

AGRICULTURE GROWTH IN ANDHRA PRADESH: A STUDY ON PERFORMANCE AND DETERMINANTS

Giribababu M*

The newly formed Andhra Pradesh State, has huge potential to develop agriculture and allied sectors. Though it has a total cultivated area of 6.35 million ha, crop productivity is low and stagnant while the cost of cultivation has been increasing in recent years. The State is not a homogenous entity in the endowments with vast tracts of dry lands and flood affected areas, despite its volatility centring on unpredictable weather conditions, huge farm expenditure and non-profitability continues to be the mainstay for millions of population in the state. Making the agriculture sector more resilient and helping the farming community is the most important priority for the state of Andhra Pradesh. The objective of the study is to assess the trends in production, area and productivity of selected crops under different phases. The study is also to investigate the factor determinants of production and productivity among the crops in Andhra Pradesh as well as India.

Keywords: Agriculture, Area, Production & Productivity

INTRODUCTION

The newly formed Andhra Pradesh State, popularly known as the “rice bowl of India” has huge potential to develop agriculture and allied sectors. Majority of the population (62%) for their livelihood depend on agriculture related activities, it contributes only 27.84% to the state Gross Domestic Product (GSDP) and is growing at 5.9% (2014-15). Though it has a total cultivated area of 6.35 million ha, crop productivity is low and stagnant while the cost of cultivation has been increasing in recent years. The State is not a homogenous entity in the endowments with vast tracts of dry lands and flood affected areas, despite its volatility centring on unpredictable weather conditions, huge farm expenditure and non-profitability continues to be the mainstay for millions of population in the state. Making the agriculture sector more resilient and helping the farming community is the most important priority for the state of Andhra Pradesh.

Sustained agricultural growth, which is facilitated by constant policy and institutional support, could augur growth in the rural economy. In fact, the growth performance of agriculture at the national level was remarkable during the 1980s. Its deceleration during the 1990s was attributed to the reduction in /or stagnation of public expenditure on agricultural infrastructure, defunct extension services, and biased economic reforms (Thamarajakshi 1999; Balakrishnan 2000; Hirashima 2000; Mahendradev 1987; Vyas 2001; Rao 2003). Recent studies include those of Bhalla and Singh (2001), Radhakrishna (2002), Bhalla and Singh (2009), and Vaidyanathan (2010).

Paddy is one of the most important staple food-grains and it is a lucrative business to various farmers in Andhra Pradesh and this is an important crop which helps to increase the economic condition of the farmers in the entire coastal region. The cultivation of paddy is generally depending on fertility

* Assistant Professor, Dept. of Economics, Nagaland University, Lumani, Zunhebato, Nagaland - 798627

of land, climate condition, high yielding varieties of seeds and irrigational potentials. Therefore the production of paddy varies between region to region and even district to district. Climatic condition in Andhra Pradesh is conducive for production of rice cultivation. On the other hand, the cultivation of sugarcane in India dates back to the Vedic period occupied 7% of the total value of agriculture output and occupied about 2.8% of India's gross cropped area during 2015-16. Sugarcane provides raw material for the second largest agro-based industry after textile. About 716 working sugar factories with total installed annual sugar production capacity of about 28.3 million tonnes are located in the country during 2015-16. Andhra Pradesh is one of the leading producers of sugarcane among the other Indian states. On contrary to that groundnut is also an important commercial crop in rain fed areas which contributes about 40 percent to the total oilseeds production in the country. India occupies first position, both in area and production, in the world. About 70% of the area and 75% of the production are concentrated in the four states of Gujarat, Andhra Pradesh, Tamil Nadu and Karnataka. In Andhra Pradesh groundnut is grown in Anantapur, Kurnool, Chittoor, Kadapa, Srikakulam and Visakhapatnam districts.

The objective of the study is to assess the trends in production, area and productivity of selected crops under different phases. The study is also to investigate the factor determinants of production and productivity among the crops in Andhra Pradesh as well as India.

DATA AND METHODOLOGY

The data has been collected from two different sources: primary and secondary. For the primary data, Multi-stage stratified proportionate random sampling technique has been applied in the selection of representative Districts, Mandals/Talukas, Villages and Households. Three crops namely, Paddy, Sugarcane and Groundnut are selected for this study, on the basis of subsistence and commercial crop base. The secondary data on area, production and productivity was used for analysis. Time series data from 1951-52 to 2014-15 has been used to understand the trend in area, production and productivity.

