ASSESSING THE FACTORS INFLUENCING THE FOOD GRAIN PRODUCTION IN ANDHRA PRADESH: DISTRICT WISE ANALYSIS

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India is one of the leading Food grains producing countries of the world with cultivated area of 121.91 Million hectares and production of 212.03 Million tonnes during 2001-02. India exports and imports Food grains and their products to and from many countries. In India, leading states in Food grains production are Utter Pradesh, Punjab, and West Bengal. Andhra Pradesh is ranked fifth, with cultivated area of 7.04 Million hectares and production of 14.84 Million tonnes during 2001-02#. Further, in Andhra Pradesh region wise descending order of Food grain production was Coastal Andhra, Telangana and Rayalaseema with respective production of 8.24, 6.46 and 1.33 Million Tonnes. The findings of the studies by Hazell (1984) Jayadevan (1991) revealed that the growth in crop production during the post-green revolution period has been accompanied with increased instability and yield fluctuation turned out to be the major source of production instability. This necessitates the present study with the following **Specific objectives**:

1. To examine the extent of instability in area, production and productivity.
2. To decompose the change in production.
3. To study the direct and indirect effects on production by explanatory variables, viz., area and productivity.

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Methodology

The study pertains to all the districts i.e., 23 districts, three geographical regions of Andhra Pradesh viz., Coastal Andhra, Rayalaseema and Telangana; and State as a whole. Time series data from 1980-81 to 2001-02 was collected from various sources published by Bureau of Economics and Statistics, Government of Andhra Pradesh. For the calculation of CV, CII and Decomposition of change in production whole period was divided into two sub periods resulting in the formation of three periods viz., Period-I (1980-81 to 1990-91), Period-II (1991-92 to 2001-02) and Overall Period (1980-81 to 2001-02) and analysis was carried out separately for each period. For path analysis overall period was taken in to account.

Analytical Tools:

I. Estimation of extent of Instability:

1) **Coefficient of variation** (CV): Which explains the fluctuations over the period.

$$CV = \frac{[1/_{N-1}\ \Sigma(X_t - \bar{X})^2]^{1/2}}{\bar{X}}$$

Where, **N** = Number of years
X_t = Area/production/productivity in the year 't'
$\bar{X}$ = Mean of Area/production/productivity.

2) **Coppock's Instability Index (CII):** Coppock's Instability Index (CII) is a close approximation of the average year-to-year percentage variation adjusted for trend. In algebraic form:

$$C.I.I = [Antilog\sqrt{logV-1}]x\ 100^*$$

$$log\ V = \frac{[log\ (X_{t+1}/X_t) - m]^2}{N-1}$$

Where, **log V** = Logarithmic variance of the series.
X_t=Area/production/Productivity in the year 't'
N= Number of years
m= Arithmetic mean of the difference between the logs of X_{t+1} etc.,

* *Kaur Narinder and Singhal K.C. (1988) India's export instability. Margin 21:54-61.*

II. Sources of Variability

i) Decomposition the Change in production:

Decomposition of change in production will result into area effect, productivity effect and interaction effect of area and productivity. In formulae form:

$$\Delta P = Ao.\Delta Y + Yo.\Delta A + \Delta A.\Delta Y$$

Where, ΔP = production difference $\quad$ $Yo.\Delta A$ = Area effect

$Ao.\Delta Y$ = productivity effect $\quad$ $\Delta A.\Delta Y$ = Interaction effect of area and productivity.

ii) Path analysis:

Path analysis was employed to study the association between the production and factors influencing it viz., area and productivity. A path co-efficient is simply a standardized partial regression co-efficient. It would measure the direct influence of one variable upon others and permit the separation of the correlation co-efficient into components of direct and indirect effects.

$$P_{1y} + r_{1,2} . P_{2y} = r_{1y}$$

$$P_{2y} + r_{2,1} . P_{1y} = r_{2y}$$

Where, r_{1y} and r_{2y} are the correlation co-efficients between Area and Production and between yield and Production respectively. P_{1y} and P_{2y} are the direct effects on production due to area and yield. The remaining term in the equation **(rij)** represents the indirect effects.

