TRENDS IN PADDY PRODUCTION IN ANDHRAPRADESH

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Abstract

Agriculture has long history of more than 5000 years and it has a backbone of Indian economy, mainly because of its large share of workforce employed and National Income in the country. But now less than 15 percent of India's national income comes from agriculture and close to 60 percent of India's labour force lives off agriculture. There is a little surprise in the fact that India's rural population leads impoverished lives. Even though Government of India and other state Governments trying to improve the agriculture sector through different programmes and policies, the production and productivity is increasing, but the growth rate is very meagre compare to other sectors. This is because mainly lack of financial assistance, lack of infrastructural facilities, land transformation, usage of traditional methods, negligence on small farmers and marginal farmers across the country. The focus of the paper is to examine the changes and instability in area, production and productivity of paddy in Andhra Pradesh (Newly carved state of Andhra Pradesh) based on time series data during 1994-95 to 2013-14. The study found that area, production and productivity has decreased during the study period. The compound growth rates of area, production and yield of paddy over the period shows positively significant. The study also confirms the magnitude of variability in production of paddy. The changes in area and productivity both was responsible for low variability in paddy of Andhra Pradesh. The percentage change over the years for area, production and productivity noted negative in the recent years in the study period. Instability in production is high in paddy crop during the study period. The yield effects the growth of production in paddy in Andhra Pradesh.

Keywords: *Change and instability, Compound Growth Rate, Decomposition Analysis*.

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INTRODUCTION

Agriculture has long history of more than 5000 years and it has a backbone of Indian economy, mainly because of its large share of workforce employed and National Income in the country. But now less than 15 percent of India's national income comes from agriculture and close to 60 percent of India's labour force depends on agriculture. There is a little surprise in the fact that India's rural population leads impoverished lives. In addition, that, Indian agriculture, year to year fluctuations in output and variations in productivity across space. In view of this, Government of India and other state Governments trying to improve the agriculture sector through different programmes and policies, the production and productivity is increasing, but the growth rate is very meagre compare to other sectors. Even though the adoption of green revolution technologies not only led India towards attainment of self-sufficiency in food grains production but also involved a large number of researchers to see its effect on agriculture instability and variations in agricultural productivity. This is because mainly lack of financial assistance, lack of infrastructural facilities, land transformation, usage of traditional methods, negligence on small farmers and marginal farmers across the country. Added to this, the programmes and policies are not completely attracted to improve the agriculture sector to all section of the farmers resulting the farmers are shifting their occupation to other non-farm sector. The farmer's community would disappear after couple of decades if it is continuing in the same trend especially in the crops of paddy, wheat, pulses, oil seeds, tobacco etc. However, there is great need to maintain the balance between producer produce and consumer paddy by careful calibration of minimum support paddy and also suitable steps are essential to solve the problems of agriculture sector.

Paddy ranks second in India among in the total food grains. It accounts for 41% of production of the total food grains. Andhra Pradesh (before bifurcation) is rated as the third largest producer of paddy in India with annual production of over 10.94 million tonnes followed by Utter Pradesh 13.7 million tonnes and west Bengal 14.28 million tonnes and which are nearly. The studies undertaken by research workers at various times mostly related to cereal crops like paddy and wheat and other crops.

Review of literature:

Hazel (1982a) study variability in production, across crops and regions in India during the period 1949-50 to 1978-79 by adopting analytical frame work to analyse variability. He concludes that increase in production instability was an investable consequences of rapid agriculture growth and there as little that can be done about it. The results at the regional level show that in Punjab, where HYV were grown on more than 80 percent are under cereals, the yield variability in all the selected crops remained constant or declined.

Another paper around the same time period by Ray (1983) was a little deeper to probe causes of instability in Indian agriculture during the period 1950 to 1980. The paper adopted very simple indicator of fluctuations in output. This was given by annual output growth rates over a specified period. The found that instability in production increased in the 1960's and rose further during 1970's for most of the crops and crop aggregates.

Sharma et al. (2006) have estimated variability in production and yield by choosing smaller set of years viz., 1981-82 to 1990-91 and 1991-92 to 2000-01. This is helpful if the instability changes over time. The author concludes the production of individual crops and total food grains had become more stable in 1990's compared with 1980's.

Jeena T Srinivasan (2012) examined the yield, input use and net returns from paddy cultivation in the kole land, against the backdrop of the attempts from the government of Kerala to increase paddy production in the state. The study finds greater role for padasekharams and padasekhara samithi's as institutions to overcome the constraints imposed by the small size of holdings. This together with a more judicious use of chemical inputs would make kole land paddy cultivation economically more viable and contribute significantly to the overall goods of enhanced paddy production in the state.