Multiple Regression Model

In addition to the usual statistical measures such as percentages, compound growth rates, the simple and multiple regression analysis are applied. The model may be extended by assuming that the dependant variable Y is a linear function of a series of independent variables and an error term. The multiple regression model may be specified as

$$Y_t = \sum_{i=0}^k \beta_i X_t + \mu_t$$

Where, Y_t is the dependent variable, the X 's are the independent variables, and μ_t is the error term.

β_1 is the constant term, or intercept of the equation.

RESULTS AND DISCUSSIONS

Table 1 : Trend in Area, Production and Productivity of Paddy, Sugarcane and Ground Nut Crops in Andhra Pradesh and India

	Andhra Pradesh			India		
	Area	Production	Yield	Area	Production	Yield
1950-51	521	331	636	30815	20580	668
1960-61	2774	3496	1261	34132	34580	1013
1970-71	3521	4786	1359	37595	42220	1123
1980-81	3600	7011	1947	40155	53630	1336
1990-91	4036	9654	2392	42698	74290	1740
2000-01	4243	12458	2936	44714	84980	1901
2010-11	4751	14418	3034	42862	95970	2240
2011-12	4096	12895	3148	44000	105301	2390
2012-13	3628	11510	3172	42754	105252	2460
2013-14	4356	12724	2921	44135	106646	2420
2014-15	3809	11565	3036	43855	104798	2390
CGR (%)	3.11	5.62	2.43	0.54	2.54	1.98
SUGARCANE						
1950-51	36	--	--	1715	57054	33422
1960-61	77	5438	70722	2424	110000	45549
1970-71	120	9122	76019	2626	126372	48322
1980-81	132	10054	76167	2675	151254	57844
1990-91	182	12667	69599	3691	241054	65395
2000-01	217	17690	81371	4328	295962	68577
2010-11	192	14964	77937	4885	342382	70090
2011-12	204	16686	81794	5038	361037	71670
2012-13	196	15567	79423	4999	34100	68250
2013-14	192	15385	80130	1993	352142	70520
2014-15	177	13150	74294	5144	359330	69860
CGR (%)	2.48	1.62	0.09	1.7	2.87	1.14
GROUND NUT						
1950-51	675	374	554	4492	3485	775
1960-61	875	484	553	6465	4812	745
1970-71	1481	1143	772	7331	6114	834
1980-81	1290	811	629	6804	5015	736
1990-91	2394	2263	947	8316	7512	904
2000-01	1874	2143	1144	6563	6415	977
2010-11	1622	1458	899	5866	8264	1410
2011-12	1307	844	646	5264	6964	1320
2012-13	1345	1115	829	4721	4694	990
2013-14	1386	1236	892	5502	9714	1760
2014-15	1029	793	771	4685	6557	1400
CGR (%)	0.65	1.16	0.51	0.06	0.98	0.91

Source: Agricultural Statistics at a glance 2015 and Hand Book of Statistics on the Indian Economy and Statistical Abstracts of Andhra Pradesh (various Issues).

The performance of agriculture in Andhra Pradesh as well as India from 1951-2015 ushered in the age of dynamism where latest technology became the order of the day in a defined policies of the economy. Production and productivity of several commodities increased tremendously, social economical, institutional and environmental reforms carried in away. Affirmative strategies were followed and policy makers and researchers were carried out through the establishment of research institutions, agricultural universities.

The table.1 shows that the trends in area, production and productivity of three selected crops both in Andhra Pradesh and India. The data indicates that the area under paddy cultivations isat increasing trend during the study period. In 1950-51, the area under paddy in Andhra Pradesh was 521 million ha and it was increased to 4751 m.ha in the year 2010-11.similarly, in India, in 1950-51 the area under paddy is 30815 m.ha increased to 44135 m.ha in 2013-14. The annual compound growth rate in AP is about 3.11 percent over the 65 five years and for India it was only 0.54 percent over the period of time. Similarly, the production and productivity of paddy during the study period, shows tremendous increase both in Andhra Pradesh and India and compound growth rate in Andhra Pradesh is higher than national average and it was 5.62, 254 and 2.43 and 1.98 production and yield respectively.

