

GROWTH AND INSTABILITY OFFRUTS IN NORTH EASTERN REGION OF INDIA

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Abstract: Being one of the biodiversity hotspot, North Eastern Region (NER) of India has immense potential for growing different variety of horticultural crops like fruits. Moreover, Fruits in NER contains one third of total fruits diversity in nation. Hence considering the importance of fruits in NER, an attempt has been made in the present paper to analyse the growth and instability in fruits production in NER. The study found that NE states are showing positive significant growth rate in case of area, production and productivity of fruits with low instability.

Key Words: Growth Rate, Instability, Productivity.

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INTRODUCTION

North Eastern Region (NER) of India, being one of the biodiversity hotspot region in India, has one of the richest reservoir of genetic variability and diversity of different crops like various kinds of fruits, different vegetables, spices, ornamental plants and also medicinal & aromatic plants etc. Because of its diversities in topography, altitude and climatic conditions, the region offers scope for cultivation of a wide variety of agricultural crops. The North Eastern region of India comprises eight states namely Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim .The North East region has its own unique combination of living species, habitats and ecosystems, which together make up its diversity rich resource.

With the absence of major industrial development, agriculture play an important role in the economic development of North Eastern Region (NER). Moreover, with having more area under hilly region, there is an immense potential for horticultural crop like fruits (Ashati & Yadav, 2011). Moreover, With the introduction of the National Horticultural Mission/ Technology Mission in horticulture, the fruits production has experience a tremendous increase in NE region. Earlier various literature has demonstrate that agricultural development is the pre-condition for growth and development (Fan et al., 2005). Johnston and Mellor (1961) stated that agriculture has direct linkage to agricultural processing industry and backward linkage to input supply industries). Because of this effects, agriculture can lead to growth for many country. Timmer (2005) stated that variation or instability in agricultural production is an important issue to be discussed because of volatility in agricultural production due to existence of external shocks.

Considering the significance of the fruits in North Eastern region, present study will analyse the growth performance and instability in area production and productivity of fruits in this region and as well as among different states.

REVIEW OF LITERATURE

There exists various literature on growth and instability of agricultural crop. Madhusudhana (2013) analyzed the area, production and productivity of groundnut crop at national level, state level and district level during 1996-2000 to 2001-2008. Paltash and Goyari (2013) found that low growth rate and increase level of instability in the post reform era. Examining the trends in

area, production and productivity of groundnut in Andhra Pradesh, Paul et al. (2009) observed a negative but non-significant trend. Agarwal et al. (2014) found a positive and significant growth trend higher instability in production. Roy et al (2015) analysed the growth performance of foodgrains in North Eastern Region and found positive and significant results.. The study also observed that, among the states, Nagaland registered the highest significant growth in area, production and yield, followed by Arunachal Pradesh and Mizoram. Area effect dominant the yield effect as a sources of output growth.

Research gap

From the above literature it is observed that an analysis of growth performance of area production and yield of a crop is important in order to know about the agricultural situation. Again due to the volatile nature of agriculture, a study on instability is also important. However, to the best of researcher knowledge no such attempt has been made in NER in case of fruits. Hence considering the importance of fruits crop in NER, present study is a humble attempt to fill this gap.

OBJECTIVE

1. To analyse the growth of area, production and productivity of fruits in North Eastern Region as well as different states.
2. To examine the instability in area, production and productivity of fruits in North Eastern Region as well as different states.

METHODOLOGY

Coverage: Coverage of the study is the North Eastern Region as a whole and different states separately. Time period for the study is from 2000-01 to 2014-15 because in 2001-02 national mission for integrated development of horticulture for North East State and Himalayan region had been started for the development of horticulture in NE region.

Data: The study is based on only secondary data. Secondary data has been collected from the ministry of Agriculture, Government of India, www.indiastat.com, Horticultural Statistical Year Book India, 2017. Data on area, production and average yield of fruits for the whole region and

each state has been collected. After that data has been analyzed by using software package SPSS, percentage, graphs etc.

Method:

Exponential Trend Equation: Compound growth rate is calculated for the growth pattern in area, production, and average yield of fruits using the exponential trend equation of following form.

$$Y_t = ab^t$$

$$\log Y_t = \log a + t \log b$$

$$r = (\text{antilog } 'b' - 1) \times 100$$

Where, Y_t = area, production or yield of rice in year 't', t = year (rank was given to year concerned; ranking of the year was done in their ascending order as per case), a and b = parameter to be estimated, r = compound growth rate.

In order to make a comparison among state percentage method and pie diagram has been used.