Unexplained variance (residual) not accounted for by the variables included could be obtained by the formula: $P_{ry} = \sqrt{1- (P_{1y}\ r_{1y} + P_{2y}\ r_{2y})}$

The correlation co-efficients between production and each of the independent variables (r_{iy}) were tested for significance by students **'t'** test

$$t = \frac{r\ \sqrt{n-2}}{\sqrt{1 - r^2}}$$

Where, r = correlation co-efficient,
n = number of years

Result And Discussion # *

I. Extent of Instability:

Among the districts, at the overall level, the lowest and the highest in area, production and productivity were recorded in West Godavari (4.51% CV and 1.94% CII) and Ananthapur (42.20% CV and 14.45% CII), Ranga Reddy (11.84% CV and 5.18% CII) and Warangal (30.58% CV and 14.47% CII) and in Guntur (10.87% CV and 4.42% CII) and Warangal (31.24% CV and 15.39% CII) (Table-1)**. In all, eighteen districts had showed higher instability in productivity than area and likewise contributed towards the production variability. During period-I and period-II instability in productivity was higher than the instability in area was recorded in twenty districts and like wise they contributed towards instability in production.

Similarly, among the regions, the lowest instability in area (4.30% CV and 1.91% CII), production (12.83% CV and 5.54% CII) and productivity (11.51% CV and 4.80% CII) were noticed in Coastal Andhra. The highest instability in area (28.96% CV and 10.46% CII) was recorded in Rayalaseema, whereas, in production (21.18% CV and 9.35% CII) and productivity (24.05% CV and 10.77% CII) were noticed in Telangana. In similarity with period-I, productivity variability was high in relation to instability in area in Coastal Andhra and Telangana regions, whereas, reverse trend was observed in Rayalaseema and hence contributed towards production fluctuations. During the period-I, productivity variability was more in relation to instability in area in Coastal Andhra and Telangana regions, whereas, in Rayalaseema it was the reverse. During the period-II, in all the three regions productivity variability has contributed more towards production fluctuations in relation to instability in area.

State as a whole, during the period I, instability in productivity (9.48% CV and 3.53% CII) in relation to instability in area (4.79% CV and 1.98% CII)

District Hyderabad was excluded from discussion not from analysis, because of very less cropped area and production.

* *Discussion was proceeded level wise. At each level all the three periods discussed.*

** *All the tables are given at the end of the discussion*

had contributed more towards production instability (13.14% CV and 5.45% CII). During the period-II, instability in productivity (12.34% CV and 5.15% CII) had contributed more towards production instability (12.02% CV and 5.42% CII) than instability in area (7.54% CV and 2.68% CII). At the overall level, variability in production (14.29% CV and 6.22% CII) had more contributed by variability in productivity (17.68% CV and 7.61% CII) than by variability in area 99.78% CV and 3.73% CII). Thus, in all the periods productivity had more effect on production, which was highest during the period under study.

Inter period comparison at regional level, revealed that instability in productivity was more than instability in area in Coastal Andhra and Telangana in all the periods. In Rayalaseema it was similar in period-II whereas, it was reversed during the period-I and overall period. At state level, during all the periods variability in productivity was more than variability in area, which had contributed towards production variability.

II. Sources of Variability

i) Decomposition of Change in production:

Among the districts, during the period-I, dominance of yield effect than other components of change in production was observed in sixteen districts (Table-2). The lowest area effect (-319.69%) and interaction effect (-210.83%) and the highest yield effect (630.51%) were recorded in Warangal showing negative destabilizing effect of area and interaction of area and yield which were countered by yield effect. During the period-II, nineteen districts showed higher yield effect than other components of change. But, in Cuddapah, where the lowest yield effect (-85.37%) and the highest area effect (204.70%) were recorded, yield has caused negative instability. During overall period, yield effect was higher than other components of change which was observed in nineteen districts. In Nellore the lowest area effect (-126.01%) and the highest yield effect (284.86%) were observed. Thus, area has caused negative destabilization.

Among the regions, dominant role of yield effect in Coastal Andhra and Telangana and area effect in Rayalaseema was observed in the period-I and

overall period, whereas, yield effect was dominant in all the regions during the overall period. Thus, as like in districts, in regions dominant role of yield effect was also clearly felt.

