

## A STUDY ON THE GROWTH AND INSTABILITY OF THE BANANA MARKET IN TAMIL NADU

<sup>1</sup>Jansirani K , <sup>2</sup>Dr. Vijayakumari Joseph

<sup>1</sup>M.Phil, Research Scholar, Department of Commerce, Madras Christian College, Tambaram, Chennai, India.

<sup>2</sup>M.Com, B.Ed., Ph.D. Associate Professor & Research Supervisor, Department of Commerce, Tambaram, Chennai, India.

### ABSTRACT

In India, bananas are a major commercial plantation crop and one of the most traded commodities globally. Tamilnadu is one of the South Indian states contributing to India's banana production significantly. In India Tamil Nadu is the fourth-largest banana growing region. In Tamilnadu all the varieties of banana are grown. The purpose of this study is to investigate the productivity and production of bananas in Tamil Nadu, India, as well as the growth rate of the planted area. A time series collected between 2010–11 and 2022–23 serves as the study's main source of data. Trend analysis and the compound growth rate were calculated in order to understand the variations in growth rates. Tamil Nadu's productivity, output, and area all show negative growth rates. The identification of banana market instability is the second objective of this investigation. Using the Cuddy-Della Valle instability measure, it was shown that Tamil Nadu had higher productivity (12.81), output (24.5), and area (8.9).

**Keywords:** Banana market, Trendline, Compound growth rate, Instability Index.

### 1. Introduction

Agriculture and associated sectors, which employ more than 50% of the workforce and contributed more than 20.2% of the country's gross value added (GVA) in 2021–2022, are the backbone of the Indian economy. Agriculture is considered a cultural practice in India rather than a way to make money. The physio-geographical and climatic features of India make it the perfect location for horticulture crops. This atmosphere ensures the nation's capacity to grow all types of fresh fruit. In recent years, horticulture production in India has increased significantly. Significant progress has been achieved in the development of several horticultural crops, resulting in increased yields. Over the past 10 years, horticultural area expanded by 2.1% each year, while annual production climbed by 3.9%. Horticultural crops yielded 334.60 million tons in 2020-21 on 27.74 million hectares of land. Fruit production increased from 76.42 million tons to 102.48 million tons between 2011–12 and 2020–21, while vegetable production increased from 156.33 million tons to 200.45 million tons.

Bananas are so popular in India that both the affluent and the underprivileged enjoy them. Bananas are the least costly fruit in the country and may be referred to as the "poor man's apple" due to their high fruit and nutritional value. Bananas are widely grown in tropical, subtropical, and coastal parts of India, where they are the most produced crop and the third largest in area. It accounts for around 14% of the total area and 32% of total fruit crop production. India has 884.00 thousand hectares of land dedicated to banana production; the country produces around 30808.00 thousand metric tonnes of bananas per year, but its productivity in 2017–18 was just 34.85 metric tonnes per ha. Bananas are the most widely farmed and eaten fruit in India. India is the world's largest banana grower, accounting for 27.74% of total crop in 2009. Maharashtra, Tamil Nadu, Andhra Pradesh, Kerala, Karnataka, Bihar, and Gujarat are significant states that

grow bananas. The state recorded around 40 lakh tons of output in the past two fiscal years. With a 6% rise in planted area between 2019–20 and 2020–21, bananas are swiftly climbing to the top of Tamil Nadu farmers' favored crops lists. The state recorded around 40 lakh tons of output in the past two fiscal years. In 2019–20, India generated about 25% of the world's total banana crop, with exports of ₹660 crore. This became India the world's largest producer of bananas. Tamil Nadu is the world's fourth largest banana producer.

### **1.1 Banana Marketing in Tamil Nadu**

India is the world's largest producer of bananas, yet most of them are consumed in the country. The primary banana-growing states of Tamil Nadu, Maharashtra, Andhra Pradesh, Kerala, Karnataka, and Gujarat export it to other regions of the country. The southern states in India produce around 40% of the country's bananas, with Tamil Nadu accounting for 15% of total banana production. Grown in rural areas, these bananas are sent to markets in northern India. The popular internal marketing strategy for bananas is covered in this article. Bananas are usually sold at higher rates in northern Indian marketplaces since they are located further away from the main agricultural belts, which are mostly in the western and southern regions of the nation.

