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Growth and instability in production and trade of cotton in India: A macro level approach

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Abstract

Cotton is known for its versatile performance and natural comforts. Its strength and absorbency quality makes it an ideal fabric. Cotton is also referred to as White Gold. It is one of the most important fibre and cash crop of India which plays a dominant role in agricultural and industrial sectors. Considering the importance of cotton in the Indian economy, the present study was conducted with an objective to analyse the growth and instability of cotton in production and trade aspects. To fulfil the objectives of the study, time series data related to area, production, productivity, import and export of cotton pertaining to a period of 30 years beginning from 1989-90 to 2018-19 were collected from various websites, research journals and government publications, etc. The data was further divided into three sub-periods period I (1989-90 to 1998-99), period II (1999-2000 to 2008-09) and period III (2009-10 to 2018-19) for the purpose of analysis. To analyse the growth rate and instability of cotton, compound annual growth rate, co-efficient of variation and Cuddy-Della Valle Index (CDVI) techniques were used. The study revealed that, area under cotton increased at a significant rate of 1.82 per cent per annum in the period under study. Period-wise analysis of growth in area indicated that it increased at decreasing rate. Production of cotton increased at a significant rate of 4.82 per cent per annum. It increased at 4.90 per cent per annum in period I which further increased to 10.15 per cent per annum in period II mainly because of introduction of hybrid cotton seeds in period I and introduction of Bt-cotton in period II. Both of these growth rates were found to be statistically significant. The rate of growth in production however, declined to non-significant rate of 0.88 per cent per annum in period III probably because of the insect pest of cotton became resistant to pesticides used for controlling them in that period. Productivity showed a significant positive growth of 2.96 per cent per annum in overall period but it increased at the rate of 8.78 per cent in period II probably because of the same reason. The quantum of exported cotton increased at 14.77 per cent per annum in the entire period under study. It declined in period I and period III at 20.69 and 10.69 per cent per annum respectively. In contrast, export of cotton increased at an impressive and highly significant rate of 89.17 per cent per annum in period II. Almost similar pattern of growth was observed in case of export value. The quantity imported cotton and its value exhibited reverse trend over time. These two items increased at the rate of 16.26 per cent per annum and 17.27 per cent per annum in overall period. Furthermore, the study indicated that the sub-period during which there was greater and significant increase in export and decrease in import. The study further revealed that growth in area, production and productivity of cotton was relatively stable in India in the period under study whereas growth in quantity and value of cotton export and import was found to be relatively instable during the study period.

Keywords: growth, trade, macro level, cotton

Introduction

Cotton is often referred to as white gold. It is one of the most important fibre and cash crops of India and plays a dominant role in industrial and agricultural sector of the Indian economy. Cotton fibre is a distinguished fibre that serves as a raw material for the textile industry having the yearly significant economic impact of \$600 billion. Globally cotton is cultivated in 34.73 million hectares and India alone accounts for around 42 per cent share in world's total area of about 13.48 million hectares (CCI, 2021). India is one of the largest producers of cotton in the world accounting for about 26 per cent of the total world production. The Indian textile industry contributes around 5 per cent to country's GDP, per cent to industrial production and 11 per cent to total export earnings. Industrial sector is the second largest employment generator in the country after agriculture, providing employment to over 51 million people directly and 68 million people indirectly, including unskilled women. Cotton is known for its versatile performance and natural comfort. Cotton's strength and absorbency makes it an ideal fabric. It can be used to create many different types of fabric for a range of end – uses,

including blends with other natural fibres like wool and synthetic fibres like polyester.

Globally, China stands first in cotton production, followed by India, United States, Brazil, Pakistan, Uzbekistan, Turkey and Australia. In India, area under cotton was 134.77 lakh hectares with a production of 365.00 lakh bales of 170 kgs and productivity of 460 kgs per hectare in 2019-20 and it was estimated that by 2021-22, area under cotton will be 120.69 lakh hectares, production will be 362.18 lakh bales of 170 kgs and productivity will be 510 kgs per hectare (COCPC, 2021). Punjab, Haryana, Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Telangana, Andhra Pradesh, Karnataka and Tamil Nadu are the major states involved in cotton production. Among the major states, Maharashtra stands first in area under cotton with 44.91 lakh hectares followed by Gujarat (26.55 lakh ha), Telangana (21.57 lakh ha), Karnataka (8.17 lakh ha), Rajasthan (7.60 lakh ha), Haryana (7.23 lakh ha) and Andhra Pradesh (6.57 lakh ha). Gujarat stands first in production with 89.00 lakh bales of 170 kgs followed by Maharashtra (87.00 lakh bales), Telangana (54.00 lakh bales), Rajasthan (29.00 lakh bales), Haryana (26.50 lakh bales) and Maharashtra and Karnataka with 20.00 lakh bales each. In case of productivity, Punjab is at the top position with 651 kgs per hectare followed by Rajasthan (649 kg/ha), Haryana (623 kg/ha), Gujarat (570 kg/ha), Maharashtra (523 kg/ha) and Andhra Pradesh (466 kg/ha). Zone wise per cent share of area under cotton indicated that, central zone holds the top position with 57.84 per cent followed by southern zone with 27.98 per cent, northern zone with 12.84 per cent, and other zones with 1.32 per cent share in total area under the crop.

