Original Research Article

Is there a variation in the Total Factor Productivity of Groundnuts? A One-Factor ANOVA Analysis of Andhra Pradesh

ABSTRACT

This paper attempts to examine the total factor productivity of some of the major oilseeds and also to observe the variation of the productivity of Groundnuts over the past decades in Andhra Pradesh. The study employs secondary data from National Statistical Office (NSO). Beside, descriptive statistics, the study relies on one-factor ANOVA analysis to address the objective. The paper finds that over the past decade, the highest total factor productivity has been for the Groundnuts and lowest for Safflower. The ANOVA (One-Factor) analysis reveals that there is a variation in the mean value between and within the group data of the oilseeds. The paper concludes that this study provides valuable insights into the total factor productivity and variation of oilseeds in Andhra Pradesh and can inform future agricultural policies in the region.

Keywords: Groundnuts, Total Factor Productivity, Oilseeds

INTRODUCTION

Andhra Pradesh is a beautiful south-eastern coastal region of India, known for its diverse agriculture, with rice and groundnuts as some of the major crops grown in the state. Agriculture is the chief source of income and main occupation for the state, with 60% of the population engaged in agricultural activities. Oilseeds, such as groundnuts, soybeans, and others, are important crops grown in the state, mostly through shifting cultivation. The Godavari and Krishna rivers flow through the state, providing irrigation for the crops. The state is also known for its rich soil and favourable weather conditions that make it an ideal location for growing a variety of crops.

India is a major exporter of groundnuts in the international market, making the productivity of this oilseed a key area of study. The total output productivity of major crops grown in India has been an area of importance for various research studies, including the examination of determinants of productivity such as area, fertilizers, manures, capital, and labor. The

productivity of oilseeds is crucial not only for the domestic market but also for the international trade. It is also important to note that the oilseeds sector plays a significant role in the rural economy of the state, providing employment and livelihood opportunities for the farmers. Therefore, the study of the productivity of oilseeds in the state of Andhra Pradesh is of great importance.

Oilseeds play a significant role in the rural economy of Andhra Pradesh, providing employment and livelihood opportunities for farmers. The productivity of oilseeds is crucial not only for the domestic market but also for international trade, as India is a major exporter of groundnuts in the international market. However, despite the importance of oilseeds in the state's economy, there is limited research on the productivity and variation of these crops in Andhra Pradesh.

Acknowledging the limited study, the paper aims to examine the variation of productivity of groundnuts and other major oilseeds grown in Andhra Pradesh. Using secondary data from the National Statistical Office (NSO), it draws a comparative analysis of the highest and lowest productivity of the selected oilseeds. It was found that over the past decade, the highest total factor productivity has been for Groundnuts. The study employs both descriptive statistics and one-factor ANOVA analysis to address the research objectives. The valuable insights from the findings into the productivity of oilseeds in Andhra Pradesh, also contributes to the existing literature on oilseed productivity by providing an in-depth analysis of the productivity of major oilseeds grown in Andhra Pradesh.

The rest of the study is organised as follows. In the following sections, we discuss the existing literature and the data and variables employed in our analysis. In addition, we present the summary statistics and percentage share of the crops. Further, we present the empirical results and conclude it with policy suggestions for the farmers and policy makers.

Literature Review

Numerous studies have been conducted to understand the developments in agricultural productivity in India and South East Asia, with a specific focus on major oil seeds. One such study, conducted by Chandel in 2007, highlighted the crucial role of technology in driving productivity of oil seeds in India. The study also emphasized the significance of production and profitability of oil seeds in curbing the increasing import bills of edible oils.

(Chand, Kumar & Kumar, 2012) evaluated the Total Factor Productivity (TFP) and its return on investment, revealing variations in crop productivity across different regions. This variation can be attributed to the geographical distinctiveness of the states. A third study, led by (Jelliffe et al 2009), examined the productivity of smallholder groundnut farmers in Northeastern Mozambique, using data from 2016. The study employed a Cobb-Douglas True Fixed Effects stochastic production frontier model, and discovered that the mean TFP index and technical efficiency of the farmers were low, with room for improvement in terms of productivity.

Overall, these studies indicate the vital role of productivity growth in the development of the agricultural sector, and the need for policies and investments to support this growth. The studies specifically underscore the importance of TFP growth and its contributions to production growth, as well as the necessity for investments in research and development to improve productivity and achieve food security. Furthermore, these studies reveal the potential for improvement in productivity among smallholder farmers, highlighting the importance of policies and investments to support these farmers.

However, there is a scarcity of comprehensive analysis on the impact of government policies on agricultural productivity, and limited attention on various demographic factors of Indian regions, as the Union of India do not share the same geographic, climatic, and access to technological factors. Therefore, our study aims to provide a holistic understanding of the major oil seed crop grown in Andhra Pradesh and its productivity, by filling this research gap.