Instability Index:

Present study will used coefficient of variation and Cuddy- Della Velle Index of Instability to examine the instability in area, production and productivity of fruits.

$$\text{Instability Index} = CV * (1-R^2)^{\frac{1}{2}}$$

Where, CV is coefficient of variation, R^2 is coefficient of determination from a time trend regression.

RESULTS AND DISCUSSION

i) Comparison of NER with India:

Table 1: Percentage Share of NER in total production and area under fruits in India

	2000-01	2014-15	% change
Area	6.2	4.9	-20
Production	4.1	3.0	-27

Source: Authors calculation (www.indiastat.com , Ministry of Agriculture, Government of India)

The table depicts the percentage share of NER in area under fruits production as compared to national data over the year from 2000-01 to 2014-15. The table reveals that the percentage share of area and production of fruits in NER region is decreasing from 2000-01 to 2014-15.

Growth and variation of fruits and vegetables in NER

Table 2: Compound Growth Rate of fruit production North Eastern states during 2000-2015

State	Area	production	Productivity
Arunachal Pradesh	0.4*** (1.4%)	-0.1 (0.9%)	-1.7*** (2.2%)
Assam	1.0** (1.1%)	1.6*** (1.1%)	0.6* (0.8%)
Meghalaya	2.1*** (2.1%)	0.2*** (1.6%)	0.1 (0.8%)
Mizoram	2.7*** (2.5%)	8.1*** (6.4%)	5.2** (7.3%)
Nagaland	3.5 (11.7%)	-13.7 (50.2%)	-2.7 (1.6%)
Manipur	2.9** (3.1%)	4.1*** (3.4%)	1.1 (2.4%)
NER	2.2* (2.2%)	2.6*** (1.7%)	0.4 (3.4%)

Source: Authors calculation.. (www.indiastat.com), Ministry of Agriculture, Government of India) (Figures in the bracket indicate coefficient of variation)

*** indicate 1% levels of significance

** indicate 5% level of significance

* indicate 10% level of significance

The above table depicts the annual compound growth rate of fruits area, production and in different NE states as well as NER as a whole. The NER as a whole indicate a positive annual growth rate for each of the component. All the NE states reveals positive and significant growth rate in fruits area except Nagaland. Manipur registered highest significant positive growth in fruits area. Except Nagaland, other NE state reveals low variation in growth of fruits area. Similarly in case of fruits production also NER as a whole reveals positive and significant growth (2.6%). Mizoram registered highest significant positive growth in case of fruits production and yield. Except Arunachal Pradesh and Nagaland all other state reveals positive and significant growth of fruit production. In case of yield, Arunachal Pradesh shows a negative but significant growth where as other state shows positive growth.

Moreover, except Nagaland, all other NE state as well as whole NER shows low variation in growth rate (indicated by low coefficient of variation). Again Assam reveals lowest variation in area growth and yield growth.

ii) Fruits scenario of different NE states

Table 3: percentage share of different states in total area under fruits in NER

Year/state	Manipur	Tripura	Nagaland	Mizoram	Meghalaya	Assam	Arunachal Pradesh
2000-01	8.58	10.04	8.58	6.25	8.37	37.16	17.75
2001-02	9.09	9.86	8.70	6.61	8.4	38.6	14.49
2002-03	11.19	11.90	3.56	7.20	6.41	38.47	17.10
2003-04	18.46	10.61	4.63	7.37	8.27	32.8	17.88
2004-05	17.41	11.02	4.52	7.20	8.09	31.72	17.23
2005-06	10.61	11.23	3.26	6.33	9.63	38.31	17.59
2006-07	6.12	6.00	46.16	3.70	5.14	21.40	9.86
2007-08	6.75	5.86	45.83	3.85	4.92	21.20	9.95
2008-09	12.56	10.81	5.39	10.10	9.77	31.17	17.07
2009-10	11.53	8.51	4.94	9.38	8.97	37.65	15.67
2010-11	17.70	9.50	4.69	7.47	7.77	30.98	18.54
2011-12	10.91	2.94	7.4	9.5	7.09	31.31	18.68
2012-13	10.7	3.03	7.6	10.2	6.85	31.11	17.94
2013-14	10.6	3.1	8.02	11.4	6.9	29.2	17.61
2014-15	15.38	3.3	7.6	11.3	6.9	29.4	18.5
% change	80	-67	-11	80	-17	-20	4

Source: Author's calculation (www.indiastat.com, Ministry of Agriculture, Government of India)

The above table shows the percentage share of different NE state in total area under fruits in NER from 2000-01 to 2014-15. The above table reveals that Assam occupies the dominant position followed by Arunachal Pradesh in area under fruits in almost all the year. However one important thing that can be notice from the table is that the share of different states fluctuates over the period. But still Assam has the highest area under fruits. Again the share of Manipur and Mizoram has increased over the year with (80%) change over the period. Tripura, Nagaland, Assam, Meghalaya reveals a negative change over the period.

