



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(9): 2209-2211
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www.thepharmajournal.com

Received: 03-08-2023

Accepted: 05-09-2023

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Study on growth analysis of groundnut in Rayalaseema region of Andhra Pradesh

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Abstract

An attempt was made to study the growth in area, production and yield of groundnut in Rayalaseema region of Andhra Pradesh state as the four districts of Rayalaseema viz., Ananthapur, Chittoor, Kurnool and Y.S.R Kadapa are contributing major groundnut area in the state. The study was based on crop area, production and yield data covering the years of 1967-68 to 2019-20 divided into three parts i.e., Part I includes 1967-68 to 1985-86, part II includes 1986-87 to 2000-01 and part three includes 2001-02 to 2019-20 based on the Pre Technology mission on oilseeds (TMO), TMO period and post liberalization period, Compound growth rate and decomposition analysis was employed. The results revealed that, the growth performance of groundnut in Rayalaseema region was declined over the years, particularly in Period III due to frequent drought spells, change climate scenario, crop shifts viz., redgram, castor and cotton etc.

Keywords: Compound Annual Growth Rate (CAGR), decomposition analysis, groundnut crop, rayalaseema region

Introduction

Groundnut i.e., king of Oilseeds is an annual legume crop is the third major oilseed crop of world and is cultivated in subtropical and tropical regions. Groundnut, ranked as the world's fifth most significant source of edible oil and vegetable proteins, boasts an oil content ranging from 44 to 56%, making it a valuable commodity. Additionally, it is a rich source of essential minerals such as phosphorus, calcium, magnesium, and potassium, along with vitamins including E, K, and various B-group vitamins. In the agricultural landscape of India during the 2019-20 periods, groundnut held a prominent position. It occupied an extensive land area of 4825 thousand hectares, resulting in a substantial production of 9952 thousand tonnes, with an impressive productivity rate of 2063 kg per hectare. This agricultural dynamo, however, exhibits regional concentration. A significant 70% of both the cultivated area and overall production are concentrated in four states of India i.e., Gujarat, Rajasthan, Tamil Nadu, and Andhra Pradesh, as per data from Source.des.ap.gov.in. Among these states, Andhra Pradesh secured the fourth position in India, contributing to 32.7% of the total groundnut cultivation area, equivalent to 661 thousand hectares. Its share of production stood at 8.8%, amounting to 881 thousand tonnes, showcasing the state's considerable role in groundnut farming. The productivity in Andhra Pradesh was noteworthy. The Rayalaseema region within Andhra Pradesh emerged as the dominant hub for groundnut production during the same period. Impressively, it commanded a staggering 95 percent share of the groundnut cultivation area, covering approximately 633 thousand hectares. Moreover, it contributed a significant 87% share of the overall groundnut production, totalling 767 thousand tonnes, and displayed a commendable productivity rate of 1210 kg per hectare, reinforcing its status as a major groundnut-producing region, according to data. (Source: www.indiastat.com).

2. Materials and Methods

For the present study, time series data on the area, production, and yield of groundnut in the Rayalaseema region of Andhra Pradesh were gathered from the season and crop reports published by the Directorate of Economics and Statistics. The total period under consideration spans from 1967-68 to 2019-20, and it has been divided into three distinct sub-periods: Period I (1967-68 to 1985-86): This period predates the Technology Mission on Oilseeds (TMO) initiative. Period II (1986-87 to 1999-2000): This phase encompasses the years from the implementation of the Technology Mission on Oilseeds (TMO) to the period just before

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liberalization. Period III (2000-01 to 2018-19): This period represents the time after the implementation of liberalization policies. The significance of these time periods selected for the study lies in their alignment with key agricultural and economic developments in the region. Period I reflects conditions before the TMO was introduced, Period II covers the TMO implementation and its immediate aftermath, while Period III delves into the post-liberalization era, providing a comprehensive view of the groundnut cultivation dynamics in Rayalaseema.

Table 1: Time periods selected for the study Time period Significance Selected years

Time Period	Significance	Selected years
Period I	Pre Technology Mission on Oilseeds(TMO) period	1967-68 to 1985-86
Period II	TMO implementation to liberalization	1986-87 to 1999-2000
Period III	Post liberalization period	2000-01 to 2018-2019

2.1 Estimation of Compound Annual Growth Rate (CAGR)

To estimate compound growth rate (CAGR), The exponential function $Y = ab^t$ was fitted.

Compound annual growth rate (r) = (antilog b - 1)*100

The compound growth rates were tested for their significance by the student's t test.

2.2 Estimation of Decomposition Analysis

To measure the contribution of area and productivity towards increasing production of groundnut decomposition analysis was used.

$$P = A_0 (Y_n - Y_0) + Y_0 (A_n - A_0) + \Delta A \Delta Y$$

Where,

P = change in production

A₀ = Area in base year

Y₀ = yield in the base year

Y_n = yield in the current year

A_n = area in the current year

ΔA = change in area (A_n-A₀)

ΔY = change in the yield (Y_n - Y₀)

Where, the first term is the productivity contribution, second term is the area contribution and the last term is the interaction effect.

