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Analysis of growth rates of rice and sorghum in Andhra Pradesh

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ABSTRACT

The growth rates of rice and sorghum for three distinct administrative and agro-climatic regions of Andhra Pradesh were studied using the time series data from 1970-71 to 1999-2000. The growth pattern was examined by fitting on exponential function ($Y=AB^t$). The growth pattern in area, production and yield of rice showed an upward trend at state and regional level except in Rayalaseema region which showed a decline in area and production. Telangana region showed highest growth rates in area, production and yield during the study period. Coastal Andhra region showed highest growth rates in terms of area, production and yield next only to Telangana region. In case of sorghum the growth rates of area and production showed a downward trend in all the regions and the state as a whole. The growth of yield in sorghum crop Rayalaseema region was highest during 1970-80 and total period followed by state as a whole and Telangana region.

Keywords: Growth rates; rice; sorghum; area; production; yield

INTRODUCTION

Andhra Pradesh is popularly known as granary of South India because of its abounding surpluses in the production of food crops. The state is not only self sufficient in food grains but also exports nearly one fifth of its rice produced. Cereals account nearly 76 per cent of the total food grains area in Andhra Pradesh. Rice, sorghum, maize, Bajra, Ragi, Korra, Varugu, Samai etc are the various cereals and millets grown in the state out of which rice and sorghum account for nearly 66.5 per cent of area and 81.7 per cent inproduction of total cereals in Andhra Pradesh during 1999-2000 hence selected for the study. Quantitative assessment of the contribution of the various factors to the growth of a crop output at the national, state or region levels is helpful in reorienting the programmes and priorities of agricultural development so as to achieve higher rates of growth. Parathasarathy (1984) measured the growth rates and instability in agricultural production for different districts

of Andhra Pradesh. He concluded that the degree of instability in agricultural production was high in all districts. The districts of north coastal Andhra combined high instability with low growth. Nalgonda district in Telugana was rather unique in having experienced high growth rates of production with low instability. Shetty (1970) analyzed trends in production at national and regional levels and to measured the contributions of three important components viz area, yield per acre and crop pattern to the growth of production of 15 principal crops at the national level and found that the production of food grains and non-food crops were positive and significant though the rate of growth of the latter was twice as high as that of the former. Asha Maheswari (1996) studied the growth pattern of paddy, Jowar, Ragi, Tur and groundnut during the period 1955-56 to 1989-90 in Karnataka and found that exponential trend rates for yield have gone up in all the cases except for groundnut; for production, they increased for all crops except for paddy and Jowar and for area they declined except for Tur.

Dhindsa and Sharma (1995) analyzed the growth rates of area, production and yield of various crops in relation to the cropping pattern changes in the Punjab state during the period 1965-66 to 1990-91 and concluded that the cropping pattern has changed in favour of only those crops like wheat, paddy, moong American cotton which have shown very high growth rates of production on account of increase in both area and yield growth rates.

The factors responsible for the growth of crop output are area sown, proportion of irrigated area, rainfall, fertilizers, improved seeds, land development, soil conservation, improved methods of cultivation, improved implement, extent of mechanized cultivation etc. These factors influence growth in different degrees in different regions. Variations of these factors result in non-uniformity in growth pattern. As such a study of inter-regional variations in area, production and yield of the two cereals would be of importance to scientists, administrators and policy makers.

METHODOLOGY

The state of Andhra Pradesh was broadly divided into three agro-climatic regions namely Coastal Andhra, Rayalaseema and Telangana which form the administrative divisions and traditional regions of Andhra Pradesh thus selected for present study. Rice and sorghum being two major crops of the state were taken for the study.

Data base and its collection

Data for the period 1970-71 to 1999-2000 at the district, regional and 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 Bureau of Economics and Statistics, Government of Andhra Pradesh and Agricultural Situation in India by Government of India.

To assess the impact of new technological innovations the whole period was divided into three sub-periods.