Table 4: Percentage share of different NE States in total fruit production in NER

Year/ State	Manipur	Nagaland	Mizoram	Meghalaya	Assam	Arunachal P
2000-01	5.70	13.96	3.20	8.99	62.21	5.91
2001-02	6.24	14.07	2.95	8.70	62.20	5.81
2002-03	8.50	4.06	3.39	9.46	69.51	5.06
2003-04	18.33	2.53	2.20	10.36	61.30	5.25
2004-05	17.19	2.62	2.27	10.70	61.67	5.53
2005-06	9.63	0.99	3.36	11.80	68.85	5.35
2006-07	10.69	-	8.38	10.93	64.96	5.03
2007-08	12.17	-	9.77	10.46	62.78	4.80
2008-09	11.07	4.90	3.98	9.55	51.02	3.50
2009-10	9.96	4.40	5.40	8.59	54.03	3.14
2010-11	8.50	4.50	10.51	7.18	48.44	3.20
2011-12	9.4	8.8	6.6	7.2	44.8	7.4
2012-13	9.9	6.2	6.6	7.1	46.4	7
2013-14	10.8	8.6	7.2	7.3	42.1	6.7
2014-15	10.6	8.1	6.5	7.5	44.6	6.5
% change	85	-41	103	-16	-28	-10

Source: Author's calculation (www.indiastat.com, Ministry of Agriculture, Government of India)

The above table reveals the percentage share of different NE states in total fruit production in NER. From the table it can be observed that Mizoram registered the highest positive change (103%), followed by Manipur (85%). However as a percentage share, Assam has the dominant position all over the year. Nagaland, which have the second highest share in 2000-01 has drastically fall down. In 2014-15, Manipur has the second largest share of fruits production. Expect Mizoram and Manipur, all other state reveals negative change.

Table 5: Percentage share of gross area under fruits of different NE states

Year/State	Arunachal Pradesh	Assam	Meghalaya	Mizoram	Nagaland	Tripura	Sikkim	Manipur	NER
2000-01	19.4	2.6	7.6	0.04	19.6	30.7	2.2	8.9	0.58
2014-15	25.8	2.7	7.6	31.5	3.3	8.9	8.4	26.6	7.1
% change	33	4	0	78,650	-83	-71	281	198	1124

Source: Author's calculation (www.indiastat.com, Ministry of Agriculture, Government of India)

The above table gives the share of area under fruits as a percentage of gross cropped area of different NE state. Except Tripura and Nagaland, all the NE states has an increased share of area under fruits as a percentage of gross cropped area. Moreover this for the overall NER region also the share has been increasing. Among the NE states Mizoram registered highest growth and that of Nagaland registered lowest (negative) growth. In 2000-01, Mizoram has the lowest area (0.04%) under fruits production among NE states but it has occupied the highest position in 2014-15 (31.5%). Whereas Tripura, where almost 31% area are devoted for fruit production in 2000-01 has been fall down to 8.9% in 2014-15. In Assam also the area under fruit production has been increased by 281% over the year. In Meghalaya, area under fruit production is remained same between the two periods with a slight variation. NER as a whole shows 1124% increase in area under fruits as a percentage of gross cropped area over the two period.

Area and production of different fruits in NER

SHARE OF DIFFERENT FRUITS IN TOTAL PRODUCTION IN 2000-01

■ pineapple ■ lemon ■ banana ■ orange ■ mango ■ litchi ■ grapes ■ coconut ■ citrus ■ arecunut ■ Apple ■ papaya

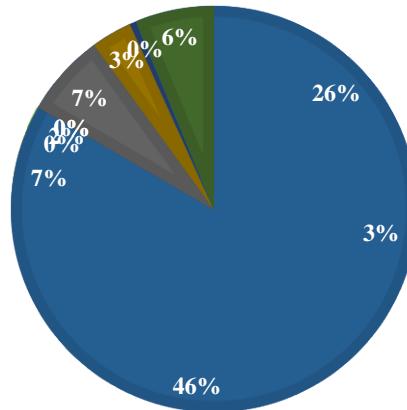


Figure 1: Share of different fruits in total fruit production in NER in 2000-01.

