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Growth and decomposition analysis of sugarcane in India

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Abstract
The study was conducted with the aim to know the growth performance of sugarcane in India. The objectives of the study were to analyse the growth and instability of sugarcane in India and to estimate the decomposition analysis of sugarcane in India. To fulfill the objectives secondary data of 30 years was utilized for analysis using the statistical tools like Compound Annual Growth Rates (CAGR), Coefficient of Variation (CV), Coppock's Instability Index (CII), Cuddy Della Valle's Instability Index (CDVI) and Decomposition Analysis model. The study period was divided into three sub-periods for better understanding. The study revealed that the area, production and productivity of sugarcane had a positive growth during all the study periods. The growth rates after period I were found to be increasing in a decreasing rate. There was stability in the growth rates of area, production and productivity during all the study periods. Area effect played the key role in the differentiation of sugarcane production in India.

Keywords: growth, instability, Coppock's, cuddy della, decomposition, sugarcane

Introduction
Agriculture has been the source of raw materials to a number of leading industries in India such as cotton, jute, plantations, textiles, sugar, Vanaspati and oils. In addition to these, many other industries indirectly depend on agriculture for their raw materials e.g. the sugar industry is among the chief industries in India drawing its raw material from agriculture. Sugar is derived from sugarcane which is an agricultural produce. The total area under sugarcane in the world was about 268 Lakh ha with production of 1949 MT and nearly 73 tonnes per ha of productivity. India, with an area of 50.61 Lakh ha, 405 MT of production and 80 tonnes/ha of sugarcane productivity has acquired second position globally after Brazil which has about 101 Lakh ha of area under sugarcane with 753 MT of production and 75 tonnes per ha of productivity (Faostat, 2018-19). The other important countries are Thailand, Mainland China, Pakistan, Colombia, Philippines, and USA. These countries contributes more than 80 per cent of the total area and production of sugarcane, globally. The top sugarcane cultivating states of India are Uttar Pradesh, Maharashtra, Karnataka, Bihar, Gujarat, Tamil Nadu, Madhya Pradesh and Haryana. With an area of 22 Lakh ha and production of 1795 MT of sugarcane, Uttar Pradesh holds first position in the country contributing nearly 48 per cent share in India's total area and production in Sugarcane followed by Maharashtra with area of 8.22 Lakh ha and 693 MT of sugarcane production. Among the top sugarcane cultivating states of India, Tamil Nadu stands first for sugarcane productivity with 107.62 MT per ha of productivity followed by Karnataka (89 MT per ha), Maharashtra (84.28 MT per ha) and Uttar Pradesh (81.31 MT per ha) (INDIASTAT, 2020).
Sugarcane occupies an important place among the various cash crops grown in India. Indian sugar market is the largest in the world and meets the domestic sugar requirements of the country. The major byproduct of sugarcane is sugar which largely in demand. Therefore, the study was carried out to know the performance of sugarcane in India with the following objectives-

1. To analyse the growth and instability of area, production and productivity of sugarcane in India
2. To estimate the decomposition analysis of sugarcane in India.

Methodology
The study is based on the secondary data. Time series data with respect to area, production and

productivity of sugarcane were collected from the official website of FAO-STAT for the period from 1989-90 to 2018-19. For analysis, the overall period was divided into two sub-periods- Period I (1989-90 to 1998-99), Period II (1999-2000 to 2008-09) and Period III (2009-10 to 2018-19).

Statistical tools

The growth trends in export, import, production and unit price of Indian sugar were estimated by using the formula.

$Y_t = AB^t$ ..... (i)

Where,

Y_t= Area/ Production/ Productivity of Sugarcane for the year't'

A= Constant

B= Growth coefficient

After transformation, the equation is of the following form

Log Yt = Log A + Log (B) ..... (ii)

Compound Growth Rate (CGR) = {antilog (b)-1}*100 … (iii)

Where, b= log (B)

Significance of regression coefficient was examined using the student's't' test.

Instability in Area, Production and Productivity of Sugarcane in India

The degree of instability was worked out by coefficient of variation (CV) and Coppock's instability index (CII).

