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Status of area, production and productivity of fruit crops (Major and indigenous) of North East India, with special reference to Assam

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Abstract
Assam is regarded as the gateway to North East India, is considered as one of the richest biodiversity hotspots due to its unique geo-edaphic and agro-ecological condition. The state consists of diverse agro-climatic conditions, varied soil type and abundance of rainfall has a wide range of fruits, some of which are still grown in semi-wild or semi-domesticated conditions and only few of them have been grown as commercial crops for their economic, social and religious importance by some of the farmers in some potential area. The indigenous fruit sector has tremendous agri-business potential which play significant role in socio- economic upliftment of rural society. The present study is confined to fruit crops (Major and traditional fruits) only. The study was based on secondary sources. The data has been collected from Horticultural Statistics at a Glance, Agricultural Statistics at a Glance, Directorate of Economics and Statistics and from different published sources. The finding of the research study reviles that, out of the total value generated from pineapple, Assam contributed 18.08 per cent. Similarly, 6.12 per cent and 5.25 per cent contribution was made in the total value of output of litchi and citrus, respectively. It was found that there has been significant growth of area, production and productivity of fruits in Assam which may be due to the realization of benefits of commercialization by the farmers along with the implementation of several schemes by the Government. The finding of the research study also reviles that the area under major fruits of Assam like aonla, banana and pineapple showed increasing trend while for fruits like mandarin, sweet orange, guava, mango and papaya showed declining trend over the period from 2012-13 to 2017-18. With the present rate of growth in fruit production and population of the state, the projected demand supply gap was found to be negative indicating surplus of fruit production in the state.

Keywords: Production, productivity, fruit crops, major, indigenous

Introduction
The scenario of horticultural sector in India has become very promising over the last few years. The percentage share of total horticulture output in agriculture was 33.00 per cent in the year 2017-18. The fruit production share 31.20 per cent to total horticulture production next to vegetable (59.20 per cent) in the year 2017-18 (Horticultural Statistics at a Glance, 2018). Apart from major fruits, Indigenous fruits are also known to play a significant role in meeting food and livelihood needs of people in the developing nations (Mabaya *et al*. 2014) [6].

Assam, the gateway to North East India, is considered as one of the richest biodiversity hotspots due to its unique geo-edaphic and agro-ecological condition. The state with diverse agro-climatic conditions, varied soil type and abundance of rainfall has a wide range of fruits, some of which are still grown in semi-wild or semi-domesticated conditions and only few of them have been grown as commercial crops for their economic, social and religious importance by some of the farmers in some potential area. Horticultural mixed farming system occupies a special position in the state due to its economic viability as compared to other field crops. Major fruit crops which were commercially cultivated in Assam were banana, pineapple, citrus, jackfruit, guava, litchi, etc. Traditional fruits can be defined as those fruits which though consumable to human beings but are less palatable than other major fruits, have lesser demand in the market, are grown to a limited extent only and are not usually cultivated in an organized way with application of inputs (Srivastava, *et al*. 2017) [7]. Other terms used to describe these fruits are ‘minor’, ‘neglected’, ‘local’, ‘indigenous’, ‘underexploited’, ‘underdeveloped’, ‘lesser known’, etc. The increase in area and production of fruit crops over the last decades emphasize ample scope for commercialization of fruit crops.

The development of agribusiness entrepreneurship can create employment opportunity for rural youth, improve rural income and also provide nutritional security for both rural and urban

Areas. The indigenous fruit sector in this connection has tremendous agri-business potential which would play significant role in socio-economic upliftment of rural society. At the advent of act east policy of Government of India, the state of Assam as well as the entire North- Eastern Region of the country as the gateway to South East Asian Nations is a top investment destination in various sectors. The development of Agriculture in general and horticulture in particular would definitely be a potential sector for economic and commercial engagement with other countries. However, to exploit the opportunities it is imperative to support general awareness in the society by minimizing knowledge and information gap, for which it needs to build a strong institutional and legal policy structures and appropriate research and development investments. Considering the location, current policies and trends and value prospects of the indigenous fruit species grown in Assam, the present paper attempted to assess the status of area, production and productivity of fruit crops (major and indigenous) of North East India, with special reference to Assam.

Methodology

Horticulture sector covers a broad range of vegetables, flowers and ornamentals, aromatic and medicinal plants, spices and commercial plantation crops. However, the present study is confined to fruit crops (Major and traditional fruits) only. The study was based on secondary sources. The data has been collected from Horticultural Statistics at a Glance, Agricultural Statistics at a Glance, Directorate of Economics and Statistics and from different published sources. The collected data's were calculated and analysed using suitable tools and technique as discussed below:

Tabular analysis was undertaken and percentage was worked out to show the share and growth of area, production and productivity of fruits in Assam compared to all India.

