

Economic Analysis of Growth Rates of Foodgrain and Non-foodgrain Crops: A Case of Andhra Pradesh

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Abstract

Contemporarily in Andhra Pradesh due to climate change, monocropping and intensification of resources, there is a shift in cropping pattern from low value crops to high value crops. Further there is also reduction in productivity of food crops over the years, but the magnitude and direction of change is unknown. To understand the situation the growth rates of major crops of Andhra Pradesh were studied using the time series data from 1980-81 to 2009-2010. The growth pattern was examined by fitting on exponential function ($Y=ABt$). Growth rates showed a significant positive growth in area under pulses, oilseeds, commercial crops, fruits and vegetables while cereals showed significant negative growth. The area under rice, jowar, bajra, and ragi are experiencing a substantial annual declining trend. The growth in area under total oilseeds and commercial crops except tobacco has recorded a mild annual increment. Similarly the production of High yielding varieties of cereals, pulses, oilseeds, commercial crops, vegetables and fruits showed a significant positive growth. The productivity of different crops recorded significant growth in the case of cereals, pulses and commercial crops. Productivity of oilseeds and fruits recorded moderately positive growth. The productivity of vegetables registered was highly significant and positive growth. It is concluded that the crops viz., maize, pulses, oilseeds, cotton, fruits and vegetables showed better performance during the entire period of the study. This indicates transformation in cropping pattern from redundant low valued crops to high valued commercial crops.

Keywords: Growth rates, Major crops, Productivity

Introduction

In India, agriculture and other allied activities contribute significantly to the Gross Domestic Product (GDP), accounting for nearly 14 per cent of the total GDP. It provides employment to around 52 per cent of the total work force while contributing 10 per cent of its total export. India, with only 2.3 per cent of world's total land area supports 18 per cent of human and 15 per cent of livestock population in the world.

Andhra Pradesh is blessed with varied agro-climatic conditions which permit the farmers of the state to cultivate not only a diversity of crops in a season, but also a number of crops like grains, pulses, oilseeds, commercial crops and horticultural crops across different seasons of the year. Agriculture assumes an essential part in the economy of State and the better performance in terms of development. In spite of the fact that its commitment to gross state domestic product (GSDP) is around one-fourth, agriculture gives occupation to almost 60 percent of labour force. Among the states, it was the only state in the country which went in for the Green Revolution in rice cultivation in the 1970s. The contribution of agriculture GSDP was higher in Andhra Pradesh as contrasted with all India level. The per capita value

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of GSDP from agriculture is relatively higher in the state when compared to all India. There have been huge changes in the structure and execution of the agrarian economy in the state. Lately, the state has additionally been confronting an emergency in horticulture with a high rate of suicides by farmers. (HDR-2007)

Andhra Pradesh is surplus rice producing state in the country in addition to Assam and frontline states as it is having command areas like Tungabhadra, Krishna, North and South Godavari. Thus it is called as "Rice Bowl of India".

The total food grain production in the state has increased from 99.91 lakh tons during 1980-81 to 155.99 lakh tones during 2009-10. The state has huge arable zone under distinctive crops having the capacity to expand further. It has paddy area of 34.41 lakh hectares, jowar area of 3.85 lakh hectares, bajra area of 0.45 lakh hectares, maize area of 7.83 lakh hectares, wheat area of 0.10 lakh hectares, ragi area of 0.45 lakh hectares making a total cereal area of 47.09 lakh hectares. Bengal gram has an area of 6.47 lakh hectares, red gram area of 4.63 lakh hectares, black gram area of 4.29 lakh hectares with a total pulse area of 19.33 lakh hectares. The area under groundnut is 13.01 lakh hectares; cotton and sugarcane are grown in area of 14.68 lakh hectares and 1.57 hectares respectively. It is desirable to study the growth in area, production and productivity of major crops in Andhra Pradesh. The present study aims at examining the growth rates in area, production and productivity of major crops in the state.

