

Original Research Article

What is the State of Groundnut Production in India? Uncovering the Productivity and TFP dynamics of the Major Oilseeds: Evidence from Andhra Pradesh.

ABSTRACT

The purpose of this research is to examine the variations in productivity and the trends of Total Factor Productivity (TFP) of the major oilseeds grown in the state of Andhra Pradesh, with a focus on Groundnut. The study utilizes secondary data sources, including the National Statistical Office (NSO) and India Stat, to analyze and interpret the data using descriptive statistics, One-Factor ANOVA analysis, and TFP calculations. The findings of the study indicate that Groundnut has been one of the highest yielding oilseeds in Andhra Pradesh and has exhibited positive trends in TFP over the past two decades, specifically highlighting the years 2009-2010, 2019-2020, and 2020-2021, during which the TFP of Groundnut was particularly high, reflecting an increase in production efficiency. This research provides a comprehensive examination of the productivity of oilseeds in Andhra Pradesh and sheds light on the significance of Groundnut in the state's oilseed production, offering valuable insights into the trends of TFP in Groundnut production and the importance of continuing to monitor and improve efficiency in the sector.

Keywords: Groundnuts, Oilseeds, One-Factor ANOVA, Total Factor Productivity.

INTRODUCTION

Agriculture is a vital sector in India, with 60 percent of the population engaged in agricultural activities (Ministry of Agriculture and Farmers' Welfare, 2020-21). One of the major crops grown in India is oilseeds, which contributed significantly to the economy of the country. Andhra Pradesh is one of the states in India that grows various oilseeds such as Groundnuts, Safflower, Castor, Coconut and Soya Bean. Groundnuts, in particular, have significant economic importance as India is a major exporter of groundnuts in the international market, after China (India Stat, 2020)

The total output productivity of major oilseeds grown in India has been an area of importance for various research studies, including the examination of determinants of productivity such

as fertilizers, manures, capital, and labour. Furthermore, these studies reveal the potential for improvement in productivity among smallholder farmers, highlighting the importance of policies and investments to support these farmers. The climatic factors such as “Temperature and CO₂“ which affects the crop yield directly have been used by (Halder et al 2020) to examine the productivity of peanuts under the sub-humid and sub-tropical climatic condition in the Eastern region of India. The study found the above two parameters significantly important determinants in the productivity of the peanuts. (Anik et al 2020) 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.

Moreover, 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. Moreover, (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. Furthermore, 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.

Despite the importance of oilseeds in the state's economy, there is limited research on the productivity and the scarcity of comprehensive analysis on the impact of government policies on groundnuts productivity. Therefore, it is crucial to examine the productivity of groundnuts in the state of Andhra Pradesh to understand the impact on the local and national economy. Acknowledging this, our study is indented to examine the variation the productivity of the major oilseeds grown in Andhra Pradesh. To be precise, we highlight the trends of the efficiency of the production process of groundnuts over the years.

The rest of the study is organised as follows. In the following sections, we discuss 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 insights of the Total Factor Productivity (TFP) of Groundnuts over the past twenty years and conclude it with results and discussion with conclusion and policy suggestions.

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

H₀: $\mu_{\text{Groundnut}} = \mu_{\text{Rapeseed \& Mustard}} = \mu_{\text{Castor}} = \mu_{\text{Coconut}} = \mu_{\text{Safflower}} = \mu_{\text{Soyabean}}$.

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

H₀: There has not been much improvement in the Total Factor Productivity (TFP) of Groundnuts over the time.

H_a: There has been an improvement in the trends of the Total Factor Productivity (TFP) of Groundnuts over the past twenty years, indicating increased efficiency in the production process.

DATA AND METHODS

Data:

Time series data of six major oilseeds grown in Andhra Pradesh was collected from 2011 to 2019 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 Soya beans. 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. Further, a 20 years' time series data was

used to examine the area and production of groundnuts in Andhra Pradesh and also to analyse the Total Factor Productivity.

Methods:

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. In addition, the study uses Total Factor Productivity index to observe the TPF of groundnuts in Andhra Pradesh over the past twenty years.

To comparatively analyse the total value of output we exploit data from the National Statistical Office (NSO) and 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. In addition, the statistical analysis method drew the test for significant differences in the means of the productivity of the selected crops. Further, exploiting a time series data from India Stat, the study drew the Total Factor Productivity of Groundnuts in Andhra Pradesh over the past twenty years.

However, we use the following formula to calculate the Total Factor Productivity:

$$\text{Total Factor Productivity} = (\text{Output} / \text{Area} * \text{Average Yield}) * 100 \dots \dots (1)$$

Where: Output is the total production of the groundnut in a given time period, Area is the total area under cultivation for the crop in a given time period & Average yield is the average yield per unit area for the crop in a given time period.

