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Review Article

Growth and Instability Analysis of fruits crops in India- An Economic Analysis

Kadli Vinayaka¹, Sameer lokapur², Ravi Gurikar³ and Roopa Hosali⁴

Department of Agricultural Economics^{1,2} and Agri-business Management^{3,4}
UAS Dharwad -05, India

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Abstract: The present study was undertaken to study the trends of area, production and productivity of fruit crops in the India. The study was based on secondary data from 2000-01 to 2010-11. The data was collected from several government publications and web site. To analyze the trend of area, production and productivity of fruit crops in the India. Besides these, compound growth rate, coefficient of variation and instability index was also estimated. India was the second biggest harvester of vegetables and fruit, representing 8.6% and 8.48% of overall production, respectively. The major fruits produced by India are mangoes, papayas, sapota, and bananas. Compound growth rate and instability index were employed to analyze the time series data for 11 years collected from national horticultural board government of India of India. The result showed that the growth rates and instability in area, production and productivity of fruits crops. In India growth rate of fruits crops productivity in India was positive (1.05%) and was associated with instability index of 10.16 per cent. In the same period a positive growth rate of area was observed (7.34%) with high instability index of 10.16 per cent, while a positive growth rate of production (8.48 %) with instability index of 0.10 per cent was observed for production. The average of area, production and productivity of fruits crops during this period were 5084.55 ('000 hectares), 55364.64 ('000 Million Tonnes) and 10.83 (Million tonne/ha). Absence of support price in the case of glut, absence of regulated markets and fluctuations in market prices were major marketing constraints while non-availability of quality testing laboratories and lack of adequate cold storage facilities were the major area and productivity constraints in India.

Keywords: Compound growth rate, Instability index and unit price.

INTRODUCTION

The growing importance of horticulture in strengthening the Indian economy has been realized of late. The contribution of agriculture towards national income was about 14.2% (Economic survey 2010-11). Horticulture from an area of just 8.5% of the gross cropped area of the country is estimated to have contributed over 24.5% to the agriculture GDP of India. It is potential source of employment especially for the youth and women in the rural area where 72.2% of the Indian population resides. The income generation through effective horticulture farming is higher as compared to agriculture farming. Horticultural farming has also increased the sustainability of the small land holding, helping the small and medium farmers who form the majority of farmers in India, to increase their per capita income. This in turn has increased the disposal income of the rural areas.

The horticultural sector in India has immense potential due to increasing domestic and international demands for raw and fresh cut produce. The current and future demand for processed horticultural produce needs to be assessed. Horticulture also faces bio-physical and socio-economic challenges for future growth and development. Towards addressing these challenges, appropriate innovations in technology, institutions, governance, markets, infrastructure and policies are crucial. This seminar is an attempt to address some of these critical issues, discuss threadbare and evolve effective policy recommendations enabling us to achieve the desired goal of horticultural development in the country with inclusive growth. Horticulture is an important segment of Agriculture, contributing about one-fifth share of the Agriculture and allied sectors.

The major fruits growing states in our country include Uttar Pradesh, Andhra Pradesh, Bihar, Karnataka, Tamil Nadu, Maharashtra, Kerala and West Bengal and other states, which have substantial area under fruit crops, are Gujarat, Assam, Madhya Pradesh and Orissa. Per capita availability of fruits & vegetable- 466g/day (2008-09). The per capita consumption of fruits in India is only around 46gm/day against a minimum requirement about 92g/day, recommended by Indian Council of Medical Research and National Institute of Nutrition, Hyderabad. With the implementation of the NHM and other schemes, Total area of all fruits in India is also increased from 2874 thousand ha in 2000-02 to 6383 thousand ha in 2000-11. It is grown extensively in Uttar Pradesh, Bihar, Madhya Pradesh, Maharashtra, Andhra Pradesh, Tamil Nadu and Karnataka. Trade in fruits has become steadily more important over the last decades. India leads the world in the production of mango (40%), banana, papaya, sapota (30%) and lime and in productivity of grapes per unit land area. The specific objectives of this study were to study the production performance of major fruit crops in India, to examine the instability in production of major fruit crops and its challenges in India. The vast production base offers India tremendous opportunities for export. During 2012-13, India exported fruits and vegetables worth Rs.5986.72 crores which comprised of fruits worth Rs. 2503.75 crores and vegetables worth Rs. 3482.97 crores.

MATERIALS AND METHODS

Secondary data for the study were collected from various published sources. Time series secondary data on area, yield, production, and fruit crops for a period of 11 years from 2000-01 to 2010-11 were obtained from the publications of FAO, APEDA, NHB.

