



## Sugarcane Production in India: Study on Growth and Instability

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### Abstract

*The study intends to examine the performance of sugarcane in India during the period of last four decades (1979-80 to 2018-19). The study is based on secondary data. Compound annual growth rate and instability index was applied to find out performance and instability in area, production and yield of sugarcane. The result of study revealed positive trends in area, production and yield of sugarcane. The entire selected determinants (area, production and yield) have shown positive change while compound annual growth rate observed positive for area in all the sub period. Compound annual growth rate in production and yield recorded positive except in sub period-III (1999-00 to 2008-09). The highest instability was recorded for production in comparison to area and yield. Similar results are observed for coefficient of variation and instability indices.*

**Key Words:** Area, Production, Yield, Growth, Instability, Sugarcane

### Introduction

Sugarcane is leading cash crop of India. It plays an important role in socio-economic development of rural India (Nida and Fazlur, 2020). India occupies second position in production of sugarcane after Brazil. In India, 4732 thousand hectares area was under sugarcane and yield was 79.6 ton per hectare while production of sugar was 32.32 million tons during 2017-18 (Indian Council of Agricultural Research, 2018). That is about 17 percent of the world's total sugar production of 166.18 million metric tons. Around 1.43 percent (Kumar, 2016) of the country's total rural population engage in sugarcane farming and contributed 1.1 percent national GDP (Solomon, 2016). Indian sugar industry is the second largest agro-based industry after textiles and it has successfully contributed towards providing employment and economic development of country (Upreti and Singh, 2017). Sugarcane is multidimensional crop and it supports to production of sugar, as well as khandsari and jaggery. In addition, it produces many by products such as molasses, bagasses, press mud, bioethanol and bio-based products. As on 30<sup>th</sup> June 2018, there were 732 sugar mills in the country (326 in co-operative 44 in public and 362 in private sector), out of which 524 mills were in operation (GoI, 2019-20) with sufficient crushing capacity to produce around 330 lakh MT of sugar.

Sugarcane requires different temperature for different growth stages. About 30° C to 18° C temperature, 100 to 150 cm rainfall and heavy soils with good drainage is more suitable for sugarcane cultivation. Sugarcane is a perennial crop that needs large amount of water so it requires 25-30 irrigation cycles per crop season. All these elements are available in most of the part of country so that sugarcane is cultivated across the country. India has two agro-climatic regions of sugarcane cultivation namely tropical and sub-tropical (Krishnamoorthy, T.S., 2017). The states of Maharashtra, Gujrat, Tamil Nadu, Andhra Pradesh and Karnataka, Madhya Pradesh, Goa, Kerala included in the tropical regions. The sub tropical region includes the states namely Uttar Pradesh, Bihar and Haryana and Punjab. In India Uttar Pradesh is the largest producer of sugarcane (Fazlur and Nida, 2019). Considering importance of sugarcane, present study conducted to know changes, growth rate and instability of area, production and yield of sugarcane in India.

### Data base and Methodology

Present study was based on secondary source of data. The time series data related to area, production and yield of sugarcane for the period of 40 years i.e. 1979-80 to 2018-19 was obtained from

the website of ICAR – Sugarcane Breeding Institute Coimbatore (<https://sugarcane.icar.gov.in/index.php/en/sugar-stats/sugarcane-statistics>). The entire study period was divided into five sub-periods in order to have a period-wise study of growth and instability trend of area, production and yield of sugarcane. The period was divided into breakup of 10 years and overall as shown follows: Period I, 1979-80 to 1988-89, Period II, 1989-90 to 1998-99, Period III, 1999-2000 to 2008-09, Period IV, 2009-10 to 2018-19 and Period V, overall 1979-80 to 2018-19.

To examine the growth in area, production and yield of sugarcane, compound annual growth rate (CAGR) method has used. Following formula has been applied for calculating CAGR in Microsoft excel (Fazlur Rahman and Nida Bee, 2019).

$$CAGR = (Ending\ Value / Beginning\ Value)^{(1/n)} - 1$$

Where, n = Number of years

Instability in area, production and yield was estimated by applying Cuddy-Della Valle instability index. The Cuddy-Della Valle Index (Sendhil Ramdas et al, 2012) was computed as,

$$I = CV \sqrt{1 - R^2}$$

Where, I = Instability index (%)

CV = Coefficient of variation (%)

R<sup>2</sup> = Coefficient of determination from a time trend regression

The coefficient of variation (C.V in %) was calculated by the formula

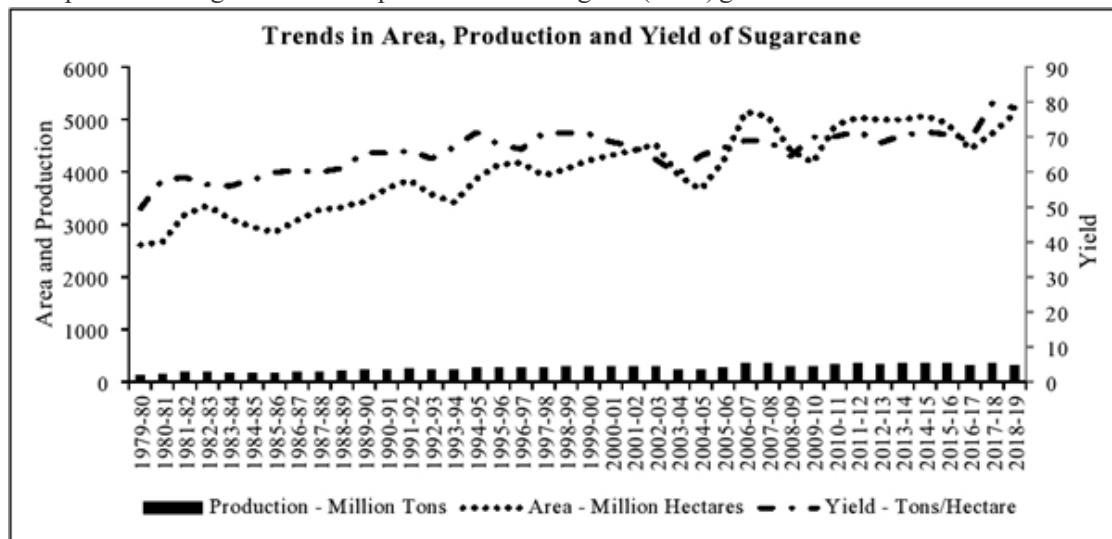
$$\text{Coefficient of variation (CV \%)} = \frac{S.D}{X} \times 100$$

