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Hadolikor SB

Department of Agricultural
Economics, College of
Agriculture, Parbhani Vasant
Naik Marathwada Krishi
Vidyapeeth, Parbhani,
Maharashtra, India

More SS

Department of Agricultural
Economics, College of
Agriculture, Parbhani Vasant
Naik Marathwada Krishi
Vidyapeeth, Parbhani,
Maharashtra, India

Corresponding Author:

Hadolikor SB
Department of Agricultural
Economics, College of
Agriculture, Parbhani Vasant
Naik Marathwada Krishi
Vidyapeeth, Parbhani,
Maharashtra, India

Status of Papaya cultivation in India

Hadolikor SB and More SS

Abstract

Growth and instability in area, production and yield of Papaya at all India level was estimated. The growth rate was estimated with the help of exponential functions. The parameter of function was estimated by Marquardt algorithm. Instability was assessed with the help of exponential CDI. The data were collected from the year 1996-97 to 2017-18. The results showed that, the area, production and yield of Papaya at all India level were shown significant positive growth. The instability in production of Papaya was more compared to area and yield. Technological and extension efforts need to stabilize the production of Papaya at all India level.

Keywords: Area, growth, instability, production, cdvi, papaya

Introduction

Papaya is considered as one of the most important fruit crop in terms of production, productivity and export potential in India. Due to the increase in market over the past two decades, the area under papaya cultivation in India was increased and reached up to 143 Mha with production of 6216 metric tons (DEC 2017-18). In India, around 24 states are growing papaya, the major producing states in India are Andhra Pradesh, Maharashtra, Chhattisgarh, West Bengal, Assam, Tamil Nadu, Jharkhand.

Many past studies have assessed growth and instability in fresh Papaya viz., Gadre (1997) [3] all these researchers have used limited data set so their results are not comprehensive. Hence, this particular study was conducted with objective to study growth and instability in area, production and productivity of fresh Papaya in India.

Materials and Methods

The current study made the use of secondary time series data on area, production and productivity of 22 years from 1996-97 to 2017-18 collected from India stat Website, APEDA, National Horticulture Board and Agricultural Statistic at a Glance 2018. The analytical tools used to estimate the growth and instability were discussed as follows:

Growth analysis

To examine the growth in area, production, productivity of fresh Papaya compound growth rate (CGR) was computed based on its fit using non-linear models, especially the exponential model. Conventionally, the compound growth rate were estimated after converting the growth model to semi-log form and estimated through Ordinary Least Square (OLS) technique assuming multiplicative errors term.

$$Y_t = \text{constant} \cdot (1 + \text{CGR})^t + E_t(1)$$

Where,

Y_t = time series data for area/production/productivity/ for year t

t = Time trends for years of interest

E_t = error terms

CGR is compound growth rate for the period under consideration.

The Marquardt algorithm was used to estimate parameters of equation. The significance of regression coefficient were tested by applying standard 't' test procedure.

Instability analysis

Cuddy-Della Valle Instability Index were used to estimate the instability in area, production, yield. This index is modification of coefficient of variation (CV) to accommodate for trend which is commonly present in time series economic data. It is superior over other scale dependent measure such as Standard Deviation or Root Mean Square of the residuals (RMSE) obtained from the fitted trend lines of raw data and hence suitable for cross comparison. The Cuddy-Della Valle Instability Index calculated as follows:

$$I_x = CV \sqrt{1 - R^2}$$

Where,

CV= coefficient of variation (σ/x)

R-2 = adjusted coefficient of multiple determination

Where, ever trend in time series data is non-significant, instability of that particular was analyzed with the help of conventional statistical tool of instability i.e. coefficient of variation. The coefficient of variation was calculated by using formula,