Coppock's instability index (CII) was calculated by the formula

C.I.I= [Antilog ($\sqrt{Vlog}$) – 1]× 100

Where,

$$Vlog = \frac{\mathcal{E}\,[\log (X_t/ X_{t-1}) - m]^2}{N - 1}$$

Here, X_t = Area/Production/Productivity in the Year't'

N = Number of Years

M = Arithmetic mean of the difference between the log of X_t, X_{t-1} and X_{t-2}

Vlog = logarithmic variance of the series

Cuddy Della Valle instability index (CDVI)

CDVI = $CV\sqrt{(1 - R2)}$

Where,

CV = Simple estimates of coefficient of variation in per cent and

R^2 = Coefficient of determination from a time trend regression (linear) adjusted by the number of degrees of freedom

Decomposition of output growth

To measure the relative contribution of area, yield to the total output of the onion crop, Minhas (1964), Decomposition analysis model was used which is given below.

Po = Ao x Yo and

Pn = An x Yn ---------- (1)

Ao, Po and Yo are area, production and productivity in base year and An, Pn and Yn are values of the respective variable in n^{th} year item respectively.

Where,

Ao and An = Area

Yo and Yn = yield in the base year and n^{th} year respectively.

Pn - Po = ΔP

An - Ao = ΔA

Yn - Yo = ΔY---------- (2)

For equation (1) and (2) we can write

Po + ΔP = (Ao + ΔA) (Yo + ΔY)

Hence,

$$P = \frac{Ao\,\Delta Y}{\Delta P} \times 100 + \frac{Yo\,\Delta A}{\Delta P} \times 100 + \frac{\Delta Y\,\Delta A}{\Delta P} \times 100$$

Production = Yield effect + area effect + interaction effect

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

Results and Discussions

Growth rate

Growth rates of any aspect gives the idea of change in them either increase or decrease over a period of time. Likewise, here the growth rates were calculated to study the changes in area, production and productivity of sugarcane over time by using exponential function. The results obtained through analysis are presented in Table 1.

Table 1: Growth rates of Area, Production and Productivity of Sugarcane in India

	Period I	Period II	Period III	Overall Period
Area				
CAGR	1.79*	1.22	0.47	1.20**
t-stat value	3.05	1.08	0.63	7.68
Production				
CAGR	3.18**	0.94	1.80	1.54**
t-stat value	4.77	0.60	1.94	7.31
Productivity				
CAGR	1.37**	-0.28	1.32*	0.34*
t-stat value	3.31	-0.46	2.59	2.81

Note: *- denotes 5% significant level and **- denotes 1% significant level.

The table depicts that, the area, production and productivity had a positive and significant growth during overall period with 1.20, 1.54 and 0.34 per cent per annum of growth, respectively. Among the study periods, period I had the highest and significant growth for area with 1.79 per cent per annum of growth rate followed by period II (1.22 per cent per annum) and period III (0.47 per cent per annum). In case of production, period I registered highest and significant growth of 3.18 per cent per annum followed by period III (1.80 per cent per annum) and period II (0.94 per cent per annum). The productivity of sugarcane had a positive and significant growth of 1.37 per cent per annum followed by period III (1.32 per cent per annum). But, period II reported a negative

growth of 0.28 per cent per annum. Similar results were obtained by Maurya *et al*. (2020) [4], Kumar and Singh, (2018) [3], and Kannan (2012) [2].

The reason behind the decline in production and productivity of sugarcane during period II might be that, during period II many states of the country faced drought conditions that may have lowered the production and negatively impacted the sugarcane productivity.

Instability Analysis

Instability index shows the degree of volatility. Therefore, to assess the degree of volatility of area, production and productivity of sugarcane, instability analysis was carried out with the help coefficient of variation (CV), Coppock's Instability Index (CII) and Cuddy Della Valle's Instability Index (CDVI). The results obtained are presented in Table 2.

