

Growth Rate of Area, Production and Productivity of Sugarcane Crop in India

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Abstract— Sugarcane is an important commercial crop of India. It plays a crucial role for overall socio-economic development of farming community. India ranks second in production of sugarcane after Brazil. In India about 4.73-million-hectare land is occupied by sugarcane crop. Based on the importance of sugarcane crop, present study was conducted to know growth rate of area, production and yield of sugarcane in India and performance of sugarcane crop in major sugarcane producing states of India. The study was based on secondary source of data. Simple statistical tools like compound annual growth rate, percentage methods were used in this study. The study reveals that compound annual growth rate in case of area, production and yield showing a positive sign. The area under sugarcane cultivation is reported an increase of 5.63 percent in a duration of thirty years between 1985 and 2015 and the sugarcane production was increased by 7.40 percent in the same period. The area and production of crop is showing a fluctuating trend because there are many factors which is responsible sugarcane cultivation like monsoon conditions, government price polices etc.

Keywords— Compound annual growth rate, Production, Sugarcane, Trends.

I. INTRODUCTION

Sugarcane is the main source of sweeteners globally and holds a prominent position as a cash crop. India occupies second position in Sugarcane cultivation after Brazil. Climatic condition of India is favorable for sugarcane cultivation therefore the production of Sugarcane spread across the country. There are two different agro-climatic regions of sugarcane cultivation in India namely tropical and sub-tropical. The tropical regions include the states of Maharashtra, Gujrat, Tamil Nadu, Andhra Pradesh and Karnataka, Madhya Pradesh, Goa, Kerala. Tropical region records the high sugar recovery due to the long sunshine hours, cool nights with clear sky and the latitudinal position of the area favorable for sugar accumulation. The sub tropical region includes the states namely Uttar Pradesh, Bihar and Haryana and Punjab. Climatic conditions are generally variable depending upon the season and sometimes within the seasons also. Sugarcane crop faces all the season in a year. Uttar Pradesh is having largest area under sugarcane crop. However, the highest sugar recovery can be obtained in the Maharashtra.

It is a major source of raw material not only sugar industry but other allied group of industries. Sugarcane and its by products provide employment opportunities to large number of people and responsible for socio-economic transformation of farming community. Sugar industry has been instrumental in resource mobilization, employment generation, income generation and creating social infrastructure in rural areas, in other words sugar industry has facilitated and accelerated pace of rural industrialization. Production of Sugarcane in India is not uniform, fluctuating trend of production has been found. This is due to the several problems faced by sugarcane industry, such as Low yield of Sugarcane, Prices fixed by government, delay in payments, unpredictable monsoon condition etc. (Gaikwad, C. 2017). Water scarcity is the major problem faced by sugarcane farmers in India, the major reason for low production and low productivity is the unpredictable monsoon condition. So, the present study will examine the growth of area, production and productivity of sugarcane crop in India and to analyze the performance of major sugarcane producing states in India.

II. MATERIALS AND METHOD

The Study is based on secondary source of data which is collected from various reports. The compound annual growth rate, percentage change or annual growth rate was calculated. Compound annual growth rates (CAGR) was worked out to study about the changes in area, production and yield of sugarcane over a period. The compound annual growth rate was calculated by fitting the following equation in the time series data area, production and yield.

$$Y_t = Y_0(1+r)^t \quad (1)$$

Taking log on both side we will get

$$\ln Y_t = \ln Y_0 + t \ln(1+r)$$

$$\text{Ln}Y_t = a + bt \quad (2)$$

Where,

$$a = \text{Ln}Y_0$$

$$b = \text{Ln}(1+r)$$

$$Y_t = \text{area/ production/ yield}$$

$$Y_0 = \text{constant}$$

$$t = \text{time period in years and}$$

$$b = \text{regression coefficient}$$

$$\% \text{ compound growth rate} = (\text{Anti log } b - 1) \times 100 \quad (3)$$