USA stands first in cotton export in the world followed by Brazil, India, Australia, Greece, Burkina Faso and other countries. In case of cotton import China stands first followed by Bangladesh, Vietnam, Turkey, Indonesia, Pakistan, Mexico, and other countries. Major importers of Indian cotton are Bangladesh, China and Pakistan. Export of cotton yarn, cotton fabrics, cotton made-ups and handloom products was worth US \$10.01 billion during 2019-20. Cotton export decreased from 58.00 lakh bales of 170 kgs in 2006-07 to 47.04 lakh bales of 170 kgs in 2019-20. In terms of value, it increased from Rs. 5267.08 crores in 2006-07 to Rs. 8731.32 crores in 2019-20. On the contrary, cotton import increased from 5.53 lakh bales of 170 kgs in 2006-07 to 15.50 lakh bales of 170 kgs in 2019-20. In value terms it increased from Rs. 752.29 crores in 2006-07 to Rs. 3588.38 crores in 2019-20. India is one of the largest consumers of cotton, it alone accounts for 22 per cent of world total cotton consumption (Cotton this month, ICAC, 2021) [1].

There are some studies dealing with export and import of the agricultural commodity from and to India. Now the less studies concentrating exclusively on cotton are few and far between. Considering the importance of cotton in the Indian economy from the point of view of domestic consumption of cotton and its export the present study was undertaken with a view to estimating the growth and instability in production of cotton and its trade.

Methodology

The study is based on secondary data. Time series data related to area, production and productivity of cotton were collected from various sources like INDIASTAT website, FAO, CCI, and other publications. The data so collected pertained to a 30-year period spanning from 1989-90 to 2018-19. The entire

period was divided into three sub-periods, period I (1989-90 to 1998-99), period II (1999-2000 to 2008-09) and period III (2009-10 to 2018-19) for the purpose of analysis.

Compound Annual Growth Rate

Growth rate of cotton was calculated using compound annual growth rate (CAGR) which indicates the tendency of variable to increase, decrease or remain constant over a period of time. The compound annual growth rate (CAGR) was estimated using the following model.

$$Y = AB^t$$

$$\log Y = \log A + t \log B$$

$$\text{Let, } \log Y = y, \log A = a \text{ and } \log B = b$$

$$y = a + bt$$

$$r = (\text{antilog } 'b' - 1) \times 100$$

Where, Y = area/ production/ productivity/international trade

a = Intercept

b = Regression coefficient

t = Time periods (t = 1, 2, 3, ..., 10)

r = Compound Annual Growth Rate (CAGR).

Measurement of instability

Instability is the deviation from the trend. It was measured by using co-efficient of variation. The standard deviation as percentage of means called as co-efficient of variation.

$$CV = \frac{\sigma}{\mu} \times 100$$

Where, CV = Co-efficient of variation

σ = Standard deviation of the variable

μ = Mean of the variable.

$$\text{Cuddy-Della Valle Index (\%)} = CV \cdot \sqrt{1 - R^2}$$

Where, C.V = coefficient of variation

R^2 = co-efficient of determination from a time trend regression adjusted to its degrees of freedom.

Results and Discussion

The growth rate of area, production and productivity of cotton in India was analysed for the period of 30 years beginning from 1989-90 to 2018-19 using compound annual growth rate. Table 1 shows the CAGR of area, production and productivity of cotton in India in period I, period II, period III and the whole period under consideration. It is evident from the table that, area under cotton in the country increased at the rate of 1.82 per cent per annum during overall period which was statistically significant at 1 per cent level of probability. Inter-period-analysis of growth in area indicated that the area under cotton increased at the rate of 2.73 per cent per annum in period I which was statistically significant. The growth in area in period II and period III was 1.25 and 1.16 per cent per annum respectively, both of these growth rates were found to be non-significant. The overall picture that emerged from the analysis, indicated that, the area under cotton increased at a decreasing rate during the period under consideration. The reason for this may be shift in the area under cotton towards the food crops like cereals and pulses in major cotton growing states. Evidences are there which supported this view Sabesh *et.al.* 2014 [8] and Shimar, 2014 [10].