Sub-period I: 1970-71 to 1979-80

Sub-period II: 1980-81 to 1989-90

Sub-period III: 1990-91 to 1999-2000

Estimation of growth rate

The growth rate was estimated using exponential functional form as under:

$$Y = AB^t$$

Loy $Y = \log A + t \log B$

Where, Y= area/production/yield

A= constant

B= regression coefficient, and

t= time in years starting from the base year 1970-71

Compound growth rate (Antilog of B-1) 100 was used to calculate the compound growth rates in area, production and yield of rice and sorghum at regional and state levels for the three sub-periods and the total period.

RESULTS AND DISCUSSION

Growth rates obtained from the exponential function fitted to area, production and yield of selected cereal crops for different regions and periods are presented in Tables 1, 2 and 3.

Growth rates of rice

It can be observed from Table1 that the compound growth rate in area in respect of rice was positive at the state level and in all the regions for all three periods and for the total period except for Rayalaseema which showed negative growth rates of area in period II and for the total period. It can also be noted from Tables 2 and 3 that growth rates in respect of production and yield were positive in all the regions and for the state as a whole in all the three periods and the total period except Rayalaseema which showed negative growth rate of yield in period III.

Relatively higher growth rates of area under rice across the three regions and state as a whole could be attributed to the spillover effects of green revolution drive adopted in late sixties and the higher productivity potential of the hither to uncultivated land motivated farmers to bring more and more land under rice cultivation. Obviously the upward trend in area allocation under this crop in subsequent periods declined due to the declining productivity potential of high yielding cultivars introduced during period I and declining productivity potential of the land due to constant exploitation.

Telangana region witnessed a higher growth rate in area under rice and farmers' positive inclination towards adoption of improved farming practices. The augmented irrigation facilities coupled with moderate increasing area under rice in coastal region compared to Rayalaseema put the growth in rice production on moderate trajectory compared to Rayalaseema region. The

Table 1. Estimates of compound growth rates of area under rice and sorghum as per regions and periods

Crop/region	Coastal	Rayalaseema	Telangana	Andhra Pradesh
Rice				
Period I (1970-1971	1.0012	1.0641	4.3781**	1.9095***
to 1979-1980)	(0.6301)	(0.7487)	(0.5573)	(0.4865)
Period II (1980-1981	0.4531	-1.4281	1.1419	0.5393
to 1989-1990)	(1.8475)	(1.5134)	(1.6570)	(2.0533)
Period III (1990-1991	0.6161***	1.3382	1.4009	0.7089
to 1999-2000)	(0.4921)	(1.2070)	(3.3051)	(1.1732)
Total Period (1970-1971	0.5628*	-1.3462*	1.6041*	0.5176*
to 1999-2000)	(0.2145)	(0.2563)	(0.3599)	(0.3447)
Sorghum				
Period I (1970-1971	-2.7785**	-1.8667	-1.6693***	-1.8816***
to 1979-1980)	(0.3091)	(0.7081)	(0.4773)	(0.4458)
Period II (1980-1981	-9.3996*	-6.4485*	-4.5710*	-5.4654*
to 1989-1990)	(0.0678)	(0.2241)	(0.1467)	(0.1350)
Period III (1990-1991	-19.0811*	-4.8025*	-4.8926*	-5.2514*
to 1999-2000)	(0.0653)	(0.2086)	(0.0450)	(0.0517)
Total Period (1970-1971	-11.2415*	-5.0986*	-3.9668*	-4.7338*
to 1999-2000)	(0.0580)	(0.0562)	(0.0523)	(0.0468)

Figures in parenthesis indicate standard errors

* Significant at 1%; ** Significant at 5%; ***Significant at 10%

higher growth rate of production achieved in Coastal Andhra and Telangana region in rice production put the growth in rice production rate as a whole on positive side (2.85%).

The growth in rice productivity during all the three sub-periods and entire period across the region and state as a whole indicated positive trajectory except during period III in Rayalaseema region.

