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Growth of Pineapple Cultivation: A Spatio-Temporal Analysis in India

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ABSTRACT

Pineapple (Ananas Comosus) is one of the most important tropical and sub-tropical fruit of Bromeliaceae family, cultivated almost one third part of the world. July to September is the main growing season in India and it takes almost 18-24 months to mature for harvesting. The main objective of this paper is to analyse the temporal growth in area, production and productivity or yield of pineapple in India. The data series of spati- temporal growth of pineapple is incorporated from 1995-96 to 2015-16. The finding of this paper revealed that the area increased from 71.3 to 109.83 (000 hectare), production 1071.32 to 1924.22 (000 MT) and productivity 15 to 17.52 (MT/hectare) in the last two decades. Over the last twenty years the percentage of growth in area, production and productivity of pineapple are 54.04, 79.36 and 16.8 respectively. The study also revealed that Assam has the largest area under pineapple cultivation, West Bengal is the leading producer and Karnataka is the largest in productivity. The huge variation in productivity of pineapple among different states are mainly because inadequate farm management techniques i.e. less use of chemical fertilizer, pesticides, improper suckers, inadequate knowledge and insufficient use of other input, which are the result of less production and productivity.

KEYWORDS: *Pineapple, Growth, AAGR, Spatio-Temporal Analysis*

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1. INRODUCTION

Pineapple scientifically calls **Ananas Comosus** of Bromeliaceae family, derived from tupi word '**nanas**' meaning 'excellent fruit'. This fruit is very delicious in nature, has excellent flavour and nutritive value. Though it has different regional name such as Keehom (Manipur), Ananus (Marathi), Annasahannu (Kannada), Anasipazham (Tamil), Kaitachchakka (Malayalam) etc. but it is popularly known as Ananas almost all part of India. It is rich in vitamin C and also the good source of other vitamin i.e. A & B. It contain a special enzyme called 'Bromelin' which help digestion of protein **(1).** It has high nutritive value, each 100 gram of edible pineapple supplies 50 K calories, 0.54 gm protein, 58 % vitamin C, 44 % Manganese, 86 % water and 13 % carbohydrate. According to health line, it has eight improve health benefit i.e. packed with variety of vitamin and minerals contain disease fighting antioxidants which reduce the risk of chronic disease like heart disease, diabetes and cancer, the anti-inflammatory properties boost the immune system.

As the population of India is very high so maximum produced pineapples are consumed by Indian people itself and rest of very least are exported to middle-east and western countries. After extraction of juice, flesh of pineapple is used as animal feed and cuisine. Beside these, jam, jelly, squash, vinegar, alcohol etc. are made from pineapple. Among all the fruits, ripen pineapple is highly perishable in nature; it cannot be kept more than 3-4 days after harvesting. There are different varieties of pineapple are grown in India as well as whole world. About 80-90 varieties of pineapple are grown in different countries of the world. The main varieties of pineapple which are grown in India are- Kew, Giant Kew, Queen, Mauritius, Jaldhup, Lakhat, Amrutha and MD-2. Having different varieties they are grown in different season in different states of India but the main growing season of whole India is July-September. Pineapple cultivation requires humid tropical climate, best and suitable is neither too hot nor too cold. The optimum temperature ranges between 15-30 degree Celsius and more specifically 22-24 degree Celsius is more favourable for its growth. Rainfall ranges between 500-5500 mm per year but 700-1500 is more favourable. According to **Chinzakhum,** slightly acidic soil with pH 5.5-6.0 is optimum for pineapple cultivation**.** It can be grown up to 1500 metres above mean sea level successfully.

