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Area Harvested And Production Of Fruit Crops In Northeast India: An Analysis

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ABSTRACT:

The northeastern states like Assam, Arunachal Pradesh, Manipur, Mizoram, Meghalaya, Nagaland, Tripura and Sikkim are suitable for the production of different horticultural crops such as different varieties of fruits. The region has sub-tropical climate with hot, humid summers, severe monsoons and mild winters. The hilly areas of northeastern states are suitable for the production of different types of fruits such as apple, kiwi, litchi, citrus, orange, banana, pineapple, plum, guava, peach, jack fruit, mango, grapes, papaya, lemon, passion fruit, dragon fruit, pear, walnut, strawberry etc. This paper is an effort to study the growth trends in the area harvested and production of fruit crops in the northeastern region of India from the year of 2004-05 to 2023-24.

As per the findings of the study, the fitted trend line of the variable of the area harvested under the fruit crops and total production of fruit crops in the northeast region of India has recorded increasing trends over the period under the study. The estimated compound annual growth rates of area harvested under fruit crops cultivation and the total production of fruit crops in the northeast region are found significant over the study period.

Key Words: Fruit Crops, Area Harvested, Production, Northeastern Region.

I. Introduction:

The northeastern region of India has predominantly humid and sub-tropical climate with hot, humid summers, severe monsoons and mild winters (Verma, et. al., 2023). Different areas located in the northeastern states like Assam, Arunachal Pradesh, Manipur, Mizoram, Meghalaya, Nagaland, Tripura and Sikkim are suitable for the production of different horticultural crops such as different varieties of fruits. The hilly areas of northeastern states are suitable for the production of different types of fruits such as apple, kiwi, litchi, citrus, orange, banana, pineapple, plum, guava, peach, jack fruit, mango, grapes, papaya, lemon, passion fruit, dragon fruit, peach, pear, walnut, strawberry etc. The eight numbers of northeastern states together accounts 5.1 percent of fruits ad 4.5% vegetables of the national horticulture production basket in the country (Sing, et. al., 2023).

In the different parts of the northeastern region, varieties of fruit crops are grown commercially. The region is the hot spot of producing different varieties of banana. For example, in the Goalpara district of Assam, verities of banana such as Bhimkal, Athiakal, Bhog, Manuhar, Honda, Malbhog, Cheni Champa, Saker Champa, Amrit Sagar, Agnisagar, Jajaji, Kabuli, Jahaji, Digjoa, Kachkal, Jatikal, etc. are cultivated intensively (Sing, et. al., 2023). Accordingly, hilly region of Meghalaya is famous for commercial production of pineapple. Similarly, in the high hills of Arunachal Pradesh and Sikkim, varieties of apples are grown commercially. The plains area of

Assam and Tripura as well as hill areas of the hilly northeastern states have the good potential of further expansion of commercial production of different varieties of fruit crops in future. This paper is an effort to study the growth trends in the area harvested and production of fruit crops in the northeastern region as a whole from the year of 2004-05 to 2023-24. As per the findings in the study, both the area harvested under the fruit crops and the total production of fruit crops in the northeastern region in India have the increasing trends over the period under the study. Secondary data have been collected from the North Eastern Development Finance Corporation (NEDFi) Ltd. data bank as per the requirement of the study.

II. Objectives of the Study:

This study is based on the following objectives.

i. To understand the present status of production of fruit crops in the northeastern region in India.
ii. To examine the trends in the area harvested and total production of fruit crops in the northeastern states as a whole from 2004-05 to 2023-24.
iii. To know the compound annual growth rates of area harvested and production of fruit crops in northeastern region of the country.

III. Methodology:

The present study is based on the secondary data. Data have been collected from the data bank of the North Eastern Development Finance Corporation (NEDFi) Ltd. Moreover, secondary data have been collected from the different articles of journals, books and other online sources.

For analyzing the collected data, different statistical tools have been applied. Trend lines of the growth of area harvested and production of fruit crops have been fitted over the study period. Ratios and percentages have been estimated. Mean, median, standard deviation, variance, maximum and minimum values have been estimated of the variables under the study. Compound Annual Growth Rates (CAGR) has been calculated of the variables area harvested and production of fruit crops.