### **1.2 Steps Involved in Marketing Process**

- **Harvesting:** Harvesting banana bunches at different stages of maturity depends on the cultivar, market distance, and intended usage. Individual plant varieties and their characteristics within a given plantation determine the harvest index, or harvest time.
- **Preparation for marketing:** The majority of producers sell their fruit to pre-harvest contractors ahead of time, and only merchant contractors pick and get the food ready for sale. In India, post-harvest care for bananas is frequently lacking. Picked, assembled, and transported as such, they are not de-handled. The wholesaler prepares the market by ripening bunches. De-handling is the retailer's responsibility.
- **Packing:** Bunches are not packaged and are offered in their natural condition. Throughout handling and transit, bunches hold together. Dried banana leaves are used to cushion or wrap bundles before they are transported to distant markets in cars or railroad trains. As sales and transportation are determined by the number of bunches, there is no packaging unit.
- **Sorting:** The majority of India, including Tamil Nadu, sells bananas in large quantities. No sifting or grading of fingers or bunches is done by the farmers or the assembling centers. The fruits are arranged by size in the store.
- **Assembling:** The procedure of assembling bunches is essential. Harvesting ripeness is a labor-intensive operation in any banana plantation since different varieties, even those cultivated in the same garden, might vary in maturation. In polyclonal gardens, where producers, contractors, or village merchants gather bunches for the market, this is particularly true.
- **Growers:** Little or marginal farmers make up the bulk of banana producers in South India, and they do not perceive any financial gain from harvesting the fruit on a regular basis and selling their little quantities. Thus, intermediaries are essential. Growers only make up a small portion of the produce assembly—at most 10%.

- **Pre-harvest contractors:** In India, the main intermediaries for assembly are pre-harvest contractors. They create deals with tiny holdings by paying them in advance for the bunches and frequently visit their banana crops. Pre-harvest contractors are the main assembly agents; they work in and around all district markets and are in charge of over 80% of the quantity assembled. They also act as the main sources of finance for farmers.
- **Village merchant:** Village merchants reside in the villages that surround and are near shandies. In their capacity as commission agents or buyers, they collect bunches and arrange for their sale in the shandies. They make up 10% of the total product.
- **Storage:** Because bananas are perishable, their fruits decay fast at all stages and are not stored for long periods of time. Fully mature fruits harvested from gardens are sold within 7 to 10 days. Long-term storage is not possible during gluts since most markets lack cold storage facilities. Illnesses and postharvest deterioration account for 10–15% of output losses.
- **Transportation:** Bananas are transported throughout the state via headloads or horses over short distances in the hills, cart loads for somewhat longer routes, and lorries for greater distances. Truck transport relies more on interstate transportation because of the difficulty of arranging train wagons at the proper time.
- **Distribution:** Growers/producers, pre-harvest contractors, wholesalers, commission agents, and retailers are involved in the distribution of bananas.

## **1.2 Problems of Marketing Bananas**

The marketing of bananas is fraught with issues, and in the end, the farmer stands to make very little money from his harvest. The issues, listed in priority order, are as follows:

- Pre-harvest contractors establish price based on plantation rather than individual bunches, resulting in high costs for producers. In addition, they choose the top 90% of bunches during harvest and pay for 90% of bunches on the plantation.
- Limited transit alternatives and poor road infrastructure are among the challenges.
- Insufficient marketing funds might hinder avoiding commission agents and pre-harvest contractors.
- Inadequate storage space and significant pricing variances.
- Marketing involves a large number of profit-making middlemen.

## **1.3 Support from central and state government schemes**

### **• Primary Processing Centers**

The Tamil Nadu Supply Chain Management Project has established eight principal processing centers for bananas in Tamil Nadu. Two are in the Nilgiris, one in Coimbatore, one in Theni, and four in Trichy (Manachanallur-II, Lalgudi, Pidaramangalam, and M. Puthur). PPC acquired APEDA accreditation in M. Pudur, Trichy District.

- **Prime Ministers Formalization of Microprocessing Enterprises**

The Ministry of Food Processing Industries (MoFPI) has launched the all-India Centrally Sponsored PM Formalization of Micro Food Processing Firms Scheme (PM FME Scheme) to provide financial, technical, and business support for the improvement of existing micro food processing firms.