It is the third most important tropical and sub-tropical fruit after banana and citrus. This plant is indigenous to South America and more specifically it is said to be originated between Paraguay and southern Brazil. By **MS-Bertone** it is considered that Parana-Paraguay river is the origin place of pineapple**.** The total area under pineapple cultivation in India and world is 1.1 lakh hectare and 10.98 lakh hectares respectively (11). According to Food and Agriculture Organization **(FAO 2017),** Indian is the fifth largest producer of pineapple in world produced 1861 thousand

metric tons out of the total world production 27403 (000 MT) about 7% of total world. The major pineapple producing states of India are Assam, West Bengal, Manipur, Mizoram, Tripura, Nagaland, Meghalaya, Bihar, Tamil Nadu, Karnataka, Kerala and Andhra Pradesh. Countries which commercially produce pineapple are Costa Rica, Philippines, Brazil, Thailand, India, Indonesia, Nigeria, China, Colombia, Mexico etc.

2. OBJECTIVES OF THE STUDY

The main objectives of this study are

- To study the Spatio-temporal growth of area, production and productivity of pineapple in India.
- To highlight the present status of pineapple cultivation in India.

3. DATABASE

The present paper is mainly based on secondary sources of data and the time period is from 1995-96 to 2015-16 i.e. two decades. The secondary sources of data mainly obtained from Horticultural Statistics Division, Department of Agriculture, cooperation & Farmers Welfare, Food and Agricultural Organization (FAO), National Horticulture Board of India (NHB), Statistical fact book, Agriculture and Processed Food Products Export Development Authority (APEDA), District Statistical Handbook, State Statistical Book etc. and retrieved from indiastat.com, westbengalstat.com, fao.org. Beside these to get adequate information related to the topic, descriptive and numerical information obtained from various national and international journals, PhD thesis, articles, projects and reports.

4. METHODOLOGY

The obtained secondary data then analysed, tabulation has been done manually, diagrams are prepared and the results have been represented with the help of MS Word and Excel 2010. Maps of the study area i.e. production are prepared with the help of Arc GIS software 10.2 and its distribution shown in simple Bar diagram on map. For the sake of analysis of collected secondary data, suitable statistical techniques have been used. To show the growth rate of area, production and productivity of pineapple in India, statistical tools like share of percentage and average annual growth rate is used.

$$AAGR = \frac{\left|\frac{End\ value - Starting\ value}{Starting\ value}\right| \times 100}{N}$$

Where, AAGR= Average Annual Growth Rate

5. RESULTS AND DISCUSSION

Indian is the fifth largest producer of pineapple in world, produced 1861 thousand metric tons out of the total world production 27403 (000 MT) about 7% of total world and ranked in second position in area under pineapple cultivation (FAO, 2017). The study revealed that the production of pineapple in India has greatly increased from 1071.2 to 1924.22 thousands metric tons in the last two decades i.e. from 1995-96 to 2015-16. The total growth of production from 1995-96 to 2015-16 is 79.36 per cent almost double the production and the average annual growth rate is 3.968 per cent. Similarly the total area and productivity of pineapple has increased from 71.3 to 109.83 thousand hectares and 15 to 17.52 metric tons per hectare respectively from 1995-96 to 2015-16. The total growth of area and productivity are 54.04 and 16.8 per cent respectively. Average annual growth rate is 2.702 and 0.84 per cent respectively **(table-1).** The area and production has shown steadily growth and the growth of productivity almost constant. Highest positive growth (19.09 %) shown in production during the year 2000-01 and highest negative growth (13.69 %) shown in the year 1996-97. Highest positive growth in terms of area (13.28 %) and productivity (14.71 %) shown in the year 2011-12 and 2000-01 respectively. Similarly highest negative growth in area (-5.40) and productivity (-10 %) shown in the year 2015-16 and 1996-97 respectively **(table-1).**

Table-1: Area, Production, Productivity and Growth of Pineapple in India (1995-96 to 2015-16)

