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Analytical Study of Growth and Instability in Cotton Production of India

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ABSTRACT:
The cotton crop in India is concentrated upto the extent of 98% in three zones of India i.e. Northern Zone, Central Zone and Southern Zone. Cotton being an important fibre crop has been focussed in the present study with respect to compound growth rate and instability in area, production and yield in the three important zones. It is found from the study that though central zone shares the maximum area and production of cotton in India, the yield is lowest in this zone. The southern zone performs better in terms of compound growth rate and instability of yield of cotton. The high instability in production of cotton in Southern India may be attributed to high instability in area under cotton. The production can be stabilised with higher growth rate only by improving the growth rate of area with stabilising effect.
KEY WORDS: Compound Growth Rate, Instability, Coefficient of Variation significant.

Introduction

Cotton is one of the important fibre crop and the most widely grown commercial crops in India. Cotton is grown mainly in three zones of India i.e. Northern Zone (Punjab, Haryana and Rajasthan), Central Zone (Gujurat, Maharastra and Madhya Pradesh) and Southern Zone (Andhra Pradesh, Telengana, Karnataka and Tamilnadu). More than 98 % of total area under cotton in India is in these three zones. The study is based on Compound Growth Rate and Instability of area, production and yield of cotton in the three zones of India (i.e. Northern Zone, Central Zone, Southern Zone) for the period from 2004-05 to 2019-20.

Materials and Methods

The study is based on the secondary source of data on area, production and yield of cotton in Northern Zone, Central Zone, Southern Zone of India and the country as a whole for the period from 2004-05 to 2019-20. The area is given in ‘000 ha, production in ‘000 bales (1 bale =

170 kg) and yield in kg/ha. The data are obtained from various volumes of Economic survey of India.

The data on area, production and yield of cotton were worked out for entire period of analysis by fitting to exponential function as follows.

$Y_t = ab^{t} e_t$

Where,

Y_t =Area/Production/Yield of major cereal crops in years.

t = time element which takes the value 1, 2, 3,.....,n

a = intercept

b = regression coefficient

e_t = random error (Samuel et al., 2013)

The compound growth model is established in the following manner

$\log Y_t = \text{Log } a + t \text{Log } b$

$Y_t' = A' + B't$

Let Log Y_t= Y_t',

Log a=A'

Log b=B'

The two generalised equations are

$$\sum_{t=1}^{n} Y_t' = \sum_{t=1}^{n} (A' + B't)$$

$$\Rightarrow \sum_{t=1}^{n} Y_t' = nA' + B' \sum_{t=1}^{n} t \quad \text{. . . equation 1}$$

$$\sum_{t=1}^{n} tY_t' = A' \sum_{t=1}^{n} t + B' \sum_{t=1}^{n} t^2 \quad \text{. . . equation 2}$$

Solving the 2 equations and multiplying equation 1 by $\sum_{t=1}^{n} t$ on both sides we get

$$\sum_{t=1}^{n} Y_t' \sum_{t=1}^{n} t = nA' \sum_{t=1}^{n} t + B' \left(\sum_{t=1}^{n} t \right)^2 \quad \text{. . .equation 3}$$

Multiplying equation 2 by n on both sides we get

$$n \sum_{t=1}^{n} tY_t' = nA' \sum_{t=1}^{n} t + nB' \sum_{t=1}^{n} t^2 \quad \text{. . . equation 4}$$

equation 4 – equation 3 we get

$$n \sum_{t=1}^{n} tY_t' - \sum_{t=1}^{n} Y_t' \cdot \sum_{t=1}^{n} t = nB' \sum_{t=1}^{n} t^2 - B' \left(\sum_{t=1}^{n} t \right)^2$$

$$\Rightarrow B' = \frac{n \sum_{t=1}^{n} tY_t' - \sum_{t=1}^{n} Y_t' \sum_{t=1}^{n} t}{n \sum_{t=1}^{n} t^2 - \left(\sum_{t=1}^{n} t \right)^2}$$

Putting the value of B' in equation 1 we get

$$A' = \sum_{t=1}^{n} Y_t' \left(\sum_{t=1}^{n} Y_t' - B' \sum_{t=1}^{n} t \right) \div n$$

Given,

Log a=A'

a=Antilog A'

Log b=B'

b=Antilog B'

Compound growth rate (C.G.R) =(antilog B' -1) x100 (Jahangirdar et al., 2004)

SE(C.G.R) = (100 x b) x SE(lnb) / ln10 (Dhakre and Sharma, 2010)

Coefficient of Variation, C.V. = (Standard Deviation/Mean) x 100

$SE(CV) = CV/(2n)^{1/2}$

Results and Discussion

The study of table 1 shows that central zone has the highest mean area and production of cotton but the mean yield of central zone is lowest. The result of the study also shows that area and production of cotton shows significant Compound Growth Rate in Central Zone, Southern Zone and at all India level. Yield of cotton shows significant Compound Growth Rate only in Southern Zone, whereas, in Northern Zone, Central Zone and at all India Level it is found non - significant. It is seen from table 2 that area and production of cotton registers highest Compound Growth Rate in Southern Zone which are 5.65 % and 5.93 % respectively, whereas, for all India level the values are 2.68 % and 2.46 % respectively. The Coefficient of variation (used as measure of instability) in area and production of cotton is also highest for Southern Zone which are 28.18 % and 29.78 % respectively. But the instability in yield of cotton is lowest in Southern Zone which is only 9.34 %. This shows that Southern Zone of India shows much better performance w.r.t. yield of cotton. The high instability in production of cotton in Southern India may be attributed to high instability in area under cotton.

Table 1: Mean of Area/Production/Yield of cotton in different zones of India

	Area (in '000 ha)	**Production (in '000 bales) (1 bale = 170 Kg**	**Yield in (Kg/ha)**
Northern Zone	1499.22	5035.33	568.73
Central Zone	6885.32	18856.24	466
Southern Zone	2527.45	8099.34	544.19
All India	11056.56	32913.48	506.63

Table 2: Compound Growth Rate (C.G.R.) and Coefficient of Variation (C.V.) of Area/Production/Yield of cotton in different zones of India

	Area		Production		Yield	
	C.G.R	C.V	C.G.R	C.V	C.G.R	C.V
Northern Zone	0.33	8.56**	1.72	18.26**	1.39	15.47**
Central Zone	2.11**	11.33**	1.68**	13.39**	-0.42	9.46**
Southern Zone	5.65**	28.18**	5.93**	29.78**	2.27*	9.34**
All India	2.68**	13.74**	2.46**	14.41**	-0.25	9.61**

Summary and Conclusion

The study shows that the zone showing higher compound growth rate also usually shows higher degree of instability in case of area and production of cotton, whereas, in case of yield the higher growth rate is accompanied by lower instability. Since the cotton crop in different zones of India shows better performance with respect to yield, the production can be stabilised with higher growth rate only by improving the growth rate of area with stabilising effect. This can be achieved by promoting the cotton farming with judicious application of modern improved technologies.

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