Percentage change in yield is given by:

$$\% \text{ change in yield} = \frac{(\text{Current year yield} - \text{Previous year yield}) \times 100}{\text{Previous year yield}}$$

III. RESULT AND DISCUSSION

3.1 Area, Production and Yield of Sugarcane in India

As already discussed, India is the second largest producer of sugarcane in the world and it has enormous influence on economy of the country. So, it is important to study the area, production and yield of Sugarcane in the country. During, 1995-96 area under sugarcane crop was 4147 thousand hectares. The area increased to 4737 thousand hectares in 2017-18. As shown in the (table1) over the years area, production and yield has increased from 1995-96 to 2017-18. The area under sugarcane has sharply increased in 2006-07 i.e. 5151 thousand hectares. It is clear from the table that area, production and yield is fluctuating in the study period. Production of sugarcane in 2017-18 was increased as compare to 2006-07, but area in 2006-07 was more, this is due to the various incentives, high yielding varieties etc. It is clear from the study that the trend of sugarcane cultivation in India is uneven.

TABLE 1
DESCRIPTIVE STATISTICS OF SUGARCANE CROP IN INDIA (1995-96 TO 2017-18)

Year	Area (‘000 Hectare)	Production (‘000 Tonne)	Yield (In Kgs./Hect.)
1995-96	4147	281100	67777
1996-97	4174	277560	66496
1997-98	3930	279540	71133
1998-99	4055	288720	71203
1999-00	4220	299320	70934
2000-01	4316	295960	68578
2001-02	4412	297208	67370
2002-03	4520	287383	63576
2003-04	3938	233862	59380
2004-05	3662	237088	64752
2005-06	4202	281172	66919
2006-07	5151	355520	69022
2007-08	5055	348188	68877
2008-09	4415	285029	64553
2009-10	4175	292302	70020
2010-11	4885	342382	70091
2011-12	5038	361037	71668
2012-13	4999	341200	68254
2013-14	4993	352142	70522
2014-15	5067	362333	71511
2015-16	4927	348448	70720
2016-17	4436	306069	69001
2017-18	4737	376905	79650

Source: Indian Sugar Mills Association. & Ministry of Agriculture & Farmers Welfare, Govt. of India

3.2 Annual growth rate of area, Production and Productivity of Sugarcane

TABLE 2
PERCENTAGE CHANGE IN AREA, PRODUCTION AND YIELD OF SUGARCANE IN INDIA (1995-96 TO 2017-18)

Year	% change in area ('000 hectare)	% change in production ('000 t)	% change in yield (Kgs/ hect.)
1995-96	0.65	-	-
1996-97	0.65	-1.26	-1.89
1997-98	-5.85	0.71	6.97
1998-99	3.18	3.28	0.10
1999-00	4.07	3.67	-0.38
2000-01	2.27	-1.12	-3.32
2001-02	2.22	0.42	-1.76
2002-03	2.24	-3.31	-5.63
2003-04	-12.8	-18.62	-6.60
2004-05	-7.01	1.38	9.05
2005-06	14.75	18.59	3.35
2006-07	22.58	26.44	3.14
2007-08	-1.86	-2.06	-0.21
2008-09	-12.6	-18.14	-6.28
2009-10	-5.44	2.55	8.47
2010-11	17.01	17.13	0.10
2011-12	3.13	5.45	2.25
2012-13	-0.77	-5.49	-4.76
2013-14	-0.12	3.21	3.32
2014-15	1.48	2.89	1.40
2015-16	-2.67	-3.83	-1.11
2016-17	-9.97	-12.16	-2.43
2017-18	6.79	24.12	16.23

Source: Calculated by authors, data obtained from Ministry of Agriculture & Farmers Welfare, Govt. of India

Compound annual growth rate was calculated on area, production and yield of sugarcane in India to know about the growth rate over a period of time. It is clear from the table that annual growth rate in area, production and yield is not even. The growth in terms of area has increased rapidly between 2005-06 and 2006-07. The highest annual growth in terms of area is found in 2006-07 i.e. 22.58 percent. The highest negative annual growth rate in area is found in 2003-04. The periods in which the area has increased; production has also increased in those periods. Compound annual growth for production is highest in 2006-07. Yield is showing better growth in 2017-18, which indicates that farmers can take up this crop in better way.