Year	Area (000 Hect.)	Growth (%)	Production (000 MT)	Growth (%)	Productivity (MT/Hect.)	Growth (%)
1995-96	71.3	-	1071.2	-	15.0	-
1996-97	68.7	-3.65	924.6	-13.69	13.5	-10
1997-98	69.3	0.87	937.1	1.35	13.5	0
1998-99	74.2	7.07	1006.4	7.40	13.6	0.74
1999-2000	75.5	1.75	1025.4	1.89	13.6	0
2000-01	78.2	3.58	1221.1	19.09	15.6	14.71
2001-02	77.2	-1.28	1182.3	-3.17	15.3	-1.92
2002-03	79.8	3.37	1171.7	-0.90	14.7	-3.92
2003-04	80.9	1.38	1234.2	5.33	15.3	4.09
2004-05	82.8	2.35	1278.9	3.62	15.4	0.65
2005-06	85.4	3.14	1352.1	5.80	15.8	2.60
2006-07	82.60	-3.28	1362.1	0.67	15.8	0
2007-08	80.0	-3.15	1244.6	-8.63	15.5	-1.90
2008-09	83.70	4.62	1340.8	7.73	16.0	3.23
2009-10	91.90	9.80	1386.8	3.43	15.10	-5.62
2010-11	88.70	-3.26	1415.4	2.06	15.90	5.30
2011-12	102.40	13.38	1505.0	6.33	14.70	-7.55
2012-13	105.2	2.73	1570.6	4.35	14.90	1.36
2013-14	109.9	4.47	1736.7	10.58	15.8	6.04
2014-15	116.1	5.64	1984.0	14.24	17.10	8.23
2015-16	109.83	-5.40	1924.22	-3.01	17.52	2.34
Total		**54.04**	**-**	**79.36**	**-**	**16.8**
Average Annual Growth Rate (AAGR)		**2.702**		**3.968**		**0.84**

Source: Ministry of Agriculture, Govt. of India (Retrieved-Indiastat.com)

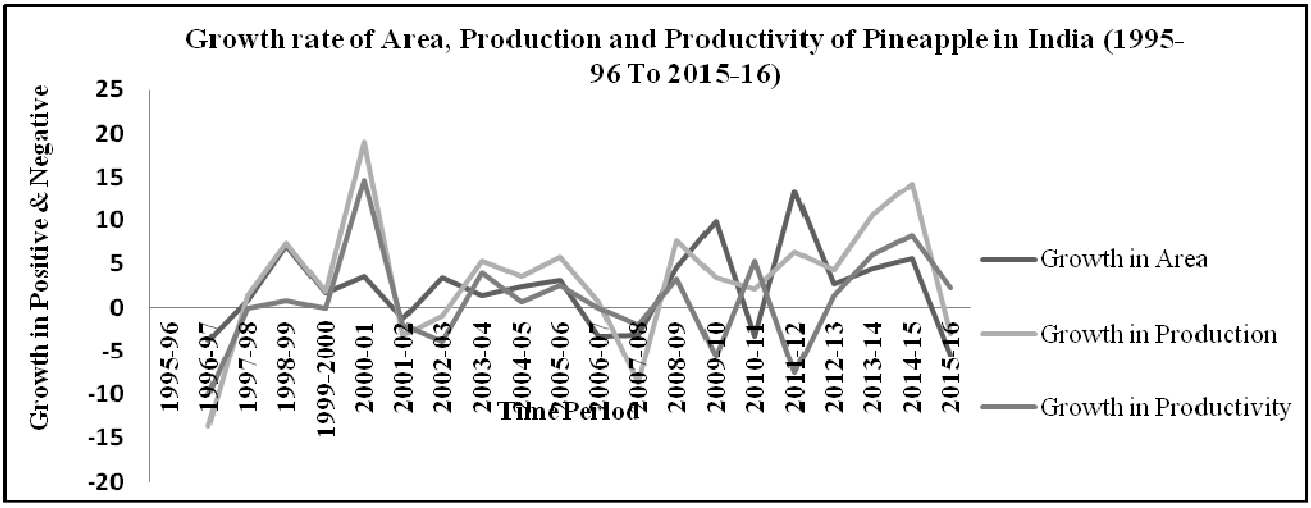

Fig: 1 Prepared by Author

5.1. STATE-WISE PINEAPPLE PRODUCTION IN INDIA (2015-16)

According to Ministry of Agriculture 2015-16, West Bengal is the leading producer of pineapple in India produced 330.07 metric tonnes followed by Kerala (305.67) Assam (285.17) etc.; whereas Maharashtra is the least producer of pineapple in India, produced 0.4 metric tonnes.