Objective

- To find the highest value of total output in a particular year in comparison to the years given.
- To study the Total Value of Output of Groundnuts in Andhra Pradesh in comparison to the Total Value of Output of Groundnuts in India.

Research Question

- Can the value of total output of the crops collected in any given years be higher than the total output of the crops calculated in the base year (2011-12)?
- Is there a variation in the Total Factor Productivity of the Groundnuts?

Hypothesis:

H_o: μ Groundnut = **μ**Rapeseed & Mustard = **μ**Castor = **μ**Coconut = **μ**Safflower = **μ**Soyabean.

Ha: At least one of the means is different from the others.

Methods and Data

Data:

Time series data from 2011 to 2019 was collected from the National Statistical Office (Ministry of Statistics and Programme Implementation) for the state of Andhra Pradesh. The data was used to compare the productivity of groundnuts with five other crops, namely; Rapeseed and mustard, Castor, Coconut, Safflower and Soyabeans. These crops were randomly selected for comparison within the state. The data was analyzed using descriptive statistics and one-factor ANOVA analysis to examine the variation in productivity and determine the determinants of productivity of the selected crops in Andhra Pradesh. The data collected and analyzed in this study provides a comprehensive picture of the productivity of these crops in the state.

Methods:

To comparatively analyse the total value of output we exploit data from the National Statistical Office (NSO) to comparatively analyze the total value of output for the selected crops in the state of Andhra Pradesh. To understand the highest and lowest total value output of the crops, we used percentage share representation in our comparative analysis. To test our hypothesis, we performed a Single-Factor ANOVA analysis on the data. This statistical analysis method allowed us to test for significant differences in the means of the productivity of the selected crops, and determine the determinants of the productivity. The data collected and analyzed in this study provides a comprehensive picture of the productivity of these crops in the state, and the ANOVA analysis helps us to draw meaningful conclusions from the data.

Definitions of Variables

a) **Groundnuts:**

Groundnut is a major crop grown in the tropic and subtropic regions, often, called earthnut, grown for its edible seeds. Native to tropical South America, the peanut was at an early time introduced to the Old World tropics.

b) Rapeseed & Mustard:

Rapeseed & Mustard are the third most edible oil seed after soyabean and palm oil. Rapeseed-mustard is a group of crops comprising rapeseed (toria, brown sarson and yellow sarson) cultivar of Brassica campestris; Indian Mustard (Brassica juncea); black mustard (Brassica nigra) and taramira (Eruca sativa)

c) Castor:

Castor or castor bean or castor oil plant, is an important plant which has various uses in medicines. Whether natural, blended or chemically altered, castor oil has both domestic and commercial usage.

d) Coconut:

An edible fruit grown throughout the tropics for decoration. The coconut palm has various nutritious, commercial and domestic usages. An essential drink in the summer, the coconut water serves as a sport drink in the humid tropic regions. Also, due to its nutritious benefits, it is a common hair dietary in the Indian households.

e) Safflower:

Safflower is a commercial cultivated vegetable oil. Due to its flavourless and colourless feature, it is used in cosmetic industry and also finds its place in the dining of salad dressing in various Indian households.

f) Soyabean:

Soyabean an alternative of protein dishes finds its place in the dining of various households. It is one of the most widely consumed cooking oils and the second most consumed vegetable oil.

Summary Statistics:

Table 1: Summary Statistics

Commodities for the state Andhra Pradesh	MEAN (IN LAKH)	STANDARD DEVIATION	VARIANCE
Groundnut	268645.5	77875.57492	6064605169
Rapeseed & mustard	1088.875	1487.250717	2211914.696
Castor	8197.75	3980.117936	15841338.79

Coconut	79746.25	5575.808968	31089645.64
Safflower	33.625	24.90517732	620.2678571
Soyabean	450.625	214.4434241	45985.98214

Source: Author's Estimates Using NSO Data

As seen in the table above, over the past decade, the highest average total value output was observed for groundnuts, with a total of 268645.5 Lakh. Conversely, it was observed that the lowest average total value output was recorded for safflower, with a mere 33.6 Lakh. Additionally, it was noted that crops such as rapeseed & mustard, castor, coconut, and soybean also possessed substantial portions of the total value of output.

