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Instability in Production and Productivity of Horticultural Crops in Assam

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ABSTRACT

Background: Horticultural crops in Assam play a significant role in contributing towards overall agricultural production of the state. During last two decades, the production of horticultural crops in the state has increased steadily but only a few studies were found on horticultural sector particularly. So, the present study examines the growth and instability in production, productivity and area of horticultural crops in Assam. It also analyzed different factors contributing towards production of horticultural crops in the state and nation.

Methods: The study is totally based on the secondary sources of data. Various statistical techniques like exponential growth rate, Karl Pearson correlation coefficient *etc*., are used to examine growth and instability. However, instability is estimated with the help of Cuddy Della Valle index.

Result: The study showed that production and productivity of horticultural crops increased over the period, but, there is instability in production, productivity and area at both state and national level. On the other hand, there is a high positive correlation found between area and production of horticultural crops. Regarding the contribution towards production of horticulture in Assam and in India, area and productivity of horticulture have found high impact respectively.

Key words: Growth, Instability, Production, Productivity.

INTRODUCTION

The economy of Assam is agrarian in nature where more than 55 per cent workers directly or indirectly depend on this sector. Major proportion of population of the state lives in rural areas where agriculture and its allied activities are the prime sources of income. The state is very rich from the natural point of view and land is also very suitable for cultivation. But, contribution towards the agriculture sector in Assam is comparatively very low than other agricultural State in the country. There is lot of reasons behind the poor growth of agriculture sector such as-frequent occurring floods, low land-man ratios, traditional method of cultivation, poor infrastructure *etc*. The results of which are farmers of the state remaining poor and outdated. The farmers are unable even to full fill their basic needs in their daily life due to poor income. Hence, diversification in the State economy has taken place. Some workers or farmers diverse their activities from farm sector to non-farm sectors and some diverse their cultivation to other crops which has a high demand in the market. Researcher or academicians have found that among the various crops cultivated in the region, farmers have transformed their cultivation crop towards various horticulture crops. Horticultural sector plays a significant role in maintaining sustainable rural livelihoods in general and in rain fed and hilly farming system in particular like Assam. Keeping view of importance and growth potentiality of horticulture sector, during 10th five year plan (2002-03 to 2006-07) country has given special emphasis on this sector for development and considerable investment measures. The prime objective of this planned investment is to increase area, production and productivity of various horticultural crops in all the north eastern states in accordance with the respective states' underlying potential and in turn to increase the livelihood of the resource poor farmers.

In modern economy, Horticulture has evolved as one of the highly potential sector for accelerating the growth of an economy. At present, it is one of the highly demanded crops and profitable crops. So, it is observed that number of underdeveloped countries or States have focused on to develop the growth of horticulture sector. Perhaps, it is the most profitable venture of all farming activities (Mahesh *et al*., 2000). Horticulture sector also provides ample opportunities for sustaining agro based industries of the economy which generates employment opportunities and increased the income of farmers. Out of the total agricultural output of the country, Horticulture contributes around 33 per cent of total output. During 2017-18, total horticulture crop production in India was 311.71 million tones (MT) from an

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area of 25.43 million hectares. In India, total crop area was 112719 thousand hectare during 2017-18 where net sown area was 68.61 per cent. Out of this net sown area, 32.21 per cent areas are used for horticulture cultivation in India. Over the last decade, around 2.6 per cent per annum area under horticulture is grown and 4.8 per cent production in increased annually.

Traditionally, Assam is a horticulture state and the socio-economic fabric of its inhabitant is largely constituted by horticulture components (Horti Vision, 2020). Horticulture sector includes fruits, vegetables, plants, spices and floriculture. However, Fruits and vegetable are contributed a major portion to the total horticulture crops in the State. In 2018-19, around 17.47 per cent of land in Assam is used for horticulture crop cultivation out of the total crop area. It is around 2.17 per cent of the total horticulture crop cultivated land of the entire nation (2018-19). Out of the total crop area of 4045496 hectare (During 2017-18) in Assam, 67.29 per cent area was used as net sown area while 26.09 per cent land was used for horticulture cultivation. It is observed in some studies done by the various researchers on instability in different crops production, productivity and areas that though the instability of the crops in State as well as in India is high but production and productivity of horticulture crops is increasing gradually. The studies found various factors causing instability in horticultural crops in State and in the Country. A study conducted on the instability of rice production in India during post reform period mentioned a prime reason of instability as distress of farmers (Jain, 2018). But, instability could be low with high growth rate (Singh and Goyari, 2013). Keeping this view, this study is an attempt is made to examine the growth and instability of horticulture crops and their relative contribution to the change in production of horticulture crop cultivation in Assam as well as in India.