For estimating the compound annual growth rate (CAGR) in the area harvested under fruit crops and production of fruit crops, the regression line (OLS) has been fitted. Accordingly, to estimate CAGR, the following semi-log linear trend equation has been estimated.

$$\ln Y = \alpha + \beta t + U \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$

Where,

lnY is the logarithmic value of the variables under consideration, that is the dependent variable.

α is the constant term, β is the coefficient to be estimated, t is the independent variable (time variable) and U is the disturbance term in the regression model.

Ordinary Least Square (OLS) technique has been used to determine the value of the respective coefficients.

The compound annual growth rate (r) has been calculated as follows-

$$r = (e^{\beta 1} - 1)*100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(ii)}$$

Where,

$e^{\beta 1}$ is the exponential value of the regression coefficient β_1

IV. Review of Literatures:

To have a deeper concept and clear understanding of the topic of the present study, various relevant literatures have been reviewed. The review of literatures has been represented in this section as follows.

Verma, Raja, Mir and Mehetre (2023) have studied on the potential of temperate fruit crops in northeastern states of India. The authors have investigated about the different fruit crops produced in the different northeastern states of country. According to the study, maximum area under the temperate fruit crops is located in Arunachal Pradesh followed by Mizoram and Sikkim. The authors studied the area harvested and production of fruit crops such as apple, grapes, kiwi, peach, pear, plum, strawberry, walnut etc. This study also focuses on the climatic conditions available in the northeastern region suitable for the production of fruit crops. Technological intervention in fruit crops production is also analyzed in this study.

Singh, Suresh and Hazarika (2023) have investigated the mainstreaming of potential fruit crops in the northeast India. According to this study, the northeast region of India has the unique combination of habitats and ecosystem with sub-tropical climatic conditions which are conducive for production for varieties of fruit crops in the region. In this study, the authors have highlighted that the eight numbers of northeastern states together accounts 5.1 percent fruit crops and 4.5 percent vegetable crops of the national production of horticultural crops basket. This study also focuses on the specific production of different fruit crops in the different northeastern states. Apple, Orange and Kiwi are the major fruit crops produced in Arunachal Pradesh. Banana, Sweet orange, pine apple, areca nut, coconut, lemon, jack fruit are some of the major fruit crops produced in Assam.

Deka, Thirugnavel, Patel, Nath and Deshmukh (2012) have studied on the horticultural diversity in the northeast India and its improvement for value addition. In this study, the authors have analyzed the diversity of horticultural crops including fruits and vegetable crops. Authors have also investigated on the value addition of the commercially produced different fruit crops in the northeast region. The chemical properties of different horticultural crops including fruit crops produced in the various locations in the northeastern states have been studied by the authors in this study.

Gaibimei, Devi, Raleng and Mate (2025) have investigated the sustainable processing and commercialization of underutilized fruits in the northeast India. According to this study, the Eastern Himalayan region of India known for its diverse natures, climatic conditions, soil, topography and also the diverse of indigenous underutilized ethno–medicinally important fruit crops produced across the different northeastern states. The authors stated that the northeastern region occupies 7.7 percent of the total geographical area of the country whereas the region supports 50 percent of the total biodiversity in the country. While analyzing the underutilized fruit crops the different northeastern states, the authors have also examined the commercialized value added fruit crops.

Gupta (2022) has studied the growth trend and potential of horticulture in northeast India. According this study, the northeast region of India is endowed with the diverse soil and agro-climatic conditions which are suitable for cultivation of large variety of temperate and tropical horticultural crops. The author pointed that the fruit crops produced in the region are highly nutritious and have a high market value within the country and also outside of the country. This study examines the state-wise and regional growth trends and variability in area and production of the fruit crops during the period 2009 to 2019. The study indicates the possibility of sustainable production of horticultural crops in all the northeastern states through the strategic planning. The fruits and spices produced in the region have the market demand in middle-east and neighboring countries. But, lack of commercialization, lack of market intelligence and linkages are some of the obstacles in the growth of exports of fruit crops grown in the northeast region in India.

Dasgupta and Dey (2024) analyzed the exports of fruit and vegetable crops from northeast India as well as the prospects and challenges of export potentialities. The study shows that the topography of the hilly of the region of northeast does not supports large scale industrialization. Rather, diversity of agro-climatic conditions of the northeastern states has the advantages of producing horticultural crops including a wide variety of fruit crops.

