Decomposition Analysis of Groundnut of India

Prince Gyan
Department of Statistic,
Sardar Patel University,
Vallabh Vidyanagar Anand

Hemant Sharma
Agro- Economic Research Centre,
Sardar Patel University, Anand

S.S.Kalamkar
Agro- Economic Research Centre,
Sardar Patel University, Anand

Abstract

This paper investigates the production, growth rate, and decomposition analysis of groundnut in India for the study period. The 60-year period of the study is divided into three sub-periods with intervals.where growth rate analysis was performed accordingly. Secondary data is used to examine the growth rate and it was observed that production and productivity also increased from 1 to 67percent during the study period, due to the launch of different schemes by the government. The results showed that the groundnut production rate in India increased significantly by 0.74 percent annually since the productivity rate increased significantly by 1.30 percent per annum. The decomposition analysis of the relative contribution of area and price effect was positive and yielded a high output of groundnut due to the development of many policies related to area extension and price policy by the government.

Keywords: Area, Growth rate, Groundnut, Area, Product, Price

Introduction

Groundnut, commonly referred to as peanut, is a significant crop that serves as a vital source of oil, food, and feed. It is cultivated in more than 100 countries worldwide. Groundnuts are extensively grown across numerous nations, covering approximately 35.5 million hectares of land. In the year 2020, the global production of groundnuts reached approximately 53.6 million tonnes, with an average yield of 16991 Kg/ha, as reported by FAO (2022). Notably, India stands as the second-largest producer of groundnuts, following China.India is a high exporter of groundnut, exporting groundnut to over 114 countries across the globe. Among the countries that depend on India for groundnut (raw and processed form), Vietnam was the largest exporter of Groundnut from India with Bangladesh, Netherlands, Nepal, and USA completing the top five during the period 2020-21 (April-Nov), which amount to 59.63 USD million, representing over 68.33% of the total Groundnut export from India (connect2india.com). Gujarat, Rajasthan, Tamil Nadu, Andhra Pradesh, and Karnataka are the highest groundnut-growing states in India, which account for more than 85 percent of the production

as well as the area (Prabha, 2022). Among the various groundnut-growing states in India, many works and data sources over the years have revealed that Gujarat is the prominent growing state in India evidenced byPrabha (2022), FAO (2022), Tiwari et al. (2019), Meena et al. (2019), etc. Smith (2022) also revealed that, Gujarat is the leading producer of groundnuts in India, averagely annual producing about 2892 thousand tonnes of groundnut followed by Rajasthan with average groundnut produce of 1041.1 thousand tonnes. Tamil Nadu on average, produces 894.9 thousand tonnes of groundnuts, whereas Andhra Pradesh and Karnataka complete the top five with an average production of 788 and 381.4 thousand tonnes per annum respectively. The table below shows the top ten groundnut-producing states of India in the year 2019-2020.

Table 1: Top ten Groundnut Production states in India (000 Tonnes)

Sr No.	State	Production	Share(%)
1	Gujarat	4,645.52	46.68
2	Rajasthan	1,619.33	16.27
3	Tamil Nadu	1,033.00	10.38
4	Andhra Pradesh	848.79	8.53
5	Karnataka	502.81	5.05
6	Madhya Pradesh	350.66	3.52
7	Maharashtra	308.99	3.11
8	Telangana	265.37	2.67
9	West Bengal	156.10	1.57
10	Uttar Pradesh	88.55	0.89

Source: Ministry of Agriculture

Methodology

This study utilized already available data from external sources within a long period of sixty (60) years, from 1959 to 2019. The data was obtained via secondary data sources such as the Ministry of Agriculture, Food and Agriculture Organization (FAO), Connect2india.com, and DA&FW. Concerning the area, production, and yield, this study analyses the growth rate of groundnut in India. The 60-year period of the study is divided into three sub-periods with intervals, that is period I (1959-1960 to 1978-1979), period II (1979-1980 to 1998-1999), and period III (1999-2000 to 2018-2019) where growth rate analysis was performed accordingly. Analysis was also performed on the entire duration, 1959-2019. The interaction effect of the area, farm harvest, price, and yield of groundnut was also examined in this study. The correlation coefficient was obtained along with a scatter plot to examine the relationship between area, production, and yield of groundnut in India whereas the growth rate was estimated by the Compound Growth Rate (CGR) method as the study considered comparison of growth rates of groundnut in India between periods