On contrary to that in sugarcane crop the growth trends in area, production and productivity are positive but lower than paddy crop. In Andhra Pradesh, the production and productivity of sugarcane depicts slow growth rate at 1.62 and 0.09 percent respectively. Whereas, in India, both the production and yield rates showsat higher than AP over a period of time. In Andhra Pradesh, frequent natural calamities (Floods) in coastal region affecting the crop and other discouraging factors like less supporting price, intentional delayed in cane crush in sugar mill and asking to harvest either before ripening or after drying the sugarcane makes the farmers to shift their cropping pattern in recent years.

On the other hand, the rain fed crop of ground nut, trends on area, production and yield rates are much lower than the other two selected wet crops both in Andhra Pradesh as well as in India. The data indicates that the compound growth rates area, production and productivities in Andhra Pradesh is slightly higher than the national average and it shows that 0.65, 116 and 0.5 percent in AP and 0.06, 0.98 and 0.91 percent in India respectively. Uncertainty in rainfalls, lack of price and marketing incentives, technological bottleneck are some of the constraints for low acreage, production and yield conditions in Andhra Pradesh.

Phase Wise Growth Rates

The entire period has been divided into four sub periods for analytical convenience and to facilitate comparison namely, pre-green revolution (1951-1965), green revolution period (1966-1980), the maturing period of green revolution along with early reform period (1981-1995) and post WTO period (1996-2015).

First Phase (Pre-Green Revolution Period) : The first phase of agricultural policy witnessed tremendous agrarian reforms, development of major and medium irrigation projects, strengthen the institutional and cooperative credit societies, land reforms etc. makes best to augment the production and productivity of major commodities in Andhra Pradesh as well as in India. The community development programme, decentralising planning and intensive area development programme initiated by the central government were also initiated for regeneration of agriculture that had stagnated during the British period. The table.2 shows that the annual compound growth rates

(ACGR) of area, production and productivity of selected crops under different phases reveals that, during the first phase, the area and production and productivity of paddy and sugarcane in Andhra Pradesh and sugarcane and groundnut in India increased tremendously and it was registered 3.04 and 4.78 per cent, whereas, in National Level, sugarcane and groundnut showed positive growth at 2.83 and 3.37 per cent respectively.

Table.2. Phase wise Compound Growth Rates of Area, Production and Yields of Paddy, Sugarcane and Groundnut crops in Andhra Pradesh

(Growth Rates in Percentages)

	Andhra Pradesh			India		
	Paddy	Sugarcane	Groundnut	Paddy	Sugarcane	Groundnut
1950-51 to 1964-65	3.04	4.78	-0.68	1.13	2.83	3.37
1965-66- to 1980-81	0.92	-0.2	0.34	0.83	-0.41	-0.83
1981-82-to 1994-95	-0.33	1.00	2.74	0.34	1.30	0.37
1995-96-to 2014-15	0.83	-0.54	-3.77	0.15	1.08	-2.33
Production						
1950-51 to 1964-65	5.64	5.77	-0.86	4.41	5.19	3.71
1965-66- to 1980-81	3.88	-0.22	2.10	3.81	1.47	1.09
1981-82-to 1994-95	1.10	0.47	1.01	2.86	2.64	0.74
1995-96-to 2014-15	1.74	0.07	-5.81	1.55	1.24	-0.72
Yield						
1950-51 to 1964-65	2.53	3.2	-0.18	3.24	2.28	0.33
1965-66- to 1980-81	2.93	0.09	1.76	2.96	1.88	1.91
1981-82-to 1994-95	1.44	-0.5	-1.68	2.56	1.34	0.37
1995-96-to 2014-15	1.10	0.66	-2.12	1.45	0.15	1.66

Source: Authors Calculations based on Hand Book of Statistics on the Indian Economy and Statistical Abstracts of Andhra Pradesh (various Issues).