Table 2: State-Wise Pineapple Production in India (2015-16)

S. No	States	Production (000 Metric Tonnes)
1	Andhra Pradesh	55.38
2	Arunachal Pradesh	37.33
3	Assam	285.17
4	Bihar	116.3
5	Karnataka	155.41
6	Kerala	305.67
7	Maharashtra	0.4
8	Manipur	128.51
9	Meghalaya	123.13
10	Mizoram	32.87
11	Nagaland	127.81
12	Odisha	11.68
13	Sikkim	0
14	Tamil Nadu	26.22
15	Tripura	180.26
16	West Bengal	**330.07**
17	Others	8.04
India		**1924.22**

Source: Ministry of Agriculture, Govt. of India (retrieved-indiastat.com)

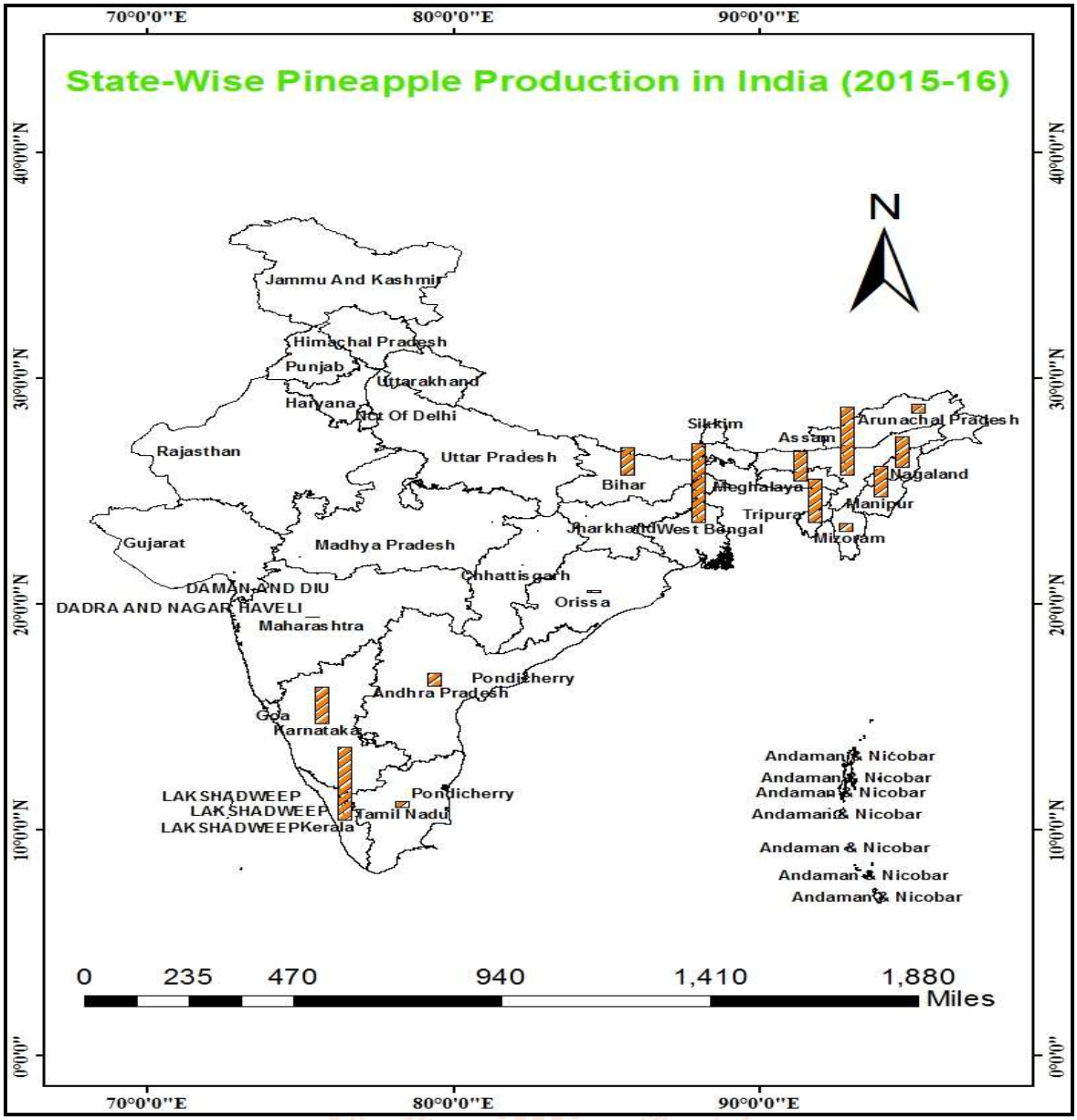

Fig. 1

5.2. AREA UNDER PINEAPPLE CULTIVATION IN INDIA: INTER-STATE GROWTH ANALYSIS

Area wise Assam possesses the largest area (16.20 thousands hectare) under pineapple cultivation in India followed by Manipur (13.66 thousand hectare) Tripura (12.69 thousand hectare) etc. Among top ten states in area under pineapple cultivation, Andhra Pradesh has the least area (3.79 thousand hectare) followed by Bihar (4.30 thousand hectare). During the last twenty