State as a whole, change in yield had higher effect on production differential than the other components of change was noticed in the period-I (353.94%), period-II (88.32%) and overall period (10.13%), that too, change in area caused negative destabilizing effect during the period-I (-197.49%) and overall period (-41.56%).

ii) Path Analysis:

Among the districts, significant correlation with production by area and productivity were noticed in thirteen and nineteen districts respectively (Table-3). Further, in fifteen districts correlation coefficient of productivity had registered higher than correlation coefficient of area. The lowest and the highest path value for area were recorded in Visakhapatnam (0.2749) and Cuddapah (1.14914) respectively. The lowest and the highest path values for productivity were recorded in East Godavari (0.5434) and Khammam (1.3575) respectively. In fifteen districts path values of productivity were higher than path values of area. In sixteen districts indirect effect of area and productivity recorded negative values. Thus, in majority of districts, productivity has more relation with production vis-à-vis area.

Among the regions, productivity in Coastal Andhra (0.9403) and Telangana (0.8113) and area in Rayalaseema (0.5987) had registered significant correlation with production, they in turn higher than their counterparts. The lowest path values for both area (0.3396) and productivity (0.9551) were recorded in Coastal Andhra region, whereas, the highest for respective variables were recorded in Rayalaseema (1.4861) and Telangana (1.2473). Path values of productivity was higher than path values of area which was recorded in Coastal Andhra and Telangana, whereas, reverse were observed in Rayalaseema. Further, in all the regions indirect effects of area and productivity values were recorded negatively. Thus, productivity had substantial effect on production vis-à-vis its counterpart.

State as a whole, significant correlation with production was observed in productivity (0.8381). While, correlation coefficient of area (-0.2120) was not significant. Further, direct effect of productivity (1.3776) on production was higher that areas direct effect (0.7626). Thus, productivity had dominant role on production than by its counterpart.

Policy Implications

1. Instability in production was more due to productivity in food crops. This indicates that growth in production depends upon factors like development of High Yielding varieties and improvement in input use efficiency.
2. Yield stabilisation should be given prime importance by way of assured supply of farm inputs and providing the remunerative prices.
3. Though area has less effect on food grain production, but for overall improvement in food grain production for supplying staple food to people, the area attributing factors like adequate supply of farm inputs for area expansion should also be given due importance.
4. The impasse in food grains production can be overcome by break through in technology, because production function parameters differ significantly from traditional to modern technology.

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Table-1: Coefficient of Variation (CV) and Coppock's Instability Indices (CII) of area, production and productivity of Food grains among districts, regions and state as a whole in Andhra Pradesh

(Values in percentages)