The Second Phase (Green Revolution Period-1966-1980): The government of India adoption of new agricultural strategy (GR) on High Yielding Variety crops, multiple cropping, modern farm practices and expanding irrigational facilities makes the state and the nation to achieve self-sufficiency in the food grain production during this period. Though this phase the area under the selected crops have not affected significantly, production and productivity have shown increasing trend in paddy and ground nut crops both AP as well as India. About 3.88 and 3.81 percent of production and 2.93 and 2.96 percent of productivity in paddy and 2.10 and 1.09 percent and 1.76 and 1.91 in groundnut respectively have achieved during the period. Though agrarian reform during this phase took back seat, extension, input supply, market infrastructure, credit institutions (Nationalisation banks in 1969 and 1980), price support and other advance technological innovations makes to meet self-sufficiency of food grain production in the Nation.

The Third Phase (The Maturing period of GR and Early Liberalisation-1981-2005): Andhra Pradesh as well as India has witnessed the process of crop diversification and cropping pattern shifts resulted into fast growth of non-food grains like horticulture, floriculture, livestock economies during this phase. The table depicts that compound growth rate in sugarcane is started to grow at faster rate in India by commercialisation of agriculture whereas, the other crops have registered declining trend. During this period, there has been significant increase in subsidies and support by the government through initiation of economic reforms with liberalisation, privatisation, globalisation and marketization policies to encourage export oriented growth through mechanisation, commercialisation and casualization of agricultural activities. Though spending on agricultural capital formation showing declining trend in real terms, private investment kept on moving on a raising trend of agricultural production and productivities (Mishra and Chand 1995).

The Fourth Phase (WTO Regime After 1995-96): Initiation of economic reforms which involves deregulation, reduced government participation in economic activities and liberalisation of external trade after setting up of World Trade Organisation in 1995, expanding domestic markets in the era of globalisation affects agricultural growth and raised new challenges among the policy makers. Introduction of new agricultural policy by the government, in 2000 with main objective to attain 4 percent growth through accelerate the resource use efficiency to meet sustainability with equity. The table shows that the area, production and productivity of all three selected crops both in Andhra Pradesh and India reveals that paddy and sugarcane gives positive growth whereas, groundnut registered negative growth in all three aspects.

Area and Productivity Effects with Production: Regression Analysis

To analyse the stability or instability of production in all selected crops both in Andhra Pradesh and India, the study try to assess the impact through using simple regression analysis. Production of particular crop as a dependant variable, area and productivity as independent variables are used in order to obtain comparability. The study computed the growth rate with different phases and corresponding time period of dependant variable i.e. production.

The Table 3a indicates that the estimation of regression between area and production of selected crops in Andhra Pradesh and India. It is evident from the table that in all the phases, paddy crop has registered positive association with dependant variable and statistical significant at 1 per cent level. The R^2 values of .995, .687, .553, .693 and .674 clearly indicate that the effect of area on production is significant for all the period under consideration. Similarly, in India, the first three phases as well as overall period show positive and statistical significance at 1 per cent level and R^2 values of .891, .787, .601 and .851 can be regarded as good fits in view of the time series data since they implies that about 89.1, 78.7, 60.1 and 85.1 percent of variations in production respectively are explained by area as explanatory variable.

Similarly, in sugarcane crop, the data reveals that the first three periods (pre-green revolution, green revolution and liberalisation) the coefficients are positive and statistically significant at 1 and 5 percent. The R^2 values of .938, .616, and .725 indicates that area has influenced production significantly in all three phases, whereas, during the post WTO period it was not significant in Andhra Pradesh. It is interesting to observe that in India, all the phases registered statistically significant with dependant variable. The R^2 values of .930, .848, .917, .662 and .968 clearly shows that the explanatory variable of area has been significantly influenced in all India level.

Table 3a. Production and Area effects among the Crops: Regression Analysis**(Andhra Pradesh)**