years remarkably highest positive growth in area observed in Tripura i.e. 217.25 per cent followed by Kerala 119.4 per cent, Manipur 48.48 per cent etc. and negative growth observed in Arunachal Pradesh i.e. -1.97 per cent **(see table-2).** It is very important to note that during 1995-96 the area under pineapple in Tripura was only 4 thousand hectare which had increased tremendous rate and reached to 12.69 thousand hectare in 2015-16 within two decades.

Table 3: State-Wise Area under Pineapple and Its Growth in India (1995-96 to 2015-16)

S. No	States	Area (000 Hectare)		Growth (Per cent)
		1995-96	2015-16	
1	Assam	13.4	16.20	20.90
2	Manipur	9.2	13.66	48.48
3	West Bengal	9.1	11.0	20.88
4	Meghalaya	9.0	11.58	28.66
5	Arunachal Pradesh	7.1	6.96	-1.97
6	Kerala	5.0	10.97	119.4
7	Tripura	4.0	12.69	217.25
8	Andhra Pradesh	3.3	3.79	14.85
9	Bihar	3.3	4.30	30.30
10	Others	7.9	18.68	136.45
Total		**71.3**	**109.83**	**54.04**

Source: Ministry of Agriculture, Govt. of India (retrieved-indiastat.com)