Objective

The objectives of the study are as follows:

1. To examine the growth and trend of horticultural crops over the year in Assam.
2. To examine the instability of horticulture crops in area, production and productivity in Assam.
3. To examine the relative contribution of area, productivity and their interaction to the change in production of horticulture crops in Assam.

MATERIALS AND METHODS

The study is entirely based on the secondary sources of data. A total of 16 years data is collected from the various government sources related to the horticulture harvest areas, production and productivity in Assam. The secondary sources of the study are collected from State Statistical Hand books and also from some authentic websites.

The study determined trend, growth rate and instability of area, production and productivity of horticulture crop in Assam from the period of 2004-05 to 2018-19 through analytical techniques such as arithmetic mean, standard deviation, exponential growth rate and coefficient of variation. The t-test is also used to test the significance of exponential growth rate and coefficient that were estimated. The exponential growth rate is expressed as:

$$y = ab^x$$

Where,

y= Represents are or production or productivity of horticulture crop.

a, b and x= Indicates intercept, slope of coefficient and time respectively.

There are various techniques used to estimate the instability of area, production and productivity such as-coefficient of variation (CV), dispersion, cuddy della valle index (CDVI), coppock instability index, *etc.* But in this study, the cuddy della valle index is used to estimate the instability index of area, production and productivity of horticultural crops in Assam. A low value of this index indicates low instability in horticulture production and vice-versa. CDVI was originally developed by Cuddy and Valle (1978) for measuring the instability in time series data that is characterized by trend. It is expressed as follows:

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

Where,

IX = Instability index.

CV = Coefficient of variance.

R^2 = Coefficient of determination from a time-trend regression adjusted by the number of degrees of freedom.

In order to study the contribution of area, productivity and their interaction of area and productivity towards increase the horticulture production in the State, a decomposition method is used and it is expressed as:

$$\Delta Q = A_0\Delta Y + Y_0\Delta Q + \Delta A\ \Delta Y \quad \text{.....(1)}$$

Where,

A_0 and Y_0= Indicated area and productivity of base year.

Δ= Represents changes in the corresponding quantities.

Q= Stands for production.

On the other hand, $A_0\Delta Y$, $Y_0\Delta Q$ and $\Delta A\ \Delta Y$ are considered as area effect, productivity effect and interaction of area and productivity effect. Thus, the change in total horticulture production can be decomposed into three effects *viz.*, productivity effect, area effect and interaction effect due to change in area and productivity.

RESULTS AND DISCUSSION

Growth of horticulture crops in Assam and India

Fig 1 clearly depicts the trend of area, production and productivity of horticulture crops in Assam. It shows that from the year 2004-05 to 2018-19, productivity and area under horticulture crops increased continuously. In the year 2004-05, total area under horticulture crop cultivation was 410.1 hectare (Hc) and increased to 712.19 hectare in 2018-19 where the productivity rate of horticulture crop increased from 7.78 MT per Hc to 10.09 MT per Hc respectively. However, the production of total horticulture crops in Assam fluctuated in the year between 2004-05 and 2018-19. In the year 2004-05, the total production of horticulture crops in

Assam was 3189.6 million tones (MT) and rose to 7182.59 million tones (MT) in 2018-19.

In order to examine the growth of area, production and productivity of total horticulture crops in Assam exponential growth rate is used. The results found that annual average exponential growth of area in horticulture cultivation of the State *i.e.*, Assam is 3.2 per cent which is significant at 0.01 level. It means the area under horticulture crops in the State increased at an average rate of 3.2 per cent during the period. Regarding the annual average exponential growth of production and productivity of horticulture in the State are 4.1 per cent and 0.8 per cent respectively which is significant at 0.01 level. It implies that production and productivity of horticulture crops in the State grew at an average of 4.1 per cent and 0.8 per cent respectively annually during the period. The details are shown in Table 1.

Similarly, Fig 2 shows the trend of area, production and productivity of horticulture crops in India during the period from 2004-05 to 2018-19. It is seen that production of horticulture crop in the country increased steadily from 169829 MT in 2004-05 to 313851 MT in 2018-19. At the same time, area under horticulture crop and its productivity rate in the nation also increased smoothly from 2004-05 to 2018-19.

