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RESEARCH PAPER

Growth rate of pineapple production in India

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Abstract: Pineapple (*Ananas comosus*) is one of the most important tropical and subtropical fruit of Bromeliaceae family, cultivated almost one third part of the world. Pineapple takes almost 16 -22 months to mature for harvesting. The main objective of this paper is to analyzed the growth rate in area, production and productivity of pineapple in India as well as Karnataka. The time series data from 2002-03 to 2021-22 for the study. The results revealed that the area (1.94%), production (2.56%) and productivity (0.64%) showed that positive and significant at one per cent level of probability in India. In Karnataka, the growth rate of productivity (0.99%) showed that positive and significant at five per cent level of productivity due to area expansion. For area (0.14%) and production (1.04%) showed positive and non-significant. Whereas, Cuddy Della Valle index (CDVI) for area, production and productivity were 6.79, 7.66 and 3.76, respectively in India. In Karnataka, the Cuddy Della Valle index (CDVI) for area, production and productivity were 10.55, 22.37 and 8.78. The slight variation in productivityof pineapple in India 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.

Key words: CAGR, CDVI, Compound annual growth rate, Cuddy della valle index, Growth rate, Instability, Pineapple

Introduction

Pineapple, scientifically known as *Ananascomosus,* is a tropical fruit that is cherished for its sweet and tangy flavor, as well as its unique appearance. Native to South America, particularly in regions like Brazil and Paraguay, pineapples have become a popular and sought-after fruit worldwide.

The pineapple plant belongs to the Bromeliaceae family and grows close to the ground, producing a single fruit on top of a sturdy stalk (Swamy *et al.* 2020). The fruit itself is characterized by its spiky, rough outer skin, which ranges in color from green to golden yellow when ripe. Inside, the edible portion is a juicy, fibrous, and succulent yellow flesh that has a delightful combination of sweetness and acidity.

Pineapples are not only enjoyed fresh but also processed into various forms, such as canned pineapple, pineapple juice, and dried pineapple. They are versatile in both sweet and savory dishes, finding their way into salads, desserts, drinks, and even main courses like pineapple-glazed ham. Additionally, the enzymes present in pineapples, such as bromelain, have been studied for their potential health benefits, including aiding digestion and reducing inflammation (Tegar *et al.* 2016 and Deokate *et al.* 2020)

Cultivation of pineapples requires a tropical or subtropical climate, as they thrive in warm temperatures and well-draining soil. The plant can take up to a couple of years to produce fruit, but once mature, it can yield multiple fruit in subsequent years. Commercially, major pineapple-producing countries include Thailand,Philippines, Costa Rica, and Indonesia. The pineapple's distinctive appearance, delicious taste, and versatility in culinary applications have made it a favorite among many cultures and cuisines around the world.

In India, pineapple is more commonly called as "Ananas". India is the seventh largest producer of pineapple.It produced 18.08 lakh metric tonnes of pineapple on 1.06 lakh hectares area and average yield of 17.06 MT/ha in 2022 (Anonymous).

In Karnataka, pineapple crop occupied an area of 2.96 thousand hectares during 2021-22 and was cultivated in 10 districts namely Shivamogga, Uttara Kannada, Dakshina Kannada, Udupi, Chikkamagaluru, Hassan, Kodagu, Mysuru, Mandya and Haveri were the most predominant pineapple growing districts.

Material and methods

The study is based on time series data from 2002-03 to 2021-22. The data has been obtained from electronic database of Horticultural Statistics Division, Department of Agriculture, cooperation & Farmers Welfare, Agriculture and Processed Food Products Export Development Authority (APEDA), Ministry of Commerce and Industry, Government of India. Besides this, various reports, projects and research articles have also been used to generate adequate information regarding the performance of pineapple cultivation in India as well as Karnataka.

The collected data than generalized and tabulation have been done by manually. For the analysis of data suitable statistical techniques have been used. To show the composition of area, production and productivity value statistical tools like growth rates and instability index is used. The following are the equations used in this paper.

Compound Annual Growth Rate (CAGR)

In order to analyze the growth rate of area, production and productivity of pineapple, compound annual growth rate and to know the variation in area, production and productivity of pineapple, instability index were computed using the following model.

$Y_t = ab^t e^u$

Where,

Y_t = dependent variable (area/production/productivity)

a = intercept term,

b = (1+ r) and 'r' is the compound growth rate

t = time period

u = error term.

The above model was expressed in logarithmic form as,

Log Y= log a + t log b+ log u

We can, thus, calculate the compound growth rate (r) as under:

CAGR (r) = (Antilog of log b -1) × 100

Where,

r = Compound growth rate per annum in per cent,

Cuddy Della Valle index (CDI)/ Instability index

The co-efficient of variation (CV) was used as the measure of instability as under,

CV (%) = (S.D / Mean) × 100

Instability index was calculated by using the equation given below,

Instability index = CV × $\sqrt{1- \text{Adjusted } R^2}$

Where,

'R^2 : Adjusted coefficient of determination

Results and discussion

Trends in area, production, and productivity of pineapple in India

The growth trends in the area, production and productivity depicted in Table 1, indicated the time series data for 20 years (2002-2022). The highest growth rate was registered for production (2.56%) followed by area and productivity with 1.94 per cent and 0.64 per cent, respectively and all were found to positive and significant at one per cent level of probability. The pineapple production was highest due to release of new high yielding varieties, the returns per rupee of investment was high as compare to other plantation crop, farmers are following solo cultivation of pineapple instead of intercropping and farmers are practicing modern production technology, export awareness to the farmers, which leads to increase in production and productivity.Whereas, the Cuddy-Della Valla Index (CDVI) for area, production and productivity of pineapple in the country showed 6.79 per cent, 7.66 per cent and 3.76 per cent, respectively. The result revealed that area, production and productivity shows that low instability because of over the years pineapple cultivation steadily increased and significant growth.