Compound growth rate

In the review of literature, it was found that several authors have effectively applied this method to examine the growth efficiency of crop production (Kumari and Ahlawat, 2021; Sharma et.al., 2017; Kumar et al., 2018). For a single sub-period, the CGR was calculated using the formula below:.

$$CGR = \{antilog\ (\beta_1) - 1\} \times 100$$

Where β_1 is the slope parameter of fitting the model of the form:

$\log Y = \beta_0 + \beta_1 X$ with β_0 as the intercept parameter, Y takes the values of the production, area, or yield of groundnut of the specified period (dependent variable) and X is the time (independent variable). The slope parameter β_1 determines the amount of change in Y values for the change in time X (independent variable)(Sharma et al., 2017). The Ordinary Least Square (OLS) method was applied to estimate the model parameters.

Component analysis

The component analysis was statistical technique commonly used to understand the impact of different variables on change or variation in a dataset. It's employed to ascertain the impact of area and yield on change. This was done by the following relation:change in production= PoAo Y (Yield effect) + PoYo A (Area Effect) + AoYo P (Price Effect) + Po A Y (Area & Yield Effect) + Ao P Y(Price & Yield Effect) + Yo P A (area & Price) + A Y P (Interaction of area, yield, and Price)WhereAo =Base year Area Po = Base year Price Yo= Base year Yield = Change (Current Year-Base Year)

The computations in this study that gave the results for the analysis were all done using R studio software as well as the graphs.

Results and Discussion

The following table shows the data of the area, production, and yield of groundnut during last six decades of the study

period (1959-60 to 2018-19) in India. It was observed that area of groundnut in India increased from 6.44 million hectares during 1959-60 to 7.40 million hectares during the year 1998-99 in the first four decades since the development of oilseeds had become an area of priority of the Government. In Andhra Pradesh, Karnataka, and Uttar Pradesh, the first Centrally Sponsored Scheme (CSS) - "Maximized production of groundnut" - was established in 1966–1967. During 1967–68 and 1968–69, this program was expanded to groundnut-growing states including Gujarat, Maharashtra, Madhya Pradesh, Odisha, Punjab, Rajasthan, and Tamil Nadu. The plan persisted during the Fourth Plan (1969–1974). During the 5th Plan (1974–1979), an intensive oilseeds development program (IODP) covering groundnut, R&M, sesame, safflower, linseed, and castor was introduced in significant oilseed-producing states. During the 6th Plan (1984–1989), the program was continued with a particular project on groundnut and soybean.

Table 2: Groundnut production, area, and yield in India from 2008–2009 to 2018–2019