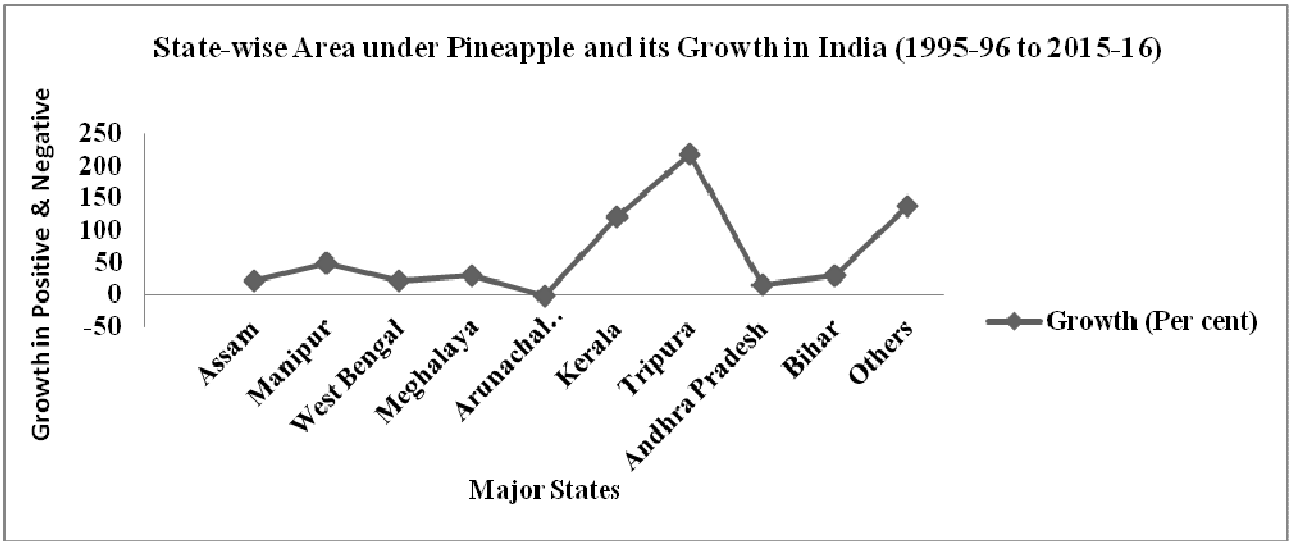

Fig: 2 Prepared by Author

5.3. PRODUCTION OF PINEAPPLE IN INDIA: INTER-STATE GROWTH ANALYSIS

Production of any horticultural fruits are played very significant role of country's economy. In this respect pineapple production of West Bengal contributes more to Indian agricultural GDP. West Bengal is the leading producer of pineapple among Indian states, it produced 232.6 thousand metric tons in 1995-96 which increased and reached to about 330.07 thousands metric tons in 2015-16 followed by Assam 199.9 thousand metric tons in 1995-96 and 285.17 thousand metric tons in 2015-16, Tripura 35.3 thousand metric tons in 1995-96 and 180.26 thousand metric tons in 2015-16 etc. Growth in production of pineapple shows the prospects of more pineapple cultivation in that particular area. Highest and rapid positive growth in production in last two decades had seen in the state of Tripura i.e.410.65 per cent, followed by Karnataka 365.30 per cent, Bihar 122.37 per cent etc. In the same way highest negative growth in production had seen in the states of Andhra Pradesh 68.26 per cent and Tamil Nadu 59.54 per cent. Although West Bengal is the leading producer of pineapple in both consecutive year i.e. 1995-96 and 2015-16 but its growth is almost constant or very low i.e. 41.90 per cent and average annual growth rate is 2.095 per cent **(table-3).**

Table 4: State-Wise Production and Its Growth in India (1995-96 to 2015-16)

S. No	States	Production (000 MT)		Growth (Per cent)
		1995-96	2015-16	
1	West Bengal	232.6	330.07	41.90
2	Assam	199.9	285.17	42.66
3	Andhra Pradesh	175.6	55.38	-68.46
4	Meghalaya	90.0	123.13	36.81
5	Manipur	66.0	128.51	94.71
6	Tamil Nadu	64.8	56.22	-59.54
7	Bihar	52.3	116.30	122.37
8	Tripura	35.3	180.26	410.65
9	Karnataka	33.4	155.41	365.30
10	Others	121.3	523.77	331.80
Total		**1071.2**	**1924.22**	**79.63**

Source: Ministry of Agriculture, Govt. of India (retrieved-indiastat.com)