Districts, Regions & State	Overall period						Period-1						Period-II					
	Area		Production		Productivity		Area		Production		Productivity		Area		Production		Productivity	
	C.V	C.I.I	C.V	C.I.I	C.V	C.I.I	C.V	C.I.I	C.V	C.I.I	C.V	C.I.I	C.V	C.I.I	C.V	C.I.I	C.V	C.I.I
Srikakulam	14.62	8.63	24.10	16.77	16.11	8.35	18.13	11.13	29.77	22.35	20.84	11.06	8.99	3.83	17.34	6.61	10.64	3.85
Vizianagaram	12.56	6.51	28.55	17.92	21.65	11.41	14.36	7.47	36.72	22.90	28.06	14.68	5.42	2.38	16.42	7.54	13.48	6.02
Visakhapatnam	8.17	3.68	24.80	12.05	19.01	8.90	8.65	3.94	25.44	11.87	19.15	8.46	8.12	3.56	23.70	12.11	17.67	8.85
East Godavari	9.36	4.12	16.96	7.51	12.61	5.74	9.68	4.17	14.20	6.43	12.22	5.85	4.25	1.67	14.95	5.55	13.04	4.96
West Godavari	4.51	1.94	17.01	7.76	16.43	7.77	4.56	1.84	14.69	6.86	14.74	7.14	4.49	1.40	14.78	5.07	12.53	4.87
Krishna	4.67	2.04	14.46	5.47	16.69	6.56	3.43	1.45	13.02	4.21	12.06	3.94	3.04	1.06	11.11	4.94	11.65	3.69
Guntur	6.60	2.96	15.45	6.79	10.87	4.42	7.85	3.48	18.42	7.82	12.34	4.84	3.51	1.44	9.24	4.04	7.92	3.31
Prakasam	17.61	7.16	22.79	10.14	25.81	12.08	10.60	3.63	19.89	9.33	20.77	9.30	14.94	5.89	23.31	9.93	14.23	5.99
Nellore	9.00	3.46	16.61	7.86	19.77	9.11	8.96	3.49	16.12	7.81	16.70	7.73	4.52	1.68	12.88	5.27	12.15	4.38
COASTAL ANDHRA	4.30	1.91	12.83	5.54	11.51	4.80	5.68	2.55	11.93	5.04	8.96	3.60	2.59	1.13	8.37	3.10	7.37	2.57
Kurnool	23.41	9.10	16.86	6.74	21.96	10.39	15.70	6.20	18.97	7.12	14.94	7.00	4.70	2.01	15.23	6.71	12.46	5.84
Ananthapur	42.20	14.45	25.70	9.18	25.24	11.47	33.07	12.26	26.86	9.04	21.27	8.95	4.18	1.81	18.51	8.45	15.72	7.09
Cuddapah	34.87	13.23	20.44	9.25	23.33	10.35	25.05	8.96	16.23	6.30	21.73	8.81	15.12	6.56	21.47	10.21	15.27	7.23
Chittoor	25.87	10.11	26.32	12.41	17.80	8.71	22.12	8.78	27.23	13.67	18.32	8.92	16.47	6.37	24.90	10.79	12.55	5.99
RAYALASEEMA	28.96	10.46	18.04	6.93	20.53	9.52	21.46	7.65	17.04	6.88	17.01	7.61	4.95	2.06	15.25	6.77	10.94	4.87
Rangareddy	10.69	4.11	11.84	5.18	29.33	6.09	9.82	3.76	13.35	5.76	16.01	6.42	6.29	2.50	10.63	4.46	7.58	3.32
Hyderabad	62.33	38.92	61.28	36.22	24.70	14.69	33.17	14.04	36.99	28.27	29.39	17.43	45.15	28.85	41.41	25.52	15.15	7.68
Nizamabad	10.81	4.79	22.06	9.59	18.32	8.22	6.60	2.88	15.72	7.03	13.56	6.00	11.40	4.94	25.41	11.31	14.60	6.39
Medak	9.27	3.74	26.37	12.15	23.02	10.51	9.06	3.65	24.78	12.13	22.45	10.01	8.46	3.49	24.84	9.54	16.60	6.20
Mahaboob Nagar	22.25	9.51	28.49	12.96	24.26	11.50	14.19	5.56	27.81	12.85	20.86	9.25	18.01	6.26	30.54	12.95	15.52	6.75
Nalgonda	16.67	6.99	19.13	8.49	23.90	10.76	9.93	3.99	18.71	8.33	20.37	8.35	9.41	3.53	18.62	8.26	11.38	4.98
Warangal	24.72	10.27	30.58	14.47	31.24	15.39	17.92	6.81	25.86	13.71	27.60	12.81	17.68	8.03	32.68	14.72	16.00	6.90
Khammam	14.00	5.72	20.76	9.58	28.25	13.09	10.02	4.00	16.61	7.90	20.14	9.20	7.95	3.23	17.21	7.79	16.03	6.56
Karim Nagar	13.34	5.73	27.15	11.91	146.24	11.69	9.08	3.56	20.57	9.42	15.74	8.06	12.45	5.43	26.91	12.11	10.53	6.70
Adilabad	10.45	4.44	26.92	12.39	33.84	14.85	5.47	2.35	13.38	6.06	12.42	5.61	5.43	2.42	25.13	9.94	25.70	9.46
TELANGANA	13.79	5.58	21.18	9.35	24.05	10.77	9.22	3.45	17.20	7.98	16.39	7.47	8.43	3.47	21.49	9.34	14.34	5.77
ANDHRA PRADESH	9.78	3.73	14.29	6.22	17.68	7.61	7.54	2.68	12.02	5.42	12.34	5.15	4.79	1.98	13.14	5.45	9.48	3.53

Table-2: Components of change in production of Food grains at district, region and state level during different periods.