TABLE 3
COMPOUND ANNUAL GROWTH RATES OF AREA, PRODUCTION AND YIELD OF SUGARCANE (1985-2015)

Year	Area (in Percent)	Production (in Percent)	Yield (in Percent)
1985-1995	3.83	5.12	1.24
1995-2005	0.13	0.00	0.00
2005-2015	1.60	2.17	0.55
1985-2015	5.63	7.40	1.68

Source: Calculated by authors, data obtained from Ministry of Agriculture & Farmers Welfare, Govt. of India

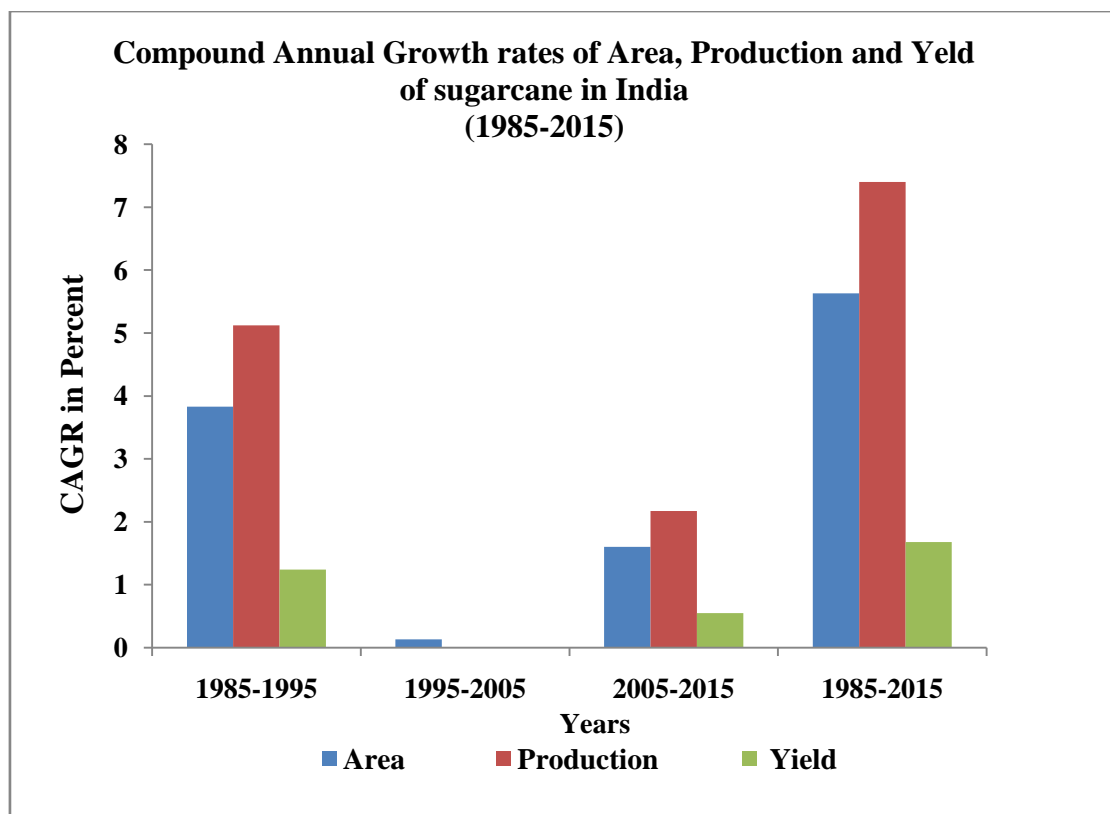


FIGURE 1: Growth rates of area, production and yield of sugarcane in India

It is clear from the table and figure that CAGR in area, production and yield is increasing between 1985-1995. But between 1995-2005 the production and yield are not increasing. After the 2005 the rate of area, production and yield started to increase but the rate of increment was very slow. The overall Compound annual growth rate of 30 years (1985-2015) for area under sugarcane crop in India is 5.63 percent. Compound Annual growth rate for production in 30 years is 7.40 percent, and for yield is only 1.68 percent.