	Paddy			Sugarcane			Groundnut		
	Con- stant	Coef- ficient	R²	Con- stant	Coef- ficient	R²	Con- stant	Coeffi- cient	R²
1950-51 to 1964-65	-18.36	1.853 (16.66)*	0.995	-4.882	81.778 (14.08)*	0.938	8.937	0.008 (0.29)	0.701
1965-66 to 1980-81	-34.96	2.559 (5.35)*	0.687	40.546	44.357 (4.51)*	0.616	-5.208	1.183 (3.66)*	0.507
1981-82-to 1994-95	-25.108	2.936 (4.01)*	0.553	-16.39	77.645 (2.12)**	0.725	-3.708	1.077 (8.18)*	0.837
1995-96-to 2014-15	-11.811	3.257 (6.37)*	0.693	165.82	-0.071 (1.10)	0.633	13.245	0.025 (1.26)	0.805
1950-51-to 2014-15	-102.02	5.053 (11.42)*	0.674	110.88	0.219 (1.88)	0.531	12.052	0.034 (2.07)***	0.637
INDIA									
1950-51 to 1964-65	-52.488	2.497 (10.29)*	0.891	-59.96	67.55 (11.00)*	0.930	-0.247	0.0787 (8.74)*	0.854
1965-66 to 1980-81	-106.68	3.919 (10.32)*	0.891	-49.10	67.65 (8.53)*	0.848	3.053	0.268 (0.26)	0.712
1981-82 to 1994-95	-222.50	6.977 (6.94)*	0.787	-113.2	96.33 (12.05)*	0.917	-5.580	1.628 (5.20)*	0.675
1995-96 to 2014-15	91.005	0.0007 (0.44)	0.601	-7.597	69.904 (5.94)*	0.662	2.619	0.715 (1.77)	0.641
1950-51 to 2014-15	-154.92	5.466 (18.95)*	0.851	-106.6	91.842 (43.65)*	0.968	1.103	0.737 (4.19)*	0.518

Note: Figures in parenthesis indicates t values,

*, **, *** indicates 1%, 5% and 10% level of significance

On the contrary, the dry crop of groundnut, the results depict that, phase I and phase III in case of India, and phase II and phase III in case of Andhra Pradesh shows the effect of area on production is positive and statistically significant. The R^2 values in case of Andhra Pradesh are .507, .837 and .637 and in case of India are, .854, .675 and .518 which reveals that the model is in good fit in view of the time series data since it implies that about 50.7, 83.7 and 63.7 per cent and 85.4, 67.5 and 51.8 per cent of variation in production explained by explanatory variables both in Andhra Pradesh and India respectively.

The regression results of production on yield are depicted in table 3b. The data shows that in all the phases, the explanatory variable has expected signs. In paddy crop except in phase IV in Andhra Pradesh, the productivity has positively associated with dependant variable and statistically significant at 1 percent. The R^2 values of .909, .631, .678, .594, and .831 clearly indicates that yield has effected significantly overall period of time and it implies that about 90.9, 63.1, 67.8, 59.4 and

83.1 per cent of variation in production is explained by explanatory variable. Whereas, in India on aggregate, all the four phases and overall period, it is significant at 1% level and the explanatory variable is influencing factor to increase the production.

On contrary to that, the other wet crop of sugarcane, only two phase i.e. 3rd and 4th phases the explanatory variable has registered significant at 5% and 1% level and the productivity is not given much impact in production during the early two phases. However, it is remarkably in all India level, the productivity has higher effect on production overall period of time and in all phases. The R^2 values of .919, .813, .833 and .897 clearly indicates that it can be regarded as good fit and it implies that about 91.9, 81.3 83.3 and 89.7 per cent of variation in production are explained by explanatory variable.

Table 3b. Production and Yield effects among the Selected Crops: Regression Analysis

