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A STUDY ON GROWTH AND INSTABILITY IN MAIZE PRODUCTION IN TAMIL NADU

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ABSTRACT

Agricultural production includes two components viz., food and non-food articles. Of all the food articles, foodgrains constitutes the most significant part of agricultural production of any country. Importance of foodgrains in the world economy is being recognized and there is an urgent need to raise production in view of the large gap between demand and supply of foodgrains. Foodgrains are grown in many states in our country providing employment to a large number of people and contributing to the growth of the vital rural economy. The major foodgrains growing states in India are Uttar Pradesh, Punjab, Andhra Pradesh, Rajasthan, Haryana, Maharashtra, Madhya Pradesh, West Bengal, Karnataka, Tamil Nadu, Bihar, Gujarat, Orissa and Chhattisgarh, which together accounted for more than 90 per cent of area and production of foodgrains. Among these states, the growing of the foodgrains has assumed greater significance in Tamil Nadu. The principal crops like paddy, millets and pulses, groundnut, cotton and sugarcane accounted for more than 60 per cent of the gross cropped area of the State. The millets viz., cholam, cumbu. ragi, maize, korrah, varahu and samai are grown in the State. In Tamil Nadu, the total area under cereals was 24.98 lakh ha. of which 19.20 lakh ha. of land was irrigated and the rest was unirrigated. Therefore, an analysis of growth and instability in maize production in Tamil Nadu is of great importance for a comprehensive understanding of the food security at the state level. In this context the present study assumes growth and instability of maize production in Tamil Nadu. This study also exhibits the inter-district analysis of the maize production in Tamil Nadu. The compound growth rate for area under maize, production and yield of maize cultivated in Tamil Nadu shows a clear picture of increasing growth. The study also concludes that there persists a huge increase in the instability of area, production and yield of the crop studied over the review period. Maize cultivation in the post-reform period remained more unstable as compared to the pre-reform period. The results of the decomposition analysis revealed that the change in mean production of Maize was mainly due to the change in mean area.

KEYWORDS
growth, instability, decomposition.

INTRODUCTION

Agricultural production includes two components viz., food and non-food articles. Of all the food articles, foodgrains constitutes the most significant part of agricultural production of any country. Importance of foodgrains in the world economy is being recognized and there is an urgent need to raise production in view of the large gap between demand and supply of foodgrains. A strong food and agricultural system thus, constitutes an important factor in the strategy of overall economic growth and development. Any change in agriculture sector has a spillover effect on the entire India economy. In India variety of crops are grown throughout the length and breadth of the country in various agro-climatic conditions. Agriculture and allied activities, the single largest sector, acts as a growth engine by ensuring food and nutritional security to the masses besides providing raw-materials to agro-based industries and also providing employment and thereby income to the rural folk of Indian Economy.

The growth in the production of agricultural crops depends on many factors such as area cropped, input management and yield. The cropped area and productivity are determined by the fertility of soil, monsoon behaviour, rainfall, irrigation, availability of agricultural labourers, climatic changes, prices etc. Foodgrains are grown in many states in our country providing employment to a large number of people and contributing to the growth of the vital rural economy. The major foodgrains growing states in India are Uttar Pradesh, Punjab, Andhra Pradesh, Rajasthan, Haryana, Maharashtra, Madhya Pradesh, West Bengal, Karnataka, Tamil Nadu, Bihar, Gujarat, Orissa and Chhattisgarh, which together accounted for more than 90 per cent of area and production of foodgrains. Among these states, the growing of the foodgrains has assumed greater significance in Tamil Nadu.

Tamil Nadu shares about 4 per cent in respect of the geographical area, 7 per cent of population and 3 per cent of water resources of the country. The gross area sown in 2010-11 accounted for about 44.1 per cent of the total geographical area, of which 56 per cent of the land was irrigated. The contribution of agriculture (including allied activities) of the State to the Gross State Domestic Product (GSDP) at Constant prices accounts for 9.16 percent (at 2004-05 constant prices) during 2010-11. However, the agriculture sector ensures household food security and brings forth equity in distribution of income and wealth which would result in the reduction of poverty.

The principal crops like paddy, millets and pulses, groundnut, cotton and sugarcane accounted for more than 60 per cent of the gross cropped area of the State. The millets viz., cholam, cumbu. ragi, maize, korrah, varahu and samai are grown in the State. In Tamil Nadu, the total area under cereals was 24.98 lakh ha. of which 19.20 lakh ha. of land was irrigated and the rest was unirrigated.

