# Performance of Major Millet Crops in Tamil Nadu : An Economic Analysis

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## Abstract

**The present study aimed at analyzing the performance of major millets in Tamil Nadu. The paper analyzed the growth rates, instability, and decomposition analysis of area, production, and productivity of major millets during the period from 1970-71 to 2011 -15 .The study period was divided into Period I (1970 to 1991) and Period II (1991 to 2015). The compound growth rate results showed that the growth rate in area and production for most of the millet crops, with the exception of maize, showed a negative growth rate. The instability indices revealed that during the Periods I and II, the instability was high. The differentiation occurred in millet production due to the area for most of the millet crops, and area and productivity for some of the millet crops. Thus, there was an immediate need of policies in order to increase the area under millet crops in Tamil Nadu so as to increase the millet production.**

***Keywords:*** **growth rate, instability, decomposition, millets**

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Millets are the traditional 'coarse cereals' whose importance is more in terms of their role as a staple crop consumed by the poor. Millets are three to five times nutritionally superior to the widely promoted rice and wheat in terms of proteins, minerals, and vitamins. Millets are one of the oldest foods known to humans and possibly the first cereal grain to be used for domestic purposes. Millets are small-seeded grasses that are hardy and grow well in dry zones as rain-fed crops under marginal conditions of soil fertility and moisture. Millets are also unique due to their short growing season.

## Indian Scenario of Millet Crops

India ranks first in millet production with 1.26 million tonnes and it contributes more than 55 % of the global production. In terms of food grain production, millets ranked fourth in India behind rice, wheat, and maize (FAO, 2011). Though the harvested area of millets has declined in India, production has remained stable at about 9.5 million tonnes in the past five decades on an average (Gupta, Sen, & Srinivasan, 2012). In India, during 2011-12, the total area under cultivation and production of pearl millet was 72.9 lakh hectares and 87.4 lakh tonnes, respectively. Rajasthan, Uttar Pradesh, and Gujarat were the leading states with a total of 54.7 lakh hectares area under cultivation and 66.6 lakh tonnes of production. Tamil Nadu stood behind these states with 0.46 lakh hectares of area under cultivation and 0.11 lakh tonnes of production.

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The total area and production of sorghum in India for the year 2011-12 was 62.1 lakh hectares of area under cultivation and 52.8 lakh tonnes of production, respectively. Maharashtra, Karnataka, and Rajasthan were the leading states in the total area under cultivation and production of sorghum, with a total of 51 lakh hectares of area under cultivation and 36.6 lakh tonnes of production. Tamil Nadu had 1.9 lakh hectares of area under cultivation and 2.5 lakh tonnes of production.

The total area under cultivation and production of maize in India for the year 2011-12 was 86.7 lakh hectares and 2.2 crore tonnes, respectively. Karnataka, Rajasthan, and Andhra Pradesh were the leading states in total area under cultivation and production of maize with the total area of 32.7 lakh hectares and 1 crore tonnes of production. Though Andhra Pradesh had less area under cultivation as compared to Karnataka and Rajasthan, it ranked first in production. Tamil Nadu had 2.8 lakh hectares of area under cultivation and 2.2 lakh tonnes of production.

The total area under cultivation and production of ragi in India for the year 2011-12 was 11.2 lakh hectares and 15.7 tonnes, respectively. Karnataka, Maharashtra, and Uttarakhand were the leading states in the production of ragi, with the total area under cultivation being 8.8 lakh hectares with the production of 12.7 lakh tonnes. Tamil Nadu had 0.82 lakh hectares of area under cultivation and 2.2 lakh tonnes of production (Directorate of Economics and Statistics, 2012).

## Objectives of the Study

The specific objectives of the study are :

**(i)** To study the growth and instability of major millet crops in Tamil Nadu.

**(ii)** To measure the sources of output growth of major millet crops using decomposition analysis.

## Scope of the Study

The study would provide a clear understanding about growth rate and instability of major millet crops in Tamil Nadu. The results of growth rate and instability would enable the farmers to take appropriate decisions on the prospects of up scaling their operations in area and production of millet crops. Based on decomposition analysis, farmers could be advised to use the scarce resources in an efficient manner, which would be helpful to take appropriate decisions to solve the problems in terms of area under cultivation and production side.

