



Growth and Instability Analysis of Large cardamom production in Sikkim

Rajiv Gurung¹ • Prof. Manesh Choubey²

¹Research Scholar, Department of Economics, Sikkim University, Gangtok, India

²Professor, Department of Economics, Sikkim University, Gangtok, India

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ABSTRACT

Sikkim is the largest producer of large cardamom in India and it alone contributes around 88 percent to the national production. However, area and production of cardamom plantations in the state have been declining in the recent years putting livelihoods of several hill farmers to considerable risks. Against such background, this study estimates and analyses the growth rates and instability of area, production and yield of large cardamom in the northeastern hilly state of Sikkim. To meet the objectives, secondary data was collected from National Horticulture Board, Government of India and Department of Horticulture, Government of Sikkim for a period 20 years from 2000-01 to 2019-20. The results of the study show that growth rate of area and production for the period 2000-01 to 2009-10 was negative i.e. -7.01% and -5.36% respectively while growth rate for yield recorded a positive growth of 1.65 % for the same period. On the other hand, area and production of large cardamom recorded a much higher and positive growth of 5.11% and 4.14% respectively during the period 2010-11 to 2019-20 while yield recorded a negative growth of -0.97%. For the overall period of study, area of large cardamom witnessed a negative growth rate of -0.21% while both production and yield registered low but positive growth rates of 0.83% and 1.04% respectively. Also, as compared to the previous period, the magnitude of instability has reduced for area, production and yield of the crop from 25.82 to 18.42, 18.29 to 13.21 and 20.03 to 12.56 respectively during 2010-11 to 2019-20.

1. Introduction

Sikkim is a small hilly state in the Northeastern Region (NER) of India. Its climate is favorable for cultivation of diverse varieties of crops especially horticultural crops. Majority of rural population depends on agriculture and allied activities for their livelihood. Large cardamom is the main cash crop of Sikkim and serves as an important source of livelihood for many in the state (Singh & Pothula, 2013). Sikkim alone contributes around 88 percent to India's total production of large cardamom (Sharma 2016) making India the second largest producer of large cardamom in the world behind Nepal. Besides Sikkim and Nepal, it is also cultivated in Darjeeling Hills of West Bengal, Arunachal Pradesh, parts of Uttarakhand, and Bhutan (Sharma et al 2009; Bisht et al

2010). Since Sikkim has been declared as the first fully organic state of India, organic large cardamom cultivated in the state has great potential in the international market (FSADD & HCDD, 2012). This crop usually grows at an altitude of 600 to 2000 metres above mean sea level and rainfall ranging from 2800 to 3500 milimetre (Bisht et al 2011) and the region provides a perfect climatic condition for its cultivation. It is one of the most expensive spices in the world. Due to its pleasant aroma, large cardamom is used mainly for flavoring food preparations. It also has high medicinal value as it can prevent and cure sore throats, lung congestion, digestive disorders and pulmonary tuberculosis. It is also used in beverages, perfumes and medicines.

*Corresponding author: rajivgurung414@gmail.com

In Sikkim, area under cultivation of large cardamom increased between 1999 and 2004 registering a record production of 5152 tonnes (Sharma et al., 2016). However, owing to weak management and shifting of labour to off-farm employment, area under large cardamom has declined (Partap et al., 2014; Sharma et al., 2016) since 2004-05 reducing the production also. Also, climate change-induced fungal infection caused significant decline in yields across the region (Chaudhary, 2015). Revival strategies like shifting the cultivation to relatively healthier lands where soils are rich, investing more time in maintenance of the plantations, sowing new saplings, irrigation, timely manuring, disease control measures, etc improved the production after 2011-12. Moreover, the state government also has been providing saplings for free which otherwise costs Rs 4-5 per sapling the. Still, area under cardamom plantations as well as productions in the state have seen sharp decline in the recent years posing considerable risk to livelihoods of cardamom-dependent hill farmers whose income have declined dramatically in the recent years (Sharma et al, 2009; Srinivasa, 2006).

Agricultural production is vulnerable to natural forces like climate change, rainfall and temperature and thus keeps deviating from the trend. Such deviations or instability increases the production risk thereby affecting farmer's income and livelihood (Raju et al 2014). In the recent times, large cardamom farmers in Sikkim have started complaining about decline in production and yield. Farmers who used to harvest around 2000 kgs of cardamom from a 7.2 hectares (ha) field now gets only 300 kgs from the same land while 300 kg of production has dropped to just 100 kgs in a span of ten years in West Sikkim (Jamwal 2018). Such deterioration in the cultivation of this crop has forced many farmers to shift to less profitable crops. Since, large cardamom is the main cash crop in the state, instability in its production has significant impact on the livelihoods of several hill farmers in Sikkim. Against this background, the present study was undertaken to estimate and analyse the growth and instability of area, production and yield of large cardamom in Sikkim.