In this study authors have examined the compound annual growth rates of production, export quantity and export earnings from the horticultural crops in the northeastern region in India.

V. Results and Discussions:

The results and findings of analysis of the study have been discussed and presented in the following sections.

V.1 Basic Statistics of Area Harvested and Production of Fruit crops in North East Region:

The basic statistics such as arithmetic mean, median, standard deviation, variance, maximum and minimum values of the variables area harvested and production of fruit crops in northeastern regions from the year of 2004-05 to 2023-24 have been estimated. The estimated values of the statistics have been presented in the following table [refer table no. 1].

Table No. 1: Basic Statistics of the Area Harvested and Production of Fruit Crops in Northeastern Region of India from 2004-05 to 2023-24:

Variable	Arithmetic Mean	Median Value	Standard Deviation	Variance	Maximum Value	Minimum Value
Area Harvested (in Thousand Hectare)	420.935	451.5	70.266	4937.406	505.5	294.1
Production of Fruit Crops (in Thousand Tonne)	4030.325	4399.4	872.714	761630.670	4990.8	2381.7

Source: Author's self estimates based on the data collected from NEDFi Ltd. Data bank.

It has been observed in the table [refer table no. 1] that arithmetic mean value of area harvested under fruit crops is 420.935 thousand hectare in the northeast region from 2004-05 to 2023-24. The median value is 451.5 thousand hectare over the same period of time in the region. The estimated standard deviation of the area harvested is 70.266 and the calculated value of variance of the 4937.406 of the area harvested under the fruit crops under the study. Moreover, it has also been found in the table that the maximum value and the minimum values of the variable area harvested are 505.5 thousand hectare and 294.1 thousand hectare respectively over period from 2004-05 to 2023-24.

The table [refer table no. 1] also shows that the arithmetic mean value of the production of fruit crops in northeast region is 4030.325 thousand tones from the year 2004-05 to 2023-24. Similarly, median value of the variable is 4399.4 thousand tones over the same period under the study. Again, the estimated value of standard deviation is 872.714 of the production of fruit crops in the region. The calculated value of the variance is 761630.670 for the same period of time. The maximum value and the minimum value are 4990.8 thousand tones and 2381.7 thousand tons respectively of the area harvested under the fruit crops in northeastern states together from 2004-05 to 2023-24.

V.2 The Trend in the Area Harvested under the Fruit Crops in Northeastern Region of India:

In this research study, the trend line has been estimated of the area harvested under the fruit crops produced in the northeastern region in India for the period under the study that is from 2004-05 to 2023-24. The actual trend line as well as the fitted trend lines have been represented in the following figure [refer figure no. 1].

