

STATISTICAL MODELING ON GROWTH RATES OF GROUNDNUT CROP FROM 1990 TO 2014, IN INDIA

Dr. P. Kalpana*

Abstract

Groundnut is one of the major source of edible oil in India. Around one-fourth of country's total edible oil is produced from groundnut. In this paper different linear and nonlinear regression models are considered to analyze the growth rates of area, production, yield and seeds of groundnut crop in India from 1990 to 2014. Also observed point to point growth rates in every year. To study the growth rates and patterns of groundnut crop, the secondary data is collected from various sources like FAO, Directorate of Economics & Statistics etc.

Keywords: Statistical Models; Growth rates; Area; Production; Seeds.

* **Assistant Professor of Mathematics, Madanapalle Institute of Technology & Science, India**

1. Introduction

Groundnut was first introduced by the Portuguese from Brazil to West Africa and then to southwestern India in the 16th century. Groundnut is the 13th most important food crop of the world. It is the world's 4th most important source of edible oil and 3rd most important source of vegetable protein. India is the second largest producer of groundnut in the world after China with around 20 per cent of world's total production. It is called the 'king' of oilseeds and accounts for nearly 25 percent of the total oilseed production of the nation. Almost every part of groundnut is of commercial value. Now-a-days the groundnut is utilized in many forms like groundnut oil, groundnut cake, groundnut kernels, groundnut shell and groundnut straw. Although there has been a significant increase in oilseed production since 1960s, the demand for oilseed production is continuously going up due to increase in population growth rate and per capita edible oil consumption. However, due to the gap between domestic availability and actual consumption of edible oils, India has to resort to import of edible oils.

Hussaini Yusuf Ibrahim et al., 2010 have done Descriptive statistics, Net Farm Income Model and Data Envelopment Analysis (D.E.A) to study the economic empowerment potentials of groundnut processing by women in rural areas of north central Nigeria. Balakrishnama Naidu et al., 2010 studied trends for Area, Production and Yield of Groundnut, Sesame, Sunflower and total Oilseeds of Andhra Pradesh from 1996-97 to 2011-2012. Ibrahim Usman et al., 2013 have done gross margin and cost benefit analysis to study the profitability of groundnut production in Nigeria. Madhusudhana, 2013 has done a comparative analysis for groundnut crop at national level, state level, and Anantapuram district level in India. SitaRambabu et al., 2013 analyzed trends and Compound growth rates for area, production and productivity of groundnut in Andhra Pradesh over a period of 1995-96 to 2010-2011. Parmar, 2013 observed Flowering and Peg initiation stage was the most critical phase for moisture requirement of groundnut using regression. Pal and Mazumdar, 2015 applied different nonlinear growth models to forecast groundnut production in India. Also used Monomolecular and Logistic models to forecast production from 2014-15 to 2019-20. Idoko Micheal Daniel and Sabo Elizabeth, 2014 interviewed 200 farmers using multi stage sampling procedure. In this study it is observed there is a need to improve bio-pesticides, harvesting, processing techniques, credits and farm input for groundnut producers Nigeria. Kanaka and Chinnadurai, 2015 discussed policy analysis matrix

techniques to model the analysis of profitability from groundnut farming in Tamil Nadu. Suresh Banakara and Gadwale, 2016 have observed trends and patterns of groundnut area production and productivity in India, Karnataka and Dharwad district from 1996-2000 to 2001-2011.

However there is a little evidence on development of statistical models to study the growth rates of groundnut crop. Pal and Mazumdar, 2015 they have applied nonlinear growth models to forecast groundnut production in India. They have not considered the remaining aspects of crop like harvested area, yield, and seed. The core objective of this work is to study the growth rates of harvested area, yield, production and seed for groundnut crop in different directions by using statistical methods.

2. Research Method

The present study utilized the time series data from 1990 to 2014 on area, yield, production and seed of groundnut collected from FAO, Directorate of Economics & Statistics etc. Nonlinear growth models have widely been used to measure agricultural growth in terms of growth rate. These are also employed in modeling and forecasting production, productivity area etc. of various commodities. Different types of non linear growth models were fitted for area, yield, production and seed of groundnut crop. Based on highest R^2 the cubic model was selected as best fitted model for groundnut crop from 1990-2014. The cubic model $y_i = b_0 + b_1t_i + b_2t_i^2 + b_3t_i^3$ was fitted to the data to compute the growth rates. The data is analyzed by using MS-EXCEL and SPSS software's. The results and used models are presented in tables-1&2.