Table 2: Instability indices of Area, Production and Productivity of Sugarcane in India

	Period I	Period II	Period III	Overall Period
Area				
CV	7.26	10.31	6.27	12.57
CDVI	4.92	9.56	6.15	7.11
CII	10.65	11.08	10.75	10.85
Production				
CV	11.04	13.44	9.37	16.53
CDVI	5.52	13.03	7.61	9.49
CII	10.79	11.39	11.00	11.12
Productivity				
CV	5.55	5.09	6.07	6.46
CDVI	3.64	5.02	4.46	5.67
CII	10.45	10.62	10.56	10.55

The table reveals that, the area, production and productivity of Sugarcane in India had a stability during all the overall study period. The sugarcane area had an instability value of 11.08 per cent of CII and 9.56 per cent CDVI during period II which was the highest, followed by period III with 10.75 per cent of CII and 6.15 per cent and period I being the lowest with 10.65 per cent of CII and 5.52 per cent of CDVI. Similar trend was observed for sugarcane production. Period II had the highest instability index value of 11.39 per cent CII and CDVI of 13.03 per cent, followed by period III with 11.00 per cent of CII and 7.61 per cent of CDVI and lastly period I with 10.79 per cent CII and 5.52 per cent of CDVI.

Even sugarcane productivity did not showed a different trend. The highest instability index value was reported by period II (CII- 10.62 per cent; CDVI- 5.02 per cent) followed by period III (CII- 10.56 per cent and CDVI- 4.46 per cent) and period I (CII- 10.45 per cent; CDVI- 3.64 per cent). The reason behind the highest instability value during period II for area, production and productivity of sugarcane may be due to the drastic decline of area under sugarcane during the period which ultimately led to the decrease in production and productivity. Similar results were obtained by Maurya *et al*. (2020) [4]

Decomposition Analysis

In this analysis attempt has been made to identify the contribution of area and productivity for change in production of sugarcane. The study period was divided into three sub periods and overall taking into consideration the importance of each sub period as discussed in methodology.

Table 3: Per cent contribution of area, yield and their interaction for change in production of sugarcane in India.

Sr. No.	Period	Area Effect	Yield Effect	Interaction
1	Period I	47.7	44.39	7.95
2	Period II	-97.1	188.38	8.74
3	Period III	54.9	37.22	7.90
4	Overall	59.2	27.75	13.09

The Table 3 indicates that, during period I, period III and overall period area effect was the most responsible factor for change in production of sugarcane in India. While during period II yield effect was found to be most responsible for change in production of sugarcane in India. The highest yield effect was observed during period II i.e., 188.38 per cent with negative yield effect i.e. -97.1 per cent and interaction effect i.e. 8.74 per cent. While during period I and period III the yield effects were (44.39and 37.22 per cent, respectively with area effect (47.7 and 54.9 per cent, respectively) and interaction effect (7.95 and 7.90 per cent, respectively). During overall period area effect, yield effect and interaction effect were recorded 59.2, 27.75 and 13.09 per cent, respectively.

Thus, overall area effect had played a driving force in the differential production of sugarcane in India during period I, period III and overall period. Similar results were obtained by Maurya *et al*. (2020) [4]

Conclusions

The study concludes that, the sugarcane area had increasing growth in a decreasing rate during the study periods. The growth rates of production and productivity of sugarcane in India had a fluctuating trend during the study periods. Also, the area, production and productivity of sugarcane in India had stability during all the study periods. The area effect was a driving force for the change in production of sugarcane in India during the study periods. In a nutshell it can be suggested that high yielding sugarcane varieties should be recommended to the sugarcane growing farmers and drought resistant varieties should be used in the drought prone areas that majorly cultivates sugarcane. This will lead to no fear of losses to the sugarcane growers and ultimately large number of area will be under sugarcane cultivation.

References

1. Kalamkar SS, Atkare VG, Shende NV. An Analysis of Growth Trends of Principal Crops in India, Agricultural Science Digest. 2002;22(3):153-156.
2. Kannan E. Trends in India's Agricultural Growth and its determinants, Asian Journal of Agriculture and Development. 2012;8:79-98.
3. Kumar A, Singh R. Dynamics of Area, Production, Productivity and Trade of Sugracane in India: Evidences from Uttar Pradesh and Maharashtra, India, International Journal of Current Microbiology and Applied Sciences. 2018;7(5):3484-3491.
4. Maurya OP, Verma OP, Kumar H, Singh J. Growth and Decomposition Analysis of Sugarcane in India, International Journal of Current Microbiology and Applied Sciences. 2020;11:585-588.
5. Minhas BS, Vaidyanath A. Growth of crop output in India 1951-54 to 1956-61: An analysis by component elements, Journal of Indian Society of Agricultural Statistics. 1965;17:230-252.