Table 2. Estimates of compound growth rates of production of rice and sorghum as per regions and periods

Crop/region	Coastal	Rayalaseema	Telangana	Andhra Pradesh
Rice				
Period I (1970-1971	2.6396***	1.7640	9.3783**	4.2018**
to 1979-1980)	(0.5413)	(0.6949)	(0.3983)	(0.3378)
Period II (1980-1981	2.3862***	1.1442	3.0089	2.5136***
to 1989-1990)	(0.5323)	(2.4219)	(0..9844)	(0.6823)
Period III (1990-1991	1.8117**	1.3979	2.3526	1.6906***
to 1999-2000)	(0.3279)	(1.6109)	(2.1172)	(0.6334)
Total Period (1970-1971	3.0502*	0.3633	4.0252	2.8544*
to 1999-2000)	(0.0834)	(1.1406)	(0.1820)*	(0.0966)
Sorghum				
Period I (1970-1971	2.8416	5.2140**	3.4545***	3.7795***
to 1979-1980)	(0.7213)	(0.4166)	(0.5557)	(0.4801)
Period II (1980-1981	-9.5340*	-3.3362	-5.2146**	-5.2571**
to 1989-1990)	(0.1723)	(0.9632)	(0.4037)	(0.3773)
Period III (1990-1991	-19.8434*	-5.9103*	-5.2677*	-5.6946*
to 1999-2000)	(0.1127)	(0.2473)	(0.2792)	(0.2198)
Total Period (1970-1971	-10.6834*	-2.1074*	-2.6792*	-3.0707*
to 1999-2000)	(0.0762)	(0.2858)	(0.1575)	(0.1413)

Figures in parenthesis indicate standard errors

* Significant at 1%; ** Significant at 5%; ***Significant at 10%

Table 3. Estimates of compound growth rates of yield of rice and sorghum as per regions and periods

Crop/region	Coastal	Rayalaseema	Telangana	Andhra Pradesh
Rice				
Period I (1970-1971	2.1177***	1.0035	4.7893*	2.5716**
to 1979-1980)	(0.5678)	(0.9293)	(0.2625)	(0.3704)
Period II (1980-1981	1.8708**	2.5723*	1.8439	1.9233**
to 1989-1990)	(0.4547)	(0.2402)	(0.5889)	(0.4026)
Period III (1990-1991	0.9451	-0.0939	0.9526	1.0331***
to 1999-2000)	(0.6710)	(8.1550)	(0.8201)	(0.5367)
Total Period (1970-1971	5.3353*	1.7376*	2.3934*	2.3575*
to 1999-2000)	(0.2144)	(0.0933)	(0.0905)	(0.0714)
Sorghum				
Period I (1970-1971	5.7706*	7.2247*	5.2089**	5.7697*
to 1979-1980)	(0.3059)	(0.2514)	(0.3023)	(0.2455)
Period II (1980-1981	-0.1534*	3.3446	-0.7437**	0.2247
to 1989-1990)	(0.1029)	(0.7984)	(2.5018)	(6.8223)
Period III (1990-1991	-2.1187	-1.0736	-0.6822	-0.4646
to 1999-2000)	(1.7120)	(1.6941)	(2.0763)	(2.4454)
Total Period (1970-1971	0.9175	3.0898*	1.3378*	1.7449*
to 1999-2000)	(0.5474)	(0.1559)	(0.2579)	(0.1712)

Figures in parenthesis indicate standard errors

* Significant at 1%; ** Significant at 5%; ***Significant at 10%

The growth in rice productivity indicated a declining trend from period to period but positive in all the regions and state except Period III in Rayalaseema region which registered a negative growth rate. The trend in rice yield was significant for the state as a whole during all the periods.

The high yielding cultivars and input intensive cultivation and cultivation of fertile, hither-to unexplored virgin fertile soils set to the higher growth in rice productivity during period I which later declined and could not be sustained.

Growth rates of sorghum

The growth in area under sorghum across the regions and state as a whole and across the three study sub-periods registered a negative trend. Obviously the declining area under sorghum was more in coastal region than in other two regions and the decline was on increasing side in the consequent periods.