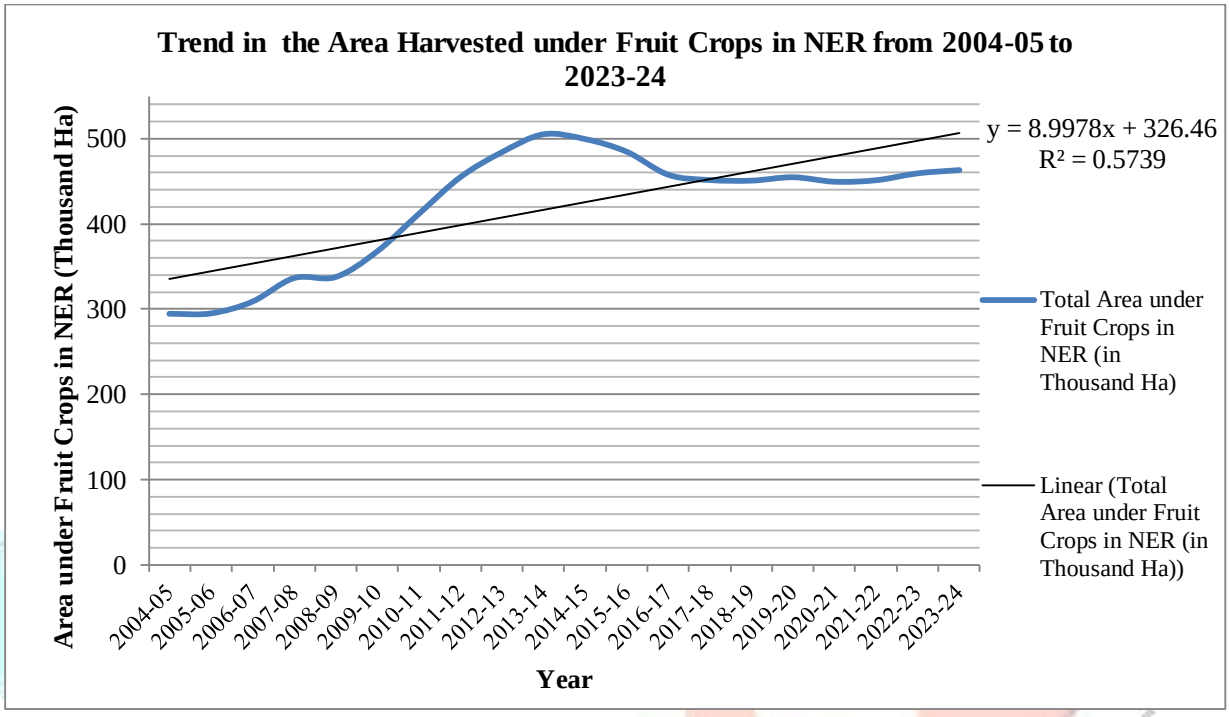

Figure- 1

It has been observed in the figure [refer figure no. 1] that the fitted trend line of the variable of the area harvested under the fruit crops in the northeast region of India has recorded an increasing trend over the period under the study that is from 2004-05 to 2023-24. It is imperative to note that the actual trend line has the fluctuations around the fitted trend line. A minute observation in the figure shows that from the year of 2004-05 to 2010-11 the actual trend line remains below the fitted trend line. Thereafter from the year of 2010-11 to 2017-18, the actual trend line remains above the fitted trend line as found in the study. Again, from the year 2017-18 2023-24, the actual trend line lies below the fitted trend line. But, it is remarkable that the area harvested under the fruit crops in the northeastern states as a whole has the increasing trend over the period under the study.

V.3 The Trend in the Production of Fruit Crops in Northeastern Region of India:

In this research investigation the trend in the production of fruit crops in the northeastern region of India has been estimated from the year of 2004-05 to 2023-24. The fitted trend line as well as the actual trend line of the variable total production of fruit crops in northeastern region has been presented in the following figure [refer figure- 2].