1) Compound Annual Growth Rate (CAGR)

Compound Annual Growth rate was calculated to analyse the year wise growth trend in area, production and productivity of major fruits.

CAGR (%) = (Antilog of b-1) ×100

Where, b = regression coefficient (slope)

This is derived by using the formula Y = abt or lnY = ln a + t ln b

Where, Y= Time series data, a= Intercept, t= Time in years, b= co-efficient

(Buragohain and Deka, 2015) [1]

2) Demand-Supply gap

a) Population forecast

According to the Census of 2011, the total population of Assam was 312.05 Lakh as against 266.56 Lakh in the 2001 population Census registering a positive growth rate of 1.58 per cent. Therefore, the projected population of Assam will be calculated as

$$r = \left\{ \left(\frac{P_{2011}}{P_{2001}} \right)^{1/t} - 1 \right\} \times 100$$

Rate of population growth over the last 10 years (r)

Where, r = Rate of population growth over the last 10 years

P2011= Population of Assam as per 2011 census

P2001 = Population of Assam as per 2001 census t = time

Therefore, population of Assam in Pn years will be

$$P_n = \left(\frac{r}{100} \times P_{n-1} \right) + P_{n-1}$$

Where, Pn= Population forecast for the year 2018, 2020 and 2025 Pn-1 = Population of the last known year

b) Aggregate demand for fruits (Dn) was projected using the formula

Dn = Population in the 'n' year * per capita fruits requirement by ICMR i.e. 230 gram/person/day

c) Supply of fruits production is projected for the year 2020 and 2025 based on past trends. It has been assumed that fruit production will grow at the same rate as observed during the period 2009-10 to 2018-19 i.e.4.87 per cent. Hence, supply in the year 2020 will be

$$S_n = \left(\frac{r}{100} \times S_{n-1} \right) + S_{n-1}$$

Where, Sn= Supply projection for the year 2020 and 2025 Sn-1 = Supply of the last known year

Results and Discussion

According to the Table 1, the percentage share of value of total fruits and vegetables of Assam to all India was 2.59 per cent in the year 2015-16. It can be observed from the table that, out of the total value generated from pineapple, Assam contributed 18.08 per cent. Similarly, 6.12 per cent and 5.25 per cent contribution was made in the total value of output of litchi and citrus, respectively.

Table 1: Value of output of major fruits of Assam in the year 2015-16 (Rs. In Lakhs)

Particulars	Assam	India	Percentage contribution of Assam (%)
Banana	125645	2888991	4.35
Mango	15146	3851055	0.39
Litchi	13797	225568	6.12
Pineapple	50427	278975	18.08
Guava	17506	430813	4.06
Citrus	114930	2189274	5.25
Total fruits and vegetables	807205	31209536	2.59

Source: Horticulture Statistics at a Glance, 2018

The area, production and productivity of fruits in Assam compared to all India are presented in Table 2. Over the years, there has been significant growth of area, production and productivity of fruits in Assam. This may be due to the realization of benefits of commercialization by the farmers along with the implementation of several schemes by the Government. It can be observed from the table that, there were significant growth in area and production of fruits in Assam from 2005-06 to 2018-19 except for the year 2005-06 and 2013-
14. The state has given tremendous push in order to increase production of horticulture sector by implementing schemes like Horticulture Mission for North East and Himalayan States (HMNEH), Mission Organic Value Chain Development in Assam (MOVCDA), Rashtriya Krishi Vikash Yojana (RKVY), etc. Though, the area and production of fruits in Assam increased from 2005-06 to 2018-19, there found nominal increased in the percentage share to all India from 2.12 per cent and 2.44 per cent during the reference period. The growth in productivity (1.97 per cent) was less compared to growth in area (2.72 per cent) and production (4.75 per cent).