The growth in production of sorghum across the regions and across the study sub-periods were akin to the growth trend in area under sorghum except the positive growth recorded in the period I apparently due to the positive growth in productivity of sorghum. However the subsequent declining productivity growth influenced the growth in sorghum production and resulted in negative growth in period II and III.

However the yield growth rates worked out for the entire period showed a positive increase across regions and for Andhra Pradesh as a whole; but there was no increase the sorghum production during the entire study period as production in the area under sorghum was more than and offset the effect of positive growth in yield.

The results are in agreement with the work done at other places on the same lines. Patel and Agarwal (1994) studied the growth and instability of groundnut production in Saurashtra region of Gujarat district and concluded that there was a negative trend in area, production and productivity of groundnut for the two periods viz 1960-61 to 1969-70 and 1970-71 to 1988-89 under study. Bastine and Palaniswamy (1994) analyzed the growth rates of area, production and productivity of major crops in Kerala including cereal crops and the plantation crops. They indicated that pepper showed positive but non-significant growth rates in area and production while insignificant in case of productivity.

Srivastava et al (2003) worked out compound growth rates of area production and productivity of pulses in all the districts of eastern UP during 1975-76 to 1999-2000 and reveled that area and production of pulses declined at the rate of 1.8 and 0.67 per cent per annum but productively increased at a compound growth rate of 1.18 per cent per year. Pervez (2001) analyzed the growth in area, production and yield in the major crops of Pakistan for a period 1970-71 to 1984-85. The study revealed that the increase in crop production was contributed largely by area that by productivity in Punjab and Sindh during 1970-71. Sindh region recorded a higher growth in area, production and yield as compared to Punjab in 1984-85. It was

also observed that Punjab recorded a low degree of instability in growth rates in most of the crops as compared to Sindh region in 1984-85.

Varghese (2004) worked out the trend in area, production and productivity of cardamom in Kerala for a period from 1970-71 to 2002-03 and found that the area under cardamom registered a negative percentage annual trend growth rate. Lathika and Kumar Ajith (2005) analyzed the growth trends in area, production and productivity of coconut in India of all the coconut producing states and union territories for which the period has been divided into two sub-periods as phase I (1951-1995) and phase II (1996-2002).

CONCLUSION

For estimating the growth pattern an exponential function was fitted to the area, production and yield of the selected crops and the compound growth rates were obtained for the period 1970-71 to 1999-2000. Following conclusion was made:

- In case of rice the compound growth rates in respect of area, production and yield were positive at the state level and regional level for all the periods and the total periods except Rayalaseema. Rayalaseema region has shown negative growth rate in the period II and the total period in respect of area and negative growth rate in the period III in respect of yield.
- The growth of area and production were found to be highest in Telangana region and the state as a whole in period I, followed by coastal Andhra region. Coastal Andhra region realized a higher growth of yield in total period followed by Telangana in period I.
- The growth rates of area and production in case of sorghum were negative and indicated a downward trend. The growth rates of area and production in coastal Andhra region showed downward trend. Both Rayalaseema and Telangana regions showed similar trend in all three sub-periods and total study period.
- The growth rates of sorghum yield were found to be highest in Rayalaseema region in period I. The yield growth declined in the period II and III in all the regions and state as a whole. During the total period sorghum yield was more in Rayalaseema region followed by state as a whole and in Telangana region.

Hence it could be concluded that the general increasing productivity growth of rice complemented by the positive growth in rice area resulted in overall increase in the rice production across regions and across study sub-periods. The seed-fertilizer-irrigation technologies introduced as a measure of green revolution

increasing support on both input as well as output fronts in the form of subsidies and price support measures could be few factors that lead to the spiraling rice production.

Increased availability of remunerative replacement crops like cotton and oilseeds such as groundnut, sunflower, castor, soybean and pulses, declining profitability and competitiveness of sorghum cultivation, erratic rainfall, less or even no input usage in sorghum cultivation, low productivity of local cultivars which occupied more than 50 per cent of sorghum area, lack of input and output support measures from government etc could be attributed to the declining sorghum cultivation and its importance.

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