## Database and Research Methodology

The present study is entirely based on secondary data. The secondary data in relation to area, production, and productivity of major millet crops from 1970-71 to 2011-15 were collected from season and crop reports of Tamil Nadu. The entire data were divided into three periods, that is, Period I, Period II, and Overall Period - this was done to find out the variation between those periods. Period I corresponds to the time period from 1970-1991 ; the Period II consists of the time period from 1991-2015; and the Overall Period is from 1970-2015.

**Compound growth rate (CGR)** is computed by applying formula :

$$Yt = ab^t$$

In the log form, it is written as:

$$\text{Log } Y_t = \text{Log } a + t \log b$$

where,
$Y_t$ = Area/production/productivity in the year *'t',*
$t$ = time element which takes the value 1, 2, 3, ……. $n$,
$a$ = intercept,
$b$ = regression coefficient.

The value of $b$ is computed by using the OLS method. Furthermore, the value of CGR was worked out as follows :

$$CGR\ (r) = (\text{antilog}\ b - 1) \times 100$$

**(1) Growth Instability :** The growth instability was estimated using Coppock's instability index (Coppock, 1962).The estimable form is given below :

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

The instability index = Antilog $(\sqrt{V}\log - 1) \times 100)$
where,
$Xt$ = area/production/yield,
$t$ = number of years,
$M$ = Mean of the difference between Logs of $Xt+1, Xt,$
Log $V$ = logarithmic variance of the series.

**(2) Decomposition Analysis :** To measure the relative contribution of area and yield to the total output change for the major crops, the decomposition analysis was used (Shende, Thakare, & Roundhal, 2011). The method states that the $A_0$, $P_0$, and $Y_0$ are area, production, and productivity, respectively in base year and $A_n$, $P_n$, and $Y_n$ are values of the respective variable in $n$th year item, respectively :

$$P_0 = A_0 \times Y_0, \text{ and}$$
$$P_n = A_n \times Y_n \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

whereas, $A_0$ and $A_n$ represent the area and $Y_0$ and $Y_n$ represent the yield in the base year and $n$th year, respectively.

$$Pn - P_0 = \Delta P$$
$$An - A_0 = \Delta P$$
$$Yn - Y_0 = \Delta Y \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Upon simplification of equation (1) and (2), it can be written as :

$$P_0 + \Delta P = (A_0 + \Delta A)\,(Y_0 + \Delta Y)$$

Production = yield effect + area effect + interaction effect

Thus, the total change in production can be decomposed into three components, that is, yield effect, area effect, and the interaction effect due to change in yield and area.

## Results and Discussion

**(1) Growth Rate of Area, Production, and Productivity :** The growth in area, production, and productivity of major millet crops in Tamil Nadu were calculated and are presented in the Table 1.

The area and production for most of the millet crops in Tamil Nadu shows a negative growth rate. The crops, with the exception of maize, like sorghum, pearl millet, ragi, korra, samai, and varagu show a negative growth rate. Even though the area and production show a negative growth, the productivity is positive for all the crops except korra. This may be because of the introduction of new varieties and hybrids in millets. Among the above-mentioned crops, maize shows a higher positive growth rate in area, production, and productivity, which is 7.88% 11.10%, and 2.98% , respectively for the overall period, which is statistically highly significant. The area under cultivation for korra and varagu account for a higher negative growth rate, which is -8.00% and -9.91% , respectively and it is the same in the case of production, that is, -9.36% and -8.68% , respectively, which is negatively significant.

**(2) Instability of Major Millet Crops in Tamil Nadu :** Coppock's instability index is used to understand the instability in area, production, and productivity of major millet crops in Tamil Nadu. The instability indices were constructed and the results are presented in the Table 2.

Coppock's instability index technique was employed to examine the extent of instability in area, production, and productivity of millet crops in Tamil Nadu (Table 2). The highest instability in area is observed during the Period I in case of ragi (68.41%) and the lowest instability is observed in case of pearl millet (8.18%).