Material and Methods

The study on growth in area, production and productivity of major crops was purposively taken up in Andhra Pradesh. The secondary data on area under different crops, production and productivity of crops were used to analyze the trends. Data for the period 1980-81 to 2009-10 at the state levels on area, production and yield were collected from Season and Crop Reports, Statistical Abstracts and Handbook of Statistics for the respective years published by the Directorate of Economics and Statistics, Government of Andhra Pradesh and Agricultural Situation in India by Government of India were used.

To assess the impact of new technological innovations the whole period was divided into two sub-periods i.e., Pre WTO and Post WTO period. Referred to as Sub-period I: 1980-81 to 1994-95, Sub-period II: 1995-96 to 2009-10

Estimation of growth rate

The growth rates were estimated using exponential growth functional form as under: $Y = AB^t$, taking log i.e., $\log Y = \log A + t \log B$. Where, Y = area or production or yield, A = constant, B = regression coefficient, and t = time in years starting from the base year 1970-71. The compound growth rate $(\text{Antilog of } B - 1) \times 100$ was used to calculate the growth rates in area, production and yield of major crops at state levels for the two sub-periods and the total period.

Results and Discussion

The peasants of Andhra Pradesh are enterprising, investment oriented and opting for new technologies and varieties in the State. Therefore to assess the agricultural transformation, the period wise compound growth rates of Area, Production and Productivity of food and non-food grain crops were analysed.

Annual compound growth rates in area, production and productivity of food grains

In Andhra Pradesh food grain crops accounts about 50 per cent of gross cropped area. The area, production and productivity of all food grains fluctuated widely during the period under consideration in the State (Table 1). The growth in area under food grains in the state has recorded a mild annual decrement (-0.84 per cent). The growth in the food grains output

in the state is around two per cent per annum. The state registered a surprising growth of 3.27 per cent in the productivity of food grains. The growth in area and production under other cereals like jowar, bajra, ragi and wheat was negative while growth in area under maize was positive. Thus it can be said that the area under cereals in Andhra Pradesh is moving from coarse cereals to rice and maize.

Among the food grains, paddy occupies the foremost position as it being the staple food of Andhra Pradesh people. It can be noted from Table 1 that the performance of paddy during the entire period under reference i.e. 1980-81 to 2009-10 was found to be non satisfactory as far as area is concerned. The area decline due to two reasons i.e. decline in net irrigated area and occurrence of frequent droughts. However the growth rates of production and productivity were highly significant at one per cent level. It indicates that the production increased due to improvement in productivity. It was revealed that the area, production and productivity were declined during sub-period II when compare to sub-period I. Overall the negative growth rate of production was largely due to decline in area under paddy crop. Bathla (2008) reported similar results while studying the extent of shift in area within the cropping sector in India.

Next to rice, jowar is the principal food grain crop in the state which is sown in both Kharif and Rabi seasons mostly under rainfed conditions. Table 1 reveals that the magnitude of growth rates of area and production of jowar were negative with a tune of -6.40 and -3.65 per cent, respectively but the growth rate of productivity turned out to be positive of 2.92 during the entire period of 30 years. This shows that the decrease in production of jowar was mainly due to reduction of area under the crop. This was in line with the findings of K Prabakaran and C Sivapragasam (2014) at the state level. Across the periods, the productivity improvement had a significant role to increase production of jowar in sub-period II as compared to sub-period I.

Ragi occupies around 0.32 per cent to the gross cropped area in Andhra Pradesh. During the study period, there was a significant decrease in area and production under ragi which might be due to low output price in the market for this crop.

Bajra crop is another important coarse grain in Andhra Pradesh. The area under bajra in the state has registered a negative growth of -7.53 per cent per annum during the study period. The production of bajra recorded a negative growth rate of -5.64 per cent per annum. The productivity of bajra in the state recorded a high positive growth during the study period. The wide spread use of High Yielding Varieties coupled with irrigation and fertilizer application led to increase in productivity. The area under bajra has declined during the study period. Across the periods, the productivity improvement had a significant role to increase production of bajra in sub-period I as compared to sub-period II.