Exponential growth Model: Growth rate on area, production, yield fruit crops were computed for a period of 11 years from 2000-01 to 2010-11. The linear, log-linear, exponential and power functions

were some of the important functional forms employed to study the growth rates. Different functional forms were tried in the past for working out growth rates in area, yield and production. Some of the important forms tried were the linear growth model ($Y = a + bt$), exponential function ($Y = ab^t$) and quadratic function ($Y = a + bt + ct^2$). However, it was found that the exponential form of the function $Y_t = ab^t$ was the better and most frequently used one.

Growth rates in area, production and productivity of fruit crops as well as quantity fruit crops were computed for a period of 11 years from 1985-86 to 2010-11. Growth rates were computed using the exponential growth function of the form¹.

$$Y = a b^t e \quad \dots\dots\dots (1)$$

Where, Y= Dependent variable for which the growth rate is estimated i.e., Area, Production, Productivity

a= Intercept

b= Regression coefficient

t= Time variable

e= Error term

The compound growth rate was obtained from the logarithmic form of the equation (1) as below

$$\ln y = \ln a + t \ln b$$

The per cent compound growth rate (g) was derived using the relationship

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

Instability Analysis: The coefficient of variation was used as measure to study the variability in production and horticultural crops from India. The coefficient of variation or index of instability were computed by using the following formula

$$CV = \frac{\text{Standard Deviation } (\sigma)}{\text{Mean } (X)} \times 100$$

Linear trend were fitted to the original data of area, production, productivity horticultural crops, for the period for the time series data of 11 years from 2001-02 to 2010-11. The trend coefficients were tested for their significance. Whenever the trend of series found to significant; the variation around the trend rather than the variation around mean was used as an index of instability. The formula suggested by Cuddy and Della² was used to compute the degree of variation around the trend. That is Coefficient of variation was multiplied by the square root of the difference between the unity and coefficient of multiple determinations (r^2) in the cases where r^2 was significant to obtain the Instability Index.

$$\text{Instability Index} = \frac{\text{Standard Deviation } (\sigma)}{\text{Mean } (X)} \times 100 \times \sqrt{1 - r^2}$$

Where,

r^2 = RSS/TSS = Goodness of fit

RSS = Regression Sum of Square

TSS = Total Sum of Square

RESULT AND DISCUSSION

Fruits and vegetables typically constitute an essential part of the daily diet in India and they are in great demand round the year from most sections of the population. The main focus of this paper is to examine how year to year fluctuations in area, production and productivity of fruit crops in India and what is the effect of newly ongoing horticultural development programmes on the its instability. The data shows the major fruit producing countries of the world where India was stand at second in area and production of fruit in the world with 8.51 million hectare area and 10. Million tones production respectively. The productivity in India was much little than Brazil and USA but higher than China. The share of major fruits in world fruit production has been presented in various references which show that India is the largest producer of mango, Papaya and banana. About 41 per cent of world's mango, followed by papaya and banana contributed about 30 per cent and 29 per cent respectively in world's fruit production.

In case of total fruit production India is contributed about 13 per cent of total world fruit. On account of prevalence of diverse agro-climatic conditions and reach variability available in genetic resources, India can become the largest producer and exporter of horticultural crops. India leads the world in the production of mango, papaya, sapota and banana. In India fruits are playing very important role in total horticulture production. The area and production of fruits crops in India were increasing impressively over the years. The productivity of fruit crops was almost stagnant over the period. Absence of support price in the case of glut, absence of regulated markets and fluctuations in market prices were major marketing constraints while non-availability of quality testing laboratories and lack of adequate cold storage facilities were the major area and productivity constraints in India

The values in the table: 2 showed that the growth rates and instability in area, production and productivity of fruits crops. In India growth rate of fruits crops productivity in India was positive (1.05%) and was associated with instability index of 10.16 per cent. In the same period a positive growth rate of area was observed (7.34%) with high instability index of 10.16 per cent, while a positive growth rate of production (8.48 %) with instability index of 0.10 per cent was observed for production. The average of area, production and productivity of fruits crops during this period were 5084.55 ('000 hectares), 55364.64 ('000 Tonnes) and 10.83 (Million tonne/ha).