(Values in Percentage)

Districts Regions & State	Overall Period				Period-I				Period-II			
	Differential Production Δp	Area Effect Δa	Yield Effect Δy	Interaction Effect Δa.Δp	Differential Production Δp	Area Effect Δa	Yield Effect Δy	Interaction Effect	Differential Production Δa.Δp Δp	Area Effect Δa	Yield Effect Δy	Interaction Effect Δa.Δp)
Srikakulam	100.00	6.11	92.96	0.93	100.00	46.29	51.11	2.60	100.00	39.23	66.62	-5.85
Vizianagaram	100.00	10.03	86.63	3.34	100.00	12.47	80.20	7.33	100.00	24.36	80.07	-4.43
Visakhapatnam	100.00	-13.15	117.20	-4.05	100.00	31.88	60.85	7.28	100.00	-88.93	204.7	-15.74
East Godavari	100.00	40.79	48.53	10.68	100.00	-140.59	207.99	32.60	100.00	14.63	78.40	6.97
West Godavari	100.00	17.38	75.68	6.94	100.00	-5.43	104.82	0.60	100.00	23.51	65.79	10.70
Krishna	100.00	-4.54	108.31	-3.77	100.00	5.48	92.58	1.94	100.00	-11.30	116.4	-5.12
Guntur	100.00	26.29	64.02	9.69	100.00	24.68	67.73	7.59	100.00	23.51	73.14	3.35
Prakasam	100.00	-17.81	130.49	-12.69	100.00	-222.40	429.12	-106.72	100.00	47.74	40.73	11.53
Nellore	100.00	-126.01	284.86	-58.85	100.00	-55.21	176.47	-21.26	100.00	-70.60	188.6	-18.00
COASTAL ANDHRA	100.00	5.39	92.12	2.48	100.00	9.49	89.16	1.35	100.00	10.82	86.10	3.08
Kurnool	100.00	1,161.73	-1,755.00	693.30	100.00	119.49	-29.23	9.74	100.00	31.99	60.76	7.25
Ananthapur	100.00	189.49	-255.98	166.49	100.00	117.31	-52.20	34.89	100.00	12.07	86.29	1.64
Cuddapah	100.00	300.21	-378.59	178.38	100.00	250.93	-306.62	155.69	100.00	204.76	-85.37	-19.40
Chittoor	100.00	134.75	-76.90	42.15	100.00	191.19	-151.05	59.85	100.00	110.04	-14.77	4.73
RAYALASEEMA	100.00	239.57	-283.86	144.29	100.00	147.39	-89.85	42.47	100.00	17.50	80.92	1.58
Ranga Reddy	100.00	-84.25	226.37	-42.12	100.00	-75.36	211.94	-36.58	100.00	-16.22	118.6	-2.40
Nizamabad	100.00	6.59	90.70	2.71	100.00	-143.82	254.93	-11.11	100.00	34.82	53.81	11.37
Medak	100.00	-2.07	103.49	-1.41	100.00	-47.11	170.99	-23.89	100.00	27.97	57.53	14.50
Mahaboobnagar	100.00	-106.99	274.02	-67.04	100.00	292.91	-243.43	50.52	100.00	-15.69	121.6	-5.89
Nalgonda	100.00	-74.92	251.88	-76.96	100.00	-63.54	200.43	-36.89	100.00	-129.1	259.5	-30.43
Warangal	100.00	-40.84	194.52	-53.68	100.00	-319.69	630.51	-210.83	100.00	31.31	55.26	13.43
Khammam	100.00	-59.26	227.55	-68.29	100.00	-150.51	307.60	-57.09	100.00	-35.96	155.1	-19.16
Karimnagar	100.00	-12.59	125.15	-12.56	100.00	-50.99	170.93	-19.93	100.00	15.61	76.84	7.55
Adilabad	100.00	-39.81	187.52	-47.71	100.00	462.35	-430.71	68.36	100.00	-5.34	113.1	-7.72
TELANGANA	100.00	-37.64	171.56	-33.93	100.00	-131.15	282.03	-50.88	100.00	6.49	90.60	2.91
ANDHRA PRADESH	100.00	-41.56	170.13	-28.57	100.00	-197.49	353.44	-55.95	100.00	8.80	88.32	2.87