Regarding the growth of area, production and productivity of horticulture crops in county, results showed that annual average exponential growth of production is 4.5 per cent at 0.01 levels of significance. The annual average exponential growth of area under horticulture crop and productivity are 2.1 per cent and 2.4 per cent respectively which is significant at 0.01 levels. The details are shown in Table 2.

An attempt is made to examine the correlation between area and production of horticulture crops in Assam and India. It is examined with the help of Karl Pearson correlation coefficient. In Assam, the Karl Pearson correlation coefficient between area and production of horticulture crop during the period is 0.835 which is significant at 0.01 level. It implies that it has highly positive relationship between area and production of horticulture crops. Increase in area under horticulture crops in the State leads to increase the production of horticulture. On the other hand, in India, the Karl Pearson correlation coefficient (r) is 0.973 which is significant at 0.01 levels. It means the relationship between area and production of horticulture crops in nation is very high. In general, it indicates that higher the size of land under horticulture crop higher is the level of production of horticulture in nation.

The growth rate of production, productivity and area under horticulture crops in the State and in national level is found positive in the respective period. It's may be due to increase in area for horticulture cultivation leads to increase

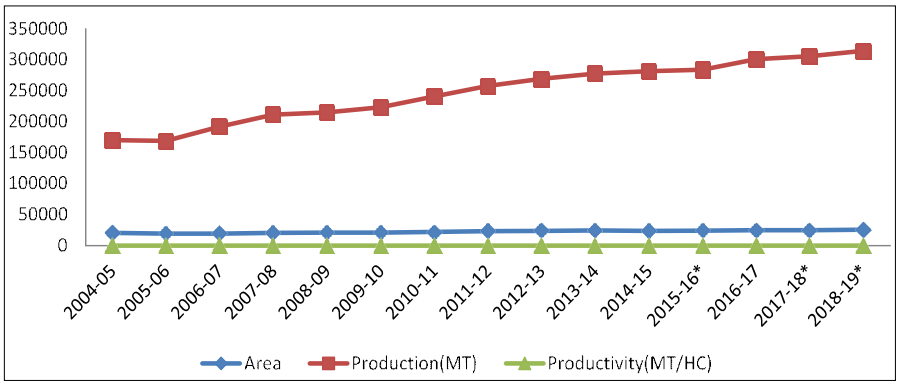


Fig 1: Trend of area, production and productivity of horticulture crops in Assam.
Source: www.indiastate.com

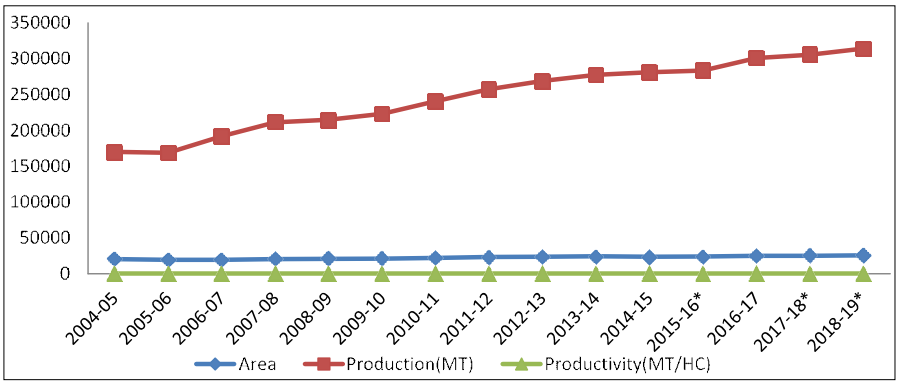


Fig 2: Trend of area, production and productivity of horticulture crops in India.
Source: www.indiastate.com

Table 1: Exponential growth in production, productivity and area of horticulture crop in Assam.

	R^2	F	Significance	Constant	b1
Area	0.775	44.825	0	448.878	0.032
Production	0.559	16.471	0.001	4032.937	0.041
Productivity	0.071	0.992	0.337	8.986	0.008

Source: Author's calculation.

Table 2: Exponential growth in production, productivity and area of horticulture crop in India.