The results of the present study substantiate the findings of Parvej *et al.* (2020) and Devaraj (2021) who reported that there was a positive and significant growth rate in area, production and productivity of pineapple over the study period (from 1995-96 to 2015-16).

Trends in area, production, and productivity of pineapple in Karnataka

The compound annual growth rate in the area, production and productivity of the state are depicted in Table 2, indicates that for, in state the highest growth rate was registered by productivity was 0.99 was positively significant at a five per cent level of probability becausefarmers are following solo cultivation of pineapple instead of intercropping and adoption of modern agronomical practices.The growth rate of area and production were 0.14 per cent and 1.03 per cent, respectively, which were non-significant. Whereas, the CDVI for area, production and productivity of pineapple showed 10.55 per cent, 22.37 per cent and 8.78 per cent, respectively (Anbarassan *et al.*2021*).*The result indicated that area and productivity showed low

Table 1. Trends in area, production and productivity of pineapple in India

Year	Area (In'000 hectares')	Production (In '000 MT)	Productivity (In '000 MT)
2002-03	79.8	1171.7	14.7
2003-04	80.9	1234.2	15.3
2004-05	82.8	1278.9	15.4
2005-06	85.4	1352.1	15.8
2006-07	82.6	1362.1	15.8
2007-08	80	1224.6	15.5
2008-09	83.7	1340.8	16
2009-10	91.9	1386.8	15.1
2010-11	88.7	1415.4	15.9
2011-12	102.4	1505	14.7
2012-13	105.2	1570.6	14.9
2013-14	109.9	1736.7	15.8
2014-15	116.1	1984	17.1
2015-16	109.8	1924.2	17.52
2016-17	111	1861	16.77
2017-18	103	1706	16.56
2018-19	105	1729	16.47
2019-20	106	1732	16.34
2020-21	106	1799	16.97
2021-22	106	1808	17.06
CAGR	1.94***	2.56***	0.64***
CDVI (%)	6.79	7.66	3.76

Note: (Source: Indiastat.com, 2002-2022)

*** Significant at 1 per cent level of probability,

**Significant at 5 per cent level of probability,

^{NS} non-significant

Table 2. Trends in area, production and productivity of pineapple in Karnataka

Year	Area (In'000 Hectares')	Production (In '000 MT)	Productivity (In '000 MT)
2002-03	2.14	86.47	40.37
2003-04	2.39	118.23	49.34
2004-05	2.5	129.37	51.61
2005-06	2.77	155.1	55.82
2006-07	3.18	190.5	59.9
2007-08	2.87	177.4	61.7
2008-09	3	186.3	61.7
2009-10	2.8	177.27	63.3
2010-11	3	186.1	62
2011-12	2.3	162	58.2
2012-13	2.7	169.3	62.7
2013-14	2.7	160	58.9
2014-15	2.5	136.3	63.3
2015-16	2.48	155.41	62.74
2016-17	2.69	164.26	61.06
2017-18	2.62	163.73	62.42
2018-19	2.34	141.86	60.73
2019-20	2.43	135.74	55.98
2020-21	2.87	164.61	57.33
2021-22	2.96	169.54	57.34
CAGR	0.14^{NS}	1.03^{NS}	0.90**
CDVI (%)	10.55	22.37	8.78

Note: (Source: Directorate of Horticulture, Lalbagh, Bangalore, 2002-2022)

**** significant at 1 per cent level of probability,

** significant at 5 per cent level of probability,

^{NS} non-significant

instability and production showed medium instability because over the years area underpineapple cultivation steadily increased and production over years increased but not significant, in the year 2019-20 and 2020-21 decreases due to over intercropping with arecanut and banana crops and also COVID -19 pandemic. Similar findings were reported byAfzal *et al.*(2019), Priyadarshini *et al.* (2020) and Zainab *et al.*(2020) they reported the compound annual growth rate of productivity is 0.01 per cent which is increasing with an average annual growth rate of 1.01 per cent.

Conclusion

Based on above findings finally it can be concluded that thearea, production and productivity of pineapple in India showed positive and significant at one per cent level of probability. In Karnataka also productivity showed positive and significant at five per cent level of probability andthe area and production were positive and non-significant.

Study as a whole, the productivity contrast among different states in Indiais mainly due to lack of adequate knowledge regardingmodern farm management technique, less awareness, less extension source from agriculture departments, lack offinancial assistance to carry out the farm. Thus, to improveproductivity and production of pineapple, farmers have to adopt and apply better modern management techniques.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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