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Dynamics of Area, Production and Productivity of Cotton Crop in India

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Abstract

The present study was conducted with the aim to calculate growth rate and variability in area, production and productivity of cotton crop in India. The data on area, production and productivity was obtained from Agriculture at a glance. The study period was from 1980-2019 which was further divided into four decades and an overall period. Compound annual growth rate and coefficient of variation were used in the analysis. The results showed that positive significant growth in area (1.51 per cent), production (4.74 per cent) and productivity (3.17per cent) was observed in the overall period. Highest variability was found in production (59.57 per cent) followed by productivity (40.74 per cent) and area (21.11) from 1980 to 2019.

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Cotton (*Gossypium* sp.) belonging to Malvaceae family is called as "King of Fibre" crop. It makes an outstanding contribution to the agriculture and industrial development for sustaining agricultural revenue, export earnings and employment generation. Although the lint fibre holds the majority of cotton's value, the cultivation of cotton also yields other by-products. Products made from cottonseed, such as animal feed and numerous goods made from oil, also have additional advantages. Cotton seed cake also shows potentiality in terms of improving nutrition when utilized as organic amendments. The production of cotton as an agricultural crop and the downstream items it account for a size-able share of the world economy.[1] Globally, cotton is one of the most popular fibre crops grown on a sizable area in almost 50 different countries varying from temperate to tropical, with significant commercial cotton production.[2] The top ten cotton-producing nations are India, Pakistan, China, Brazil, Turkey, Australia, Turkmenistan, the United States, Uzbekistan, and Burkina. India is the world's top producer of cotton, accounting for 26 % of global production, yet it has a very poor yield per hectare.[3]

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Until the 1970s, India imported large amounts of cotton, averaging 8 to 9 lakh bales per year. Cotton production in the country acquired the necessary momentum through increased area and seeding of hybrid types only after the advent of special schemes such as intensive cotton production programmes during the mid 1970's. The recent export statistics showed that out of the 54.83 lakh bales of cotton exported by India in the year 2020–21, 21.97 lakh bales were sent to China. After Bangladesh, China was the country that imported the most cotton from India. In terms of yarn exports, out of the 980 million kg in total exports in 2020, 275 million kg of cotton yarn was shipped from India to China. The main country importing yarn from India was China4. Cotton can be considered as an important crop which benefits both the industrial and agricultural sectors, which are directly related to India's GDP.

Numerous research studies on the growth of cotton production have been carried out, both in India and overseas. A study conducted on growth in cotton cultivation in Tamil Nadu concluded that cotton production is declining in the state.[5] A study conducted to determine the growth and variability in area, production and productivity of cotton crop, concluded that cotton has experienced moderate to high significant growth in area, production and productivity over the study period and It has been determined that there continue to be significant variations in the expansion of area, production, and yield of cotton due to the variability in these factors.[6] Another study found modest yearly growth rates of harvesting area, production, and yield with positive significant trends7. The present study aims to determine growth and variability in cotton area, production and productivity over the years.

Methodology

The study was based on secondary data related to area, production and productivity which were obtained from Agriculture at a glance, published by Directorate of economics and statistics. The study period was from 1980-2019. It was further divided into four decades and overall period as well: Decade I – 1980-89, Decade II- 1990-99, Decade III- 2000-09, Decade IV- 2010-19, and Overall period- 1980-2019. The statistical tools used in the study are as follows:

Absolute Change: It is the absolute difference between the starting and final values over time. The absolute change in area, production, and productivity were calculated by taking the average of the base year and the average of the current year in each period, and the change in area, production, and productivity was calculated by:

Absolute change= $Y_n - Y_o$

where,
Y_n = average of the current three years
Y_o = average of the beginning three years

Relative Change: The relative change facilitates comparison analysis. This measure was calculated for comparative change among the variables chosen for the study. The following formula was used to calculate relative change:

Relative change = (Yn-Yo)/Yo × 100

Compound annual growth rate (CAGR): In the study, CAGR was utilized to assess the growth rate of area, production and productivity the over time. The following formula was used to calculate the CAGR.

$Y_t = ab^t$

Compound annual growth rate (%) = (Antilog b-1) × 100

Where,
Y= Area, production, and productivity in the year 't' for which the growth rate is estimated
t= Time in year
b = Regression coefficient

Coefficient of Variation (CV)

The degree of dispersion around the mean is measured using the coefficient of variation. It is given in percentage form as the standard deviation to mean ratio.

CV= standard deviation/mean× 100

Results and Discussion

Compound growth rate of the area under cotton cultivation over the years is presented in

Table 1. During 1980-89 cotton area has decreased by a relative change of -9.52 per cent. Cotton area has increased in the period 2000-09 by a relative change of 14.29 per cent. The relative change for the overall period was 62.86 per cent. In absolute terms area has decreased by -0.75 mha in the period 1980-89 whereas area has increased by 1.43 mha during the period 1990-99. Results showed that highest growth in area (2.71) was recorded during the period 1990-99 which was significant at 1 per cent. Negative growth (-1.25) was reported in the period 1980-99. The overall period showed a significant growth rate of 1.51 percent in area under cotton crop.