Percentage Share of the Crops:

Table 2: Percentage Share

	Percentage Share of Crops					
Years	**Groundnuts**	**Rapeseed & Mustard**	**Castor**	**Coconuts**	**Safflower**	**Soyabeans**
2011-12	72	1.53	1.65	24.6	0.01	0.2
2012-13	73.69	0.11	3.97	22.11	0.01	0.11
2013-14	77.16	0.21	2.7	19.74	0.01	0.2
2014-15	68.12	0.35	3.03	28.35	0.02	0.12
2015-16	78.1	0.06	2.24	19.5	0.01	0.08
2016-17	73.83	0.2	1.51	24.27	0.01	0.18
2017-18	83.06	0.09	1.32	15.5	0	0.04
2018-19	66.36	0.16	1.76	31.6	0	0.12
Average% Share	74.04	0.34	2.27	23.21	0.01	0.13

Source: Author's Estimates Using NSO Data

The above table presents the percentage share of different crops in the state of Andhra Pradesh from 2011-2012 to 2018-2019. It can be observed that Groundnuts have the highest average percentage share of 74.04% among all the crops. Rapeseed & Mustard, Castor, Coconuts, Safflower and Soyabeans have an average percentage share of 0.34%, 2.27%, 23.21%, 0.01% and 0.13% respectively. It is also noticeable that the percentage share of Groundnuts has been fluctuating between 66.36% and 83.06% over the past decade. However, the percentage share of Safflower is relatively low, ranging from 0% to 0.02% over the past decade, with an average of 0.01%. Furthermore, it is also observed that the percentage share of Rapeseed & Mustard, Castor, and Soyabeans is also relatively low, with an average of 0.34%, 2.27%, and 0.13% respectively. This data suggests that Groundnuts is

the major crop grown in Andhra Pradesh and other crops have relatively less share in the state.

Results of Single Factor ANOVA Model:

We employ single factor ANOVA analysis to understand the variation and differences of the means of the groups. Therefore, we take the following hypothesis for the study

H_o=μGroundnut=μRapeseed& Mustard=μCastor=μCoconut=μSafflower=μSoyabean

Ha= At least one of the means is different from the others

(Here, μ is the mean value of the respective mentioned crops)

Source of Variation	Sum of Squares	Degree of Freedom	Mean Square	F-Statistic	P-Value	F crit
Between Groups	4.58E+11	5	9.15E+10	89.84543	2.59E-21	2.437693
Within Groups	4.28E+10	42	1.02E+09			
Total	5.01E+11	47	-	-	-	-

Therefore, we now report the Table of One Factor ANOVA results

Table 3: ANOVA (One-Factor Analysis)

Source: Author's Estimates

The above table shows the results of a One-Factor ANOVA analysis of the Total Factor Productivity of different oilseeds in Andhra Pradesh. The table shows the source of variation, Sum of Squares, Degree of Freedom, Mean Square, F-Statistic, P-Value and F critical. The source of variation is divided into two parts, between groups and within groups. The "Between Groups" represents the variation between the means of different oilseeds, while the "Within Groups" represents the variation within each group of oilseeds.

The Sum of Squares for "Between Groups" is 4.58E+11, with a degree of freedom of 5 and Mean Square of 9.15E+10. The F-Statistic is 89.84543, which indicates the ratio of variation between groups and within groups. The P-value is 2.59E-21, which is less than 0.05, indicating that the null hypothesis (there is no significant difference in the means of the oilseeds) is rejected. The F critical is 2.437693, which is used to determine if the F-Statistic is statistically significant.

The Sum of Squares for "Within Groups" is 4.28E+10, with a degree of freedom of 42, and Mean Square of 1.02E+09. The total Sum of Squares is 5.01E+11, with a degree of freedom of 47.

These results suggest that there is a statistically significant difference in the Total Factor Productivity of different oilseeds in Andhra Pradesh, and the Groundnuts are found to be the major crop grown in Andhra Pradesh with high productivity.

Conclusion and Policy Implications:

In conclusion, this study has provided valuable insights into the total factor productivity and variation of oilseeds in Andhra Pradesh. We found that over the past decade, the highest total factor productivity has been for Groundnuts, with the lowest for Safflower. Our study also revealed that there is a variation in the mean value between and within the group data of the oilseeds.

Based on our findings, we recommend the following policy suggestions for farmers and policymakers:

- To increase the productivity of Groundnuts, farmers should be encouraged to adopt new technologies and best practices in cultivation, such as using improved seed varieties, optimal use of fertilizers, and efficient irrigation systems.
- The government can also provide subsidies and other financial incentives for farmers to invest in these technologies, which will help to boost productivity.
- To diversify the oilseeds sector and reduce the risk of crop failure, farmers should be encouraged to grow other oilseeds such as castor, rapeseed and mustard, coconut, safflower and soyabeans.
- To increase the competitiveness of the oilseeds sector in Andhra Pradesh, the government can provide infrastructure support such as storage facilities, transportation and processing facilities.
- To promote the export of oilseeds and increase the income of farmers, the government can provide technical assistance and training to farmers on how to meet the quality standards of international markets.
- Finally, regular monitoring and evaluation of the productivity of oilseeds in Andhra Pradesh should be conducted to assess the impact of these policy recommendations and make necessary adjustments.

Overall, this study highlights the need for the government and farmers to work together to increase the productivity of oilseeds in Andhra Pradesh and contribute to the development of the state's economy.

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