2. Objectives

The objectives of the study are

- (i) to study the growth rates in area, production and yield of large cardamom.
- (ii) to find out the instability in area, production and yield of large cardamom.

3. Data and Methodology

Sikkim was selected purposively for the study as it is the largest contributor to national large cardamom production. Sikkim contributes around 88 percent to India's total production of large cardamom. The study is entirely based on secondary data on area, production and yield of large

cardamom in Sikkim. The data were obtained from various sources like Directorate of Economics and Statistics, Department of Agriculture and Farmers Welfare, Govt of India, Department of Agriculture, Govt of Sikkim and published sources like Horticultural Statistics at a Glance (various issues). In this study, the total period of twenty years has been divided into two decades namely Period I: 2000-01 to 2009-10 and Period II: 2010-11 to 2019-20. Instability and growth rate of area, production and yield of large cardamom were estimated and analyzed for the overall study period also.

1. Following formulae of compound growth rates were used to analyze the data and study the trends in large cardamom.

$$\text{Log } Y = \beta_0 + \beta_1 t + u_t$$

Where, Y = Area/Production/Yield of large cardamom in Sikkim

t = Time period (years)

β_0 = intercept

β_1 = slope co-efficient

u = disturbance term

$$\text{CAGR (r)} = (\text{Exp } (\beta_2) - 1) * 100$$

2. Instability

In order to measure the instability in area, yield and production of large cardamom, the coefficient of variation (CV) of the variables has been estimated using the formula

$$CV = \frac{\text{Standard Deviation}}{\text{Arithmetic Mean}} * 100$$

4. RESULTS & DISCUSSION

The area, production and yield of large cardamom in Sikkim for the period 2000-01 to 2019-20 are presented in Table 1. In the last two decades, the average of area under large cardamom during Period I i.e. 2000-01 to 2009-10 remained at 20.63 million hectares which later increased marginally to 20.59 million hectares during Period II i.e. 2009-10. Similarly, the average production of large cardamom showed an increase from 3.73 metric tons during Period I to 4.29 metric tons in Period II. Also, average yield of large cardamom in the state increased by around 1.12 times from 188.2 kg per hectare during Period I to 211.45 kg per hectare during Period II. Through both periods, area, production and yield have shown similar pattern of increase during the both periods in Sikkim.

Growth Rates of area, production and yield of Large Cardamom in Sikkim

The growth analysis would indicate the general pattern of growth of the crop. The compound growth rates of area, production and yield of large cardamom were calculated for both sub-periods and also for the overall period. The growth rates are presented in Table 1.

Table 1. Area, production and yields of large cardamom in Sikkim, 1996-97 to 2020-21 (Area in `000 ha; Production in `000 tonnes and Yield in kg per ha)

| Year | Area (000 ha) | Production(000 tonnes) | Yield(kg/ha) |
|--------------|---------------|------------------------|--------------|
| 2000-01 | 23.5 | 4.7 | 200 |
| 2001-02 | 23.5 | 4.6 | 195.74 |
| 2002-03 | 20.9 | 4.5 | 215.31 |
| 2003-04 | 24.7 | 3.5 | 141.7 |
| 2004-05 | 24.8 | 3.7 | 149.19 |
| 2005-06 | 24.8 | 3.7 | 149.19 |
| 2006-07 | 24.8 | 3.7 | 149.19 |
| 2007-08 | 12.8 | 2.9 | 226.56 |
| 2008-09 | 13.01 | 2.74 | 210.61 |
| 2009-10 | 13.5 | 3.3 | 244.44 |
| 2010-11 | 15.02 | 3.51 | 234 |
| 2011-12 | 15.6 | 3.68 | 236 |
| 2012-13 | 16.01 | 3.84 | 240 |
| 2013-14 | 22.76 | 3.69 | 162 |
| 2014-15 | 23.08 | 4.08 | 177 |
| 2015-16 | 17.48 | 4.11 | 235 |
| 2016-17 | 23.3 | 4.63 | 199 |
| 2017-18 | 23.3 | 4.86 | 209 |
| 2018-19 | 23.3 | 5.03 | 216 |
| 2019-20 (PE) | 23.3 | 4.78 | 205 |

Source: Horticulture Statistics at a Glance (Different Issues).

PE Provisional Estimates

Table 2. Growth rates of Large Cardamom in Sikkim during 2000-01 to 2019-20

| | Area | Production | Yield |
|------------------------------------|-------|------------|-------|
| Period I: 2000-01 to 2009-10 | -7.01 | -5.36 | 1.65 |
| Period II: 2010-11 to 2019-20 | 5.11 | 4.14 | -0.97 |
| Overall Period: 2000-01 to 2019-20 | -0.21 | 0.83 | 1.04 |

Source: Computed using Table 1 data.