Table 1 reveals that the magnitude of growth rates of area, production and productivity of wheat were negative with a tune of -1.05 and -0.15 per cent, respectively but the growth rate of productivity turned out to be positive of 1.47 per cent which has highly significance. Across the periods, the productivity improvement had a significant role to increase production of wheat as compared to sub-period I. In general the growth rates of area and production of wheat were quite unsatisfactory during the sub-period I and the entire period.

Maize is becoming important crop in the Andhra Pradesh in recent years. The Overall growth rates of area, production and productivity has highly significant and positive. The growth rates of this crop were higher than those of any other cereal crop. The fast increment in growth rates of this crop is mostly because of its usage as raw material for poultry feed as a backward linkage for poultry industry and most importantly increase in the prices of this crop more than the MSP, in addition being a C4 plant maize yield has been increasing at the rate of 3.58 per cent per annum. In Andhra Pradesh, maize production was increasing at 7.44 per

cent per annum during the study period. Similar trend was reported by Singh and Singh (1991) and Sinha and Thakur (1993) who observed an increasing trend in yield level in their study. Looking to the period wise growth rates, it reveals that the sub-period II had the highest growth rate of production with increase in area allocation. The overall performance of maize depicted a very good picture during the period under consideration.

The total area under pulses in the state is 19.33 lakh hectares. The pulses output recorded significant increment of 4.01 per cent per annum. The reason for the increase in the output under all the pulses might be due to better relative prices. The growth in area under pulses in the state is around 1.31 per cent per annum. The productivity showed a high and significant growth rate of 2.71 per cent per annum. This growth might also be referable to the exertions of the research projects at the national and state level in improving productivity of pulses over the years; the availability of good quality seeds that minimize the incidence of soil borne diseases and the availability of improved package of practices.

Red gram is one among only a few crops, which had positive growth rates of area, production and productivity throughout the entire period as well as individual period. The growth rate in area under red gram was about 2.55 per cent per annum. Red gram production in the state is growing at around 6.74 per cent per annum, which is highly significant. The red gram productivity in the state witnessed significant annual increment of 3.41 per cent per annum. Across the periods, the productivity had a significant role to increase the production of red gram in sub-period II as compared to sub-period I. This is mainly due to release of new variety namely Maruti by ICRISAT.

The area under black gram has witnessed an annual growth of 2.33 per cent per annum. The growth in production of black gram was 2.05 per cent per annum. However black gram showed declining growth rate (-0.25 per cent) with respect to its productivity (Table 1). Similar trend was reported by Acharya *et al.* (2013) who observed decreasing trend in yield level in their study. This clearly reveals that there is a vast scope to improve the productivity of black gram in Andhra Pradesh. During sub-period I, the growth rates area and production shows highly significance while productivity shows non-significance. In sub-period II, area and production of black gram has negative growth rates, while the productivity has positive growth rate.

Growth Rates of Area, Production and Productivity of Non-foodgrains

Table 2 showed the growth in area, production and yield of major oilseeds in Andhra Pradesh. The total area under oilseeds in the state is 18.12 lakh hectares. The state registered an increase in production under oilseeds with 1.37 per cent per annum. The area under oilseeds was increasing slightly at 0.72 per cent per annum. The state registered an annual increment of 0.64 per cent growth in the productivity of oilseeds. A close observation of period wise growth rates reveals that the production performance was relatively good in sub-period I than sub-period II due to more productive area under total oilseeds.

Andhra Pradesh is one of the important states in the country to grow oil seed crops like Groundnut extensively. Table 2 reveals that, the overall area and production has negative growth rates i.e. -0.17 and -1.67 per cent, respectively. While the productivity has positive growth rate i.e. 0.95, but overall the growth rates of area, production and productivity of groundnut crop are non-significant. From this it was concluded that the negative growth rate in production during entire period was largely due to decline in area under groundnut crop. During the sub-period II, the area and production has negative growth rates, while the productivity has positive growth rate. The unfavourable terms of trade especially after the 1990s due to liberalization seem to have significantly affected the crop. Recurrent monsoon failures and incidence of bud necrosis and stem necrosis badly affected groundnut yields (Rama rao *et al.* 2008).