**Table 1. Compound Growth Rate for Area, Production, and Productivity of Major Millets in Tamil Nadu**

| Sl.No | Crop | Periods | Area | Production | Productivity |
|---|---|---|---|---|---|
| 1 | Sorghum | Period I | -0.98*** | 2.77* | 3.79** |
| | | Period II | -3.83*** | -4.06*** | -0.23 |
| | | Over all | -3.09*** | -1.87*** | 1.26*** |
| 2 | Pearl Millet | Period I | -2.86*** | -0.06 | 2.87*** |
| | | Period II | -8.0*** | -6.16*** | 2.00*** |
| | | Over all | -5.24*** | -3.38*** | 1.96*** |
| 3 | Maize | Period I | 2.67*** | 5.81*** | 3.05*** |
| | | Period II | 12.48*** | 19.31*** | 6.07*** |
| | | Over all | 7.88*** | 11.10*** | 2.98*** |
| 4 | Ragi | Period I | -2.51** | -0.04 | 2.52* |
| | | Period II | -3.18*** | -3.14*** | 0.04 |
| | | Over all | -2.87*** | -1.79*** | 1.11*** |
| 5 | Korra | Period I | -3.34*** | -6.52*** | -3.28*** |
| | | Period II | -10.89*** | -10.29*** | 0.67*** |
| | | Over all | -8.0*** | -9.36*** | -1.4*** |
| 6 | Samai | Period I | -2.15*** | 1.14 | 3.36*** |
| | | Period II | -6.66*** | -6.02*** | 0.68 |
| | | Over all | -5.27*** | -3.19*** | 2.19*** |
| 7 | Varagu | Period I | -6.07*** | -5.54*** | 0.56 |
| | | Period II | -10.31*** | -8.07*** | 2.50*** |
| | | Over all | -9.91*** | -8.68*** | 1.36*** |

***-1 % significant, **5 % Significant, *10 % Significant

**Table 2. Coppock's Instability Index for Major Millets in Tamil Nadu (%)**

| Sl.No | Crop | Periods | Area | Production | Productivity |
|---|---|---|---|---|---|
| 1 | Sorghum | Period I | 11.03 | 126.58 | 122.59 |
| | | Period II | 12.60 | 16.96 | 22.27 |
| | | Over all | 11.81 | 78.96 | 77.94 |
| 2 | Pearl Millet | Period I | 8.18 | 29.51 | 23.41 |
| | | Period II | 20.58 | 28.77 | 21.87 |
| | | Over all | 15.56 | 28.86 | 22.36 |
| 3 | Maize | Period I | 28.44 | 37.22 | 30.90 |
| | | Period II | 20.37 | 36.61 | 31.60 |
| | | Over all | 24.74 | 37.21 | 30.96 |
| 4 | Ragi | Period I | 68.41 | 41.27 | 70.69 |
| | | Period II | 8.46 | 19.81 | 13.39 |
| | | Over all | 44.56 | 31.31 | 46.76 |
| 5 | Korra | Period I | 36.66 | 44.34 | 17.78 |
| | | Period II | 39.20 | 38.12 | 9.65 |
| | | Over all | 37.83 | 40.94 | 14.14 |
| 6 | Samai | Period I | 10.60 | 36.04 | 30.82 |
| | | Period II | 15.47 | 28.70 | 23.37 |
| | | Over all | 13.40 | 32.31 | 26.90 |
| 7 | Varagu | Period I | 14.53 | 41.98 | 34.77 |
| | | Period II | 38.82 | 68.69 | 33.26 |
| | | Over all | 28.25 | 55.23 | 33.60 |

During Period II, the highest instability in area is observed in case of korra (39.20%) and the lowest in case of ragi (8.46%). In overall period, the highest instability is observed under area in case of ragi (44.56%) and the lowest in case of sorghum (11.81%).

In case of production, during Period I, sorghum (126.58%) is highly instable and pearl millet (29.51%) has the lowest instability, and during Period II, production is highly instable in case of varagu (68.69%) and production has lowest instability in case of sorghum (16.96 %). In the overall period, the highest instability is observed in production of sorghum (78.96%) and the lowest instability is observed in case of pearl millet (28.86%).

Apart from area and production, the instability in productivity during the Period I is highest in case of sorghum (122.59%) and lowest in case of korra (17.78%). In Period II, it is highest in case of varagu (33.26%) and lowest in case of korra (9.65%) and during the overall period, the highest instability is observed in case of sorghum (77.94%) and lowest is observed in case of korra (14.14 %).