3. Results and Discussions

3.1 Compound Annual Growth Rate (CAGR)

Table 2 provides insightful findings regarding groundnut cultivation over three distinct periods. During Period I, the growth rates for groundnut cultivation area and production were positive. Notably, the expansion of cultivation area was statistically significant at both the 1 percent and 5 percent levels, while the increase in production did not reach statistical significance. Conversely, the growth rate in yield was negative and statistically non-significant during this period.

Table 2: Compound annual growth rates of area production and yield of Groundnut in Rayalaseema region of Andhra Pradesh.

CAGR	Area (%)	Production (%)	Yield (%)
Period I	1.37***	1.26 ^{NS}	-0.11 ^{NS}
Period II	0.9 ^{NS}	-0.01 ^{NS}	-0.9 ^{NS}
Period III	-4.01***	-2.26 ^{NS}	1.83 ^{NS}

*** Significant at 1% level** Significant at 5% level, NS-Statistically non-significant

In Period II, the growth rate of the cultivation area was positive but statistically non-significant. Both production and yield exhibited negative growth rates, and these trends were also statistically non-significant. Moving to Period III, both the cultivation area and production experienced negative growth rates. The contraction in cultivation area was statistically significant at the 1% level, whereas the decline in production did not attain statistical significance. Meanwhile, the growth rate in yield was positive but, like the previous periods, statistically non-significant. Comparing the growth rates of groundnut cultivation area across the three periods, Period I showed the highest growth rate at 1.37%, followed by Period II at 0.9%, and Period III at -4.01%. Notably, the growth rate in cultivation area was positive and significant in Period I. The growth rates of groundnut production over these periods, the highest growth rate was observed in Period I at 1.26%, followed by Period II at -0.01%, and Period III at -2.26%. However, it is worth noting that only the growth rate in production during Period I was positive, albeit statistically non-significant. Regarding the growth rates of groundnut yield, Period I exhibited the highest growth rate at 1.83%. Conversely, Period II showed a decrease of -0.9%, and Period III had a slight decline of -0.11%. Importantly, all the growth rates in yield across the study periods were statistically non-significant.

3.2 Decomposition Analysis

The effect of area, productivity, and their interaction on the change in groundnut production in the Rayalaseema region was assessed through decomposition analysis, and the results are presented in Table 3. Upon inspection of the table, the following findings were observed:

Period I: During this period, the dominant contributor to the change in production was the yield effect, accounting for a significant 128.25%. This was followed by the interaction effect, which had a negative impact (-7.51%), and the area effect, which also had a negative influence (-20.74%).

Period II: In this phase, the most profound contributor to the change in production was once again the yield effect, making up 43.98%. Following closely was the area effect, contributing 38.20%, and finally, the interaction effect had a contribution of 17.81%.

Table 3: Decomposition analysis in area production and yield of Groundnut crop in Rayalaseema region of Andhra Pradesh

Periods	Change in production	Area effect	Yield effect	Interaction effect
period I	183556	-20.74	128.25	-7.51
Period II	854275	38.20	43.98	17.81
Period III	-77532	-970.67	566.24	504.42

Period III: Notably, during Period III, the change in production was highly influenced by the yield effect, showing a substantial increase of 566.24%. The interaction effect also

played a significant role, contributing positively at 504.42%. However, there seems to be a typographical error in your sentence regarding the interaction effect, as it states both a positive and negative impact (-970.67%). Please clarify this discrepancy. These findings provide valuable insights into how different factors, such as area, productivity, and their interaction, have contributed to changes in groundnut production over the specified time periods in the Rayalaseema region.

The analysis revealed that, during Period I and period II, yield effect had contributed to the change in production, while during Period III, the change in production was negative and the effects of area was also negative (-90.67%) followed by yield and interaction effects were positive i.e., (566.24%), (504.42%) respectively. This can be concluded that the production of groundnut was negative in period III compared with period I and Period II.

4. Conclusions

The growth performance of groundnut in the Rayalaseema region has experienced a decline over the years, particularly in Period III, which corresponds to the post-liberalization era. An analysis of the Compound Annual Growth Rate (CAGR) and decomposition of area, production, and yield of groundnut in the three study periods reveals noteworthy trends: Period I and Period II: These periods witnessed accelerated growth rates in groundnut area. This growth can primarily be attributed to the implementation of oilseeds development programs, including the Technology Mission on Oilseeds (TMO). During this phase, there was a strong emphasis on transferring the latest agricultural technologies to farmers, supplying High Yielding Varieties (HYVs), and ensuring timely input distribution. These efforts resulted in an expansion of groundnut cultivation. However, the increased growth rates in groundnut cultivation area during Periods I and II were not sustained in subsequent periods. Several factors contributed to this decrease in growth rates for groundnut area, production, and yields. These factors include recurring drought spells, shifting climate patterns, and changing cropping patterns such as the transition to crops like Redgram, castor, and cotton. These challenges have collectively impacted the groundnut farming landscape in the Rayalaseema region. The declining growth performance of groundnut, particularly in the post-liberalization Period III, underscores the complex interplay of factors affecting agricultural production and highlights the need for adaptive strategies to address the challenges faced by farmers in the region.

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