Table 1: Growth in area, production and productivity of cotton.

Area				
	Period I	Period II	Period III	Overall
CAGR	2.73**	1.25	1.16	1.82**
t value	4.85	1.71	1.48	9.80
Production				
CAGR	4.90**	10.15**	0.88	4.82**
t value	6.26	6.68	0.93	15.18
Productivity				
CAGR	2.15**	8.78**	-0.21	2.96**
t value	3.40	7.82	-0.24	10.35

Note: - * - 5% level of significance. ** - 1% level of significance

So far growth in production of cotton was concerned, it was observed that cotton production increased at a highly significant rate of 4.82 per cent per annum during entire period under study. Inter-period comparison of growth in production of cotton indicated that it increased at the rate of 4.90 per cent per annum during period I which was statistically significant at 1 per cent level of significance. The rate of growth further increased to a statistically significant rate of 10.15 per cent during period II. However, it declined to a lower and non-significant rate of 0.88 per cent per annum during period III. It implied that cotton production increased at an increasing rate in period I and period II. In contrast, it increased at a decreasing rate during period III. Introduction of hybrid seeds of cotton may be the reason for significant growth in production of cotton in period I, while introduction of Bt-cotton in period II may have provided fresh impetus to the rate of growth in production of cotton in that period to the higher level. Thereafter, insect pests of cotton became largely resistant to the pesticides used for controlling this infestation which may have resulted in decline in production of cotton in period III.

In case of growth in productivity of cotton, it was estimated that productivity of cotton increased at the rate of 2.96 per cent per annum during the overall period which was significant at 1 per cent level of probability. When a comparative study of growth in cotton productivity during the different sub-periods under study was made, it was found that period II registered a higher growth rate of 8.78 per cent per annum which was highly significant followed by significant positive rate of 2.15 per cent per annum during period I and a negative non-significant rate of 0.12 per cent per annum during period III. Infestation of insect pest and adverse climatic conditions may be the reason for decreased productivity of cotton during period III. The scenario was found to be similar with the findings of Niranjana *et.al.* (2017). Trade performance of cotton in India is shown in Table 2. A perused the table indicated that export of cotton increased at the rate of 14.77 per cent per annum during the overall period which was statistically significant at 1 per cent level of probability. As a matter of fact, export of cotton decreased during period I and period III at 20.69 per cent per annum and 10.69 per cent per annum respectively. Non-significant negative rate of growth was found in period I. whereas negatively significant growth rate was observed in period III. It was only period II which recorded a highly impressive and statistically significant growth rate of 89.17 per cent per annum. In period I and period III, a reduced quantity of cotton was exported probably due to higher domestic consumption in

period I and adverse climatic conditions and non-availability of promising cotton varieties along with higher domestic consumption of cotton may be the reason for reduced rate of growth in period III. However, the rate of reduction in period III was less than that in period I. Introduction of Bt-cotton during period II which had a higher yield potential may have been the main reason for larger export of cotton during this period. Value of export too followed almost a similar pattern; it recorded a significant growth of 16.88 per cent per annum during overall period. Here again, the value of export achieved a highly significant growth of 98.01 per cent per annum during period II, probably because of the same reason as discussed in case of quantum of cotton exported.

Table 2: Growth rate of export and import of cotton

Export Quantity				
	Period I	Period II	Period III	Overall
CAGR	-20.69	89.17**	-10.69**	14.77**
t value	-2.11	5.71	-4.12	4.56
Export Value				
CAGR	-18.50	98.01**	-11.50**	16.88**
t value	-1.75	6.19	-3.71	4.86
Import Quantity				
CAGR	68.81*	-9.30	32.81**	16.26**
t value	2.50	-1.83	4.96	4.97
Import Value				
CAGR	65.32*	-3.19	26.69**	17.27**
t value	2.62	-0.76	5.23	5.91

Note: - * - 5% level of significance. ** - 1% level of significance

The quantity of imported cotton exhibited reverse trend. The quantum of imported cotton grew at a significant rate of 16.26 per cent per annum during the overall period. It increased at the rate of 68.81 per cent per annum which was significant at a 5 per cent level of probability in period I and 32.81 per cent per annum during period II which was found to be significant at 1 per cent level of probability. It was only in case of period II that the growth rate of import quantity of cotton got reduced probably as a result of higher production of cotton in the country on account of introduction of Bt-cotton during that period. The value of imported cotton follows almost a similar pattern. It showed the positive and significant growth of 17.27 per cent per annum during overall period. It increased at a significant rate of 65.32 per cent per annum and 26.69 per cent per annum during period I and period III respectively. Only in case of period II, it diminished at the rate of 3.19 per cent per annum which was non-significant. The study further revealed that the sub-period during which there was a greater and significant increase in productivity and production of cotton, also witnessed a greater and significant increase in export and a greater and significant decrease in import.

