Growth and Instability Analysis of Grapes Production in Karnataka

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ABSTRACT

Grape is one of the major fruits in Karnataka. Despite the fact that Mango and Banana are the important conventional fruit crops produced in Karnataka, in recent years the grapes production has been increased significantly because of the government's horticultural crops production policies and more importantly the Wine Policy of 2007. In this backdrop, the study has examined the growth performance of grapes in the state of Karnataka for a period of fifteen years from 2004-05 to 2018-19. The study has revealed that the annual growth performance of grapes in area under crop (7.45 %), production (8.31 %) and productivity (0.83 %). The state performance is little better than the all India level performance. The instability indices for area (4.26), production (11.91) and productivity (7.94) are relatively lower than the all India level. On the whole, the study reveals that there is a further scope for the enhancement in production of grapes in the State by adopting appropriate production technology.

Keywords: *Area, Production, Productivity***,** *Compound Growth Rate, Instability Analysis, Performance*

INTRODUCTION

Grape is one of the most important fruit crops produced in India and the world. Even though the cost of production is high and high risk of losing crop, the production of grapes provides certain returns to the farming community (Prakash Mokashi *et al.,* 2014). Consequently,a large number of farmers in many parts of the country have been showing interest towards grape cultivation. Grape is grown under a variety of soil and climatic conditions in three distinct agro-climatic zones, namely, sub-tropical, hot tropical and mild tropical climatic regions in India (Mohite, 2002). More than 80 per cent of the total production is consumed as table grapes in India, and more than 70 per cent of the total production is harvested in March-April. Indian fresh grapes have more demand in the international markets, especially in European and Asian countries (Handiganur and Haranesh,1995). Grapes are exported through three different agencies viz., Grower Exporters, Growers' Cooperatives and the Trader exporters.

Major grape producing states in India are Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, and the north-western region covering Punjab, Haryana, Western Uttar Pradesh, Rajasthan, and Madhya Pradesh. Maharashtra ranks first in terms of production accounting for more than 80 percent of total production with high productivity in the country (Sathyendra Kumar and Devaraj, 2018), Grape is produced in India covering an area of 139 thousand hectares with a production of 2920.09 thousand metric tons. The grape sectoris occupying about 1.7 per cent of the total area under fruit crops in India. In addition, the country exportsfresh grapes to other countries. The country exported 2,46,134 metric tons of grapes accounting for Rs. 2,335 crores of value during the year 2018-19. Karnataka is a second largest grape producing state in India. Varieties of grapes are produced in Vijaypura, Belagavi, Bagalkot, Kolar, and Bangalore rural and urban districts in Karnataka. In Karnataka the fruit is produced in an area of 27 thousand hectaresand accounts forabout 524 thousand tons of output with 20 tons/ha of productivity in Karnataka.

OBJECTIVE OF THE STUDY

The main purpose of the study is to analyze the growth and instability in area, production and productivity of grapes in major grapes producing districtsof Karnataka and to evaluate the policy imperatives for the development of grapesector in the state.

METHODOLOGY

In this study two important statistical tools namely compound annual growth (CAGR) and

Instability analysis(CV) were employed. Growth is a measure of past performance of an economic variable. They are commonly used as summary of trends in time series data. In order to study the variability(CV) in production of grapes, an index of instability is developed as a measure of variability.

1. Growth Rate Analysis

Time series data on area, production and productivity of grapes in India and Karnataka for the period from 2004-05 to 2018-19 were collected from the government reports, NHB Publications (2004-05 to 2014-15) and Horticultural Statistics at a Glance for the years 2015, 2016 and 2017, GOI. Horticulture Statistics of Karnataka state at glance published by Directorate of Horticulture, government of Karnataka is also used for the necessary data.

The exponential function model is used to compute the annual compound growth rates in area, production, and productivity for grapes in India and Karnataka.

$$y = ab^t e^u$$

y = dependent variable for which growth is to be estimated

a = intercept

b = regression coefficient

t = time variable

e = exponent term (2.3018)

u = disturbance term

The logarithmic form of equation is log y=log a + t log b+u

The compound growth rate (g) in percentage is computed from the relationship.

$$g = (\text{anti log of log } b) - 1 \times 100 \text{ or } g = (b-1) \times 100$$

The standard error of the growth rate was estimated and tested for its significance with 't' test. If the compound growth rate is positive, the variable starts increasing, if the compound growth rate is negative, the variable starts decreasing year by year.