The disaggregate analysis for the state of Andhra Pradesh has shown that despite progress in irrigation and other infrastructural developments in agriculture, the instability in agriculture production has increased after early 1990's in the major crops. In contrast to this, farm harvest

paddy of ground nut has shown a decline in instability during 1995 to 2009 as compared the period 1981 to 1995. The study has indicated that in large state like Andhra Pradesh the instability status perceived through the state level data may be vastly different from that experienced at the disaggregate level. The instability in cotton production increased at the state level but decreased in two- third districts (NCAEPR, Policy paper 26).

K Solman Raju Paul's (2013) study measured the change and instability in area, production and yield of groundnut in Andhra Pradesh during 1995-96 to 2010-11. This study observed that the compound growth rates of area, production and productivity of groundnut over the study period shows negative and non- significant. This study also revealed that the total production of groundnut was completely due to change in area under the crop as the yield and interaction effects were very small.

Paddy is the major consumption cereal crop of Andhra Pradesh. Thus considering the importance and need, the present study has been taken up to analyse the trends in the production of paddy in Andhra Pradesh. In this context the study measured the change and instability in area, production and yield of paddy in Andhra Pradesh based on secondary data during 1994-95 to 2012-13. The study area analysed that area, production and productivity of paddy over the period shows negatively non-significant. The study also confirms the magnitude of variability in production of paddy. The overall movements in area and productivity both was responsible for low variability in paddy of Andhra Pradesh. Further the study conducted a decomposition analysis to determine contribution of different components of growth rate. The decomposition analysis revealed that in the total production of paddy was completely due to the change in yield or change in area and the interaction effect was very small.

The specific **objectives** of the study are as follows:

1.   To study the trends in growth of area, production and productivity of paddy in Andhra Pradesh.

2.   To examine the contribution of area, productivity towards increasing the production, the magnitude and instability for paddy crop.

Methodology and Sources:

The time series data on area, production and productivity of paddy from 1994-95 to 2013-14 were collected from various publications and websites of Directorate of Economics and statistics at a glance, Statistical Abstracts of Andhra Pradesh, Directorate of Economics and Statistics, Andhra Pradesh.

Analytical Procedure:

In order to examine the nature of change of instability and degree of relationship in area, production and yield of paddy in Andhra Pradesh, various statistical measures such as mean, correlation coefficient and coefficient of variation were worked out.

The production of paddy is likely to be influenced by the area in order to estimate the parameter, simple linear regression models were fitted to examine the change of production by change of area.

The model can be expressed as

$$Y = \alpha + \beta X + u \qquad \text{------------------------- (1)}$$

Where Y= Production

α= Intercept

β = Regression coefficient

X = Area in hectares.

Compound Groth Rate Analysis:

The exponential function $Y_t = A\ B^t\ U_t$ was fitted the data to compute the compound growth rates.

Where Y_t = Depenent Variable for which growth rate was estimated

A= Intercept

B= Regression coefficient

t= Years which takes values 1, 2, 3…. n

U_t= Distubance term for the year t

The eqution was transformen into log-linear form for estimation purpose and was estimated using ordinary least squares technique. The compound growth rate (CGR) in percentage was then computed from the relationship.

Compound growth rate = (Antilog B – 1) *100   -------------------------   (2)

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The compound growth rates were tested for their significance by student t- test.

An index of instability was computed for examining the nature and degree of instability in area, Production and productivity in Andhra Pradesh. The coefficient of variation (CV) was worked out for area, production and yield to measure of variability. However, simple coefficient of variation does not explain properly the trend component inherent in the time series data. Alternatively, the Coefficient of variation around the trend line rather than coefficient of variation around the mean was suggested by Cuddy-Della Valle (1978) as a better measure of variability.

Instability Index (IX) is given by the formula:

$$IX = CV \, (1 - \overline{R}^{\,2})^{1/2}$$

Where, CV – Coefficient of Variation (in percent)

$\overline{R}^{\,2}$ – Coefficient of determination from a time trend regression adjusted by the number of degrees of freedom.

ADDITIVE DECOMPOSITION MODEL:

The main source of growth of agricultural production is cropped area and productivity and cropping pattern. For estimating the individual contribution of these factors to the growth of output a number of additive and multiplicative models of decomposition have been developed. In view of the difficulty involved in starightforward interpretation of these results of multiplicative models, only additive models of decomposition are considered here.