Year	Area	Prodn	Yield	Year	Area	Prodn	Yield	Year	Area	Prodn	Yield
1959-60	6.44	4.56	708	**1979-80**	7.17	5.77	805	**1999-00**	6.87	5.25	764
1960-61	6.46	4.81	745	**1980-81**	6.80	5.01	736	**2000-01**	6.56	6.41	977
1961-62	6.89	4.99	725	**1981-82**	7.43	7.22	972	**2001-02**	6.24	7.03	1127
1962-63	7.28	5.06	695	**1982-83**	7.22	5.28	732	**2002-03**	5.94	4.12	694
1963-64	6.89	5.30	769	**1983-84**	7.54	7.09	940	**2003-04**	5.99	8.13	1357
1964-65	7.38	6.00	814	**1984-85**	7.17	6.44	898	**2004-05**	6.64	6.77	1020
1965-66	7.70	4.26	554	**1985-86**	7.12	5.12	719	**2005-06**	6.74	7.99	1187
1966-67	7.30	4.41	604	**1986-87**	6.98	5.88	841	**2006-07**	5.62	4.86	866
1967-68	7.55	5.73	759	**1987-88**	6.84	5.85	855	**2007-08**	6.29	9.18	1459
1968-69	7.09	4.63	653	**1988-89**	8.53	9.66	1132	**2008-09**	6.16	7.17	1163
Percentage Change	10.1	1.5	-7.8	**Percentage Change**	19.0	67.4	40.6	**Percentage Change**	-10.3	36.6	52.2
1969-70	7.13	5.13	720	**1989-90**	8.71	8.10	930	**2009-10**	5.48	5.43	991
1970-71	7.33	6.11	834	**1990-91**	8.31	7.51	904	**2010-11**	5.86	8.26	1411
1971-72	7.51	6.18	823	**1991-92**	8.67	7.09	818	**2011-12**	5.26	6.96	1323
1972-73	6.99	4.09	585	**1992-93**	8.17	8.56	1049	**2012-13**	4.72	4.70	995
1973-74	7.02	5.93	845	**1993-94**	8.32	7.83	941	**2013-14**	5.51	9.71	1764
1974-75	7.06	5.11	724	**1994-95**	7.85	8.06	1027	**2014-15**	4.77	7.40	1552
1975-76	7.22	6.76	935	**1995-96**	7.52	7.58	1007	**2015-16**	4.60	6.73	1465
1976-77	7.04	5.26	747	**1996-97**	7.60	8.64	1138	**2016-17**	5.34	7.46	1398
1977-78	7.03	6.09	866	**1997-98**	7.09	7.37	1040	**2017-18**	4.89	9.25	1893
1978-79	7.43	6.21	835	**1998-99**	7.40	8.98	1214	**2018-19**	4.73	6.73	1422
Percentage Change	4.2	21.1	16.0	**Percentage Change**	-15.0	10.9	30.5	**Percentage Change**	-13.7	23.9	43.5

The 6th Plan period (1984–1985) saw the beginning of the National Oilseeds Development Project (NODP), which was carried on during the 7th Plan (1985–1986). It was observed that area of groundnut in India increased from 4 to 19 percent in the first three decades due to the area expansion policy. It is also observed that the production and productivity also increased from 1 to 67 percent during the study period due to the launch of different schemes like Oilseeds Production Thrust Project (OPTP), a special project with 100% support from the Central Government, and Technology Mission on Oilseeds (TMO) in 1986 both continued NODP on a "50:50" sharing basis between the Central and State Governments. Up to 1990–1991 and afterward as a single oilseed production program on a "75:25" sharing basis, these programs were carried out under the auspices of TMOP and continued until 2003–2004.The correlation coefficient method is used in describing the association between area and production as well as yield and production (table 3). Pearson's product-moment correlation of area and production in India over the study period is 0.0514 which is statistically not significant with a 95% confidence level, which indicates that increment in the area does not strongly affect (increase) the production of groundnut in India. Also, the correlation of yield and production in India over the study period (1959-1960 to 2018-2019) is revealed to be 0.785 with a 95% confidence level. Hence increment in yield increases the production of groundnut in India. The t-test statistic was used for a test at a 5% significance level.
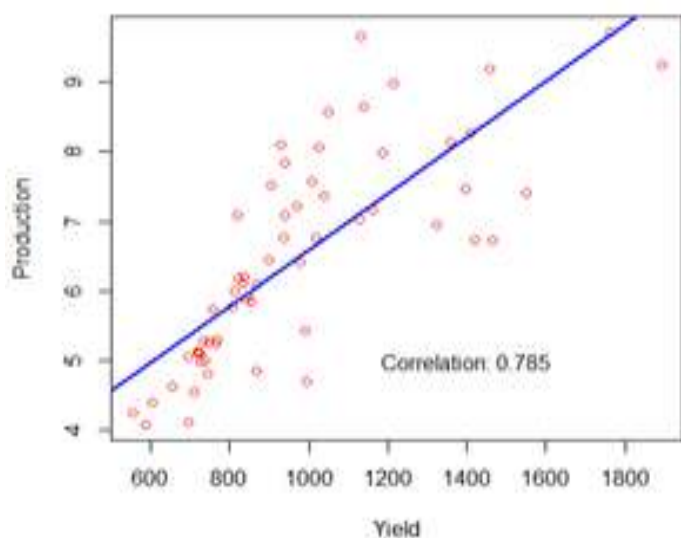
Table 3: Correlation between Area and Production, Yield and Production of groundnut

	Pearson's product-moment correlation	t	p-value
Area Vs Production	0.0514	9.6555	0.6966
Yield Vs Production	0.785	0.39185	1.12e-13