ANDHRA PRADESH

	Paddy			Sugarcane			Groundnut		
	Con- stant	Coef- ficient	R ²	Con- stant	Coef- ficient	R ²	Con- stant	Coeffi- cient	R ²
1950-51 to 1964-65	-43.508	0.065 (11.40)*	0.909	7.382	0.794 (1.88)	0.207	-3.577	0.015 (2.49)**	0.323
1965-66 to 1980-81	28.371	0.016 (2.54)*	0.631	100.64	0.031 (0.06)	0.214	-1.519	0.0151 (7.28)*	0.803
1981-82 to 1994-95	-13.944	0.0435 (5.23)*	0.678	-199.52	4.262 (2.23)**	0.277	7.905	0.011 (2.27)**	0.284
1995-96 to 2014-15	121.26	-0.003 (1.07)	0.594	-92.688	3.311 (3.36)*	0.386	-4.858	0.0228 (9.70)*	0.839
1950-51 to 2014-15	-7.298	0.039 (17.60)*	0.831	-74.790	2.551 (3.80)*	0.184	-1.825	0.018 (6.50)*	0.401
INDIA									
1950-51 to 1964-65	-12.150	0.046 (19.48)*	0.964	-69.71	3.95 (12.19)*	0.919	-0.811	0.007 (1.99)***	0.233
1965-66 to 1980-81	-12.834	0.049 (29.40)*	0.985	-93.02	4.626 (7.52)*	0.813	0.079	0.007 (18.42)*	0.963
1981-82 to 1994-95	-12.742	0.049 (36.89)*	0.990	-241.31	7.256 (8.06)*	0.833	-2.569	0.011 (9.20)*	0.867
1995-96 to 2014-15	101.642	-0.006 (2.17)**	0.608	-256.82	8.247 (3.79)*	0.444	1.352	0.005 (5.70)*	0.643
1950-51-to 2014-15	12.925	0.033 (7.78)*	0.490	-188.62	6.899 (23.38)*	0.897	0.944	0.005 (10.88)*	0.653

Note: Figures in parenthesis indicates t values,

*, **, *** indicates 1%, 5% and 10% level of significance

It is interesting to observe that the effect of yield on production in case of groundnut, both in Andhra Pradesh and India shows positive growth and statistically significant overall period. In fact, the

scrutiny of actual productivity during the last 35 years shows that in spite of fluctuations, yield has been a prominent factor in acceleration of production with the launch of technology mission in 1980's and subsequent focus on oil seeds production in the country in the 1990's and early 21st century. The productivity levels are strengthen and the technology incorporation in the groundnut production has given encouraging response to the Indian growers.

Empirical Evidences from Field Survey

The productivity trends along with percentage change in selected crops are shown in table .4. The data indicates that the yield rate in selected village is slightly higher than State average in paddy and considerable lower in sugar and groundnut crops. The productivity distribution among the farm size groups, large farmers produces higher yield followed by medium farmers, small farmers and marginal farmers respectively. The data reveals that there is positive association between farm size and productivity, except marginal and small farmers in case of sugarcane crop. Similarly, the productivity changes over a period of 10 years, both in paddy and groundnut shows an increasing trend in all farm size groups, while negative trend has been registered in sugarcane crop with respect to small and medium farmers. It is interesting to note that there is not much difference in sugarcane crop, in both the periods and the average productivity is almost constant among all the farm size groups.

Table.4 Productivity Trends among the crops across the farm size groups

	2003-04			2013-14			Change in productivity 2003-04 to 2013-14 (%)		
	Pad- dy	Sugar- cane	Ground- nut	Paddy	Sugar- cane	Ground- nut	Pad- dy	Sugar cane	Ground nut
Marginal Farmers	2154	40.13	233.66	3255	40.38	318.2	51.11	0.62	36.18
Small Farmers	2147	40.00	264.62	3532.5	39.5	351.74	64.53	-1.25	32.92
Medium farmers	2250	40.83	306.37	3630	40.0	399.04	61.33	-2.13	30.24
Large farmers	2325	40.83	394.18	4031.2	41.03	473.0	73.38	0.49	19.99
All	2219	40.44	299.71	3612.1	40.22	385.49	62.78	-0.54	28.62

Field Survey-2003-04 and 2013-14

Note: Paddy and Groundnut in Kgs and Sugarcane in tons.

Factor Determinants-Multiple Regression Analysis

Model

$$\text{LogYield} = \beta_0 + \beta_1 \text{LogEdu} + \beta_2 \text{Logage} + \beta_3 \text{LogWoP} + \beta_4 \text{LogLs} + \beta_5 \text{LogIrriInt} + \beta_6 \text{LogFercon} + \beta_7 \text{LogPescon} + \beta_8 \text{Loglabuse} + \beta_9 \text{LogTratec} + \varepsilon$$

Where,

Yield =Yield in kg/acre,

Edu = education,

Age = Head of household age,

Wop = Working Population LS= Land Size (Owning Lands)
 Irrint = Irrigation Intensity Fer con= Fertiliser Consumption
 Pescon= Pesticide Consumption Labuse: Labour Utilisation
 Tratec= tractor/technology use Log= natural logarithm
 β_0 = constant β_1 to β_9 are coefficients
 ε = random error term

The regression results across the crops are shown in table.5. All the coefficients of the variables have the expected signs except irrigation intensity in groundnut crop. In case of paddy, the coefficients of education and working population are positively associated with dependant variable and are statistically significant at 5% level, whereas, the coefficient of pesticide consumption is negative (.109) and it is statistically significant at 1 % level. It means that one percent increase in use of chemical pesticides the crop yield decreased by .109 percent. The R^2 value of .645 can be regarded as quite a good fit in view of cross sectional data and it implies that about 64.5 per cent variation in yield is explained by explanatory variable.