By considering two factors namely cropped area and yields as a source of growth of crop output can be decomposed as follows.

It is clear that

$$P = A. \, Y$$

If ΔP, ΔA and ΔY are respectively the changes in production, area and yield during the period under consideration, then

$$P + \Delta P = (A + \Delta A)(Y + \Delta Y)$$
$$= Y \, A + A. \, \Delta Y + Y. \, \Delta A + \Delta A. \, \Delta Y$$

(OR)

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ΔP   = A. ΔY + Y. ΔA + ΔA. ΔY

Thus the differential production in a given period of time is decomposed in to the following three components.

i). A. ΔY: the effect of change in yield of crops (the yield effect)

ii). Y. ΔA: the effect of change in the cropped area (the area effect)

iii). ΔA. ΔY: the residual i.e. the interaction effect due to change in cropped area and yield of crop. (Interaction effect)

The rea effect indicates the change in output due to change in area, when there is no change in the yield. The yield effect indicates the change in output that could be attributed to the interaction between changes in yield and changes in cropped area. This is simple additive model of decomposition and it can be conviniently used for studying the contribution of area and yield to the growth of outputnof a single crop.

Cobb - Douglas Production function:

Most standard form of for production of a single good with two factors, the function was developed by Charles Cobb and Paul Douglas during 1927-1947

$$Y = A \, L^{\alpha} \, K^{\beta} \, e^{u}$$

Where Y= Production of paddy

L= Land or area used for production of paddy

K= Productivity

α and ß are the output elasticities of land and productivity respectively.

The above can be estimated by using Ordinary Least Squares (OLS) method.

The above function can be transformed into log – linear form as:

$$Ln \, Y = Ln \, A + Ln \, L + Ln \, K + e_i$$

The value of input coefficients implies their contribution to the production of paddy or the coefficients are the level of determination to paddy production.

RESULTS AND DISCUSSIONS:

In order to overcome the problem of different units of physical output while analysing the growth pattern of paddy crop Index numbers were constructed. Table.1 shows the index numbers

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of area, production and productivity of paddy of Andhra Pradesh during the period 1995-96 to 2013-14 with the base year as the triennium 1995-96 to 1997-98. These indices provide an idea about the growth in area, production and productivity of paddy in Andhra Pradesh.

Table: 1. Area, Production and Productivity of Andhra Pradesh (13 districts) over the period from 1994-95 to 2013-14 Base year Index Triennium 1994-95 to 1996-97.

YEAR	AREA (Lakh hectares)	% change over year	PRPODCTION (Lakh tonnes)	% change over year	YIELD (Kg per hectare)	% change over year
1994-95	97.87		97.84		100.01	
1995-96	98.04	0.17	96.70	-1.13	98.69	-1.33
1996-97	104.15	6.11	105.46	8.76	101.31	2.62
1997-98	96.80	-7.35	95.81	-9.65	99.03	-2.28
1998-99	105.36	8.56	102.43	6.61	97.26	-1.76
1999-2K	99.82	-5.54	109.04	6.61	109.29	12.02
2K-01	102.11	2.29	119.09	10.04	116.68	7.39
2001-02	95.31	-6.80	115.87	-3.21	121.62	4.95
2002-03	70.75	-24.56	78.72	-37.15	111.32	-10.31
2003-04	74.17	3.42	89.66	10.94	120.95	9.63
2004-05	84.41	10.24	109.49	19.82	129.77	8.82
2005-06	95.52	11.10	107.95	-1.54	113.07	-16.70
2006-07	97.78	2.26	112.09	4.14	114.69	1.62
2007-08	98.56	0.78	119.44	7.35	121.24	6.55
2008-09	102.12	3.56	131.53	12.10	128.86	7.62
2009-10	88.13	-13.99	112.10	-19.43	127.26	-1.60
2010-11	105.05	16.92	116.75	4.65	111.19	-16.07
2011-12	88.91	-16.15	114.69	-2.06	129.06	17.88
2012-13	83.71	-5.20	101.64	-13.05	121.49	-7.58
2013-14	97.92	14.21	117.94	16.29	120.50	-0.98

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The above indices provide an idea about the growth in area, production and productivity of paddy in Andhra Pradesh showed a decreasing trend over the study period i.e.1994-95 to 2013-14. The percentage change over the year during the study period for the area of paddy in Andhra Pradesh had negative values except 12 years i.e. 1995-96, 1996-97, 1998-99, 2k-01, 2003-04, 2004-05 to 2008-09, 2010-11, and 2013-14. The percentage change over the year during the study period for the production of paddy in Andhra Pradesh had negative values except 8 years i.e.1996-97,1998-99,1999-2k,2000-01,2003-04,2004-05,2006-07,2007-08,2008-09,2010-11 and 2013-14. The percentage change over the year during the study period for the productivity of paddy in Andhra Pradesh had negative values except 9 years i.e. 1996-97,1999-2k, 2000-01,2001-02,2003-04,2004-05,2006-07,2007-08,2008-09 and 2011-12.