The relationship between area and production as well as yield and production are also visualized in the figures (A&B) below. From figure A, it is observed that the points h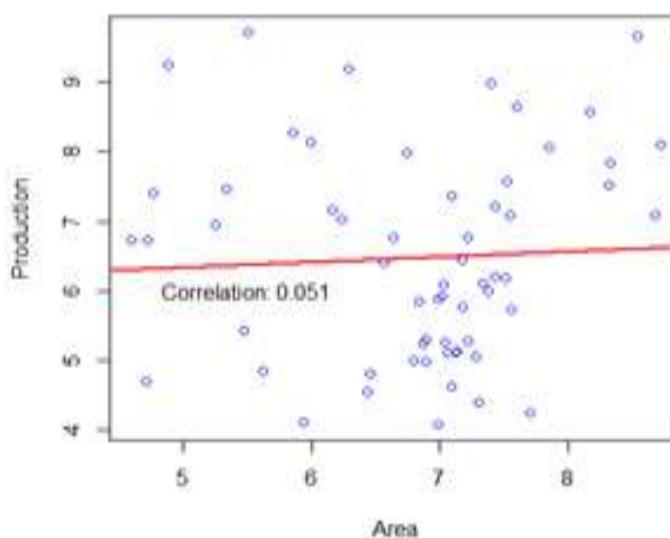ave a greater density around the straight line implying that yield and production have a linear association (linear correlation), hence increase in yield may increase production, whiles from figure B, the points are farther away from the regression line and it is increasing nor decreasing (no linear correlation).

Figure A

Figure B

The Compound Growth Rate of Indian Groundnut Area, Production, and Yield

The CAGR of different variables of Groundnut for India was calculated separately from 60years of data from 1959-2019 and is presented in table 4.

Table 4: Compound Growth Rates of Area, Production, and Yield of Groundnut in India

Period	Area	Production	Yield
I (1959-79)	0.27 (0.14)	1.18 (0.03)	0.90 (0.09)
II (1979-99)	0.50 (0.11)	2.33 (0.00)	1.83 (0.00)
III (1999-2019)	-1.87 (0.00)	1.37 (0.14)	3.29 (0.00)
Overall (1959-2019)	-0.55 (0.00)	0.74 (0.00)	1.30 (0.00)

The value in parenthesis is the p-value, at a 5% significant level

The table shows that the production growth rate of the chosen crop in India increased dramatically at a rate of 1.18 percent year during the first period (1959–1979). It was found that the production rate increased greatly and grew at a rate of 2.33 per year during the second phase of the study. Groundnut production thrives in favorable conditions thanks to the greater yield that drives output (and profitability) and groundnut area development. During period III, the growth of production of groundnut decreased and it was non-significantly found to be 1.37 percent per annum, which is due to the significant annual decline in the area by 1.87 percent and significant growth rate in yield by 3.29 percent per annum. The results of negative growth of the groundnut area align with the study conducted by Meena et. al. 2022, Sharma et al. 2022, Sharma and Burark 2021, Sharma et al. 2018, and Meera and Sharma 2015.The study period revealed that the growth rate of output of groundnut in India increased significantly by 0.74 percent annually, which is because the productivity increased significantly by 1.30 percent per annum, where the area declined significantly at a rate of 0.55 percent annually. The yearly output of groundnuts is rising steadily in the nation and demonstrated positive growth over the research period, particularly because the increased production was driven by the highest rate of productivity growth, signifying a growth driven by technology. Over the course of the trial, production increased by 0.74 times, and yield increased by 1.30 times.

Component analysis

To ascertain the impact of area and yield on the change in the production of groundnut in India within the study period, the component analysis is employed. Decomposition analysis of the relative share of the yield effect, area effect, price Effect, Area & Yield Effect, Price & Yield Effect, area & Price, and Interaction of area, yield, and Price effect on groundnut output growth in India in table below. From the Table 5, the relative contribution of the Yield effect, Area Effect, Price Effect, Area & Yield Effect, Price & Yield Effect, area & Price, and Interaction of groundnut in India was recorded at 165.05, -626.83, 268.01,166.45,-71.16,270.28 and -71.77 percent, respectively. The relative contribution of area and price effect was positive with high output growth of groundnut due to the development of many policies related to area extension and price policy by the government. The breakdown analysis of the growth of groundnut crops during the full study period (1959-2019) showed that the price & yield effect, or 270.28 percent, was primarily responsible for the increase in groundnut production.

