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## **Growth and instability of garlic in India**

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### **Abstract**

The study was conducted to investigate growth and instability in area, production and export of garlic the nature of data used for the study is entirely based on secondary source of data from 1990-91 to 2019-20. Compound Growth Rate, coefficient of Variation, Coppock's Instability Index are used to work out growth and instability. Coefficient of variation and Coppock's instability index showed highest variation in export value in the overall period. The growth rate analysis of area, production, productivity, export quantity, export value and unit value of export of garlic in overall period showed positive and significant growth rate.

**Keywords:** Growth, instability, garlic, India

### **Introduction**

India's diverse climate assures availability of all kinds and varieties of fresh fruits and vegetables. Increase in exports lead to economic growth (Agrawal, 2014) <sup>[1]</sup>. Indian Agriculture occupies a significant role both in the internal and external trade of the country. Further, foreign exchange generated through agriculture exports helps to meet import debts of the country (Faye, 2001) <sup>[3]</sup>. The agriculture sector employs 50 per cent of the work force in the country contributing 18 per cent to the GDP (Dolli and Divya, 2020) <sup>[2]</sup>. Growth in one per cent of agriculture GDP can produce three times more benefit in eliminating poverty than the growth in other non-agriculture sectors (Janvry and Sadoulet, 2010) <sup>[4]</sup>.

### **Methodology**

#### **Compound Annual Growth Rate**

In the present study, the compound growth rates in area, production and productivity of garlic in India were estimated by fitting exponential type of equation

$$Y = ab^t$$

Where

A = Intercept

B = Regression co-efficient or trend value

T = time variable

Y = Area/production/productivity/export

CGR = (Antilog b - 1) x 100.

#### **Coefficient of Variation**

Coefficient of Variation (C.V) is the simplest measure of variation around the trend, it over-estimates the level of instability in time series data which are characterized by long-term trends.

$$\text{Coefficient of variation (C.V)} = \frac{\text{Standard Deviation}}{\text{Mean}} * 100$$

#### **Coppock's Instability Index (CII)**

Coefficient of instability is another measure of instability besides coefficient of variation. Coppock's Instability Index is close approximation of the average year to year percentage adjusted for the trend and pronounced than the absolute variation. Coefficient of instability was worked out using Coppock's Instability Index (CII).

Coppock's instability index = Antilog ( $\sqrt{V \log - 1}$ ) x 100

Where,

$$V \log = \frac{\sum (\log \frac{X_{t+1}}{X_t} - m)^2}{n}$$

Where,

$X_t$  = Area/Production/Productivity/Export

t = number of years

m = mean of the difference between logs of  $X_{t+1}$ ,  $X_t$

Log V = Logarithmic variance of the series

### Results and Discussion

#### Analysis of growth rates

The study attempts to analyses the performance of garlic with respect to area, production, productivity, export quantity, export value and unit value of export. The analyzed growth rates are presented in the table 1.

**Table 1:** Compound Growth rate

Particulars	CGR	SE
<b>Area</b>		
Period I	2.58*	0.0039
Period II	6.51**	0.0019
Overall Period	5.42**	0.0014
<b>Production</b>		
Period I	3.93**	0.0051
Period II	9.32**	0.0040
Overall Period	7.25**	0.0019
<b>Productivity</b>		
Period I	1.33**	0.0017
Period II	2.63**	0.0032
Overall Period	1.74**	0.0009
<b>Export Quantity</b>		
Period I	-7.64	0.0241
Period II	11.22	0.0392
Overall Period	7.57*	0.0118
<b>Export Value</b>		
Period I	-0.26	0.0217
Period II	21.33*	0.0370
Overall Period	15.41**	0.0111
<b>Unit Value of Export</b>		
Period I	8.01**	0.0062
Period II	8.92**	0.0074
Overall Period	7.32**	0.0024

**Note:** \*\* - significant at 1% level, \* - significant at 5% level

The total study period (1990-91 to 2019-20) was divided in to three sub-periods viz., period I (1990-91 to 2004-05), period II (2005-06 to 2019-20) and period III (1990-91 to 2019-20). The exponential functional form was employed to compute the growth rates and the results are presented in the Table 1.

The data presented in Table 1 revealed that the area of garlic in period I and period II had shown a positive growth rate of 2.58 per cent per annum and 6.51 per cent per annum respectively. In period I, the growth rate of area of garlic was found to be statistically significant at 5 per cent level of significance whereas in period II, it was found to be statistically significant at 1 per cent level of significance. Growth rate of production of garlic had shown a positive growth rate of 3.93 per cent per annum and 9.32 per cent per annum in period I and period II respectively and found both to be statistically significant at 1 per cent level of significance. Growth rate of productivity of garlic had shown a positive growth rate in period I and period II with 1.33 per cent per annum and 2.63 per cent per annum respectively and found both to be statistically significant at 1 per cent level of significance.

It was also observed that in the overall period area of garlic had shown a positive growth rate of 5.42 per cent per annum and found to be statistically significant at 1 per cent level of significance. This shows that the area of garlic was increasing during the overall period. Similarly, production and

productivity of garlic in the overall period had shown a positive growth rate of 7.25 per cent per annum and 1.74 per cent per annum respectively and found to be statistically significant at one per cent level of significance. This shows that the production and productivity of garlic was increasing during the overall study period along with area.