Therefore, an analysis of growth and instability in maize production in Tamil Nadu is of great importance for a comprehensive understanding of the food security at the state level. In this context the present study assumes growth and instability of maize production in Tamil Nadu. This study also exhibits the inter-district analysis of the maize production in Tamil Nadu.

OBJECTIVES

The main objectives of this study are as follows:

1. To estimate the rate of growth and instability in maize production, area and yield in Tamil Nadu,
2. To know the sources of instability in production of maize in Tamil Nadu,
3. To measure the relative contribution of area, yield and their interaction to production of maize in Tamil Nadu; and
4. To suggest some policy measures to overcome the problems faced in the agriculture sector.

METHODOLOGY

The methodology used in the study is discussed in this section. It includes period of study, sources of data and analytical techniques used in this study.

PERIOD OF STUDY

The present study utilizes time series data with respect to area, production and yield of maize cultivated in the state of Tamil Nadu from the year 1979-80 to 2010-11. The entire study period is divided into two periods. Period I is Pre-reform period related to 1979-80 to 1990-91. Period II is Post-reform period related to 1991-92 to 2010-11.

SOURCES OF DATA

The present analysis was based on secondary data relating to the area, production and yield of maize cultivated in Tamil Nadu. The data was obtained from various Season and Crop Reports published by the Department of Economics and Statistics, Chennai. District wise data were used to study the growth, instability and sources of instability in maize production in Tamil Nadu. According to the Season and Crop Report - 1979-80, there were 15 districts in Tamil Nadu. Presently the state is demarcated into 32 districts including so many new born districts. Comparable data were not available for the period of all the 32 years particularly for newly formed districts as these were created in different years during the study period. To make the comparison feasible, the new born districts were merged

with the parent districts to form 15 original districts. Out of 15 districts only 9 districts had data for entire study period. So that the analysis was restricted to those nine districts only. The secondary data compiled from the various season and crop reports were formatted by using electronic spreadsheets (MS-Excel 2007). SPSS-15 (Statistical Package for Social Sciences) software was used for the data analysis.

ANALYTICAL TECHNIQUES

The collected data were systematically analyzed through the following techniques.

COMPOUND GROWTH RATE

To study the growth pattern of area, production and yield of major foodgrains in Tamil Nadu for the period 1979-80 to 2010-11, a semi log transformation model was used.

INSTABILITY

To measure the instability in area, yield and production of foodgrains in Tamil Nadu, the coefficient of variations (CV) was worked out.

DECOMPOSITION MODEL

In order to find out the sources of growth and variability in maize production in Tamil Nadu, Hazell's decomposition model was employed. A fairly long period of 32 years was taken to measure the sources of change in the variance of maize production. Here an attempt is made to break down the growth of maize production during 1991-92 to 2010-11 over the period of 1979-80 to 1990-91. Hazell (1982) suggested the linearly detrended data for his entire decomposition analysis. Because the long-term trend in each variable needs to be remove in order to separate it from the short-term stochastic variation.

ANALYSIS AND DISCUSSION

Tamil Nadu is a well known place for Paddy production. Apart from Paddy, some other foodgrains including Cholam, Cumbu, Ragi and Maize are also cultivated. In this study, maize was selected for analysis.

Keeping in view the objectives of the study, data pertain to area, production and yield of maize was collected for the period of 32 years from 1979-80 to 2010-11. The necessary data were obtained district wise as well as state level from the various Season and Crop Reports published by Department of Economics and Statistics, Government of Tamil Nadu, Chennai. The collected data were systematically analyzed through the Compound growth rate analysis, Instability analysis and Decomposition Analysis. This following section presents the results of analysis and interpretation.

GROWTH PERFORMANCE OF MAIZE

The growth pattern, in terms of area, production and yield of Maize cultivated in the state of Tamil Nadu has been studied at the district level as well as the state as a whole during the pre and post reform periods and the results are depicted in the Table 1, 2 and 3.

TABLE 1: GROWTH RATE OF AREA UNDER MAIZE CULTIVATION (in Per cent)

District	Pre-reform Period	Post-reform Period	Overall Period
North Arcot	-3.30	1.38	4.14
Salem	29.43	25.59	17.99
Dharmapuri	-8.26	-0.86	1.34
Coimbatore	10.91	5.24	4.83
Periyar	6.84	16.23	15.64
Tiruchirappalli	-14.38	55.18	40.72
Pudukkottai	-1.86	34.59	9.65
Thanjavur	-6.92	20.46	6.40
Madurai	40.48	6.63	12.47
State	**3.94**	**13.74**	**12.94**

Source: Computed

The area under Maize cultivation in Tamil Nadu had shown a positive growth rate of 3.94 per cent in the pre-reform period as revealed by table 1. On the other hand, area under Maize cultivation in the post-reform period had shown a much improved growth rate of 13.74 per cent.

