

Trends in Area Production and Productivity of Groundnut in Uttar Pradesh: Future Business Implications

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ABSTRACT: India has been ranking among top three producers of Groundnut in the world, Gujarat, Tamil Nadu and Madhya Pradesh being the major producing states in the country. However, there has been a consistent fluctuation in the area and production over the years and across the State. Uttar Pradesh being one of the most populous state in the country has been ranking amongst the top two states as far as mustard production is concerned. However it ranks 8 as far as the production and productivity groundnut is concerned. Groundnut oil being a major cooking medium and groundnut seeds an important ingredient in the processing sector, the paper aims to analyse trends in area, Production and Productivity of Groundnut in Uttar Pradesh with future business implications. Orthogonal polynomial technique has been deployed to examine the trends.

Keywords: Trends, Polynomial, fluctuations, groundnut, area effect, productivity effect.

I. INTRODUCTION

India has been enjoying top three positions amongst the producers of Groundnut in the world and has been a major global player in the vegetable oil economy. In 2010 Groundnut in India produced 26.68 per cent of the total edible oilseeds in the primary sector comprising of Groundnut, Rapeseed/ Mustard, Soyabean, Sunflower, Sesamum, Niger and Safflower and contributed 26.95 per cent of the total edible oil of 70. 43 lakh tones produced from these seeds (Ministry of Agriculture). A scrutiny of the raw time series data of the area production and productivity reveals that though area and production have shown fluctuations over the years the increase in productivity in recent past has been encouraging and stabilized the production. In spite of the fact that area was growing negatively. In 1964-65 area under groundnut was 7.38 million hectare which rose to 8.53 million hectare in 1988-89 and then it declined to 5.53 million hectare in 2013-14. Production has shown considerable fluctuation and stood at 9.67 million tonnes in 2013-14. In the state of Uttar Pradesh in area under groundnut has decreased tremendously from 3.29 million hectare in 1964-65 to 1.34 million hectare in 1988-89 and further to 0.96 million hectare in 2013-14. Production has shown similar trends and yield have been stagnant. The table given below gives the comparative picture of area production and productivity of Groundnut in India and Uttar Pradesh:

Table 1.1: Area Production and Productivity of Groundnut in India and Uttar Pradesh

Year	Area (000 hectare)		Production (000 tonnes)		Productivity (kg/hectare)	
	India	U.P.	India	U.P.	India	U.P.
2009-10	5480	91 (1.66%)	5430	61 (1.12%)	991	670 (67.08%)
2010-11	5860	85 (1.45%)	8260	84 (1.01%)	1411	988 (70.02%)
2011-12	5260	92 (1.75%)	6960	92 (1.32%)	1323	1000 (75.58%)
2012-13	4720	94 (1.99%)	4700	94 (2%)	914	1000 (109.40%)
2013-14	5530	96 (1.74%)	9670	86 (0.88%)	1764	896 (50.79%)

Source: Ministry of Agriculture

Note: Figures in brackets are percentage to all India

Between 2009-10 to 2013-14 there has not been much increase in the share of Uttar Pradesh in the all India area coverage under Groundnut which increased marginally from 1.66 per cent to 1.74 per cent in 2013-14. The share of production on the other hand declined from 1.12 per cent in 2009-10 to 0.88 per cent in 2013-14 indicating towards the technological issues manifesting in the productivity of crops. In terms of value the contribution of groundnut in the total value of output in agriculture has been very neagr, more or less same at constraint and current prices ranging from 2.6% in 2006-07 to 2.4% in 2010-11.

II. REVIEW OF LITERATURE

The review of literature brings out the challenge of increasing the productivity of oilseeds in light of international edible oil markets. Between 94-95 and 2003-04 the world primary vegetable oil production grew by 47 percent while the trade grew by 66%. A huge gap exists in the demand and supply. The existing yield gap from 1212 kgs/Ha in India to 1626 kgs/Ha of the world average (agricultural statistics at a glance) in triennium ending 2012 suggests vast potential that needs to be tapped.

Authors have also pointed out that in India oilseed cultivation is becoming unattractive mostly because of low yields, Trade liberalization has also led to low edible oil prices exerting a decreasing pressure on oilseed prices.

B.Madhusudhana states though ranking second in the world production India ranks 8th in the groundnut productivity Cultivation in marginal lands, low technology, rainfed areas and inadequate plant potential are some of the reasons cited for low productivity As pointed out that liberalization led to low remunerative prices to the farmers Roy Ramendu feels that the Technology Mission which has great hopes for improving the oilseed scenario in India and the states resulted in limited success.