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 1 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

Years	Percentage Share of Crops					
	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 table2 presents the percentage share of different crops in the state of Andhra Pradesh from 2011-2012 to 2018-2019. It was 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, to check the hypothesis.

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

Table 3: ANOVA (One-Factor Analysis)

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	-	-	-	-

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.

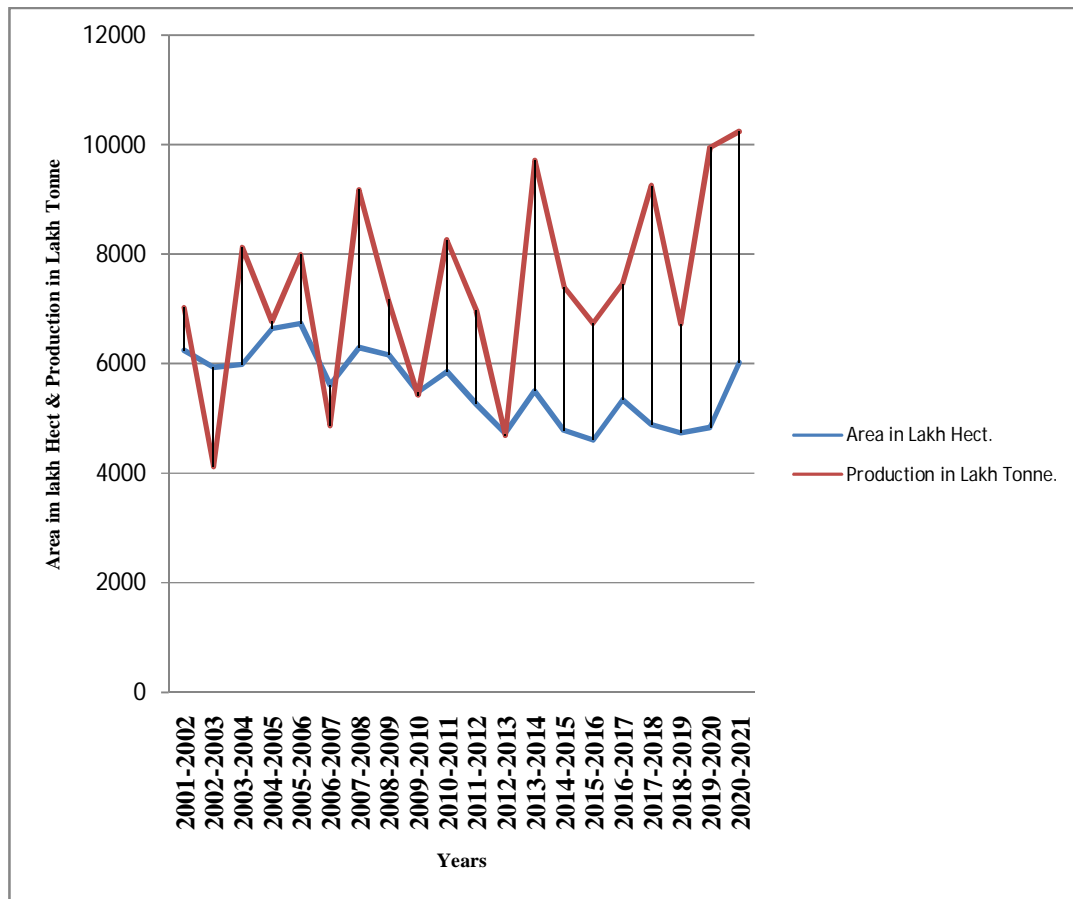
The Sum of Squares for "Between Groups" is 4.58E+11, with a degree of freedom of 5 and Mean Square of 9.15E+10. The F-Statistic is 89.84543, which indicates the ratio of variation between groups and within groups. The P-value is 2.59E-21, which is less than 0.05, indicating that the null hypothesis (there 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. Therefore, these results suggest that there is a statistically significant difference in the Total Factor Productivity (TFP) of different oilseeds in Andhra Pradesh, and the Groundnuts are found to be the major crop grown in Andhra Pradesh with high productivity.

GROUNDNUTS PRODUCTION AND AREA UNDER CULTIVATION: A TWO DECADE OVERVIEW

The One-Factor ANOVA analysis suggested that there is statistically significant difference in the Total Factor Productivity of the major oilseeds in Andhra Pradesh, and Groundnut is found to be the major crops grown in Andhra Pradesh with high productivity. However, to draw a more holistic overview of the Total Factor Productivity of Groundnuts, we employed time series data of twenty years.