The district wise analysis revealed that, Madurai (40.48%) and Salem districts (29.43%) witnessed a remarkable growth rate in Maize cultivated area in the pre-reform period. During the post-reform period the performance of Tiruchirapalli (55.18%) and Pudukkottai districts (34.59%) is a notable one.

TABLE 2: GROWTH RATE OF PRODUCTION OF MAIZE (in Per cent)

District	Pre-reform Period	Post-reform Period	Overall Period
North Arcot	-0.57	9.77	4.22
Salem	33.57	25.83	21.24
Dharmapuri	-8.26	8.45	1.21
Coimbatore	9.67	13.41	9.39
Periyar	13.77	22.69	16.62
Tiruchirappalli	-13.11	58.99	22.05
Pudukkottai	2.81	21.85	-0.21
Thanjavur	0.28	14.47	-0.13
Madurai	47.77	13.79	24.49
State	**7.29**	**18.80**	**13.31**

Source: Computed

The growth rate of Maize production was 7.29 per cent during the pre-reform period, in the state level, whereas, during the post-reform period, the growth rate of Maize production was increased to 18.8 per cent. During the pre-reform period, Madurai district (47.77%) registered a higher growth rate in Maize production. Whereas, Tiruchirappalli district (58.99%) registered higher growth rate in the post-reform period.

TABLE 3: GROWTH RATE OF YIELD OF MAIZE CULTIVATED IN TAMIL NADU (in Per cent)

District	Pre-reform Period	Post-reform Period	Overall Period
North Arcot	2.83	5.81	2.75
Salem	3.20	4.75	2.24
Dharmapuri	0.01	8.56	3.72
Coimbatore	-1.12	9.17	3.42
Periyar	6.49	5.74	3.45
Tiruchirappalli	1.46	3.09	1.71
Pudukkottai	4.76	6.55	3.37
Thanjavur	7.74	3.16	2.61
Madurai	5.19	5.31	2.84
State	**6.25**	**5.34**	**2.62**

Source: Computed

It is evident from table 3 that, the Maize yield had shown a positive growth rate of 6.25 per cent. In the case of post-reform period, the growth rate of Maize yield had shown a slighter decline as compared to the previous period.

From the district wise analysis, it is clear that, Thanjavur district showed the highest growth rate of Maize yield and Coimbatore district showed the lowest growth rate, during the pre-reform period.

It is also clear from the Table 3 that, during the post-reform period, all the districts witnessed a positive growth rate in Maize yield. Coimbatore district showed the highest growth rate of 9.17 per cent among the others.

INSTABILITY IN MAIZE CULTIVATION

An attempt is also made in this study is to examine how year to year fluctuations in crop output changed from one period to another period, and what is the effect of new economic policy on the instability in crop output. Accordingly, the instability measures (Coefficient of Variation) for area, production and yield of Maize at the district level as well as at the state level in Tamil Nadu during the pre and post reform periods were computed and the results are depicted in the Table 4, 5 and 6.

TABLE 4: INSTABILITY INDEX OF MAIZE CULTIVATED AREA IN TAMIL NADU (in Per cent)

District	Pre-reform Period	Post-reform Period	Overall Period
North Arcot	108.61	94.03	97.88
Salem	86.56	109.1	148.98
Dharmapuri	165.88	47.97	202.06
Coimbatore	55.82	28.32	44.06
Periyar	35.57	80.29	113.95
Tiruchirappalli	104.25	115.74	160.78
Pudukkottai	31.95	118.54	81.61
Thanjavur	29.59	94.69	70.79
Madurai	119.35	44.74	88.62
State	**26.34**	**68.0**	**95.73**

Source: Computed

It is evident from the Table 4 that the coefficient of variation in Maize cultivated area in Tamil Nadu for post-reform period was much higher than the pre-reform period.

It could be observed from the district wise analysis that there was a decline in instability of Maize cultivated area in North Arcot, Dharmapuri, Coimbatore, and Madurai districts during the post-reform period than the pre-reform period.