Table 5 : Factors Determinants for Productivity Among the Selected Crops –Regression Analysis

Sl. No	Coefficients	2003-04			2013-14		
		Paddy	Sugarcane	Ground nut	Paddy	Sugarcane	Ground nut
1	Constant	3.71	4.962	155.14	2.31	5.150	1.739
2	Education	0.498 (2.18)**	0.147 (2.16)**	0.044 (0.08)	0.017 0.44	0.130 1.94***	0.086 1.03
3	Age	-0.064 (1.66)	-0.014 (0.06)	1.789 (1.98)***	-0.024 0.42	-0.011 0.49	0.047 0.31
4	Working population	0.057 (2.80)*	0.021 (0.51)	22.58 (2.04)**	0.019 0.62	0.034 1.03	0.079 0.79
5	Land size	0.024 (1.36)	0.004 (0.22)	21.73 (4.32)*	0.060 2.43**	0.009 0.50	0.210 3.94*
6	Irrigation Intensity	0.004 (0.09)	-0.026 (1.11)	--	0.045 1.98***	0.033 1.96***	--
7	Fertiliser consumption	0.029 (0.73)	0.038 (0.81)	0.042 (0.03)	-0.027 0.47	0.046 1.03	-0.146 1.09
8	Pesticides consumption	-0.109 (3.12)*	-0.050 (0.70)	-1.332 (0.52)	0.117 2.15**	-0.031 0.45	-0.128 1.11
9	Labour Use	0.017 (0.65)	0.292 (2.18)**	2.671 (0.98)	0.002 0.01	0.286 2.23**	0.496 1.99***
10	Tractor/ technology use	0.064 (0.96)	0.420 (2.01)**	-8.907 (0.43)	0.273 1.96***	5.295 2.07**	-0.025 0.29
R2		0.645	0.786	0.657	0.664	0.541	0.697
F-Statistics		3.57	1.41	2.85	1.60	1.41	2.17
N		50	50	50	50	50	50

Note: Dependant Variable: Productivity (figures in parenthesis indicate' values)

, *, ** and *** indicates 1, 5 and 10 percent level of significance

Correspondingly, in case of sugarcane, education, labour use and tractor utilisation are found to be positive and significant at 5 percent level which means that, one percent increase in education of the farmer cultivator, labour use and tractor use lead to increase in yield by .147, .292 and .420 percents respectively. R^2 value of .786 implies that about 78.6, percent of variation in yield is explained by independent variables. On the other hand, the dry crop of Groundnut, interestingly, age of the farmer, family working population and farm size are positive and significant with dependant variable. It means that, one percent increase in the age of the farmer; family working population and farm size an acre, the corresponding increase in yield are by 1.78, 22.58 and 21.73 percent respectively. The R^2 value of .657 implies that about 65.7 per cent of variation in yield is explained by these independent variables. The F-Statistics for all selected crops also indicate that the combination of all individual variables is good.

Similar results for the year of 2013-14 has depicted in the table. In case of paddy, farm size, irrigation intensity, pesticide consumption, and tractor use are positive and significant with dependant variable. Interestingly, the pesticide consumption is positive during the year, 2013-14 in the study region as it experienced three consequent floods (*Leher, Helen and Hudhud*) makes them to use more pesticides than before to protect from pest and deceases. The R^2 value of .664 implies 66.4 per cent variations in yield are explained by independent variables. In the same way, sugarcane crop, the coefficients of farmer education, irrigational intensity, labour use and tractor use are significant at 5% and 10% levels which implies that one percent increased the above independent factors, the yield is increased by .130, .033, 0.286 and 5.29 percent respectively. Whereas, in case of groundnut, since it is a rainfed crop, irrigation intensity was not shown an expected sign and the coefficients of farm size and labour use are significant at 1% and 10 percent levels respectively. The R^2 values of .697 imply that 69.7 percent variation of yield is explained by explanatory variable.