Table 2: Percentage share of Assam in total area, production and productivity of fruits in India/Growth trend in area, production and productivity of fruits in Assam in comparison to India (Area in Lakh ha; Production in Lakh MT; Productivity in Kg/ hectare)

Year	Assam			India			% share of Assam to all India	
	Area	Production	Productivity	Area	Production	Productivity	Area	Production
2005-06	1.13	13.52	11964.60	53.24	553.56	10400.00	2.12	2.44
2006-07	1.14	13.72	12035.09	55.54	595.63	10720.00	2.05	2.30
2007-08	1.16	14.08	12137.93	58.57	655.87	11200.00	1.98	2.15
2008-09	1.34	16.61	12395.52	61.01	684.66	11220.00	2.20	2.43
2009-10	1.27	15.65	12322.83	63.29	715.16	11300.00	2.01	2.19
2010-11	1.37	16.56	12087.59	63.83	748.78	11730.00	2.15	2.21
2011-12	1.38	17.75	12862.32	67.05	764.24	11400.00	2.06	2.32
2012-13	1.51	20.74	13735.10	69.82	812.85	11640.00	2.16	2.55
2013-14	1.42	20.25	14260.56	72.16	889.77	12330.00	1.97	2.28
2014-15	1.44	20.12	13972.22	61.10	866.02	14170.00	2.36	2.32
2015-16	1.44	20.56	14277.78	63.01	901.83	14310.00	2.29	2.28
2016-17	1.62	23.72	14641.98	63.73	929.18	14580.00	2.54	2.55
2017-18	1.47	21.24	14448.98	65.06	973.58	14960.00	2.26	2.18
2018-19	1.67	25.18	15077.84	66.48	985.79	14828.90	2.51	2.55
CAGR	2.72***	4.75***	1.97***	1.29*	4.38***	3.05***		

Source: Directorate of Economics and Statistics, Govt. of India
***Significant at 1 per cent, *Significant at 10 per cent