	R^2	F	Significance	Constant	b1
Area	0.919	147.249	0	18902.934	0.021
Production	0.953	261.997	0	168964.731	0.045
Productivity	0.871	88.08	0	8.938	0.24

Source: Author' calculation.

Table 3: Instability in area, production and productivity of horticulture crop in Assam and India.

	Area		Production		Productivity	
	Instability index	CV	Instability index	CV	Instability index	CV
Assam	7.08	15.60	14.20	21.18	13.94	13.76
India	2.63	9.56	2.90	19.59	3.41	3.41

Source: Author calculation.

the production of horticulture crops. Since, production and area under horticulture crops is found highly positive relation. Its implies that the production of horticulture in Assam and in India are high possibility to depend on size of land used for horticulture cultivation.

Instability of area, production and productivity of horticulture crops in Assam and India

Table 3 shows the instability of production, productivity and area of horticulture crops in Assam and in India as a whole. The instability in production, productivity and area under horticulture crops is examined with the help of Cuddy-Della instability index. Result shows that instability of area, production and productivity in Assam is found to be high as compared to India. Infect, there is a huge gap in instability of horticulture crop in production, productivity and area between Assam and India. Similarly, the coefficient of variance in area, production and productivity of horticulture crops in Assam is comparatively very high than India. The details are clearly given in Table 3.

It is observed that instability index of horticulture crop production in Assam is around 14.20 which is double than the instability index of area under horticulture (7.08). It implies that instability of horticulture production in Assam is comparatively very high area under horticulture crop. Results, productivity instability index of horticulture in State is high (13.94) and it's very close to production instability index of horticulture crop of State by 6.86. In case of India, the instability index of area, production and productivity of horticulture crops stands under 3.5. Regarding the coefficient of variance in area, production and productivity of horticulture crops in Assam as well as in India are found high than the instability index. It's simply implies that instability among the area, production and productivity of horticulture crops has been found in the State as well as in Nation. But, instability of area, production and productivity of horticulture crops in Assam is comparatively high than in India. It may be due to traditional methods of cultivation, seasonal nature of cultivation, lack of market facilities *etc.*, in Assam.

Effect on change in production in Assam and India

Table 4 shows the contribution of different factor in the production of horticulture crops in Assam and India. The increase in horticulture production in Assam due to area, yield and their interaction was 23.72 per cent, 58.85 per cent and 17.47 per cent respectively during the period 2004 to 2019 while in India, it was 54.69 per cent, 30.90 per cent and 14.33 per cent respectively. It is observed that in Assam, the productivity has a major contribution to increased production of horticulture crops followed by area and interaction between area and productivity. However in case of India, area has a major contribution to increased production of horticulture followed by productivity and their interaction effect.

Table 4: Contribution of different factor in production of horticulture in Assam and India.

Effect	Horticulture crop	
2004-2019	Assam	India
Area ($A_0\Delta Y$)	23.72	54.69
Productivity ($Y_0\Delta A$)	58.85	30.90
Area * Productivity ($\Delta A\ \Delta Y$)	17.47	14.33

Source: Author calculation.

CONCLUSION

Based on the increasing trend of production, productivity and area under horticulture crop cultivation in the State over the period, it can be conclude that horticulture has a significant impact on Assam economy. The growth rate of horticulture production in Assam as well as in India is almost same *i.e*., around 4 per cent. However, the productivity rate of horticulture crops in Assam is comparatively low than in India over the period. It may be due to use of traditional method of cultivation techniques, seasonal nature of cultivation, lack of irrigation facilities and poor infrastructure *etc*. Despite these, the productivity rate of horticulture crop in State and in nation was found positive and it's significant also. On the other hand, there is a highly positive correlation found between area and production in horticulture crops in Assam as well as in India. At the same time, instability in production, productivity and area under horticulture has found in Assam as well as in India. But, instability in Assam is comparatively found high than in India. Regarding factors effect in production of horticulture were found that all the factors *viz*., area, productivity and interaction between area and productivity have high contribution in Assam as well as in India. It is found that area under horticulture crop in Assam have high contribution towards production of horticulture crops whereas in India, the productivity has high contribution. It reflects that production of horticulture is increased due to increase the size of area under horticulture cultivation in Assam. But in India, production of horticulture crops is increased due to increase in productivity. This study clearly shows that production of horticulture sector is increased due to increase in area which is not feasible in the long run. So, effective measures should be taken to increase productivity through increase in production solely.

Conflict of interest: None.

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