In case of export of garlic, it was observed that the export quantity and export value in period I showed a negative non-significant growth rate with -7.64 per cent per annum and -0.26 per cent per annum respectively, whereas unit value of export of garlic in period I showed a positive significant growth rate with 8.01 per cent per annum at 1 per cent level of significance. In period II, export quantity of garlic showed non-significant positive growth rate with 11.22 per cent per annum whereas export value and unit value of export in period II showed positive growth rate with 21.33 per cent per annum at 5 per cent level of significance and 8.92 per cent per annum at 1 per cent level of significance respectively.

In overall period, it was observed that the export quantity, export value and unit value of export of garlic showed a positive growth rate of 7.57 per cent per annum, 15.41 per cent per annum and 7.32 per cent per annum respectively. It was found that the export quantity of garlic was statistically significant at 5 per cent level of significance whereas export value and unit value of export was statistically significant at 1 per cent level of significance. This showed that the export

quantity, export value and unit value of export have been increasing throughout the study period.

The results obtained are in close agreement with the findings of Kumar *et al.* (2019) [5] where it was concluded that there was a positive growth in area, production and productivity of garlic in India. Yogesh and Mokshapathy (2014) [8], concluded that there was a positive growth in export quantity and export value of garlic in India. Hence, the hypothesis i.e., there is significant growth in area, production, productivity and export of garlic in India is accepted here.

### Instability Index

In order to study the variability in area, production, productivity, export quantity, export value and unit value of garlic exports during the study period, co-efficient of variation and coppock's instability index was worked out. It was used to work out instability index for the total period (1990-91 to 2019-20) which was divided in to three periods viz., period I (1990-91 to 2004-05), period II (2005-06 to 2019-20) and over all period (1990-91 to 2019-20).

**Table 2:** Instability

Period	Particulars	Area	Production	Yield	Export Quantity	Export Value	Unit Value
Period I	MEAN	105.05	460.47	4.34	3591467.93	35907585.20	11.88
	SD	18.48	111.59	0.38	2786843.92	25756355.65	5.52
	CV (%)	17.59	24.23	8.66	77.60	71.73	46.41
	CII (%)	12.02	12.93	10.91	25.78	22.10	15.15
Period II	MEAN	247.38	1439.45	5.62	17534496.2	556016550	32.95
	SD	69.65	671.19	1.05	12113838.76	431715199.71	15.01
	CV (%)	28.15	46.63	18.70	69.09	77.64	45.55
	CII (%)	13.37	15.30	11.82	45.13	49.30	16.01
Overall period	MEAN	176.21	949.96	4.98	10562982.07	295962067.60	22.42
	SD	88.01	686.55	1.01	11174513.06	400320116.04	15.44
	CV (%)	49.95	72.27	20.33	105.79	135.26	68.85
	CII (%)	16.27	19.14	11.99	41.47	56.63	19.59

**Note:** CV- Coefficient of Variation, CII- Coppock's Instability Index

It could be seen from Table 2 that the instability in area of garlic was higher in the overall period with 49.95 per cent whereas in period I and period II instability in area of garlic was 17.59 per cent and 28.15 per cent respectively. The production of garlic exhibited higher variability in the overall period with 72.27 per cent whereas in period I and period II instability in production garlic was 24.23 per cent and 46.63 per cent respectively. The instability in productivity of garlic was higher in overall period with 20.33 per cent whereas in period I and period II instability in productivity of garlic was 8.66 per cent and 18.70 per cent respectively.

Coppock's Instability Index showed high variation in the overall period for area, production and productivity of garlic with 16.27, 19.14, 11.99 per cent respectively. In period II, Coppock's Instability Index for area, production and productivity of garlic was 13.37, 15.30 and 11.82 per cent respectively followed by period I with 12.02, 12.93 and 10.91 per cent for area, production and productivity of garlic respectively. Coefficient of Variation and Instability Index was higher in production followed by area and productivity in all the periods.

Export quantity of garlic showed variability of 105.79 per cent in overall period followed by period I with 77.60 per cent and period II with 69.09 per cent. Instability in export value of garlic is highest in overall period with 135.26 per cent followed by period II with 77.64 per cent and period I with 71.73 per cent. Unit value of export of garlic showed high instability in the overall period with 68.85 per cent followed by period I with 46.41 per cent and period II with 45.55 per cent. Coppock's Instability index showed highest variation was in export value of garlic in the overall period with 56.63 per cent similar to Co-efficient of Variation. I. However instability index for export quantity, export value and unit value of export was 25.78, 22.10 and 15.15 per cent respectively during period I. However instability index for export quantity, export value and unit value of export was 45.13, 49.30 and 16.01 per cent respectively during period II.

Instability index for export quantity, export value and unit value of export was 41.47, 56.63 and 19.59 per cent respectively during the overall period.

The results are similar to the findings of (Patil and Kerur, 2016) [6] concluding that instability in garlic area, production and productivity is increasing. It is clear from the above discussion that garlic has shown inconsistent export performance over the period of study.

### Conclusion

It is important to increase export share of garlic by taking appropriate efforts. Increasing the productivity of garlic through advanced technology such as tissue culture and biotechnology and increase in area under bigger clove quality garlic, which has high demand in international markets can increase per cent share of Indian garlic in world garlic exports (Sekhar *et al.*, 2014) [7].

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