriculture by Using the Artificial Neural Network. *Journal of Food Quality*, 2021. https://doi.org/10.1155/2021/9939906

Nations, O.F. and A.O. 2024. Oilseeds and oilseed products. In OECD-FAO Agricultural Outlook. https://doi.org/https://doi.org/10.1787/4c5d2cfb-en

Patel, N., CHoudhary, H. and Goswami, S. 2024. Pathways and Strategy for Accelerating Growth in Edible Oil towards Goal of Atmanirbharta.

Roy, A., Singh, K.M., Kumari, T., Ahmad, N., Singh, R., Singh, R.P. and Sinha, D.K. 2022. Dynamics of Oilseeds Production and Decomposition of output Components of Oilseeds in Bihar. *Economic Affairs* (New Delhi), **67**(2): 23–29.

Sangsefidi, S.J., Moghadasi, R., Yazdani, S. and Nejad, A.M. 2015. Forecasting the prices of agricultural products in Iran with ARIMA and ARCH models. *International Journal of Advanced and Applied Sciences*, **2**(11): 54–57.

Thoenes, P. and Yang, D. 2020. Food Outlook June 2022. FAO, June.

Vinnichek, L., Pogorelova, E. and Dergunov, A. 2019. Oilseed market: Global trends. IOP Conference Series: *Earth and Environmental Science*, **274**(1). https://doi.org/10.1088/1755-1315/274/1/012030