The impulses and incentives by the state and central governments to increase agricultural productivity in Andhra Pradesh though encouraging, it poses many challenges before planners and researchers. The production and productivity of many crops in Andhra Pradesh are lagging behind the national levels because, by and large, the cultivation is carried out in marginal lands under rainfed conditions. The crops are susceptible to weather (either droughts or floods), pest and deceases, low level of credit and investments, inadequate technology and limited marketing facilities, low supporting prices (the farmers are taking crop holiday), low efficiency in processing sector, lack of improved seeds, substandard fertilisers and micro nutrients and inefficient post-harvest management are some of the major constraints affecting the overall production in Andhra Pradesh.

According to the farmers' perception, the absence of appropriate crop rotation, heavy infestation of weeds and insects causing by drought or floods, soil problem like acidity, iron toxicity, sulphide injury, Larvae attack, Borer infestation in case of sugarcane, Tobacco Caterpillar and groundnut leaf miner and blast & brown spots in case of paddy affected on yields as well as quality of output which hampering the sales of commodities in all selected villages.

CONCLUSION

It is clear that increasing compound annual growth rates of productivity in case of paddy and sugarcane have positive impact on growth rate of production, while decrease in the area under the crops have failed to accelerate the output in both Andhra Pradesh and India. On the contrary in case of groundnut, the area has positive impact on production and statistical significant. The success of green revolution was limited and the State as well as central government has to take an affirmative action

plan to promote agricultural sector. To break the productivity plateau, the investment in technology, higher capital formation, opening of better market avenues, improved efficiency in processing sector, better cropping system, improved extension activities, adequate focus on post-harvest management, pest and disease control, encouraging scientific methods and effective and efficient implementation of all RythuKosam strategies shall go a long way in augmenting the growth of Agriculture and there will be no doubt to bring some long lasting results in newly created Andhra Pradesh.

References

- Balakrishnan, P. (2000), "Agriculture and Economic Reforms: Growth and Welfare" *Economic and Political Weekly*, Vol.35, No.12, 999-1004.
- Bhalla, G.S. and G. Singh (2001), "Indian Agriculture: Four Decades of Development, *Sage Publications*, New Delhi.
- Bhalla, G.S. and G. Singh (2009), "Economic Liberalisation and Indian Agriculture: A State wise Analysis" *Economic and Political Weekly*, Vol.45, No.52, 34-44.
- George, P. S., and Chandan Mukherjee, (1986) "Disaggregate analysis of the growth performance of rice in Kerala", *Indian Journal of Agricultural Economics*, 41(1), pp. 1-16.
- Hirashima, S. (2000); "Issues in Agricultural Reforms: Public Investment and Land Market Development" *Economic and Political Weekly*, Vol.35, No.43&44 Pp.3879-3884.
- Indiradevi, P., Thomas, E. K., and Thomas, J. K., (1990) "An analysis of cropping pattern in Kerala", *Agricultural Situation in India*, 45(3), pp. 183.
- Mahendradev, S. (1987); "Growth and Instability in Food grains Production: An Inter-State Analysis" *Economic and Political Weekly*, Vol.22, No.39, A82-A92.
- Mukesh Kumar, (2011) "Trends in Indian Agricultural Production in Pre and Post Reform Period" *Southern Economist*, 50 (15) pp. 20-21.
- Radhakrishna, R. (2002), Agricultural growth Employment and Poverty: A policy Perspective" *Economic and Political Weekly*, Vol.37, No.3, 243-250.
- Thamarajakshi, R. (1999), "Agriculture and Economic Reforms" *Economic and Political Weekly*, Vol.34, No.14, Pp.2393-2395.
- Vaidyanathan, A. (2010). "Agricultural Growth in India, Role of Technology, incentives and Institutions. *Oxford University Press*, New Delhi, India.
- Vyas, V.S. (2001); "Agriculture: Second Round of Economic Reforms" *Economic and Political Weekly*, Vol.36, No.14, 829-836.