It is also clear that the instability in area wise Maize cultivation in Salem, Periyar, Tiruchirappalli, Pudukkottai and Thanjavur districts were much higher in the Post-reform period than the pre-reform period.

TABLE 5: INSTABILITY INDEX OF MAIZE PRODUCTION IN TAMIL NADU (in Per cent)

District	Pre-reform Period	Post-reform Period	Overall Period
North Arcot	79.3	194.3	196.51
Salem	84.92	152.03	200.32
Dharmapuri	167.8	85.57	169.82
Coimbatore	52.1	113.78	135.54
Periyar	47.49	134.13	177.88
Tiruchirappalli	98.25	127.78	175.63
Pudukkottai	22.93	158.81	132.98
Thanjavur	38.1	132.9	99.55
Madurai	123.01	101.9	144.67
State	**29.38**	**115.69**	**152.7**

Source: Computed

As far as the production of Maize in Tamil Nadu is concerned, the coefficient variation was much higher in post-reform period (115.69%) than the pre-reform period (29.38%). At the district level, Dharmapuri and Madurai districts witnessed a decline in instability during the post-reform period.

Apart from Dharmapuri and Madurai districts, all other districts observed a huge increase in the instability. During the overall study period, the maximum instability (200.32%) was noticed in Salem district and the minimum instability (99.55%) was observed in Thanjavur district.

TABLE 6: INSTABILITY INDEX OF MAIZE YIELD IN TAMIL NADU (in Per cent)

District	Pre-reform Period	Post-reform Period	Overall Period
North Arcot	29.28	60.71	57.84
Salem	40.85	50.58	49.03
Dharmapuri	4.4	80.79	81.02
Coimbatore	24.2	87.51	85.42
Periyar	33.82	65.26	64.92
Tiruchirappalli	10.82	35.12	32.38
Pudukkottai	39.57	70.01	69.2
Thanjavur	38.06	40.34	42.27
Madurai	36.09	55.5	54.01
State	**27.95**	**52.88**	**50.93**

Source: Computed

It is evident from the Table 6 that the coefficient of variations of Maize yield in Tamil Nadu for post-reform period was almost doubled from the pre-reform period.

It is also clear that the instability of Maize yield in all the districts were higher in the Post-reform period than the pre-reform period.

During the overall period, the maximum instability (85.42%) was observed in Coimbatore district and minimum instability (32.38%) was observed in Tiruchirappalli district.

COMPONENTS OF CHANGE IN AVERAGE PRODUCTION OF MAIZE

The pure effect of change in the mean yield and change in mean area, the effect of interaction between changes in mean area and mean yield and the change in covariance between area and yield was analyzed by using Hazell's statistical procedure. The decomposition analysis was carried out and the percentage contribution of each component towards the change in average production of Maize were estimated for each study districts and for the state as a whole.

Components of change in the average production of Maize are presented in the Table 7.

TABLE 7: COMPONENTS OF CHANGE IN AVERAGE PRODUCTION OF MAIZE (in per cent)

Districts	Change in Mean Yield	Change in Mean Area	Interaction between Changes in Mean Yield and Mean Area	Change in Area-Yield Covariance
North Arcot	53.15	2.72	1.18	42.95
Salem	1.42	73.16	19.17	6.24
Dharmapuri	-139.76	126.34	106.27	7.14
Coimbatore	30.44	36.28	26.08	7.2
Periyar	4.7	57.13	34.4	3.77
Tiruchirappalli	0.69	79.67	21.28	-1.64
Pudukkottai	-599.03	606.27	354.4	-261.65
Thanjavur	-113.47	171.42	62.59	-20.54
Madurai	2.1	67.41	27.19	3.3
State	6.11	63.95	26.28	3.66

(Source: Computed)

It is very clear from the table 7 that, Pudukkottai, Dharmapuri and Thanjavur districts revealed a negative change in mean yield (-599.03%, -139.76%, and -113.47%) respectively, while positive change in mean yield showed in North Arcot (53.15%), Coimbatore (30.44%), Periyar (4.7%), Madurai (2.1%), Salem (1.42%) and Tiruchirappalli (0.69%) districts.

The change in the mean area and interaction between changes in mean yield and area was positive in all the districts. Pudukkottai district has registered the highest percentage in change in mean area (606.27%) and interaction between changes in mean yield and area (354.4%).

The change in area-yield covariance was negative in Pudukkottai (-261.65%), Thanjavur (-20.54%) and Tiruchirappalli (-1.64%) districts, and the same was positive in the remaining districts.