The growth rates worked out with the above equation were converted into percentage for better understanding and effective comparison. Growth rates were tested for their significance using the 't' test.

1. Instability Analysis

In order to study the variability in area and production of grapes, an index of instability is developed as a measure of variability. The coefficient of variation (CV) is calculated using the following formula:

$$\text{Co} - \text{efficientofvariation (CV)} = \frac{\text{StandardDeviation}}{\text{Mean}} \times 100$$

The formula suggested by Cuddy and Della (1978) is used to compute the index of instability.

$$\text{IndexofInstability} = \frac{\text{StandardDeviation}}{\text{Mean}} \times 100 \times \sqrt{1 - R^2}$$

Coefficient of variation is multiplied by the square root of the difference between the unity and coefficient of multiple determinations (R^2) in the cases where R^2 is significant.

RESULTS AND DISCUSSION

The area under grape cultivation in Karnataka was more than doubled from last 15years, the area under crop has been increased to 29.11 thousand hectares in 2018-19 from 10.14 thousand hectares in 2004-05. The production of all varieties of grapes was increased to 642.33 thousand tonnes during the same period. This tremendous increase in production was due to favourable climatic conditions for grapes (Sharanesh *et al.*1998) and_Karnataka Grape Processing and _Wine Policy of 2007. In addition to this a great production support from State Horticultural Department, Government of Karnataka and increasing demand for grapes in domestic and international markets.

The data on area, production, and productivity of grapes in India and Karnataka from 2004-05 to 2018-19 is given in the following table.

Table 1
Area, Production & Productivity of Grapes in India and Karnataka from 2004-05 to 2018-19

Year	Area (in '000' HA)		Production (in '000' MT)		Productivity (in MT/HA)	
	India	Karnataka	India	Karnataka	India	Karnataka
2004-05	57.80	10.14	1474.80	185.81	25.52	18.33
2005-06	60.50	10.27	1564.70	190.29	25.86	18.52
2006-07	66.00	12.08	1649.60	216.64	24.99	18.00
2007-08	65.00	14.31	1685.30	258.81	25.93	18.09
2008-09	68.00	15.46	1735.00	278.56	25.51	18.02
2009-10	80.00	17.36	1878.00	317.64	23.48	18.30
2010-11	106.40	16.29	880.70	278.91	8.28	17.13
2011-12	111.00	19.06	1235.00	310.39	11.13	16.29
2012-13	116.00	19.76	2221.00	292.65	19.15	14.81
2013-14	118.00	20.35	2483.00	391.16	21.04	19.22
2014-15	122.96	21.73	2822.78	417.74	22.96	19.22
2015-16	121.65	23.35	2590.04	445.52	21.30	19.08
2016-17	135.95	24.43	2683.26	458.02	19.74	18.75
2017-18	138.91	26.61	2920.09	524.26	21.02	20.00
2018-19	139.00	29.11	2958.00	642.33	21.28	22.07

Source: National Horticulture Board & Department of Horticulture, Government of Karnataka**.**

Tables 1 reveal the area, production and productivity of grapes from 2004-05 to 2018-19 in India and Karnataka. The data show that the Karnataka's share in India's total area under crop and production in 2004-05 was 17.54 per cent and 12.59, respectively. This has been increased to 20.94 and 21.71 percent respectively in 2018-19. The productivity of grapes increased from 18.33 tons/ ha in 2004-05 to 22.07 tons/ha in 2018-19. It is noticed from the data that the productivity in Karnataka was little higher than the country's average.