3.3 State-wise Sugarcane cultivation in India

**TABLE 4
AREA, PRODUCTION AND PRODUCTIVITY IN MAJOR SUGARCANE PRODUCING STATES, 2017-18**

States	Area (Million hectare)	% to All India	Production (Million tonnes)	% to All India	Productivity (Kg. / hectare)
Uttar Pradesh	2.23	47.21	177.06	46.98	79255
Maharashtra	0.90	19.06	83.13	22.06	92166
Karnataka	0.35	7.40	28.26	7.50	80751
Tamil Nadu	0.18	3.80	16.54	4.39	92002
Bihar	0.24	4.99	13.98	3.71	59202
Gujrat	0.18	3.85	12.05	3.20	66220
Haryana	0.11	2.41	9.63	2.56	84500
Punjab	0.10	2.03	8.02	2.13	83583
Andhra Pradesh	0.10	2.09	7.95	2.11	80283
Uttarakhand	0.09	1.90	6.30	1.67	70044
Madhya Pradesh	0.10	2.07	5.43	1.44	55408
Telangana	0.04	0.74	2.56	0.68	73086
Others	0.12	2.45	5.98	1.59	-
All India	4.73	100.00	376.90	100.00	79650

Source: Ministry of Agriculture & Farmers Welfare, Govt. of India

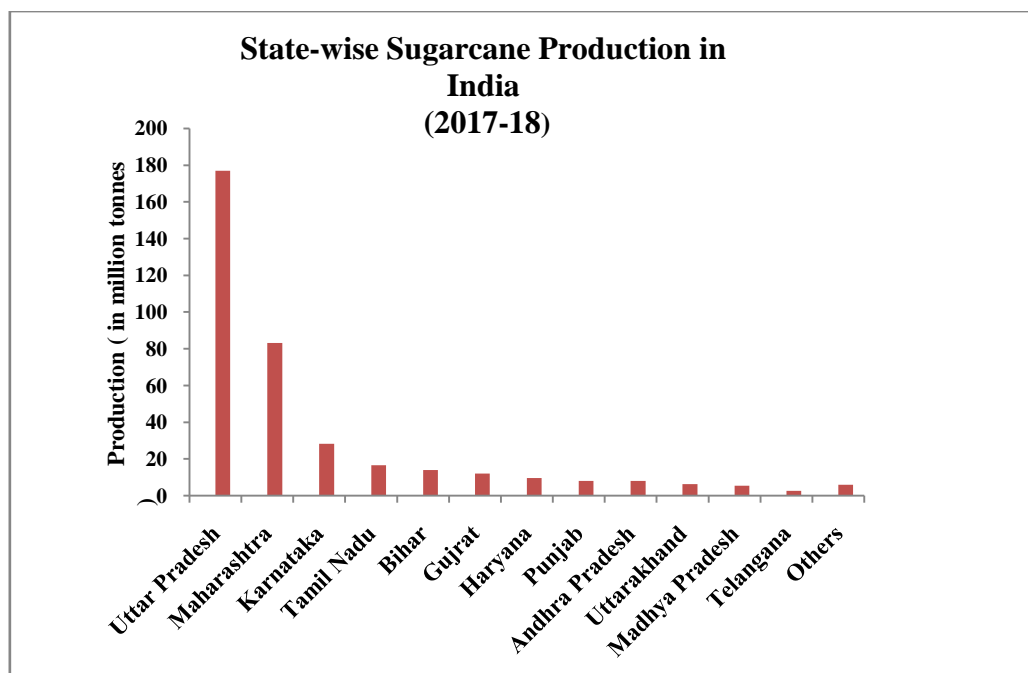


FIGURE 2: State-wise Production of Sugarcane in India

Table 4 depicts the state-wise area, production and productivity of Sugarcane in India. The data reveals that the Uttar Pradesh is the leading sugarcane producing state followed by Maharashtra and Karnataka. While analyzing the production of the states it is clear from the study that production is directly related to the area under sugarcane. The total production of the whole country was 376.90 million tonnes in 2017-18. As we have discussed that the highest area under sugarcane cultivation was contributed by the states of Uttar Pradesh, Maharashtra, Karnataka and Tamil Nadu. Thus, it is obvious that the production would be also higher in these states. Expectedly, the data shows, Uttar Pradesh is the largest producer of sugarcane in the country, this state alone produced 177 million tonnes, which is about 47 percent of the total production of the country. Maharashtra is the second leading producer of sugarcane in the country sharing about 22 percent of the total production of the country, which is about 83 million tonnes. As well as Karnataka is the third largest producer of sugarcane accounting about 8 percent production of the country, which is about 28 million tonnes. Similarly, Tamil Nadu produced 16.54 million tonnes of sugarcane and shares 4.39 percent production to the production of the whole country, this state ranks at fourth place in terms of production. In addition to this, Bihar Gujrat, Haryana, Punjab and Andhra Pradesh are the other significant producing states of India, the share of these states ranges between 1 and 4 percent to the total production of the country. Uttarakhand, Madhya Pradesh, Telangana and other many states had the minor production of sugarcane.