The average production of Maize for the state as a whole was predominantly due to change in mean area (63.95%) followed by interaction between changes in mean yield and area (26.28%) change in mean yield (6.11%) and change in area-yield covariance (3.66%).

COMPONENTS OF CHANGE IN THE VARIANCE OF PRODUCTION OF MAIZE

The change in variance of production of maize was decomposed by using the analytical procedure developed by Hazell (1982). The factors responsible for the change in the variance of maize production are decomposed in to ten components. The components of change in the variance of production of Maize at the district wise and state level have been shown in Table 8. The perusal of the table reveals that interaction between changes in mean area and yield accounted as high at 32.33 per cent of the total change in the variance of Maize production in Tamil Nadu. Interaction between changes in mean area and yield and changes in area-yield covariance contributed more than 20 per cent and the change in residual explaining 14.18 per cent of variability in Maize production. The pattern was different for different districts.

For example, in case of North Arcot district, change in residual accounted for the largest share followed by change in mean yield. In case of Salem district, change in yield variance accounted for the most of the changes in the variance of production of Maize followed by interaction between changes in mean yield and area variance. In the case of Dharmapuri district, interactions between changes in mean yield and area variance and change in area variance were important components explaining larger proportions in the variability of Maize production between the two periods. Most of the changes in the variance of Maize production in Thanjavur district were due the changes in area-yield covariance and changes in yield variance.

CONCLUSION

The compound growth rate for area under maize, production and yield of maize cultivated in Tamil Nadu shows a clear picture of increasing growth. The study also concludes that there persists a huge increase in the instability of area, production and yield of the crop studied over the review period. Maize cultivation in the post-reform period remained more unstable as compared to the pre-reform period. The results of the decomposition analysis revealed that the change in mean production of Maize was mainly due to the change in mean area.

TABLE 8: COMPONENTS OF CHANGE IN THE VARIANCE OF PRODUCTION OF MAIZE (in per cent)

District	Change in Mean Yield	Change in Mean Area	Change in Yield Variance	Change in Area Variance	Interaction between Changes in Mean Yield and Mean Area	Change in Area-Yield Covariance	Interaction between Changes in Mean Area and Yield Variance	Interaction between Changes in Mean Yield and Area Variance	Interaction between Changes in Mean Area and Yield and Changes in Area-Yield Covariance	Change in Residual
North Arcot	17.07	-0.04	5.08	-4.39	-0.04	11.37	0.23	-4.64	5.52	69.86
Salem	0.04	14.51	0.02	31.05	-0.22	0.51	4.16	18.4	17.76	13.78
Dharmapuri	-227.7	1.97	-37.55	93.91	1.6	3.15	35.39	224.43	-1.78	6.58
Coimbatore	8.93	-0.61	23	-4.3	-2.78	8.17	56.28	-8.4	17.73	1.98
Periyar	0.04	5.29	0.53	9.21	-0.53	0.8	35.98	14.43	12.1	22.16
Tiruchirappalli	0.09	1.15	0.02	59.79	-0.11	-0.3	19.1	36.21	-8.61	-7.35
Pudukkottai	6.04	-3.23	82.35	3.59	10.6	84.93	-68.62	5.43	-31.19	10.1
Thanjavur	4.31	-33.71	36.4	28.87	2.63	59.77	-29.08	24.93	-23.63	29.5
Madurai	0.31	18.72	0.19	3.9	-1.49	1.06	36.52	3.78	23.81	13.2
State	0.11	11.28	1.19	9.19	-0.82	2.9	32.33	9.1	20.55	14.18

Source: Computed

POLICY IMPLICATIONS

In the view of the above findings following suggestions are recommended for suitable policy formulations.

- Supply of land resource is limited in nature. To meet the future increased demand for foodgrains, the productivity should be boosted up by adoption of improved technologies like hybrid varieties cultivation.
- Long-term investments should be encouraged and boosted up to bring the uncultivated barren and waste lands under the plough.
- Site specific techniques depending on the type of soil and pattern of rainfall have to be increasingly made familiar with the farmers.
- Packages for efficient water harvesting technology should be adopted for getting maximum benefit from the available water resources.
- The production and distribution of seed of improved varieties need to be paid special attention to bring stability in production.
- Expansion of area under irrigation, development of watershed and development of varieties resistant to insects, pests and climate stress are the other major factors for reducing variability in area, production and yield.
- Farmers should be encouraged to use appropriate amounts of inputs like fertilizers, improved seeds, pesticides and water.

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