A K Bharti and others (2012) point out that in Uttar Pradesh the production gains in oilseeds were largely due to the expansion in area rather than in Productivity. Authors go on to say that the favourable situation created through the technology mission on oilseeds resulted in expansion of marginal lands causing a decline in average yields. In Uttar Pradesh the area under oilseeds increased from 2.97% in 1970-71 to 3-25% in 2005-06.Among the oilseed crops drastic reduction in the area has been found under groundnut(1.47% to 0.42%) AK Bharti et al

The studies by the same authors indicate that overall groundnut production in Uttar Pradesh was not satisfactory before and after the technology mission covering a period of 35 years from 1970-71 to 2005-06.Analysing a combined effect of area and productivity they found that though in the first half of the study the production differential was negative but with a positive share of 51% of productivity. But the drastic decline in area contributed negatively by -117% which made the production differential negative.

Several studies(review by Vaidyanathan 1934, Panse and others 1947 ,Sekhar and associates 1978,Saini and associates 1975) substantially indicate that use of fertilizers in the form of Nitrogen and Phosphorous, and the application of micronutrients like Zinc,Boron and Molybdenum increased the yield of groundnut in parts of Maharashtra, Madhya Pradesh,Tamil Nadu,Bihar and Punjab.

Ma Cynthia Bantilan(2012) point out that huge inefficiency exists in groundnut production system which can be removed by a good seed variety replacement efforts and adoption of low cost technology. A better integration with the processing sector through clusters can also help stabilize the groundnut production in India .

Anil Kumar Singh and others have studied the oilseed and pulses scenario in eastern India during 2050-51. In their article they opine that deviations in agro-climatic conditions and its impact on rainfall will substantially impact the potential of oilseeds in eastern India. 27 districts of eastern UP fall in this region according to the classification of Indian Council of Agricultural Research. Summer Groundnut is also having good potential waiting to explore its possibilities in this region (Chand and Singh, 2012).

Amongst the major Groundnut producing states in India Gujarat ranks first and second in area and production respectively while Tamilnadu figures on top as far as the productivity of the Groundnut is concerned. Comparatively the state of Uttar Pradesh stands 8th in all the area production and productivity. Within the state Groundnut comprised 8.55 per cent of the total area under five major edible oilseeds as shown in the table below

Table 1.2: Area and Production of Major Edible Oils in Uttar Pradesh

Crop	AREA	% to All U.P.	PROD	% to All U.P.
Rapeseed Mustard	604264.7	57.49	689602.7	81.25
Groundnut	89839	8.55	78551.67	9.26
Til	339993	32.35	57074.33	6.72
Sunflower	3603	0.34	7194.333	0.85
Soyabean	13388	1.27	16318	1.92
All U.P. 5 Crops	1051088	100.00	848741	100.00

Authors calculation from Statistical Diary of Uttar Pradesh

The contribution in production was 9.26 per cent of the total of five edible oilseeds grown in Uttar Pradesh namely Groundnut, Rapeseed/ Mustard, Sesamum, Sunflower and Soyabean. This distribution is based on average of three years triennium ending 2011-12

Objectives

It is worthwhile to study the dynamics of Groundnut cultivation in Uttar Pradesh keeping in view the vast yield gaps that leave tremendous potential for growth. This paper aims to

- To study the empirical trends in area under cultivation, production and productivity of Groundnut in Uttar Pradesh
- To analyse the growth rates and area and productivity effects as the preliminary determinants of production
- To analyse business implications in the future

III. METHODOLOGY

We have used secondary data of Groundnut Area, Production and Productivity which has been collected from statistics published by Ministry of Agriculture and Farmers Welfare. A fifty year time series has been used to apply orthogonal polynomial technique to get trends in area production and productivity. In order to know relative strength of area or productivity in production, Area and Productivity effect has been calculated with the help of simple regression analysis. SPSS has been used for data processing and analysis. The trend fitting by the use of the orthogonal polynomial has been simple as it does not assume any particular degree of the polynomials. The tabulated values of the ξ have been obtained from the statistical table for the required number of observations (N=50). If a polynomial of five degrees has to be fitted the final equation obtained would be of the type:

$$Y_t = a_0 + a_1 \xi_1 + a_2 \xi_2 + a_3 \xi_3 + a_4 \xi_4 + a_5 \xi_5 + a_n \xi_n$$

Where Y' is the estimated trend value while a_0, a_1, a_2, a_3, a_4 and the a_5 are the constraints and Where Y' is the estimated trend value while a_0, a_1, a_2, a_3, a_4 and the a_5 are the constants and ξ are the tabulated values of the polynomials' for required number of observations.