Table.2. Relationship between Area and Production of Paddy.

Criteria	Value of correlation coefficient	P-value(2-tailed)
Area Vs Production	0.595	0.006**

**correlation coefficient is significant at 1 percent level (2-tailed)

Correlation Analysis: A commonly employed method for measuring the changing attitude of two variables i.e. area and production is correlation. This procedure built on the relation that if area influencing the production. The numerical evidence of this relationship is in the table.2. The correlation coefficient of area and production of paddy over the period i.e.1994-95 to 2013-14 is 0.595, which is significant at 1% level of significance and it implies that the increment of area influence the production of paddy to increase.

Table.3. Testing dependence of production on Paddy.

Criteria	Intercept	Regression coefficient	t- value	p-value
Regression	25.7	1.89	3.142	0.006**

** Significant at 1% level of significance (2- tailed)

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Regression Analysis: The simple linear regression was fitted for estimating the response of production of paddy due to change of their respective area. It was observed the table.3 that the production of paddy was significantly increase by 1.89, a unit change in area in the study period.

Table.4. Compound Growth rates of Area, Production and Productivity of Paddy.

Growth Rate	Area	Production	Productivity
Compound Growth Rate Value	0.996	1.009	1.01

Compound Growth rates and coefficient of variation gives an idea about the trend in the production. Table.4 shows that area, production and productivity of paddy in Andhra Pradesh have no negative trends of 0.996,1.009,1.01 percent per annum respectively over the study period.

Table.5. Instability in Area, Production and Productivity of Paddy.

Statistical tools	Area	Production	Productivity
Arithmetic Mean	24.892	72.727	2932.34
Standard Deviation	2.571	8.1612	279.02
Coefficient of Variation(CV)	10.329	11.222	9.515
Instability Index (IX)	6.84	7.21	6.14

Variability in agricultural production consists of variations in area, yield and their interactions. Varition in area under crop occurs mainly in response to distribution, timeliness and variations in rainfall and other climatic factors, expected paddy and variability of crop-specic inputs. All these factors also affect the variations in yield. Further, yield also affected by the outbreak of diseases, pests and other natural or man-made hazards like floods, droughts and many other factors. Different events may affect the crop area and yield in the same, opposite or different way. The instability of paddy, production and productivity are shown in table.5. From the table instability in production is high compared to area and production of paddy in Andhra Pradesh.

Table.6. Decomposition Analysis of Area, Production and Productivity of Paddy of Andhra Pradesh over the period from 1995-2014.

Area effect	Yield effect	Interaction effect
-0.66	1.6	-0.16

In order to find out the contribution of area, production and productivity y and the interaction of the two in increasing the production, decomposition analysis was carried out. The results are presented in table.6. It is clear that from the table, during the overall period, the total production of paddy was completely due change in crop yield and interaction effect was very small. Therefore, it is concluding that production growth in paddy over the period of 20 years has been slow and unstable with substantial temporal variations in the state.

Table.7. Production function analysis of factors contribution in production of paddy.

	coefficient	Standard Error	Significance
Area	1.002	0.002	0.000[*]
Yield	1.000	0.003	0.000[*]

*The coefficients are significant at 1% level of significance.

In order to find out the contribution of area and productivity in increasing the production, production function analysis was carried out. The results are presented in table.7. It is clear that from the table, the coefficients are significant at 1 percent level of significance.

Conclusions

The main source of agriculture production is cropped area and productivity and cropping pattern. Decomposition analysis was used for estimating the individual contribution of these factors to growth of output and also used Cobb- Douglass production function for knowing their contribution.The correlation coefficient tells the relationship between production and area is Percent. The regression analysis revealed that a unit change in area will lead to 1.89 unit times of production was increased. Compound growth rate in productivity is higher in the study period. Therefore, it is concluded that production growth in paddy over the period of 20 years has been

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slow and unstable. It is time for repeat of green revolution with low cost such as Organic farming, nature farming etc...

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