Table 5: Component Analysis of Production of Groundnut in India (%)

Period	Area Effect	Yield Effect	Price Effect	Area & Yield	Area & Price	Price & Yield	Interaction Effect
I (1959-79)	41.27	48.16	2.32	7.40	0.36	0.42	0.06
II (1979-99)	7.6	120.55	-20.58	3.87	-0.66	-10.45	-0.34
III (1999-2019)	197.67	-546.53	217.42	170.24	-67.73	187.25	-58.33
Overall (1959-19)	165.05	-626.86	268.01	166.45	-71.16	270.28	-71.77

Conclusion & Policy recommendation:

The findings clearly demonstrate that during periods 1 to 3, India's groundnut production and yield increased at a faster rate. The whole time showed that the productivity rate greatly improved by 1.30 percent per year, when the area significantly decreased at a rate of 0.55 percent annually, and that this resulted in a significant increase in groundnut production in India of 0.74 percent yearly. The yearly output of groundnuts is rising steadily in the nation and demonstrated positive growth over the research period, particularly because the increased production was driven by the highest rate of productivity growth, signifying a growth driven by technology. During period 3, the growth rate of production was low as compared to the second period due to the negative growth rate in the area (1.87) of groundnut. The relative contribution of area and price effect was positive with high output growth of groundnut due to the development of many policies related to area extension and price policy by the government. The policy implications of decomposition analysis are significant as each individual growth component has limited potential for expansion over time. For instance, the growth potential of land, known as the acreage effect, is constrained by the scarcity of water resources. If current yield trends persist, the growth in crop production will decrease over time due to the limitations on land's growth potential. To address this issue, a second yellow revolution is necessary to enhance groundnut production in the country and achieve self-sufficiency in edible oil production for India.

References:

- Agricultural Statistics at a Glance (2021), Ministry of Agriculture &Farmers Welfare, Department of Agriculture, Cooperation & Farmers Welfare, Directorate of Economics & Statistics, Govt of India.

- Hemant Sharma and S.S. Burark (2021). Measurement of Growth in Total Factor Productivity of Gram in Rajasthan. International Journal of Agriculture and Statistical Science 17 (1): 261-266.

- Hemant Sharma, Burark S.S. and T.B. Parihar (2018) Dynamic growth and decomposition analysis of major pulses in Rajasthan. Bioved, 29(1): 91–96

- Hemant Sharma, S.S. Burark, Hari Singh, Latika Sharma, G.L. Meena (2022) Growth of Rapeseed & Mustard Output in Rajasthan: A Component Analysis. AMA, Agricultural Mechanization in Asia, Africa and Latin America.53 (4):7251-7256.

- Kumari P. & Ahlawat M. (2021).Growth Efficiency in Production of Major Crops in Haryana: A District Level Study. Research and Reviews Journal of Agriculture and Allied Sciences. Vol. 10(4):1-28.

- Meena, Murlidhar &Khunt, K. & Meena, Hari &khorajiya, H. (2019). Assessing export competitiveness of Indian groundnut. Agricultural Economics Research Review. 31. 221-230. 10.5958/0974-0279.2018.00039.3.

- Meera and Hemant Sharma (2015) "Growth and Instability of Wheat Production in Rajasthan" Indian Journal of Economics and Development. 11(4): 945-950.

- Prabha R. (2022). An Analysis of Growth Performance of Groundnut Crop in India. International Journal of Research Publication and Reviews, 3(6):1474-1478.

- Sharma, H., Parihar T. B. and Kalana K.(2017). Growth rate and Decomposition Analysis of Onion Production in Rajasthan State of India. Economic Affairs, Vol. 62, No. 1, pp. 157-161.

- FAO (2022). FAOSTAThttps://www.fao.org/faostat/en/?#data/QCL

- https://www.statista.com/statistics/1317053/india-groundnut-export-value-by-leading-destination/

- https://agriexchange.apeda.gov.in/india%20production/AgriIndia_Productions.aspx?productcode=1007