Table 2
Growth & Instability in Area, Production and Productivity of Grapes in India and Karnataka

	Area		Production		Productivity	
	India	Karnataka	India	Karnataka	India	Karnataka
Compound annual growth rate (CAGR) (In Percent)	7.36	7.45	5.77	8.31	-1.48	0.83
Average	100.48	18.69	2052.08	347.25	21.15	18.39
Standard Deviation (SD)	30.72	5.76	660.52	130.22	5.20	1.63
Co-efficient of Variation (CV) (Percent)	30.57	30.81	32.19	37.50	24.59	8.88
R^2 (In Percent)	94.12	98.09	64.12	89.92	10.43	20.14
Instability Index (In Percent)	7.41	4.26	19.28	11.91	23.27	7.94
Contribution of total production of India in 2018-19 (In Percent)	100.00	20.94	100.00	21.71	100.00	103.71

Source: Computed based on data (2004-05 to 2018-19) from NHB and Department of Horticulture, Govt. of Karnataka

From the above table, the data reveal that there is a moderate degree of positive growth in area under production in India and Karnataka, During the study period the data on grape production show that the CAGR in Karnataka is better than the all India level. This indicates that the State has potential to produce a sizeable output. Though the area under grape and production has been increased both at all India and Karnataka State level, the CAGR in productivity per hectare has shown a negative growth of -1.48 at all India level and a very low degree (0.83) of positive growth in Karnataka. The coefficient of variation in area and production for India and Karnataka is 30.81 percent and37.50 percent respectively. The result on productivity reveal that Karnataka is much better than India between 2004-05 and 2018-19. The instability indices show a relatively smaller instability in area under crop (4.26%) and production (11.91%) a reasonable instability for Karnataka. Overall, the analysis indicates that there is a moderate variation in area, production and productivity of grapes during study period.

The table.3 below indicates the district-wise growth rate of the area, production and productivity of grapes in Karnataka for the period between 2004-05 & 2018-19. The data shows that growth rate in area and production, except in two districts namely Bengaluru urban and Kolar, all other major grapes producing districts recorded positive growth rate during the study period. A very high degree of positive growth rate of 66.78 per cent in area under production seen in Chikkaballapur district and a moderate degree of positive growth rate in the districts of Belagavi (11.28%), Vijayapura (8.49%), Bagalkot (7.86%) and Koppal (7.60%) followed by low degree of positive growth in Kalaburgi (4.10%) and Bengaluru rural (3.73%) districts. The data reveals that growth rate in area under the production, a low degree of negative growth for Bengaluru urban district and a moderate degree of negative growth for Kolar district during the study period.

Correspondingly, in respect of production for the same period Chikkaballapur district show a very high degree of (105.82%) positive growth rate followed by a moderate degree of positive growth in Vijayapura (13.77%), Belagavi (11.05%), Kalaburgi (8.03%) and Bagalkot (7.82%) districts. Koppal (5.47%) and Bengaluru rural (1.47%). districts recorded low degree of positive growth. Whereas Kolar (-17.33) and Bengaluru urban (-7.14) districts show negative growth rate in production the same study period.

Table 3

District-wise Growth rate in area, production & productivity of grapes in Karnataka between 2004-05 & 2018-19

Districts	Area	Production	Productivity
Bengaluru (U)	-6.97	-7.14	-0.18
Bengaluru (R)	3.73	1.47	-2.18
Chikkaballapura	66.78	105.82	23.41
Kolar	-16.18	-17.33	-1.37
Bagalkot	7.86	7.82	-0.04
Belagavi	11.86	11.05	-0.73
Vijayapura	10.29	13.77	3.15
Kalaburgi	4.10	8.03	4.10
Koppal	7.60	5.47	-1.98
Other Districts	7.12	6.98	4.08
Overall Growth Rate of the State	**7.45**	**8.31**	**0.81**

Source: Computed based on data from Department of Horticulture, Govt. of Karnataka

In respect of growth rate in productivity, Chikkaballapur district show a substantial moderate degree of positive growth (23.41) followed by low degree of positive growth (3.15) in Vijayapura. The data reveals that Bangalore urban, Bangalore rural, Kolar, Bagalkot, Belagavi and Koppal districts show low degree of negative growth during the same period.

Overall, the data Indicates that, the share of Karnataka in area under grapes and production in India is increasing over a period of time. This trend reveals that there is a better opportunity for the State to make use of the available recourses to enhance the quality of grapes output at all India level. As a result of this, India can meet the growing demand for grapes in domestic as well as in international market.

CONCLUSION

Variation in area, production and productivity is increasing every year, there is still scope for further improvement in existing as well as in newer area. It is also very important to the grapes producers to establish their own organizations or companies to garner the benefit of quality production, value addition, and marketing and export of grapes on the co-operative basis. This would not only reduce the cost of production and marketing but facilitate to increase the benefits in general and the small and marginal farmers in particular.

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