Table-3: District wise, region wise and state as whole Path values for Food grains

Districts, Regions & State		Area	Productivity	Correlation With Production	Residual
Srikakulam	Area	0.4230	0.4573	0.8803**	
	Productivity	0.2995	0.6458	0.9453**	0.0172
Vizianagaram	Area	0.2902	0.5750	0.8651**	
	Productivity	0.2207	0.7559	0.9766**	0.0108
Visakhapatnam	Area	0.2749	0.6035	0.8784**	
	Productivity	0.2161	0.7677	0.9838**	0.0032
East Godavari	Area	0.6421	0.2178	0.8599**	
	Productivity	0.2574	0.5434	0.8007**	0.0127
West Godavari	Area	0.2977	0.4523	0.7500**	
	Productivity	0.1693	0.7955	0.9648**	0.0092
Krishna	Area	0.3595	-0.7243	-0.3648	
	Productivity	-0.2209	1.1789	0.9580**	0.0018
Guntur	Area	0.3225	0.1573	0.4799*	
	Productivity	0.0570	0.8907	0.9477**	0.0011
Prakasam	Area	0.5995	-0.1086	0.4909*	
	Productivity	-0.0754	0.8640	0.7886**	0.0244
Nellore	Area	0.8042	-0.0636	0.7406**	
	Productivity	-0.0761	0.6727	0.5966**	0.0031
COASTAL ANDHRA	Area	0.3396	-0.0415	0.2981	
	Productivity	-0.0148	0.9551	0.9403**	0.0008
Kurnool	Area	1.4244	-1.0147	0.4097	
	Productivity	-1.0668	1.3548	0.2881	0.0262
Ananthapur	Area	1.4209	-0.6799	0.7410**	
	Productivity	-1.0520	0.9184	-0.1336	0.0698
Cuddapah	Area	1.4914	-0.8557	0.6357**	
	Productivity	-1.1341	1.1253	-0.0088	0.0618
Chittoor	Area	0.8964	-0.1884	0.7080**	
	Productivity	-0.2342	0.7210	0.4867	0.0145
RAYALASEEMA	Area	1.4861	-0.8873	0.5987**	
	Productivity	-1.1171	1.1804	0.0633	0.0355
Rangareddy	Area	0.9358	-0.8215	0.1144	
	Productivity	-0.5980	1.2856	0.6876**	0.0090
Hyderabad	Area	1.1011	-0.1899	0.9112**	
	Productivity	-0.5242	0.3989	-0.1253	0.0467

Districts, Regions & State		Area	Productivity	Correlation With Production	Residual
Nizamabad	Area	0.5400	-0.1290	0.4110	
	Productivity	-0.0758	0.9186	0.8428**	0.0039
Medak	Area	0.3390	0.0137	0.3527	
	Productivity	0.0050	0.9333	0.9383**	0.0047
Mahaboobnagar	Area	0.9226	-0.3263	0.5962**	
	Productivity	-0.3508	0.8583	0.5076*	0.0143
Nalgonda	Area	0.7935	-0.7940	-0.0005	
	Productivity	-0.4955	1.2716	0.7761**	0.0135
Warangal	Area	0.9082	-0.6570	0.2512	
	Productivity	-0.5144	1.1601	0.6457**	0.0227
Khammam	Area	0.6088	-1.0101	-0.4013	
	Productivity	-0.4530	1.3575	0.9045**	0.0164
Karimnagar	Area	0.5362	-0.4277	0.1086	
	Productivity	-0.2127	1.0784	0.8658**	0.0081
Adilabad	Area	0.3308	-0.7007	-0.3700	
	Productivity	-0.1995	1.1621	0.9626**	0.0038
TELANGANA	Area	0.7239	-0.7512	-0.0273	
	Productivity	-0.4359	1.2473	0.8113**	0.0078
ANDHRA PRADESH	Area	0.7626	-0.9745	-0.2120	
	Productivity	-0.5395	1.3776	0.8381**	0.0071

** 1% Level of significance * 5% Level of significance*