Table-1: Area/yield /production /seeds with point to point year wise growth rates of groundnut crop from 1990 to 2014.

Year	Area harvested in Ha	Area growth rates	Yield in tons/Ha	Yield growth rates	Production in tons	Production growth rates	Seed in tons	Seeds growth rates
1990	8309000	-4.61	0.9044	-2.74	7514700	-7.23	606753	4.32
1991	8667900	4.32	0.8185	-9.50	7094600	-5.59	571620	-5.79
1992	8166000	-5.79	1.0489	28.15	8565000	20.73	582540	1.91
1993	8322000	1.91	0.9409	-10.30	7830000	-8.58	549430	-5.68
1994	7849000	-5.68	1.0271	9.16	8062000	2.96	526680	-4.14

1995	7524000	-4.14	1.0073	-1.93	7579000	-5.99	531720	0.96
1996	7596000	0.96	1.1378	12.96	8643000	14.04	496300	-6.66
1997	7090000	-6.66	1.0395	-8.64	7370000	-14.73	517720	4.32
1998	7396000	4.32	1.2144	16.83	8981600	21.87	480711	-7.15
1999	6867300	-7.15	0.7657	-36.95	5258100	-41.46	459102	-4.50
2000	6558600	-4.50	0.9881	29.05	6480300	23.24	436667	-4.89
2001	6238100	-4.89	1.1265	14.01	7027500	8.44	415485	-4.85
2002	5935500	-4.85	0.6943	-38.37	4121100	-41.36	419090	0.87
2003	5987000	0.87	1.3574	95.51	8126500	97.19	464828	10.91
2004	6640400	10.91	1.0202	-24.84	6774400	-16.64	471520	1.44
2005	6736000	1.44	1.1867	16.32	7993300	17.99	393057	-16.64
2006	5615100	-16.64	0.8661	-27.02	4863500	-39.16	440440	12.05
2007	6292000	12.05	1.4594	68.50	9182500	88.80	431543	-2.02
2008	6164900	-2.02	1.1627	-20.33	7168100	-21.94	383425	-11.15
2009	5477500	-11.15	0.9911	-14.76	5428500	-24.27	410200	6.98
2010	5860000	6.98	1.4104	42.31	8265000	52.25	371700	-9.39
2011	5310000	-9.39	1.3115	-7.01	6964000	-15.74	333900	-10.17
2012	4770000	-10.17	0.9843	-24.95	4695000	-32.58	367500	10.06
2013	5250000	10.06	1.8042	83.30	9472000	101.75	364000	-0.95
2014	5200000	-0.95	1.261	-30.11	6557000	-30.77	354000	-2.75
Ann ual Aver age	6632892		1.1011		7200668		458884. 4	
S.D.	1113663		0.2435		1437279		74072.5	

Table-2: Best fitted non-linear cubic model for area/production/yield/seed for groundnut crop

Item	Equation	R Square	Sig.	Constant	b1	b2	b3
Area	Cubic	0.913	0	8972438	-281186	9099.2	-164.51
Yield	Cubic	0.33	0.035	0.87	0.037	-0.003	9.71E-05
Production	Cubic	0.076	0.635	7877337	8770.56	-11817	430.953
Seed	Cubic	0.904	0	616881	-17142	204.688	4.636