Table 1: Absolute change, relative changes and growth rate of area (Million ha) under cotton in India

Decade	Base year	Current year	Absolute change	Relative change (%)	CAGR (%)
1980-89	7.92	7.16	-0.75	-9.52	-1.25
1990-99	7.55	8.97	1.43	18.9	2.71**
2000-09	8.44	9.65	1.20	14.29	2.03*
2010-19	11.8	12.89	1.09	9.27	1.08
Overall	7.91	12.89	4.97	62.86	1.51**

Base year-Average of triennium ending average
Current year- Average of triennium ending average
** & * significant at 1 and 5 per cent level

Compound growth rate of cotton production over the years is presented in Table 2. Cotton production has increased by a relative change of 156.5 per cent in the period 2000-09. In the period 2010-19 production has decreased by a relative change of -5.37 per cent. The production in overall period has increased by 332.29 per cent in relative terms. Cotton production has decreased by -1.83 per cent in absolute terms during 2010-19. Significant growth in production was seen in the period 2000-09 which was 13.60 per cent. In the period 2010-19, cotton production had experienced a negative growth rate of -0.86 per cent. Cotton production increased at a considerable pace of 4.74 per cent throughout the course of the period.

Table 2: Absolute change, relative changes and growth rate of production (Million Bales 170 Kg. of each) under cotton in India

Decade	Base year	Current year	Absolute change	Relative change (%)	CAGR (%)
1980-89	7.47	8.85	1.37	18.38	2.79
1990-99	10.32	11.56	1.24	12.02	2.29
2000-09	9.38	24.06	14.68	156.5	13.60**
2010-19	34.14	32.31	-1.83	-5.37	-0.86
Overall	7.47	32.30	24.83	332.29	4.74**

Base year-Average of triennium ending average
Current year- Average of triennium ending average
** & * significant at 1 and 5 per cent level*

Cotton productivity increased by a relative change of 124.51 per cent between 2000-09. Productivity fell by a relative change of -13.55 percent between 2010-19. In relative terms, productivity increased by 165.28 percent throughout the course of the past forty years. Cotton productivity fell by -66.66 per cent in absolute terms between 2010-19. Cotton productivity peaked between 2000-09, with a substantial growth rate of 11.34 per cent. Productivity decreased at a negative rate of -1.93 percent from 2010 to 2019, the slowest of all the years studied. The overall period has experienced a significant positive growth rate of 3.17 per cent for cotton productivity.

Table 3: Absolute change, relative changes and growth rate of productivity (kg/ha) under cotton in India

Decade	Base year	Current year	Absolute change	Relative change (%)	CAGR (%)
1980-89	160.33	207.33	47	29.31	4.09*
1990-99	232.67	219	-13.67	-5.87	-0.40
2000-09	189	424.33	235.33	124.51	11.34**
2010-19	492	425.33	-66.66	-13.55	-1.93
Overall	160.33	425.33	265	165.28	3.17**

Base year-Average of triennium ending average
Current year- Average of triennium ending average
** & * significant at 1 and 5 per cent level

The variability of area, production and productivity are presented in Table 4. It showed that area under cotton crop has seen maximum variation in the period 1990-99 (9.56 per cent), followed by period 2000-09 (8.84 per cent), period 1980-89 (6.39 per cent) and period 2010-19 (6.26 per cent). The overall period has seen a variation of 21.11 per cent. Over the years, variability in cotton area has ranged from 6.26 to 21.11 per cent.

Table 4: Coefficient of variation of Area, Production and Productivity of Cotton in India

S.No.	Decade	Variable	Mean	SD	CV
1.	1980-89	Area	7.482	0.47	6.39
		Production	7.95	1.51	19.04
		Productivity	180.6	32.08	17.76
2.	1990-99	Area	8.291	0.79	9.56
		Production	11.534	1.37	11.92
		Productivity	236.8	19.69	8.31
3.	2000-09	Area	8.849	0.78	8.84
		Production	17.161	6.46	37.65
		Productivity	324.8	104.77	32.25
4.	2010-19	Area	12.198	0.76	6.26
		Production	33.263	2.59	7.79
		Productivity	465.1	43.67	9.39
5.	Overall	Area	9.205	1.94	21.11
		Production	17.477	10.41	59.57
		Productivity	301.825	122.97	40.74

Cotton production variability was highest in 2000-09 (37.65 per cent), followed by 1980-89 (19.04 per cent), 1990-99 (11.92 per cent), and 2010-19 (7.79 per cent). Cotton production variability has ranged from 7.79 to 37.65 per cent over the years. Cotton production has varied by 59.57 per cent over the time.

Yield has seen highest variability in the period 2000-09 (32.25 per cent), followed by 1980-89 (17.76 per cent), 2010-19 (9.39 per cent) and 1990-99 (8.31per cent). The overall period has seen a variability of 40.74 per cent. Cotton productivity has varied between 8.31 and 32.25 percent over the years. Production has seen highest variability (59.57 per cent) in the overall period followed by productivity(40.74 per cent) and area (21.11).

Conclusion

From the study it can be concluded that lesser growth in cotton area whereas moderate growth rate in production and productivity were seen over the years. In case of variability, production has experienced highest variation over the years followed by productivity and area. When it came to the area, production, and productivity of cotton crop, there were significant ups and downs in the growth that repealed its smoothness. Number of ups and downs in the area, production, and yield of a non-food crop shatter the cultivators' expectations resulting in shifting to traditional crops. To promote cotton production in the nation, it is necessary to offer HYV, suitable inputs, as well as efficient disease and insect control.

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Conflict of interest

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