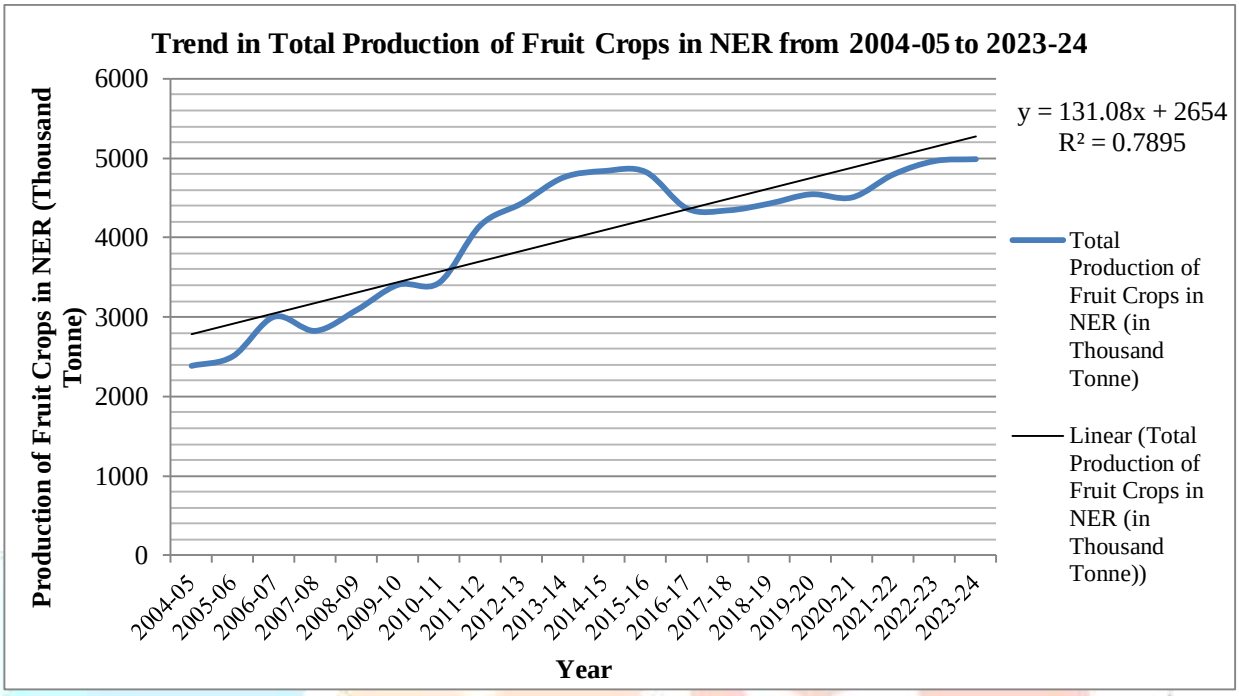

Figure- 2

It has been observed in the figure [refer figure no. 2] that the total production of fruit crops in the northeastern region of India has maintained an increasing trend over the period under the study, that is from the year of 2004-05 to 2023-24. It is important to note that the actual trend line has the fluctuations around the fitted trend line as found in the figure. From the year of 2004-05 to 2010-11 the actual trend line remains below the fitted trend line. Thereafter, from the year of 2010-11 to 2017-18 the actual trend line lies above the fitted trend line. Again, from the year of 2017-18 to 2023-24, the actual trend line lies below the fitted trend line. The overall note is that the total production of fruit crops in the northeastern states as a whole has the increasing trend over the period under the present study.

V.4 Compound Annual Growth Rates of the Area Harvested and Production of Fruit Crops in Northeastern Region of India:

To understand clearly about the present status as well as the growth trends in the area harvested under the fruit crops and total production of fruit crops in the northeastern states as a whole, Compound Annual Growth Rates (CAGR) have been estimated over the period under the study that is from 2004-05 to 2023-24. The estimated values of the compound annual growth rates of the concerned variables have been presented in the following table [refer table no. 2].

Table No. 2 The Compound Annual Growth Rates of Area Harvested and Production of Fruit Crops in the Northeastern Region of India from 2004-05 to 2023-24:

Variable	All India		
	Coefficients (CAGR)	R^2	F Value
Area Harvested under Fruit Crops (in Thousand Hectare)	**0.024*** ** (0.005)	0.597	26.639***
Production of Fruit Crops (in Thousand Hectare)	**0.036*** ** (0.005)	0.774	61.747***

Source: Self estimates based on data published by NEDFi Ltd.
Note: *** indicates significance at 1 percent level, ** indicates significance at 5 percent level and * indicates significance at 10 percent level. Values in the parentheses represent standard error.

It has been observed in the table [refer table no. 2] that the estimated value of the coefficient of the variable Area Harvested under Fruit Crops is 0.024 and it is statistically highly significant at 1 percent level. This indicates that the compound annual growth rate (CAGR) of the area harvested under the fruit crops in the northeast region is 2.4 percent and this growth rate is significant over the period under the study. The estimated value of R square is 0.597 which shows that 59.7 percent change in the dependent variable is explained by the independent variable. Moreover, the value of F statistics is significant implying that the regression model is better fitted.

From the table [refer table no. 2] it is also observed that the estimated value of the coefficient of the variable Production of Fruit Crops in the northeastern region is 0.036 and it is statistically highly significant at 1 percent level. This indicates that the compound annual growth rate (CAGR) of Production of Fruit Crops in the northeastern region is 3.6 percent and the growth rate is significant over the period under the study. The estimated value of R square is 0.774 which implies that 77.4 percent change in the dependent variable is explained by the independent variable. Moreover, the value of F statistics is significant which implies that the regression model is better fitted.

VI. Conclusion:

The analysis and discussions in this study conclude that the area harvested under the fruit crops and the total production of fruit crops in the northeastern region have the increasing trends over the twenty years period under the study. The plains as well as the hilly areas of the northeastern states are the hotspots for producing different subtropical fruits varieties. The region contributes significantly towards total national products of horticultural crops particularly fruit crops. Commercial production of fruit crops contributes in employment generation as well as income earnings to the people in the region. Moreover, fruit crops produced in the northeastern region of India have high nutritious value and thus have demand in national and international markets. Policy adoption by the government for sustainable and intensive fruit crops production in northeastern region and their proper implementations will further expedite commercial production of fruit crops production in the northeastern states of India.

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