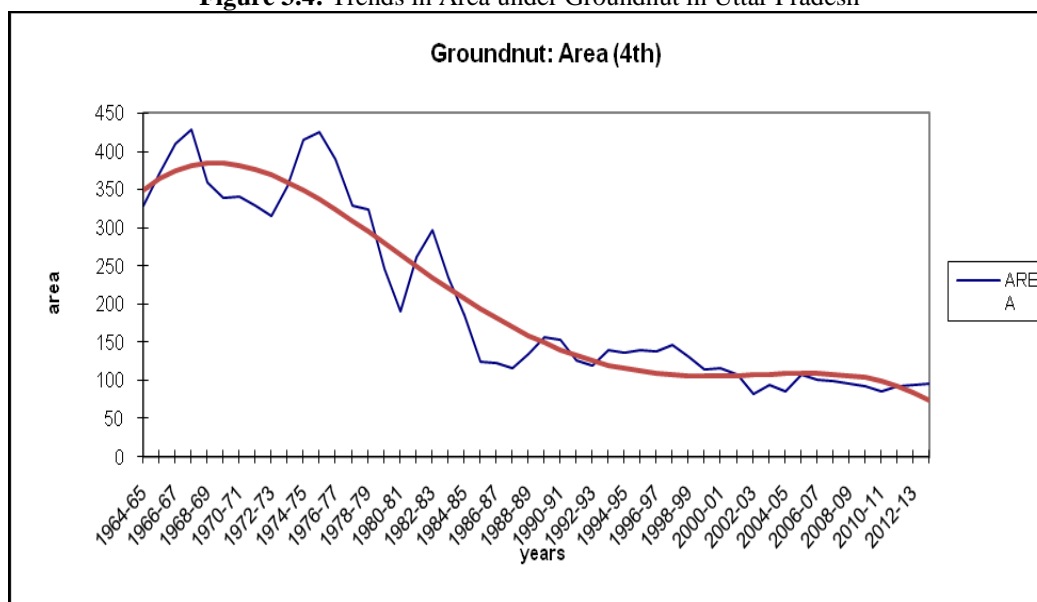
Trends in area under cultivation

In order to get the best fit we have taken the trend line of Groundnut area at 4th degree polynomial corresponding to the equation given below:

$$Y_t = 2080432.82 + 534914.15 \xi_1 + 33366.41 \xi_2 + 13346.39 \xi_3 + 19178.41 \xi_4 + 1454.66 \xi_5$$

The overall compound annual growth rate of area on actual and estimated time series shows a negative growth rate of -3.53 per cent. Figure 1.1 below illustrates the movement of trends of estimated values against the actual.

Figure 3.4: Trends in Area under Groundnut in Uttar Pradesh



The 4th degree fit apparently shows two points of inflexions indicating two phases:

Table 1.3: Phase wise Compound Annual Growth Rate (CAGR) of area under Groundnut in Uttar Pradesh

Phase	Period	CAGR (%)
Phase I	1964-65 to 1969-70	1.918164862
Phase II	1969-70 to 2013-14	-3.632386465

Source: Author's Calculation on secondary data obtained from IndiaStat.com

In the first phase during the period 1964-65 to 1969-70 the area increased at the rate of 1.92 per cent. But in the second phase lasting till the terminating year of the study (2013-14) it fell consistently at the rate of -3.63 per cent annually.

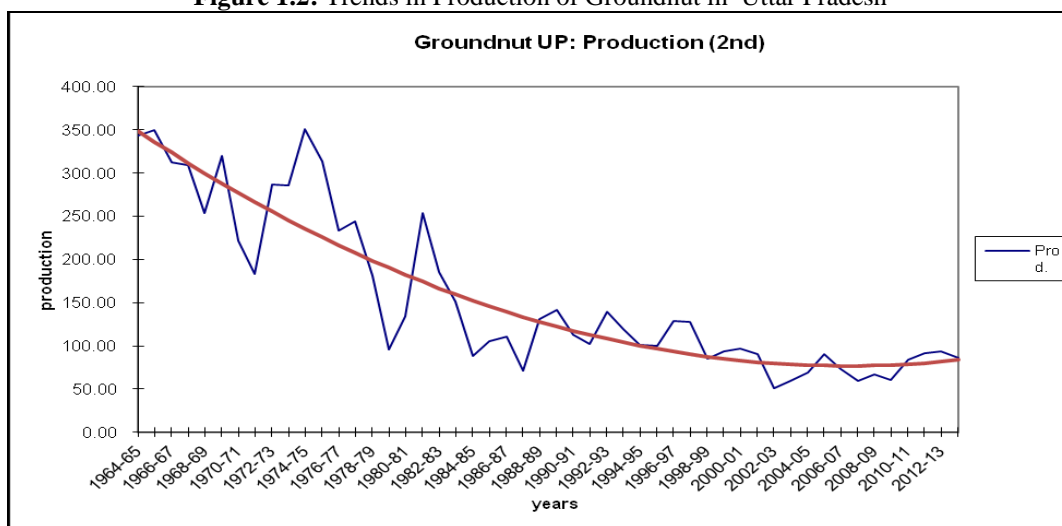
Trends in Production

The second degree polynomial was found to be the best fit corresponding to the equation:

$$Y_t = 1228778.94 + 304536.92 \xi_1 + 39832.87 \xi_2 + 107.11 \xi_3 + 616.93 \xi_4 + 1634.04 \xi_5$$

Both the overall actual and estimated series show a growth rate of -3.34 per cent. Figure 1.2 exhibits the trends.

Figure 1.2: Trends in Production of Groundnut in Uttar Pradesh



The trends in production are similar to those in area except that area increased initially and then declined continuously.

Table 1.4: Phase wise Compound Annual Growth Rate (CAGR) of production of Groundnut in Uttar Pradesh

Phase	Period	CAGR (%)
Phase I	1964-65 to 2013-14	-3.342

Source: Author's Calculation on secondary data obtained from IndiaStat.com

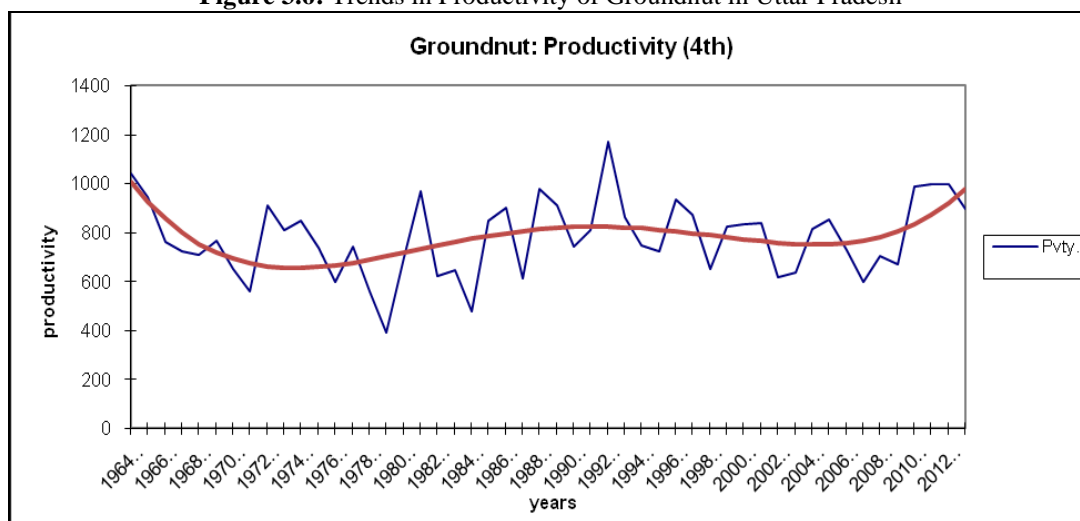
Trends in Productivity

The 4th degree polynomial was found best fit in case of productivity of Groundnut in Uttar Pradesh corresponding to the equation below:

$$Y_t = 30328029.62 + 30120.18 \xi_1 + 41289.09 \xi_2 + 28277.55 \xi_3 + 197474.82 \xi_4 + 26194.14 \xi_5$$

The actual and estimated series exhibits a positive growth rate of 0.2 per cent. The figure 1.3 below reveals four distinct phases.

Figure 3.6: Trends in Productivity of Groundnut in Uttar Pradesh



The phase wise growth rates are given in the table below

Table 1.5: Phase-wise Compound Annual Growth Rate (CAGR) of Productivity of Groundnut in Uttar Pradesh

Phases	Period	CAGR (%)
Phase-I	1964-65 to 1974-75	-4.20
Phase-II	1974-75 to 1991-92	1.511
Phase-III	1991-92 to 2004-05	-0.796

Phase-IV	2004-05 to 2013-14	2.942
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In the first phase there is sharp decline in the productivity of Groundnut which shows a negative growth rate of -4.20 which turns positive in the second phase. In the third phase again there is decline with a negative growth rate of -0.796 per cent which is arrested and strengthened in the last phase with a growth rate of 2.94 per cent.