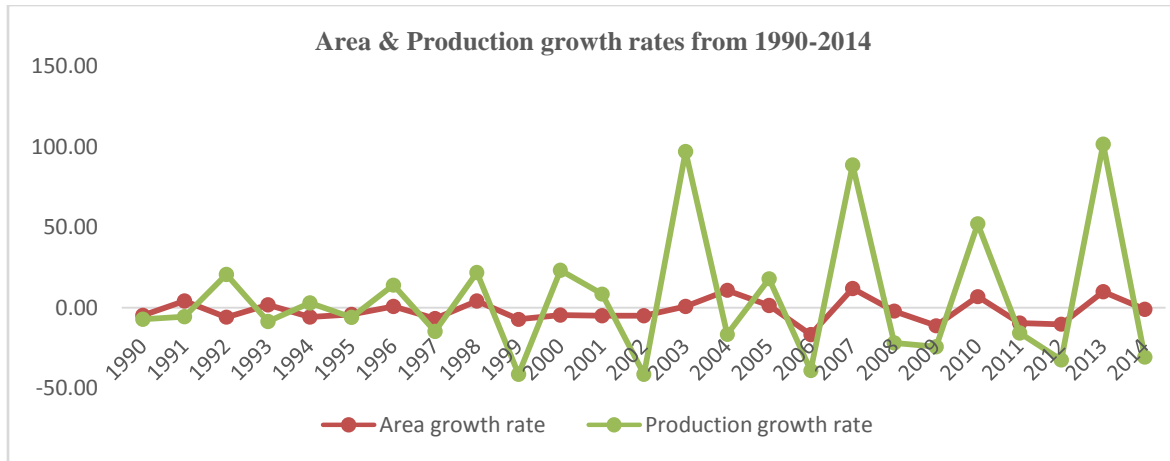


Figure 1. Area & Production growth rates from 1990-2014

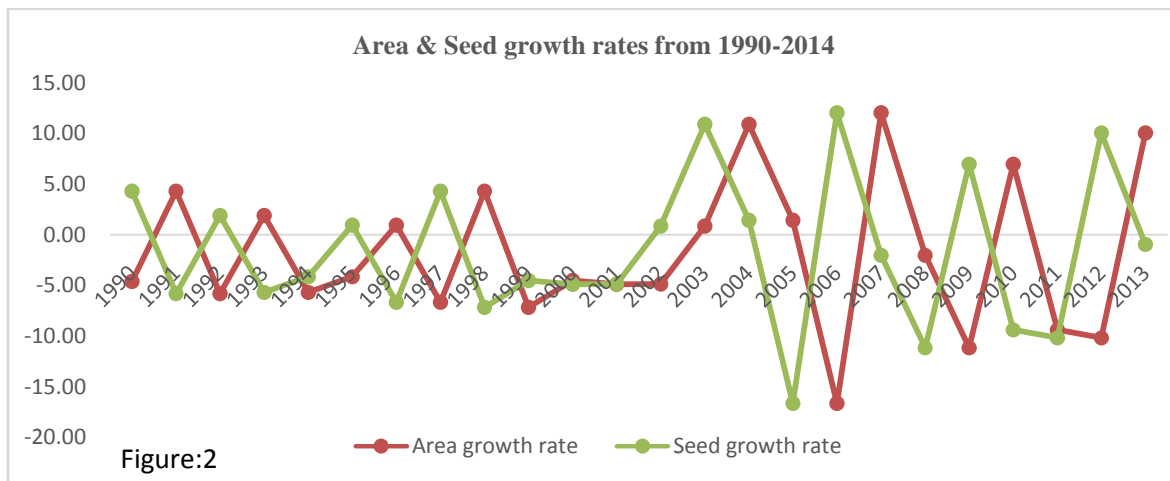


Figure:2

Figure 2. Area & Seed growth rates from 1990-2014

3. Results and Analysis

From the table-1, it is observed that maximum utilized harvested area is 8667900 Ha in 1991 and minimum utilized harvested area is 4770000 Ha in 2012. It is also observed that utilization of harvested area is following decreasing pattern from 1990 to 2014. It is observed that highest yield is 1.8042 tons/ Ha in 2013 and smallest yield is 0.6943 tons/ Ha in 2002. It is observed that maximum production is 9472000 tons in 2013 and minimum production is 4121100 tons in 2002. It is observed that maximum seed is 606753 tons in 1990 and minimum seed is 333900 tons in 2011. The annual average with S.D. of harvested area, yield, production and seed are 6632892Ha, 1.101136 tons/ Ha, 7200668 tons, 458884.4 tons and 1113663, 0.243511, 1437279 and 74072.5. It has been observed from table- 2 that all the four aspects area, yield, production

and seed have been fitted with suitable models but area, yield, production and seed followed cubic model only with highest R^2 values 0.913, 0.33, 0.076 and 0.904 and the four aspects area, yield, production and seed are statistically significant.

4. Conclusion

Groundnut crop is the major oil seed crop in India and it plays a vital role in bridging the vegetable oil deficit in the country. It is noticed that the utilization of harvested area is declined from 1990 to 2014. From the statistical analysis it is observed that area, yield, production and seed growth rates are statistically significant. Figures-1&2, it is found that area and production growth rates as well as area and seeds growth rates are following opposite directions in most of the years. These results show that poor farming is running in groundnut crop from 1990 to 2014 in India. The government it is required to take more care for groundnut cropping in India.

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