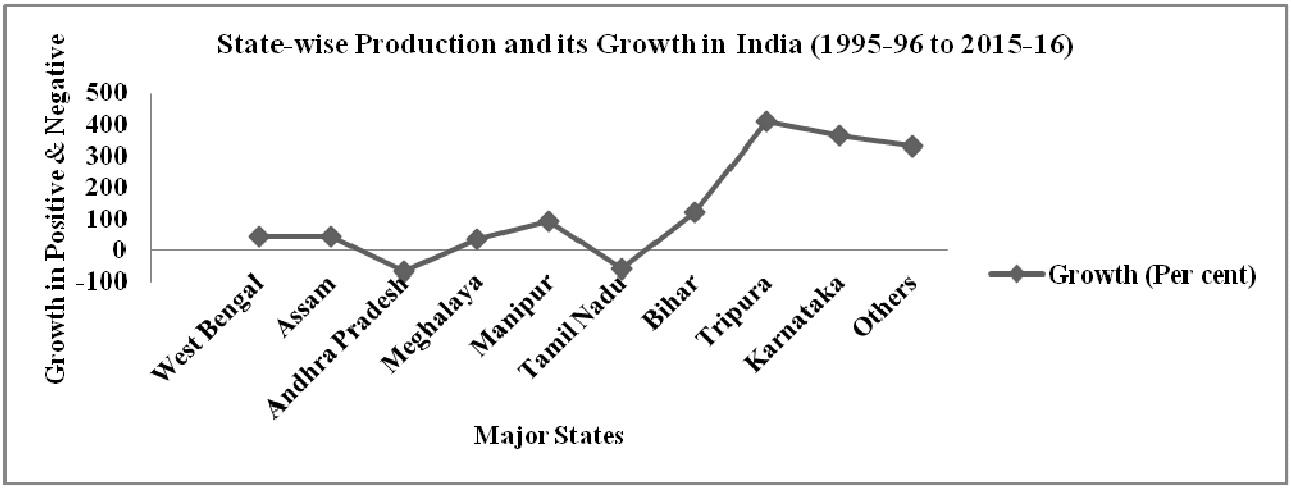

Fig: 3 Prepared by Author

5.4. PRODUCTIVITY OF PINEAPPLE IN INDIA: INTER-STATE GROWTH ANALYSIS

Productivity is one of the important indicators of pineapple cultivation through which output and benefit ratio can be estimated. In term of productivity, an enchanting feature of growth has been seen in Karnataka. In the last two decades, Karnataka recorded the highest positive growth in productivity accounting 406.63 per cent followed by Bihar 70.60 per cent, Tripura 61 per cent **(table-4).** In the same way a striking features has been seen in negative growth also in Andhra Pradesh. Andhra Pradesh recorded the highest negative growth in productivity during the last twenty years, accounting -72.54 per cent followed by -21.18 per cent **(table-4).** Low productivity of pineapple is mainly seen in north-eastern states. Overall growth in productivity in the last two decades in India is 16.8 per cent. The huge variation or difference in productivity among different states is clear from the studies of different literatures, are mainly due to inadequate farm management techniques i.e. improper use of suckers, less use of pesticides, more use of manures etc.

Table 4: State-Wise Productivity and Its Growth in India (1995-96 to 2015-16)

S. No	States	Productivity (MT/Hectare.)		Growth (Per cent)
		1995-96	2015-16	
1	West Bengal	25.56	30.0	17.37
2	Assam	14.92	17.60	17.69
3	Andhra Pradesh	53.21	14.61	-72.54
4	Meghalaya	10.0	10.63	6.3
5	Manipur	7.17	9.41	31.24
6	Tamil Nadu	43.2	34.05	-21.18
7	Bihar	15.85	27.04	70.60
8	Tripura	8.82	14.20	61.0
9	Karnataka	12.37	62.67	406.63
10	Others	15.35	29.64	93.09
Total		**15**	**17.52**	**16.8**