**(3) Decomposition Analysis :** The results of the decomposition analysis were calculated and are presented in the Table 3. It is seen from the Table 3 that the trend in production changes due to area under cultivation. Productivity has been highly positive in case of maize, varagu, and korra. But in case of sorghum, pearl millet, and samai, the area effect is positive. The interaction effect is positive only for maize, ragi, and sorghum, however, the area effect is greater than the yield effect in case of maize and sorghum. The area effect is found to be the highest in case of sorghum for Period I and II and it is -3314.45% and -4866.89 %, respectively, but in the overall period, the area effect is highest in case of pearl millet (246.22%). The yield effect is found to be the highest in ragi (-6937.46%) and maize (3498.16%) in Period I and II, respectively. In case of interaction effect, the interaction effect is highest in case of ragi (11319.75%) in Period I and the interaction effect is highest in case of sorghum (-1431.16%) in Period II. During the overall period, the interaction affect is found be the highest in case of ragi (1848.06 %).

**Table 3. Decomposition Analysis**

| Crop | Particulars | Period I 1970-1991 | Period II 1991-2015 | Overall 1970-2015 |
|---|---|---|---|---|
| Sorghum | Area effect | -3314.45 | -4866.89 | 168.68 |
| | Yield effect | 1973.24 | 967.89 | -69.15 |
| | Interaction effect | 1441.20 | -1431.16 | 0.46 |
| Pearl millet | Area effect | 1315.28 | 1522.37 | 246.22 |
| | Yield effect | -966.27 | -678.62 | -137.0 |
| | Interaction effect | -250.00 | 132.64 | -9.21 |
| Maize | Area effect | 63.08 | 1989.74 | 35.20 |
| | Yield effect | 88.45 | 3498.16 | 60.47 |
| | Interaction effect | -51.54 | 307.63 | 4.32 |
| Ragi | Area effect | -4282.29 | 746.08 | -563.17 |
| | Yield effect | -6937.46 | -163.75 | -1184.89 |
| | Interaction effect | 11319.75 | -106.47 | 1848.06 |
| Korra | Area effect | 70.31 | 19.09 | 77.50 |
| | Yield effect | 44.08 | -1.36 | 34.06 |
| | Interaction effect | -14.39 | -0.09 | -11.56 |
| Samai | Area effect | 2285.54 | 2377.13 | 171.13 |
| | Yield effect | -1826.83 | -56.32 | -61.0 |
| | Interaction effect | -358.71 | 42.24 | -10.13 |
| Varagu | Area effect | 102.04 | 29.73 | 109.0 |
| | Yield effect | 8.77 | -2.06 | 5.12 |
| | Interaction effect | -10.81 | -6.47 | -14.12 |

So, during all the three periods, the area is responsible for increasing production for most of the millet crops. It is indicated that area is a driving force in the differential production of most of the millet crops in Tamil Nadu for all the three periods.

## Summary and Conclusion

The status of millet cultivation in Tamil Nadu is under a risky situation, the compound growth rate results show that the growth rate in area and production for most of the millet crops shows a negative growth except for maize. The reason for the decline in area under millets crops in Tamil Nadu may be because of the increase in cost of cultivation, change in climate factors, prevailing low market prices during the harvesting season, etc. In case of productivity, most of all the millet crops show the positive growth rate except korra and it was due to the development of new varieties. The instability indices revealed that during the Periods I and II, the instability was high. The differentiation occurs in millet production due to the area for most of the millet crops, and productivity for some of the millet crops. Thus, there is an immediate need for government policies in order to increase the area under cultivation for millet crops in Tamil Nadu to increase the millet production.

## Policy Implications

- Increase the area, production, and productivity of millets by adoption of hybrid seeds, improved technologies,

rehabilitation of irrigation systems, etc.

- Strengthening of extension, increase the awareness and importance of millets among the farmers.
- Millets should be provided through the public distribution system because millets are highly enriched nutritious food.
- Price intelligence has to done through proper trainings via farmers' training centres (KVKs), state agricultural universities (SAU), and research stations.
- The government should be initiated for providing better prices of millets to farmers at market mandis.
- Millets farmers should be associated among themselves to meet out the bulk purchase for poultry feed units.
- Institutional finance and insurance are offered generously for the farmers who cultivate preferred grains such as rice, wheat, and cash crops. It must be extended to millet farmers also.

## Limitations of the Study and Scope for Further Research

The study was based on the secondary data collected from various published sources. There are limitations inherent in the secondary data. Even though the analysis were carried out both in dynamic and static settings, the results and policies are subject to change in short run as well as long run and this would have implications on the area, production, and productivity of millets crops in Tamil Nadu. These limitations need to be addressed in future studies.

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