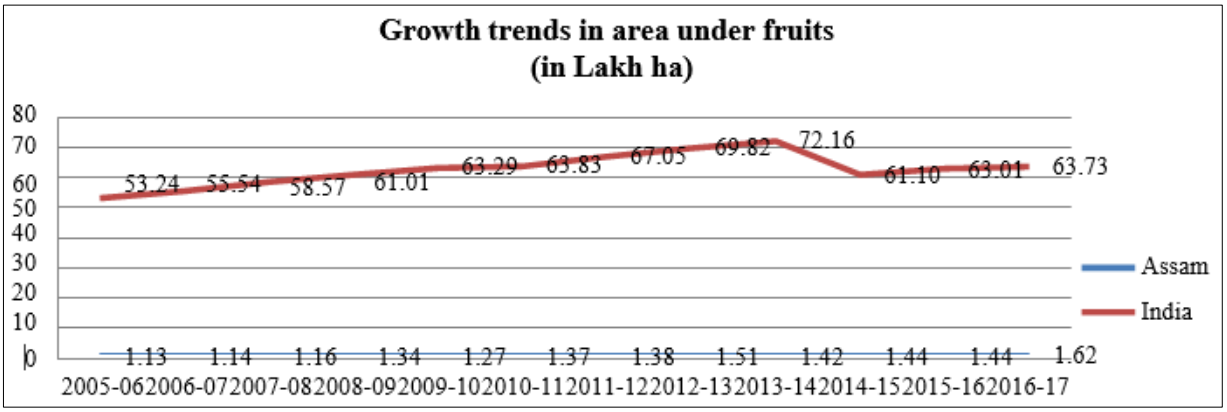

Fig 1: Growth trends in area under fruits in Assam

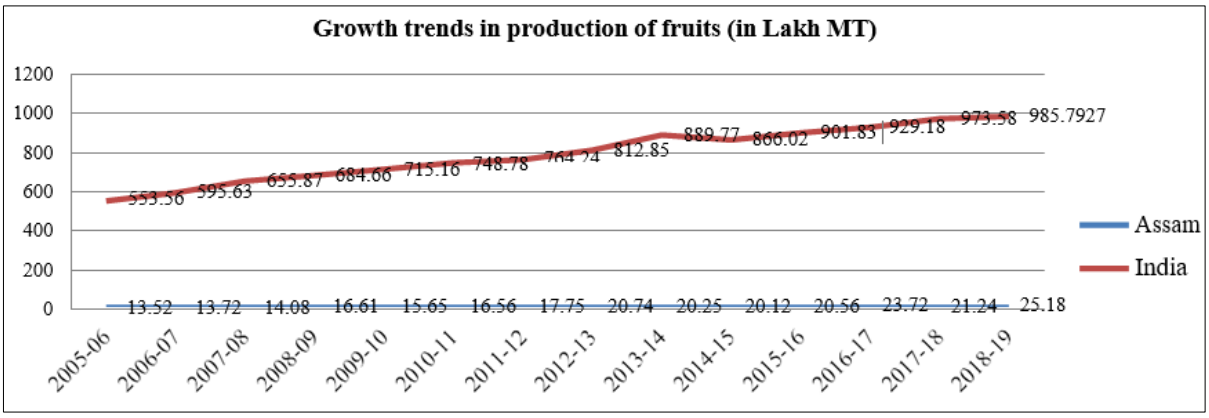

Fig 2: Growth trends in production of fruits in Assam

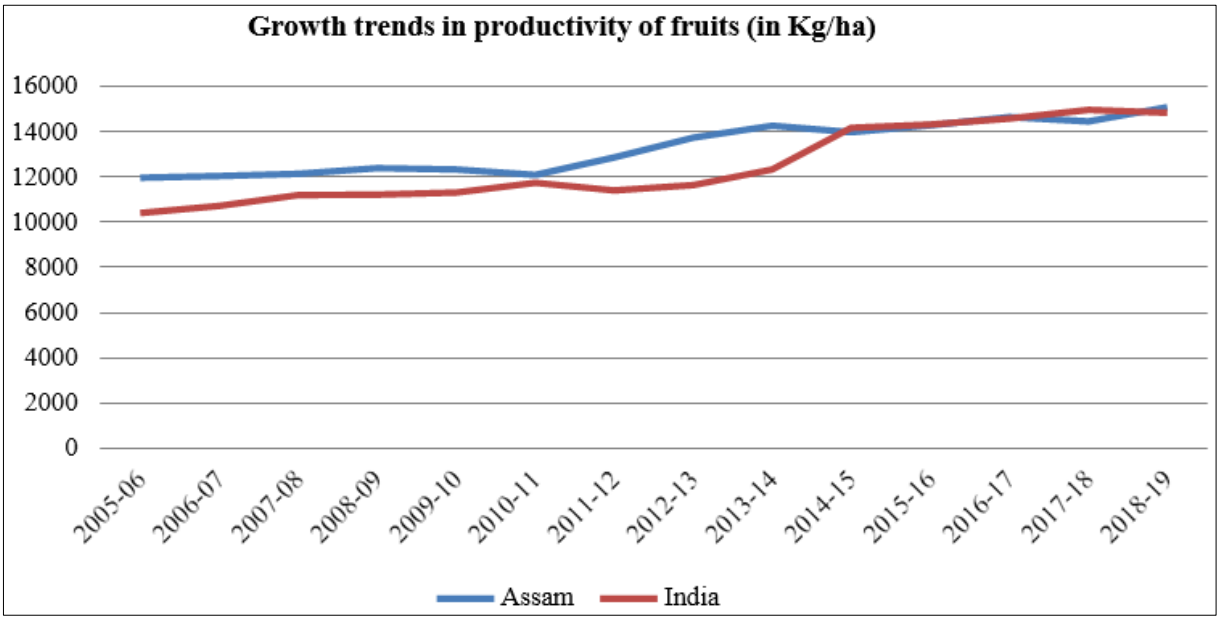

Fig 3: Growth trends in productivity of fruits in Assam

From the Table 3, the area under major fruits of Assam like aonla, banana and pineapple showed increasing trend while for fruits like mandarin, sweet orange, guava, mango and papaya showed declining trend over the period from 2012-13 to 2017-18. Similarly, the production trend of aonla, banana, mandarin, sweet orange and pineapple was found to increase during the period. No significant change in the productivity was seen during the period under study. It can be observed that there was a considerable gap between area, production and productivity of almost all the crops in Assam compared to other parts of India. There is a need to improve the productivity of the major fruits using modern technologies and improved variety for overall growth in the horticulture sector of the state.

The Table 4 simply indicates that there exists a sufficient gap between demand and supply of fruits in Assam till the year 2020. The availability of milk in the state was around 77.94 per cent in 2012 which increased to 97.74 per cent in the year 2020 of the total requirement. The per capita availability of fruits in the state was 179 gram only in 2012 which increased to 225 gram in the year 2020 slightly below the ICMR recommendations (230 gram/person/day) implying a little demand -supply gap. With the present rate of growth in fruit production and population of the state, the projected demand supply gap was found to be negative indicating surplus of fruit production in the state.