Area and Productivity Effect

The comparative picture of the overall and estimated growth rates of area production and productivity as given in the table below seems interesting

Table 1.6: Compound Annual Growth Rate of Area, Production and Productivity of Groundnut in Uttar Pradesh

1964-65 to 2013-14	Area	Production	Productivity
Overall Actual	-3.535	-3.342	0.200
Overall Estimated	-3.535	-3.342	0.200

Source: Author's Calculation on secondary data obtained from IndiaStat.com

Whereas both area and production exhibit a negative growth rate the productivity shows positive trend. It seems clear that this small positive rate of growth explains marginally lower rate of growth in production as compared to the area. It seems appropriate at this point to examine the area and productivity effects.

To analyze the stability/ instability in overall Groundnut Production in Uttar Pradesh we need to see the area and productivity effect. To achieve this we have treated production as dependent variable and Area and Productivity as independent variable. In order to obtain comparability we have computed the growth rates in conformity with phases and corresponding time periods of dependent variable i.e., production.

The sub-divisions of the trend line by phases will pose the problems of comparisons of the growth rates since the trend phases in the dependent and the independent variables may not be as uniform as desired for comparison. In this case there is a single phase in the estimated values of Production hence problem has simplified and estimated values of independent variable have also been taken for the single phases. The results have been presented in the table below:

Table 1.7: Overall and Phase wise Compound Annual Growth Rates as well as Area and Productivity Effect of Groundnut in Uttar Pradesh

Period/ Phases	Growth Rates (%)			Estimated Regression between Production as Dependent Variable & Area as independent variable			Estimated Regression between Production as Dependent Variable & Productivity as independent variable		
	Area	Production	Productivity	Constant	Reg.Coeff. associated with Area	R ²	Constant	Reg.Coeff. associated with Productivity	R ²
Actual 1964-65 to 2013-14	-3.535	-3.342	0.200	.073 (.259)	.934 (17.172)	.860	1.709 (.682)	.480 (1.271)	.033
Estimated 1964-65 to 2013-14	-3.535	-3.342	0.200	.205 (1.406)	.912 (32.606)	.957	15.177 (3.191)	-1.541 (-2.156)	.088
Single Phase (1964-65 to 2013-14)	-3.535	-3.342	0.200	.205 (1.406)	.912 (32.606)	.957	15.177 (3.191)	-1.541 (-2.156)	.088

Source: Author's Calculation on secondary data obtained from IndiaStat.com

Note: Figures in bracket indicate t values

It is evident that initially the area shows an increase but then there is a sharp and continuous fall. A significant R square indicates that area effect has dominated, though negatively. The productivity effect has not been significant in comparison though it has helped production marginally indicated by a slight lower growth rate of production (-3.342%) compared to the growth rate of area (-3.535%). In other studies too (A K Bharti and others, 2012) where combined effect of area and productivity have been studied, similar situation has emerged. Over a thirty year period where a positive effect of 51 % by productivity the first half of the study period was nullified with a -117 % negative contribution of area which made production differential negative.

IV. FUTURE AND BUSINESS IMPLICATIONS:

Through the oilseeds have a meagre role to play in the state economy. The food grain production dominated the scenario with 446.64 million tonnes of production in 2009-10 of which cereal comprised 95.73%, pulses 4.27% of the total production and oilseeds constituted only 1.81%. In terms of value also the share of oilseeds in the value of output in agriculture of the state has been varying between 2.6% to 2.4% between 2006-07 to 2010-11 (source state planning Institute). Nevertheless, importance of oilseed cannot be disregarded. Population of Uttar Pradesh will reach 26 crores in 2020 for which 54.19 lakh metric tonnes oilseeds will be

required. For nutritional and food security oilseed crops must be promoted. India is well placed globally in the groundnut production but rising consumption has left little scope for export of oil. In Uttar Pradesh too the major cooking medium happens to be mustard oil but groundnut enters like business stream in the form of oil, direct consumption, as snacks in the form of roasted, seeds and crackers, chickkies, peanut butter and namkeens. The oil cake being rich in protein is also preferred for animal and poultry feed.

V. CONCLUSION

The very fact that both area and production of groundnut in the state has declined considerable over 50 years it clearly implies that the state is dependent on other states like Gujarat, Tamil Nadu and Madhya Pradesh for meeting its demand of groundnut related products. Several processed products from other States can be seen on the market shelves in the State. Uttar Pradesh must become self sufficient in groundnut to strengthen its overall economic position and also contribute to the national economy. Several policy and technological issues must be addressed in order to arrest the decline in the area by giving due weight to oil seeds crop like sugarcane and wheat and steps must be taken to evaluate the low yield levels which shall go a long way in establishing the production in the State.

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