The state registered a highly significant increase in area under sunflower (14.36 per cent). This could be attributed to the high price prevailed for sunflower as well the Technology Mission on Oilseeds triggered sunflower cultivation in Andhra Pradesh. The significant and positive growth in production of sunflower was observed in the state with the growth rate of 17.17 per cent per annum and thus it was area led growth. However, the growth in productivity of sunflower in the state was low (2.45 per cent) when compare to area and production. During sub-period I, there were high growth rates in area, production and productivity but in sub-period II there was a decline in growth rates, which is mainly due to post economic reforms which led to increase in import of edible oils with positive terms of trade.

This reveals that the increase in production of total oilseeds during entire period was largely due to the rapid expansion of area under total oilseeds. This was in accordance with the findings of Singh and Dhaliwal (1993) at all India level. Thus there is a vast scope to improve the productivity of total oilseeds in Andhra Pradesh.

Sugarcane is the main sugar crop in Andhra Pradesh. The state registered a highly significant increase in output of sugarcane (2.03 per cent). Irrigated area growth, better prices and less labour requirement contributed a lot to the growth of total area under sugarcane. The area under sugarcane was increased by 0.68 per cent per annum. The growth performance of sugarcane productivity in the state registered an increasing growth of 0.30 per cent per annum. Samui *et al.* (2005) reported similar result while analyzing the area, production and productivity of sugarcane in Maharashtra.

The overall growth rates of area, production and productivity of cotton has positive growth rates i.e. 4.06, 4.92 and 1.96 per cent, respectively (Table 2). The estimated compound growth rates were found to be highly significant at 1 per cent level. The increase in production during sub-period I was brought about largely by expansion of area under the crop. But in sub-period II improvement in productivity had contributed to increase in production of crop.

The tobacco area was declining (-1.24 per cent). The production of tobacco was increasing at 0.84 per cent per annum during the study period. The yield growth of tobacco in the state was increasing at the rate of 2.12 per cent per annum. During sub-period II the production performance of tobacco was better than that of sub-period I. The increase in production of tobacco crop was largely brought about by the improvement of productivity. The findings of the study at all India level are in line with the results obtained by Acharya *et al.* (2013).

The growth in area, production and productivity of total fruits are depicted in Table 2. The growth in area under total fruits has recorded highly significant increment of 6.38 per cent per annum. The production of total fruits significantly increased (7.10 per cent) during the study period. This might be due to the rapid expansion of area under fruits crops. Moreover, the increase in demand for fruits, better prices, relatively higher income with improved management practices and difficulties faced in rainfed farming like drought and scarcity of labour in recent years encouraged the growth in fruits production. The production performance of fruit crops was relatively very high during sub-period II when compared to entire period of study. This is due to stimulus given by Government of India through NHM.

In general, a significant growth in area and production of vegetables was observed during the study period (Table 2). The increase in demand for vegetables, better prices and improvement in income levels with improved varieties and production technology in recent years have encouraged the growth in vegetable production in the state. During the sub-periods I and II the area, production and productivity of vegetable crops has highly significant positive growth rates. The production

performance of vegetable crops was relatively very high during sub-period II when compared to entire period of study.

The increase in area under horticulture crops is credited to the State's policy of promoting horticulture as a measure of risk minimization under schemes like Andhra Pradesh Micro Irrigation Project (APMIP), National Horticulture Mission (NHM) and RKVY for post harvest technology.

Conclusion

The study revealed that the area under jowar, bajra, ragi and wheat are experiencing a substantial annual decrement. The area under rice has recorded a mild annual decline. The overall area under cereals is revealed to be decreasing annually. This is a good sign for efficient use of natural resources in the state. The area under pulses, sunflower, cotton, vegetables and fruits in the state is increasing year after year. It is concluded that the crops viz., maize, pulses, oilseeds, cotton, fruits and vegetables showed better performance during the entire period. The production of cereals, pulses and fruits increased due to both production and productivity improvement. The production of maize and sunflower increased due to only area expansion rather than productivity improvement. Thus there is a need to take up productivity enhancing measures in these crops like varietal improvement, improved cultural practices, distribution of planting materials, disease control measures, and selection of appropriate crop according to agro climatic conditions and irrigation facilities. While the production of jowar, bajra, ragi, and wheat increased due to productivity improvement only (Figure1). The rate of increase in production of maize, red gram, total pulses, sunflower, cotton, fruits and vegetables was noticed to be higher in the State during the study period. The improvement in productivity was found in maize, wheat, red gram, total pulses and fruits. It was concluded that the shift from low value crops to high value crops like pulses, oilseeds, cotton, fruits and vegetables brings about better standard of living and development in farming community.