Growth in Area

It is observed from Table 2 that the area under large cardamom in Sikkim recorded a negative growth rate of -7.01 percent during Period I. However, during the Period II, the area witnessed an immense positive growth rate of around 5.11 percent. For the overall period, area under large cardamom recorded a negative growth rate of around -0.21 percent.

Growth in Production

Similarly, production of large cardamom also has recorded a negative growth rate of -5.36 percent in Period I. Following the pattern of area, production of large cardamom in the state also has recorded a significant growth rate of 4.14 percent in the Period II. However, production has witnessed a

comparatively lower growth rate of 0.83 percent only for the entire period of study.

Growth of Yield

Yield of large cardamom in Sikkim recorded a positive growth rate of 1.65% during Period I. However, during Period II, the growth rate of yield of large cardamom decreased and recorded a growth rate of -0.97% which is lower than the growth rate for the overall period. Finally, the growth rate of yield of cardamom for the entire period showed a positive growth of around 1.04 percent.

Instability Analysis

The magnitude of instability in area, production and yield of large cardamom are worked out for the two sub-periods and the results are presented in Table 3.

Table 3. Instability in Area, Production and Yield of Large Cardamom in Sikkim

| | Area | | | Production | | | Yield | | |
|----------------|-------|------|-------|------------|------|-------|--------|-------|-------|
| | AM | SD | CV | AM | SD | CV | AM | SD | CV |
| Period I | 20.63 | 5.33 | 25.82 | 3.73 | 0.68 | 18.29 | 188.2 | 37.7 | 20.03 |
| Period II | 20.31 | 3.74 | 18.42 | 4.22 | 0.56 | 13.21 | 211.3 | 26.53 | 12.56 |
| Overall Period | 20.47 | 4.49 | 21.9 | 3.98 | 0.66 | 16.5 | 199.75 | 33.87 | 16.96 |

Source: Computed using Table 1 data.

From the above table, it is clear that the instability in area under large cardamom declined from 25.82 percent in the Period I to 18.42 percent in the Period II. Similarly, instability in production of large -cardamom also decreased from 18.29 percent during Period I to 13.21 percent in the Period II. Following the same pattern, instability in the yield of large cardamom also decreased from 20.03 in Period I to 12.56 percent in Period II. During the overall period i.e. 2000-01 to 2019-20, instability in rice production is higher than the instability in the area and yield while instability in production is the lowest for large cardamom in Sikkim.

5. DISCUSSION

Large cardamom is the main cash crop of Sikkim and its cultivation serves as an important source of livelihood for many agricultural households in the state. However, large cardamom plantations in the state that once offered a perfect climatic condition and fertile soil for its cultivation have now started showing decline in production mainly due to new diseases, attacks by mammalian pests and insect pests, altered climatic patterns, declining labour availability, inadequate irrigation and lack of quality planting materials (Sharma et al., 2016). Such decline in area, yield and production due to above mentioned factors has caused drastic fall in the incomes of the cardamom-dependent farmers posing a considerable risk to their livelihoods (Hunsdorfer, 2013; Singh & Pothula, 2013).

During the first decade i.e. from 2000-01 to 2009-10, average area under large cardamom remained at 20.63 million hectares which later increased marginally to 20.59 million hectares during the second decade i.e. 2009-10 to 2019-20. Also, the crop's average production increased from 3.73 metric tons during Period I to 4.29 metric tons in Period II. Across the two periods, average yield of large cardamom in the state improved by around 1.12 times from 188.2 kg/ha during Period I to 211.45 kg/ha during Period II. Increase in the large cardamom production was mainly due to the improvement in the yield than expansion in area. Thus, major policy intervention to improve the crop production would be to increase the area under large cardamom, better management of plantations and pest control measures. Trainings can be organized to help farmers learn methods to protect the crop from the effects of climate change.

While area, production and yield have shown similar pattern of increase during the both periods in Sikkim, instability of area, production and yield have, however, shown decrease across the two periods implying low but stable growth in all three parameters.

6. CONCLUSION

The results of the present study show that growth rates of area and production of large cardamom were both negative in the Period I but in the Period II, growth rates were much higher as compared to Period I. On the other hand, growth rate of yield was positive in the Period I but decreased and became negative in the Period II. However, for the overall period i.e. from 2000-01 to 2019-20, growth rates of production and yield witnessed a positive growth rate while only area recorded a negative growth rate. Instability analysis in the study shows that the magnitude of instability of area, production and yield of large cardamom has declined I Period II. Instability for the overall period has remained lower than that of Period I but higher than the magnitude of instability in the Period II.

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