Performance Analysis of Sorghum in Tamil Nadu

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Abstract
Sorghum (Jowar) is an important crop for poor, small and marginal farmers in Tamil Nadu. In the production of sorghum, Tamil Nadu ranked 4th in India. The purpose of the study is to observe the trend and instabilities in the area, production and yield of sorghum in Tamil Nadu from 1991-92 to 2021–22 using the simple regression model, the coefficient of variation, the Cuddy Della Valle index and decomposition analysis. The growth analysis specifies that sorghum area has decreased with a compound growth rate of 0.47 percent, production of sorghum has reduced from 552.6 thousand tonnes to 427.21 thousand tonnes and the growth analysis of yield shows that it has increased by 0.37 percent in the overall study period. The results expose that instability in the area in terms of CDVI value was 6.26 percent, the instability in production was 34.67 percent, and instability in yield exposes the highest variability of 22.98 percent in the entire period. Instability in the area in terms of coefficient of variation values was 23.67 percent, in production coefficient of variation was 34.33 percent, and in yield it was 23.09 percent instability in the entire period. It can be resolved that production of sorghum was more unstable in association with yield and area in Tamil Nadu during all sub-periods and the entire period. The entire period analysis tells that the area and yield effects were 140.48 and 98.33, respectively, while the interaction effect was -31.34. According to the study, both area and yield were increased sorghum production of the state.
Keywords: Sorghum, Area, Production, Yield, Growth, Instability

Introduction

The sorghum grain harvested during the rainy season is used for both animal feed and human consumption in India. It is therefore essential to the survival of both the human and animal populations. In India, Maharashtra and Karnataka contributed 57.2% of sorghum production. The next major producers are Madhya Pradesh, Tamil Nadu, Rajasthan and Andhra Pradesh contributing 11.9%. 9.0%, 6.3%, & 6.3% respectively. Globally sorghum is the major millet contributing 65% of total millets. The area of sorghum is near stable between 42.16 million hectares and 40.98 million hectares, while production is between 60.18 million metric tonnes and 58.70 million metric tonnes during 2010–2020. The sorghum production has reduced from 32.79 million metric tonnes in 2010 to 30.46 million metric tonnes in 2020, while the area devoted to other millets exhibited a downward tendency from 36 million hectares in 2010 to 33.02 million hectares in 2020.

Period of the Study

1991 economic reforms have enhanced terms of trade for agriculture and created new opportunities, such as benefits from trade and specialisation, broadening choices in new technology, including biotechnology. The National Agricultural Policy was introduced in the year 2000 and in 2013 the National Food Security Act was introduced for promoting millets in PDS. To make the Public Distribution System more economical and accessible for the general public, the government added millets to it. On the basis of these revolutions in

the Indian economic system, the study period covers 30 years, i.e., 1991-92 to 2021-22, encompassing three sub-periods: Period I (1991-92 to 1999-2000), Period II (2000-01 to 2012-13) and Period III (2013-14 to 2021-22).

Data Sources

Secondary data is collected for this study. The data was collected from Millets Stats, Indian Institute of Millets Research, Directorate of Economics and Statistics, Ministry of Agriculture and Farmers' Welfare, Government of India.

Tools of Analysis

To analyse the area, production and yield of sorghum in Tamil Nadu during the study period, the following appropriate statistical tools were used. The compound growth rate of sorghum was estimated by using the regression analysis and the decomposition is used to estimate the area, yield, and interacting effects on the progress of sorghum in Tamil Nadu. The Cuddy-Della Valle index computes the relative instability of millets in terms of area, production and yield.

Table 1 Growth Rate in Area of Sorghum in Tamil Nadu

Particulars	Period of Study			
	Period I (1991-92 to 1999-00)	Period II (2000-01 to 2012-13)	Period III (2013-14 to 2021-22)	Over all Period (1991-92 to 2021-22)
Area in beginning year ('000 Hectares)	511.8	331.30	347.13	511.8
Area in ending year ('000 Hectares)	351.30	331.30	397.61	397.61
Observation	9	13	9	31
CAGR (%)	-4.90*	-4.87*	3.28*	0.47*

Source: Computed from collected data; **Note:** *Significant at one percent level

The above table exhibits the compound growth of the area under sorghum cultivation in Periods I, II, and III and the overall period has been estimated. The entire area in the state given to farmers for sorghum cultivation grew from 511.8 thousand hectares to 351.30 thousand hectares during Period I. It is observed that the area did not change during the first and last years of the study period. It was 331.30 thousand hectares in period II, but in period-III, it has decreased from 511.8 thousand hectares to 397.61 thousand hectares. The growth analysis specifies that the compound growth of sorghum area has decreased to -4.90 percent during Period I, -4.87 percent in period II and 3.28 percent in period III, and 0.47 percent in the entire period.

Table 2 Growth rate in Production of Sorghum in Tamil Nadu

Particulars	Period of Study			
	Period I (1991-92 to 1999-2000)	Period II (2000-01 to 2012-13)	Period III (2013-14 to 2021-22)	Over all Period (1991-92 to 2021-22)
Production in beginning year ('000 tonnes)	552.6	306.00	449.57	552.6
Production in ending year ('000 tonnes)	345.80	165.02	427.21	427.21
Observation	9	13	9	31
CAGR (%)	-5.68*	-2.21*	0.95*	-0.35*

Source: Computed from collected data; **Note:** * Significant at one percent level

The above table analyses the sorghum production. The total sorghum production in the period I was 552.6 thousand tonnes, and it has decreased to 345.80 thousand tonnes. In period II it was 306.00 thousand tonnes and reduced to 165.02 thousand tonnes and in period period-III further, it decreased from 449.57 thousand tonnes to 427.21. It is noted that the production of sorghum was reduced from 552.6 thousand tonnes to 427.21 thousand tonnes in the overall period.