Importance of indigenous fruits in Assam

There are quite large numbers of indigenous fruits in Assam which are traded or consumed locally. Most commonly grown indigenous fruit crops of Assam were leteku (*Baccaurea sapida*), Bael (*Aegle marmelos*), Poniol (*Flacourtia gangomos*), Nagatenga (*Rhus semialata*), Thereju (*Prunus jenkinsii*), Kordoi (*Averrhoa carambola*), Mirika tenga (*Parameria polyneura*), Amora (*Spondias mangifera*), Outenga (*Dillenia indica*), Silikha (*Terminalia chebula*), Bhomora (*Terminalia belerica*), Amlokhi (*Phyllanthus emblica*), Leteku (*Baccurea sapida*), Pora amlokhi (*Phyllanthus acidus*), etc (AERC Report, 2013). Apart from nutritive and medicinal values, they provide ample scope foe value addition due to presence of good flavour, colour and juice content (Barua *et al*., 2019) [9]. These crops are easier to grow, hardy in nature and therefore can thrive even under most adverse condition. In Assam, indigenous fruit crops are found in all the agro-climatic zones grown under wild and semi-wild condition. Many indigenous crops are well adapted to marginal land with low cost inputs, thus benefits for the survival of poor communities by generating sustainable income. But, it is to be mentioned here that, no systematic data on area, production and productivity was recorded in the state so far. Therefore, systematic cultivation of indigenous fruit crops needs to be encouraged in the state for overall development of the horticultural sector.

Table 3: Area, Production and Productivity of major fruits in Assam

Major fruits	2012-13			2013-14			2014-15			2015-16			2016-17			2016-17		
	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity
Aonla	0.89 (0.82)	16.02 (1.26)	18000.00	0.9 (0.87)	16.27 (1.33)	18077.78	0.90 (0.95)	16.27 (1.39)	18077.78	0.92 (1.04)	16.84 (1.73)	18304.35	0.91 (0.98)	16.70 (1.55)	18351.65	0.91 (0.98)	17.76 (1.65)	19516.48
Banana	51.51 (6.64)	837.02 (3.16)	16250.00	50.81 (6.33)	857.72 (2.89)	16881.00	51.28 (6.24)	865.67 (2.96)	16881.00	51.1 (6.07)	882.71 (3.03)	17274.00	49.27 (5.73)	854.85 (2.80)	17350.00	53.08 (6.01)	913.27 (2.96)	17206.00
Mandarin	15.85 (5.09)	195.82 (6.74)	12355.00	15.67 (4.75)	188.78 (5.53)	12047.00	15.76 (5.27)	202.38 (5.47)	12841.00	15.65 (3.94)	210.14 (5.11)	13427.00	15.04 (3.67)	203.52 (4.59)	13532.00	14.95 (2.05)	203.72 (3.99)	13627.00
Sweet orange	0.14 (0.04)	1.68 (0.05)	12000.00	0.14 (0.04)	1.85 (0.05)	13214.00	0.14 (0.05)	1.85 (0.04)	13214.00	0.46 0.19	4.76 0.14	10348.00	0.14 (0.07)	1.89 (0.06)	13500.00	0.14 (0.08)	1.98 (0.06)	14143.00
Guava	5.27 (2.24)	105.83 (3.31)	20082.00	4.19 (1.56)	83.8 (2.28)	20000.00	4.23 (1.72)	84.52 (2.12)	19981.00	4.36 1.71	95.62 2.36	21931.00	4.38 (1.68)	96.14 (2.51)	21950.00	4.43 (1.67)	96.69 (2.39)	21826.00
Mango	5.39 (0.22)	55.27 (0.31)	10254.00	4.49 (0.18)	44.59 (0.24)	9931.00	4.59 (0.21)	45.69 (0.25)	9954.00	4.62 0.21	46.15 0.25	9989.00	4.66 (0.21)	47.15 (0.24)	10118.00	4.68 (0.21)	48.44 (0.22)	10350.00
Papaya	8.74 (6.61)	174.59 (3.24)	19976.00	7.50 (5.62)	149.14 (2.64)	19885.00	7.42 (6.45)	148.86 (3.03)	20062.00	7.22 5.45	145.48 2.57	20150.00	6.92 (5.15)	141.75 (2.39)	20484.00	7.21 (5.21)	147.40 (2.46)	20444.00
Pineapple	16.24 (15.44)	268.82 (17.12)	16553.00	16.54 (15.05)	288.60 (16.62)	17449.00	16.01 (13.79)	281.27 (14.18)	17568.00	16.2 14.75	285.17 14.82	17603.00	16.27 (14.62)	268.92 (14.45)	16529.00	16.30 (15.83)	296.52 (17.38)	18191.00

Source: Agricultural Statistics at a Glance, 2018
Figures in parenthesis indicates percentage share in all India

Table 4: Demand-Supply gap of fruits in Assam (Lakh MT)

Year	Population (Lakhs)	Demand (Lakh MT)	Supply (Lakh MT)	Demand- Supply Gap
2018	327.08	27.46	25.18 (91.70)	2.28 (8.30)
2020	337.49	28.33	27.69 (97.74)	0.64 (2.26)
2025	365.01	30.64	35.13	-4.48

Worked on the basis of data of Agricultural Statistics at a Glance, various issue

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