Where, S.D = Standard Deviation of area/production/yield

X = Mean value of area/production/yield

### Result and Discussion

The following figure revealed the uneven trend of area, production and yield of sugarcane during the study period (1979-80 to 2018-19). This uneven trend is associated with the erratic nature of monsoon, uncertainty of irrigation and changing policies of minimum support price (MSP) of sugarcane. The total area under sugarcane cultivation grew from 2610 million hectares in 1979-80 to 5114 million hectares in 2018-19. The growth trend shows that the area under sugarcane cultivation grew at a compound growth rate of 1.74 per cent. The study of the sub-periods shows that there has been positive change. Second sub period recorded highest (25 %) growth in all determinants.



country. It leads to declined sugar prices. Due to this in the subsequent crushing season sugar prices fall, it leads to emergence of crises between miller and farmers. It has adverse impact on the area and production of sugarcane. The sugarcane production of the country increased from 128.83 million tons in 1979-80 to 306.87 million tons in 2018-19. The production of sugarcane grew at a compound growth rate of 2.24 percent. The study of sub periods shows all the sub period recorded positive change. During the period of investigation yield of sugarcane increased from 49.36 tons/ha in 1979-80 to 78 tons/ha in 2018-19 at a compound growth rate of 1.19 percent. Positive change was observed in all sub periods except in third sub period.

Changing pattern of area, production and yield of sugarcane is the result of farmers' decision and competing crops. However, there are other factors such as availability of seeds, availability of irrigation, access to sugar factories, access to credit, product price support policy, subsidies and agro-climatic factors such as soil, temperature, rainfall distribution, etc. Percentage change in area, production and yield is depicted in table 1. Significant changes in area, production and yield of sugarcane was recorded during sub period-II. Area and production of sugarcane recorded positive change in all sub period, while yield recorded negative change during sub period-III.

**Table: 1 Changes and Compound Annual Growth Rate of area, production and yield of Sugarcane in India**

Period	Area		Production		Yield	
	Change %	CAGR%	Change%	CAGR%	Change%	CAGR%
Period-I	--	2.74	---	2.78	--	2.38
Period-II	25	1.85	46.6	2.78	17.15	0.91
Period-III	15	0.50	13.2	-0.54	-1.76	-1.03
Priod-IV	10	2.28	15.1	0.51	8.39	1.25
Period-V (overall)		1.74		2.24		1.19

Source: Calculated by authors, data obtained from ICAR – Sugarcane Breeding Institute, Coimbatore.

Compound annual growth rate of area, production and yield of sugarcane was calculated to know the growth rate over a period of time. It is clear from the table 1 that annual growth rate in all three component was not same. The highest compound annual growth in terms of area was found in 1979-80 and 1988-89 i.e. 2.74% while lowest (0.50%) found in 1999-00 to 2008-09. Compound annual growth for production was recorded same (2.78%) during the sub period-I and II. Yield is showing highest compound growth during sub period-I. Compound annual growth rate over the period of four decade for area, production and yield was 1.74%, 2.24% and 1.19% respectively.

**Table: 2 Coefficient of variation and Instability Index of area, production and yield of Sugarcane in India**

Period	Area		Production		Yield	
	CV %	Instability %	CV %	Instability %	CV %	Instability %
Period-I	8.76	7.53	12.44	8.67	5.86	3.95
Period-II	7.23	5.19	9.74	5.49	4.00	2.88
Period-III	10.31	10.11	13.44	13.84	5.08	5.31
Priod-IV	6.32	6.48	7.46	7.90	5.32	4.28
Period-V (overall)	18.69	7.51	24.65	10.70	9.33	5.60

Source: Calculated by authors, data obtained from ICAR – Sugarcane Breeding Institute, Coimbatore.

Table 2 revealed instability in area, production and yield of sugarcane. During the entire

period, highest instability was recorded for production in comparison to area and yield. The overall instability in production was 10.70%, while the instability in area and yield were 7.51% and 5.60% respectively. The highest instability in area, production and yield of sugarcane was found in sub period-III, it was 10.11% in area, 13.84% in production and 5.31% in yield respectively. Sub period-II recorded lowest instability in all three components.

### Conclusion

The findings of the study recorded that there are fluctuations in the area, production and yield of sugarcane in India, and no uniform pattern of growth in all three aspects. From the study it is found that the growth rate of all three aspects is very low. The compound annual growth rate of area, production and yield increased at a rate of 1.74 percent, 2.24 percent and 1.19 percent respectively. Instability analysis showed that production recorded more variability compared to area and yield respectively. Comparatively third sub periods recorded more instability than other sub periods.

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