The growth analysis shows that the compound growth rate of sorghum production was increased 0.95 per cent in the period III and the compound growth rate decreased -2.21per cent in the period II, -5.68 per cent in period I and in the overall period compound growth rate has declined -0.35 per cent. It is observed that the production of sorghum was negative growth, where the growth rate of production of pulses was lower as compared to the twenties due to the negative growth rate in the nineties.

Table 3 Growth Rate in Yield of Sorghum in Tamil Nadu

Particulars	Period of Study			
	Period I (1991-92 to 1999-00)	Period II (2000-01 to 2012-13)	Period III (2013-14 to 2021-22)	Over all Period (1991-92 to 2021-22)
Yield in beginning year (kg/Hectares)	1079.72	923.63	1,295.11	1079.72
Yield in ending year (kg/ Hectares)	984.34	851.23	735.55	735.55
Observation	9	13	9	31
CAGR (%)	-0.82*	2.79*	-4.69*	0.37*

Source: Computed from collected data; **Note:** * Significant at one percent level

The above table explains the yield of sorghum. It exposed that in period I the yield of sorghum has decreased from 1079.72 to 984.34 kg per hectare, in period II it has decreased from 923.63 kg per hectare to 851.23 kg per hectare and in period III it has decreased from 1,295.11 kg per hectare to 735.55 kg per hectare. Finally, it has decreased from 1079.72 kg per hectare to 735.55 kg per hectare in the entire period. The growth analysis of yield exposed that in period I the compound growth rate has decreased to -0.82 percent, -4.69 percent in period III, increased with 2.79 percent in period II, and 0.37 percent in the overall study period.

Table 4 Instability in Area, Production and Yield of Sorghum

Particulars	Period I (1991-92 to 1999-00)		Period II (2000-01 to 2012-13)		Period III (2013-14 to 2021-22)		Over all Period (1991-92 to 2021-22)	
	CV	CDVI	CV	CDVI	CV	CDVI	CV	CDVI
Area	16.16	5.59	22.98	11.94	15.25	13.03	23.67	6.26
Production	20.90	12.01	16.15	18.52	27.38	29.11	34.33	34.67
Yield	8.99	9.22	21.87	24.77	28.41	27.39	23.09	22.98

Source: Computed from collected data

The co-efficient of variation measures instability but it overemphasizes the level of it in time-series data. The exact direction of the instability is shown by the Cuddy Della Valle Index (1978). The instability in terms of coefficient of variation and Cuddy Della Valle index of area, production and yield of sorghum are shown in the above table. The results show that instability in the area in terms of CDVI values were more in Period III that is 13.03 percent than Period II (11.94%) and Period I (5.59 %) and 6.26 percent in the entire period. Period III has the highest output variability in terms of CDVI at 29.11 percent, followed by Periods I and II (18.52%) and I (12.01%), with an overall period instability of 34.67 percent. Instability in yield reveals the highest variability of yield in terms of CDVI, which is 27.39 per cent in Period III followed by Period II (24.77%), Period I (9.22%) and 22.98 percent instability in the entire period.

Instability in area in terms of coefficient of variation values was more in Period II which is 22.98 percent, in Period I (16.16), in Period III (15.25%) and 23.67 percent in the overall period. The highest variability in production in terms of coefficient of variation is 27.38 per cent in Period III followed by Period I (20.90%) and Period-II (16.15%) with 34.33 percent instability in the overall period. Instability in yield exposes the highest variability of yield in terms

of coefficient of variation, which is 28.41 percent in Period III, followed by Period II (21.87%), Period I (8.99%) and 23.09 percent instability in the overall period. It can be resolved that production of Sorghum was more instable in yield and area in Tamil Nadu during all periods.

To reduce the instability in sorghum production, the government should adopt an area covered under high yielding varieties of sorghum to enhance the high growth rate in sorghum production and adopt improved scientific on-farm methods to increase the quality of the sorghum in Tamil Nadu.

Table 5 The Effect of Area, Yield and Interaction on Sorghum Production in Tamil Nadu

Particulars	Period I (1991-92 to 1999-00)	Period II (2000-01 to 2012-13)	Period III (2013-14 to 2021-22)	Over all Period (1991-92 to 2021-22)
Area effect	23.61	17.01	868.69	140.48
Yield effect	83.79	19.65	-292.38	98.33
Interaction effect	-74.02	-1.54	126.33	-31.34

Source: Computed from collected data

The decomposition is designed to determining the area, yield, and interacting effects on the development of sorghum production in Tamil Nadu from 1991-92 to 2021-22 and for each sub-period. The overall period analysis exposes that the area and yield effects were 140.48 and 98.33, respectively, while the interaction effect was -31.34.The study states that both area and yield contributed increased sorghum production to the state.

A first sub-period analysis reveals that there was a 23.61 percent positive impact on area. While interaction had a negative effect on sorghum production during the first sub-period, yield had a positive effect on sorghum production during the sub-period i.e. 83.79. Area, yield, and interaction effects were 17.01 percent, 19.65 percent, and -1.54 percent during the second sub-period of study, respectively. During the third sub-period, there was a satisfactory effect of area and interaction on Sorghum production 868.69 and 126.33 respectively. Using decomposition analysis, it was exposed that the area effect played a noteworthy role in sorghum production of the state in the study period.

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