Table-1: All India area, production and productivity of fruits crops

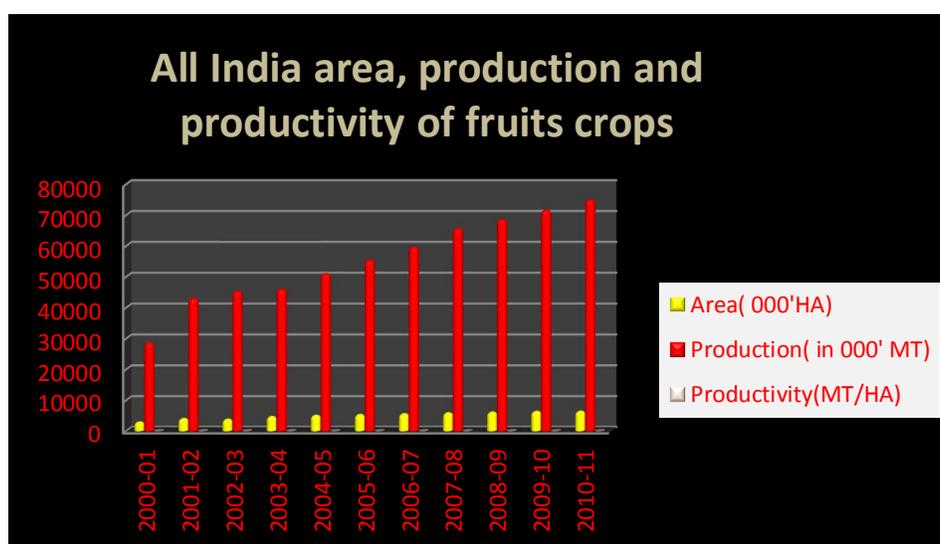
YEAR	Area('000'HA)	Production(in '000' MT)	Productivity(MT/HA)
2000-01	2874	28632	9.96
2001-02	4010	43001	10.72
2002-03	3788	45203	11.93
2003-04	4661	45942	9.86
2004-05	5049	50867	10.07
2005-06	5324	55356	10.40
2006-07	5554	59563	10.72
2007-08	5857	65587	11.20
2008-09	6101	68466	11.22
2009-10	6329	71516	11.30
2010-11	6383	74878	11.73
Total	55930	609011	119.11

Table-2: Compound growth rates of area, production and productivity of fruits crops in India and their instability in India

Particulars	India		
	Growth rate (%)	Mean	Instability index (%)
Area(000'HA)	7.34** (0.08)	5084.55	10.16
Production(in 000' MT)	8.48** (0.08)	55364.64	0.10
Productivity(MT/HA)	1.05** (0.005)	10.83	0.19

Note: ***Significant at 1% level,

** Significant at 5% level

**Figure1:** Parentheses indicate standard errors of coefficient

Same results were found in following reviews G.L.Kaul³ he analyzed the role of horticultural crops in crop diversification, human nutrition and industrial growth and in generating income and employment under Indian situation. His analysis is more valid today when Indian agriculture is getting more and more commercialized and competitive. These crops have been identified as most remunerative crops for replacing subsistence farming in the rainfed dry land, hills, arid and coastal agro- ecosystems. These crops are characterized by high productivity per unit area, much higher than the field crops. Their role in improving environment is an added advantage. The biomass available particularly from the tree crops is phenomenal which either gets recycled into the soil to add to its fertility, or is amenable to industrial use for value addition, thus further enhancing their economic viability⁷.

Mamale Desai⁴ analyzed the export growth of mangoes from India to different countries using the exponential model of the form $y=ab^t$. He observed that the Hong-Kong depicted negative growth, but it was not significant. The possible reason that could be attributed for this phenomenon was firstly the increased imports from Pakistan and Sri Lanka. The second reason would be the changing political scenario i.e., from capitalized to communist governed economy led to the changes in the import policies. But export value growing at positive rate, the possible reason could be the inflation over the years which have resulted in to a positive growth in value terms in spite of negative growth in quantity of mango exports.

Phuke *et al.*⁵ analyzed the export potential of banana in India for the period of 1991-92 to 2001-02. Linear growth model, $Y^{\wedge} = a + b x$ and log linear equation, $\log Y^{\wedge} = \log a + \log b$ were used to work out growth rates. At All India level, the highest area and production was recorded in the year 2001-2002, whereas, productivity was the highest in 2000-2001. The compound growth rate increase in area of the country was 2.19 per cent per annum during study period.

Sharma and Kalita⁶ studied the variation and instability in area, production and productivity of major fruit crops in Jammu and Kashmir for the period from 1974-75 to 1999-2000. It revealed that growing of pear, cherry and almond were more risky compared to other fruit crops in the state as revealed by higher coefficient of variation. The coefficient of area production and productivity of these were more than 78 per cent. The raising of apple in the state was less risky, which had a coefficient of variation of less than 35 per cent.

POLICY IMPLICATIONS

1. The growth rate analysis indicated that the increase in production was due to area, rather than productivity, which calls for intensive efforts to increase productivity of fruits in India.
2. Non-availability of scientific storage facility was one of the major factors contributing to lower returns from fruits. Therefore, suitable storage facilities are essential to stabilize the returns of fruits growers by increasing the storage life of the fruit.
3. High priority need to be given to increase the area and productivity of fruits to meet the increasing domestic demand on one hand and to build up a sustained supply to the international markets to earn precious foreign exchange
4. International trade fairs, exhibitions etc., may be organized to gain knowledge about the quality preference and thereby planned measures could be initiated to promote the required quality of grapes of the needy country.

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*** Corresponding author: Kadli Vinayaka;**
Department of Agricultural Economics UAS Dharwad -05, India