Source: www.indiastat.com, Ministry of Agriculture, Government of India)

SHARE OF DIFFERENT FRUITS IN TOTAL PRODUCTION IN 2014-15

■ pineapple ■ lemon ■ banana ■ orange ■ mango ■ litchi ■ grapes ■ coconut ■ citrus ■ arecunut ■ Apple ■ papaya

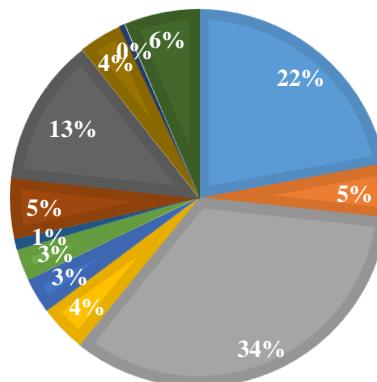


Figure 2: Share of different fruits in total fruit production in NER in 2014-15

Source: www.indiastat.com, Ministry of Agriculture, Government of India

in 2000-01 and 2010-11. In 2000-01, banana dominants the total fruits production followed by pineapple, orange and citrus fruits. However in 2010-11 still banana occupied the dominant position but its share has been decreasing. Similar is the case for pineapple production. However, the share of citrus fruits has increased slightly. Other fruits contain a very small share of less than 10%

The following two figure 3 & 4 depicts the share of different fruits in total area under fruits from 2000-01 to 2014-15. The figure shows that during 2000-01, arecunut dominants the total area under fruits by occupying 33% of total area, followed by banana (27%) and pineapple (15%). Other fruits occupies only a small portion of less than 10%. However during 2014-15, the share of arecunut has fall drastically to 8%. During 2014-15, the share of other two major crop, banana and pineapple also decreased but still banana occupies the highest position. Moreover this share of other fruits like orange (8%), citrus (11%), coconut (11%), has increased. The share of other fruits like litchi, papaya, mango has been also increase during that position. This may indicate increased diversification in the fruits production in NER.

SHARE OF DIFFERENT FRUITS IN TOTAL AREA OF FRUITS 2000-01

■ pineapple ■ lemon ■ banana ■ orange ■ mango ■ litchi ■ grapes ■ coconut ■ citrus ■ arecunut ■ Apple ■ papaya

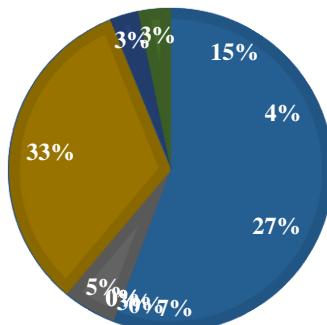


Figure 3: Share of different fruits in total area under fruits in NER in 2000-01 Source: www.indiastat.com, Ministry of Agriculture, Government of India

SHARE OF DIFFERENT FRUITS IN TOTAL AREA UNDER FRUITS IN 2014-15

■ pineapple ■ lemon ■ banana ■ orange ■ mango ■ litchi ■ grapes ■ coconut ■ citrus ■ arecunut ■ Apple ■ papaya

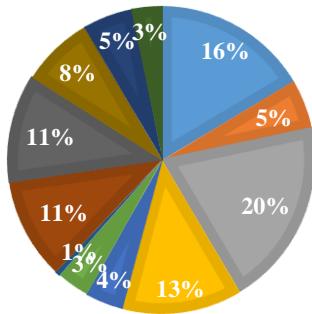


Figure 4: Share of different fruits in total area under fruit in NER in 2014-15
Source: www.indiastat.com, Ministry of Agriculture, Government of India

Instability in Fruits:

Table 6: Instability index for area production and yield of fruits

	Area	Production	Yield
NER	1.7	1	3.3
Arunachal Pradesh	0.7	0.8	1.3
Assam	0.8	0.7	0.7
Meghalaya	1.4	0.86	0.8
Mizoram	1.3	3.7	5.6
Nagaland	11.4	48.9	48.7
Manipur	2.2	2.3	2.2

Source: Authors calculation (www.indiastat.com), Ministry of Agriculture, Government of India)

The above table depicts the instability index for fruits in the north eastern region. It can be observed from the table that except Nagaland, all the NE state reveals low instability in area, production and average yield under fruits.

CONCLUSION

Thus from the above discussion it can be concluded that all the NER states are showing positive compound growth rate in area under fruits, with low instability. However, despite of immense potential for the development of fruits production due to favorable climate but its progress is not that much satisfactory. Infect, its share has been decreasing at all India level. Sates like Manipur,

Mizoram, Meghalaya are showing better results. Hence a policy towards the development of fruits will increase overall performance of North Eastern Region.

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