Source: Ministry of Agriculture, Govt. of India (retrieved-Indiastat.com)

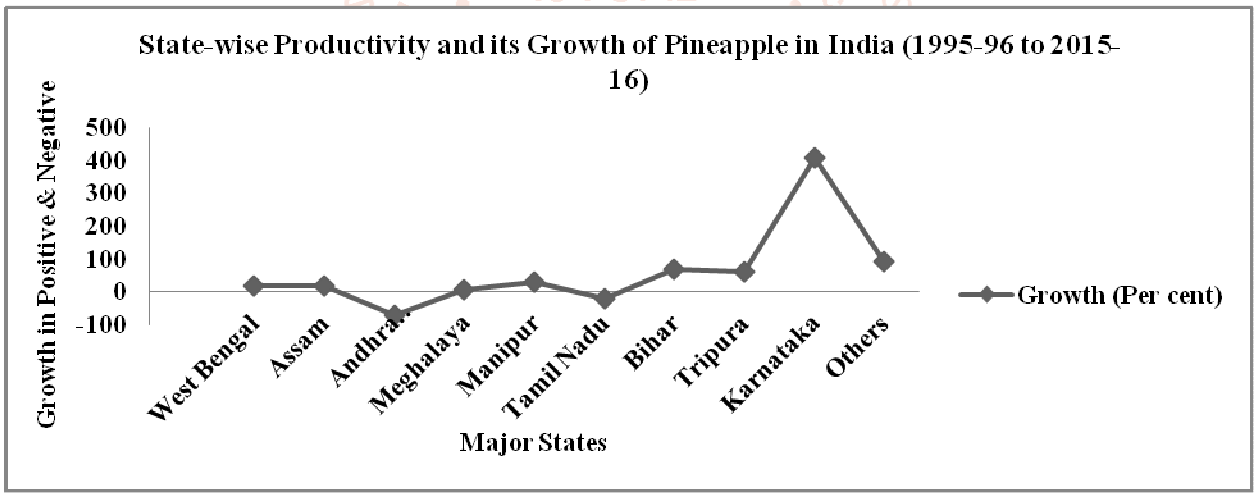

Fig: 5 Prepared by Author

CONCLUSIONS & RECOMMENDATIONS

Based on above findings finally it can be concluded that the area, production and productivity of pineapple in India is growing considerably lower rate during the last two decades. Area under pineapple is increased very faster rate in Tripura and Kerala while in Andhra Pradesh shown negative growth. Production is increased very faster rate i.e. three to four times in Tripura and Karnataka while negative growth in production shown in Andhra Pradesh and Tamil Nadu. The growth of productivity shown very fast rate in Karnataka followed by Bihar, Tripura etc. while in negative growth shown in Andhra Pradesh and Tamil Nadu. At present the performance of production and productivity of pineapple is higher in south Indian states like Kerala and Karnataka, east-Indian states like West Bengal and Bihar, north-eastern states like Tripura and Manipur. According to 2015-16 data, about 48 per cent production comes from seven sister states alone (Assam, Tripura, Meghalaya, Manipur, Mizoram, Nagaland and Arunachal Pradesh) about 23 per cent east India (West Bengal and Bihar), 28 per cent south India (Kerala, Karnataka and Andhra Pradesh and Tamil Nadu) 1 per cent rest of Indian states. It is obvious from the literature that the productivity contrast among different states in India is mainly due to lack of adequate knowledge regarding modern farm management technique, less awareness, less extension source from agriculture departments, lack of financial assistance to carry out the farm. Thus to improve productivity and production of pineapple, farmers have to adopt and apply better modern management techniques which are already being using higher productivity states like Karnataka, Tamil Nadu and Kerala. Government should provide financial assistance to pineapple farmers for purchasing timely chemicals and fertilizers, provide them time to time training and should install "Krishi mela" to aware the farmers for the sake of increasing production which will enrich the Indian wealth.

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