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Table 1: Compound Growth Rates of Foodgrain Crops

Sr. No	Crop	Sub-period I 1980-81 to 1994-95			Sub-period II 1995-96 to 2009-10			Overall period 1980-81 to 2009-10		
		A	P	Y	A	P	Y	A	P	Y
1	Paddy	0.13	2.17**	2.11***	-0.24	1.72	1.72***	-0.01	1.72***	1.57***
2	Ragi	-5.11***	-3.63***	1.54***	-6.73***	-6.56***	1.21	-5.73***	-5.08***	0.49
3	Jowar	-6.24***	-4.51***	1.84**	-7.32***	-2.21**	5.49***	-6.40***	-3.65***	2.92***
4	Bajra	-9.76***	-8.44***	1.54	-6.28***	-4.67**	1.28	-7.53***	-5.64***	1.90***
5	Wheat	-4.49***	-3.89**	2.70	-0.91	2.74	3.60**	-1.05**	-0.15	1.47***
6	Maize	-0.26	2.20	2.56*	7.19***	10.44***	3.02***	3.76***	7.44***	3.58***
7	Red gram	2.62***	4.21	2.43	2.18***	6.40***	4.22**	2.55***	6.74***	3.41***
8	Black gram	7.93***	8.63***	0.66	-1.98*	-1.53	0.18	2.33***	2.05**	-0.25
9	Total pulses	1.07***	3.41***	2.31***	1.57**	6.35***	4.90***	1.31***	4.01***	2.71***
10	Total foodgrains	-1.93***	1.16*	4.33***	0.005	2.89***	2.91***	-0.84***	1.83***	3.27***

***, **, * Significance at 1, 5 and 10 per cent level of significance. Area in 000' ha, production in 000'tones, yield kg/ha.

Table 2: Compound growth rates of non-foodgrain crops

Sr. No.	Crop	Sub-period I 1980-81 to 1994-95			Sub-period II 1995-96 to 2009-10			Overall period 1980-81 to 2009-10		
		A	P	Y	A	P	Y	A	P	Y
1	Groundnut	4.54***	5.48***	0.89	-2.39***	-5.57	4.18	-0.17	-1.67	0.95
2	Sunflower	40.74***	47.24***	4.66***	1.96	4.47***	2.49*	14.36***	17.17***	2.45***
3	Total oilseeds	4.71***	6.24***	1.45	-1.34**	0.87	2.24	0.72**	1.37**	0.64
4	Sugarcane	0.43	1.78	-0.30	-0.10	0.26	0.35	0.68**	2.03***	0.30**
5	Cotton	4.53***	6.09***	1.23	1.50	5.18	4.48***	4.06***	4.92***	1.90***
6	Tobacco	-1.61	0.39	-1.06	-0.08	2.91	2.91***	-1.24**	0.84	2.12**
7	Fruits	4.72***	8.47***	3.57***	6.25***	9.70***	3.24*	6.38***	7.19***	0.76
8	Vegetables	3.74***	5.86***	2.03***	5.42***	8.37***	3.07***	4.97***	7.95***	3.03***

***, **, * Significance at 1, 5 and 10 per cent level of significance.

Area in 000 ha, production in 000 tonnes, yield kg/ha. Sugarcane: production in 0000'tones, yield in tonnes/ha.

Cotton: production in 000' bales and yields in kg lint/ha. Fruits and Vegetables: production in 000' metric tonn

Figure 1: Compound Growth Rates of Area, Production and Productivity of Jowar, Bajra, Ragi and Wheat