Instability analysis of cotton

With a view to study the instability in area, production and productivity of cotton in India, co-efficient of variation and Cuddy-Della Valle's Index (CDVI) were used. These indices were estimated using a 30-year time series data related to area, production and productivity of cotton. The results of the analysis have been shown in Table 3.

Table 3: Instability in growth of area, production and productivity of cotton.

Area				
	Period I	Period II	Period III	Overall
CV	9.55	7.11	7.36	18.63
CDVI	4.87	5.99	6.50	9.12
Production				
CV	15.97	31.15	8.28	42.22
CDVI	6.96	11.65	7.94	15.22
Productivity				
CV	8.33	26.10	7.63	28.00
CDVI	5.46	8.65	7.61	13.42

The CV and CDVI were 18.63 and 9.12, 42.22 and 15.22 and 28.00 and 13.42 in the overall period under study. These indices were 9.55 and 4.87 in period I, 7.11 and 5.99 in period II and 7.36 and 6.50 in period III in case of area of cotton during the study periods. In case of production, these indices were 15.97 and 6.96 in period I, 31.15 and 11.65 in period II and 8.28 and 7.94 in period III. In case of productivity of cotton, these indices were 8.33 and 5.46 in period I, 26.10 and 8.65 period II and 7.63 and 7.61 in period III. These indices gave an indication that area, production and productivity of cotton were relatively stable in India during the period under study.

The CV and CDVI with respect to export quantity and value and import quantity and value have been presented in Table 4.

Table 4: Instability in growth of Export and Import of cotton.

Export Quantity				
	Period I	Period II	Period III	Overall
C.V	89.94	112.44	38.76	103.19
CDVI	75.79	67.47	24.20	72.96
Export value				
C.V	99.25	118.43	43.50	114.43
CDVI	91.51	69.06	28.53	81.72
Import Quantity				
	Period I	Period II	Period III	Overall
C.V	139.66	50.53	72.45	94.11
CDVI	114.32	40.11	36.94	71.05
Import value				
C.V	116.94	36.18	64.82	98.37
CDVI	97.14	34.89	31.08	63.75

The indices were 103.19 and 72.96 for export quantity, 114.43 and 81.72 for export value, 94.11 and 71.05 for import quantity and 98.37 and 63.75 for import value in the overall period under study. Further, period-wise indices were 89.94 and 75.79 in period I, 112.44 and 67.47 in period II and 38.76 and 24.20 in period III for export quantity. For export value these indices were 99.25 and 91.51 in period I, 118.43 and 69.06 in period II and 43.50 and 28.53 in period III. In case of import quantity of cotton, these indices were 139.66 and 114.32 in period I, 50.53 and 40.11 in period II and 72.45 and 36.94 in period III. For import, value these indices were 116.94 and 97.14 in period I, 36.18 and 34.89 in period II and 64.82 and 31.08 in period III. These indices indicated that quantity and value of cotton export and import were relatively instable during the period under consideration.

Conclusion

In sum area under cotton increased at a non-significant rate of 1 and 2 per cent per annum. It is interesting to note that sub-period wise analysis of growth in area revealed that it increased at decreasing rate during the study period.

Production of cotton increased at 4 and 2 per cent per annum during the entire period under consideration which was found to be statistically significant. Almost similar pattern was noticed in case of growth in productivity of cotton in the period under study. It is noteworthy here that growth in production and productivity was higher in period II probably because of introduction of Bt-cotton during that period. Quantum of exported cotton declined during period I, non-availability of promising cotton varieties during that period coupled with higher domestic consumption may be the reasons for this observation. Similarly, higher domestic consumption and adverse climatic conditions may be the reason for less export during period III. Value of exported cotton exhibited the similar trend. On contrary, just reverse trend was observed in case of quantum of imported cotton and its value. The study further revealed that the sub-period during which there was a greater and significant increase in productivity and production of cotton, also witnessed a greater and significant increase in export and greater and significant decrease in import. Furthermore, are production and productivity of cotton were found to be relatively stable. In contrast, cotton export and import were observed to be relatively instable.

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