The productivity of any crop depends upon many factors, like physical conditions, technological advancement, market and payment with a good product value. The average productivity of India was 79650 KG/hectare in 2017-18. It has been found that the state of Maharashtra had the highest productivity i.e. 92166 KG/hectare in the same year. Haryana ranks second in terms of the sugarcane productivity; the productivity of sugarcane in Haryana was estimated 84500 KG/hectare. Punjab was scaled to the third position in terms of the productivity, i.e. 83583 KG/hectare. Uttar Pradesh, being the largest producer of sugarcane, has an average productivity which is quite similar to the average productivity of the country. The states of Bihar and Madhya Pradesh represented very low productivity because of low fertility in the soil and the lack of technological advancement.

IV. CONCLUSION

From the above discussion it was found that the area under sugarcane was found to be increased by 5.63 percent over thirty years (1995 to 2015), whereas production and yield increased at 7.40 percent and 1.68 percent. It is clear from the study that trend of sugarcane cultivation in India is fluctuating, no uniform pattern of growth has observed. This is due to many problems faced by sugarcane farmers includes the problem of scarcity of water, sugarcane pricing problems etc. Sugarcane crop requires regular supply of larger quantity of water for its growth. Availability of Sufficient water mainly depends on rainfall. Fluctuation in seasonal rainfall in India adversely affects the production of sugarcane. Sugarcane being a long duration crop which requires more irrigation. Poor water availability leads to drying of crop and yield loss. Other major reason of fluctuation in sugarcane crop is sugarcane pricing policies, major changes in agricultural product prices from year

to year affect product supply and producers' decisions about production. With the huge stakes involved in the cane crop and in the sweet commodity, government policies relating to the sector have always been arbitrary, with politicians formulating rules not on the basis of sound economic principles, but under the pressure of different interest and then resulted policies could provide benefit to different stakeholders. Despite of large area under sugarcane crop farmers are still using traditional methods and equipment in sugarcane cultivation. The lack of usage of mechanization in India is due to the small size of land holding, improper crop spacing, and lack of finance. Some machines are worthy, and these are not affordable to farmers but introduction of costly machines through custom hiring centers can help the farmers to get the benefits of machinery.

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