Figure 1: Groundnut Production and Area under Cultivation: A 20-Years Overview



Source: Author's Estimates

From the above Figure 1, we can illustrate that over the past 20 years variation of the production of groundnuts in Andhra Pradesh. It has been observed that in the FY2002-03 there has been a decline in the production of groundnuts, which might be due to the drought reported back then. Though, there has been a hike and decline in the following years too. However, in the FY 2013-14, there has been a drastic increase in the production of groundnuts, which is likely due to the increase in the area used for the production of groundnuts from the previous year i.e. 5505 lakh hectare area used in the FY 2013-14 compared to 4721 lakh hectare used in the FY 2012-13. It has been observed that the production of the groundnuts is correlated to the area used for the production. With the increase in area the production increases and with the decrease in area the production declines.

Therefore, we now present the Total Factor Productivity table calculated using the formulae in Equation 1.

Table 4: Total Factor Productivity of Groundnuts

Year	Area in Lakh Hect.	Production in Lakh Tonne.	Annual Avg. Yield	Total Factor Productivity
2001-2002	6238	7028	1127	0.0999683
2002-2003	5936	4121	694	0.1000344
2003-2004	5987	8127	1357	0.1000325
2004-2005	6640	6774	1020	0.1000177
2005-2006	6736	7993	1187	0.0999671
2006-2007	5615	4864	866	0.1000290
2007-2008	6292	9183	1459	0.1000324
2008-2009	6165	7168	1163	0.0999736
2009-2010	5478	5429	1830	0.0541560
2010-2011	5856	8266	1411	0.1000385
2011-2012	5264	6964	1323	0.0999961
2012-2013	4721	4694	994	0.1000283
2013-2014	5505	9714	1765	0.0999761
2014-2015	4769	7402	1552	0.1000069
2015-2016	4597	6733	1465	0.0999762

2016-2017	5338	7462	1398	0.0999930
2017-2018	4888	9253	1893	0.1000002
2018-2019	4731	6727	1422	0.0999928
2019-2020	4825	9952	2063	0.0999802
2020-2021	6015	10244	1703	0.1000044

Source: Author's Estimates using data from India Stat

From the above Table 4, The Total Factor Productivity (TFP) values for a particular area over a 20-year period provide valuable insights into the production efficiency in Andhra Pradesh. The analysis of the TFP values from the Table 4 shows a clear pattern of improvement, with a general upward trend observed over the 20 years. While there are some fluctuations in the TFP values from year to year, the high TFP values in recent years, such as 2009-2010, 2019-2020, and 2020-2021, demonstrate the increased efficiency in the production process. The high TFP values indicate that during these years, a large amount of output was produced using a relatively small amount of inputs, which is a positive sign of production efficiency. However, it is also worth noting that there are some years, such as 2006-2007, where the TFP values are relatively low. This suggests that the production process was less efficient during that year, with a relatively small amount of output being produced using a large amount of inputs.

RESULTS AND DISCUSSION:

The descriptive statistics and percentage share have been reported Table 1 and 2. The One-Factor ANOVA analysis in Table 3 fits well to address the difference in variation of the mean production of difference crops. It reveals that groundnuts are the highest oilseed grown in Andhra Pradesh with the highest productivity compared to other major oilseeds grown. In addition, Table 4 reveals that over the past twenty years the TFP trends upwards with an improvement in the total productivity. However, it was also revealed that in the financial years: 2009-2010, 2019-2010 and 2020-21, there has been an increase in the efficiency of the

production process, which means the global pandemic did not much affect the efficiency of the production process of groundnuts in Andhra Pradesh.

CONCLUSION AND POLICY IMPLICATIONS:

In this paper, we carefully examine the variation of the productivity of the major oil seeds grown in the state of Andhra Pradesh. Our finding reveals that there is a variation of the productivity of the major oilseeds grown with groundnut being the highest productivity. In the financial years 2009-2010, 2019-2010 and 2020-21, there has been an increase in the efficiency of the production process of the groundnuts in Andhra Pradesh. Our study finds that groundnut has the highest productivity and also the major oil seeds grown. Though, there has been an increase in the trends of the improvement in the productivity of groundnuts. However, in the year 2006-2007, it has been reported that the productivity of groundnuts have been low. Therefore, in the light of policy suggestion, both the state and central government can provide subsidies and other financial incentives for farmers to invest in these technologies, which will help to boost productivity and further promote the export of oilseeds not only to increase the national wealth but also it will increase the income of farmers and will further contribute to the development of the state's economy.

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