$$CV (\%) = \frac{\text{Standard deviation (a)}}{\text{Mean (x)}} \times 100$$

Results and Discussion

Growth in area, production and yield of fresh Papaya in India

Descriptive statistics of area, production and yield of fresh Papaya in India

The descriptive statistics of area, production and yield of fresh Papaya in India is presented in table 01. The outcomes revealed that, mean cultivated area, production and yield was 92.29 million thousand hectares, 3359.23 million tons and 34.49 MT/ha respectively. The median for area, production and yield was 78.40 million thousand hectares, 2749.70 million tons and 35.05 MT/ha, respectively. The maximum area under cultivation was 138.40 million thousand hectares; the production was 5988.80 million tons and yield was 44.20 MT/ha. Whereas, minimum area under the cultivation was 58.20, minimum production and minimum yield was 1181.0 million tons and 18.30 MT/ha. The outcomes of Skewness, Kurtosis, Jarque-Bera of area, production and yield of fresh Papaya uncover that data was not distributed normally.

Table 1: Descriptive Statistics of area, production and yield of fresh Papaya in India.

Descriptive statistics	Area	Production	Yield
Mean	92.29	3359.23	34.49
Median	78.40	2749.70	35.05
Maximum	138.40	5988.80	44.20
Minimum	58.20	1181.0	18.30
Std. Dev.	28.60	1657.30	7.63
Skewness	0.44	0.34	0.56
Kurtosis	1.59	1.62	2.25
Jarque-Bera	2.53	2.17	1.68
Probability	0.28	0.33	0.43
Observations	22	22	22

(Note: Area in thousand hectares, Production in million tons and yield MT/ha.)

Growth rate in area, production, and productivity of fresh Papaya in India

The need of growth rate analysis of area, production and yield is to study the performance of single commodity imparting to

agricultural production, Compound growth rate of area, production and yield is presented in the table 02 for the period of 22 years i.e. from 1996-97 to 2017-18.

The outcomes are presented in table 02. It is well defined from the table 02 that, the area under Papaya cultivation was showing positive growth from 66.83 thousand hectares to 135.07 million thousand hectares during the study period. The compound growth rate estimated in area is 4.62, in production it was 8.00 percent and for yield it was 3.43 percent per annum. The production of Papaya was 1416.53 thousand million tons in 1996-97 and was increased to 5865.30 million tons in end year. The growth rate of production in study period was estimated 8.00 percent per annum. The outcomes showed positive growth in the area, production and productivity of Papaya during the study period. The growth in all the parameters was significant at one percent level of significance.

Table 2: Growth in area, production and yield of fresh Papaya in India

Particulars	Area	Production	Yield
Beginning year (1996-97)	66.83	1416.53	21.13
End year (2017-18)	135.07	5865.30	43.43
Observations	22	22	22
Mean	92.29	3359.23	34.49
CGR	4.62**	8.00**	3.43**
SE	0.34	0.36	0.24
“t” Value	15.50	22.16	14.21

(Note: Area in thousand hectares, Production in million tons and yield MT/ha. hectare.)

** Significant at 1 percent level of significance

Instability in area, production and yield of fresh Papaya in India

One should not remain obvious of instability by studying growth rates only. As a result growth rates will illustrate lonely the rate of growth over a particular period, while instability will resolve, whether the growth performance is stable or unstable for a period of time. Cuddy-Della Valle Instability was used to evaluate the instability in area, production and yield.

It can be understood from table 03 that, coefficient of variation of fresh Papaya in area was found to be 30 percent and Cuddy-Della Valle instability index was 12 percent during the period of study. Coefficient of variation of Papaya production and yield was observed 49 percent and 22 percent. Cuddy-Della Valle instability index was 13 percent and 7 percent, respectively.

Table 03 observed that, coefficient of variation was more during the period of study in production compared to area and productivity. During the study period, instability in Papaya production is far greater compared to yield and area under the crop. The area and yield of fresh Papaya at national level was stable as compared to the production of Papaya. This higher level of instability in production is an interaction effect of area and yield of fresh Papaya.

Table 3: Instability in area, production and yield of fresh Papaya in India.

Particulars	Area	Production	Yield
CV	0.3098	0.4933	0.2213
CDI	0.1236	0.1378	0.071

Conclusion

The area, production and yield of fresh Papaya at all India level were shown significant positive growth. The instability in production of Papaya was more compared to area and

yield. Technological and extension efforts needs to stabilize the production of Papaya at all India level.

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