- **Food processing unit assistance**

Unorganized micro food processing facilities can get a credit-linked capital grant equivalent to 35% of the project cost for renovations, up to a maximum of ₹10 lakhs per unit. Members involved in micro food processing can also get ₹ 40,000 in initial funding to buy tiny instruments and operating capital.

- **Assistance with marketing and branding**

FPOs, co-ops, and SHGs may get up to ₹ 5 lakhs from the State Nodal Agency to prepare a Detailed Project Report (DPR) for proposals related to marketing and branding.

- **Support for the development of common infrastructure**

The concept for the establishment of common infrastructure included financial support. There are credit-linked grants available that can pay up to 35% of the project's overall cost.

- **Research and capacity building**

The conversion of disorganized micro food processing units into organized units requires training.

#### **1.4 Subsidy schemes available for setting up a Banana Ripening Chamber:**

- **Agricultural Marketing Infrastructure under NABARD (Central Government Scheme):** The scheme provides the following benefits when creating a banana ripening chamber with a maximum capacity of 5,000 MT or 50 MT: (i). Panchayati and Registered FPO businesses, female farmers and business owners, and SC/ST company owners and cooperatives would get 33.33% of the project cost, up to a maximum of ₹30 lakhs. (ii). For all other recipient categories, the maximum is ₹25 lakhs, or 25% of the project cost.

- **Agriculture Infrastructure Fund Scheme (Central Government Scheme):** The program offers financial support for starting a Banana Ripening Chamber in the form of interest subsidies of 3% annually for 7 years and credit guarantee coverage fees, which are made available on loans up to ₹ 2 crores through the CGTMSE (Credit Guarantee Funds Trust for Micro and Small Enterprises).

- **Assistance for the establishment of processing and supply chain infrastructure Beneficiaries:** APEDA-registered exporters, as well as public sector firms, are entitled to ask for assistance from central and state governments.

- a) **Integrated Pack House and processing facilities:** Equipment for collecting, cleaning, washing, sorting/grading, pre-cooling, packaging, and cold storage is available, as is a handheld Near-infrared Spectroscopy (NIR) device and hot water dip treatment. The pattern of assistance would be up to 40%, with a maximum of ₹ 200 lakhs.

- b) **Purchase of insulated, reefer transport /mobile pre-cooling units:** The assistance will be up to 40% of the total cost subject to a ceiling of ₹ 200 lakhs.

- c) Cable handling system for banana and other crops: The assistance will be up to 40% of the total cost subject to a ceiling of ₹ 200 lakhs.
- Food quality and safety Food processing establishments fill up the voids needed for goods with added value. Assistance will cover up to 40% of the overall cost, with a cap of ₹ 200 lakhs for detectors, sensors, vibrators, and any other equipment or technology that is needed.
  - Central and state government entities will establish common infrastructure facilities including laboratories, integrated pack houses, and processing units, among others. There would be a cap of ₹ 600 lakhs on the aid, with up to 90% of the authorized cost covered.

#### **1.4 Related Schemes of other Agencies National Horticulture Board (NHB)**

Construction, enlargement, and modernization of cold storage facilities for horticulture products are eligible for support under the NHB Scheme of Capital Investment Subsidy. These facilities can have capacities ranging from 5000 MT to 10,000 MT. This is an unrestricted credit-linked program with a 40% capital cost cap of up to ₹30.00 lakhs per project in the general region and a 50% cap of up to ₹37.50 lakhs per project in the case of NE &Hilly.

- **National Horticulture Mission (NHM):** Cold storage facilities up to 5000 MT in capacity are eligible for assistance via the NHM/HMNEH open-ended program. In general, credit-linked projects receive subsidies at a rate of 35% of the project's capital cost; in hilly and scheduled regions, the amount is 50%.
- **Small Farmer Agri-Business Consortium (SFAC):** support for the cold storage If the installation of cold storage represents no more than 75% of the total financial outlay (TFO), then cold storage setup as part of an integrated value chain project is eligible for funding. Projects receiving subsidies are eligible for funding at a rate of 25% of capital costs, with a cap of ₹2.25 crores in the general region.
- **Agricultural and Processed Food Products Export Development Authority APEDA):** It encourages the creation of cold chains as a means of expanding the industries related to the goods that are intended for export. Up to a maximum of ₹ 75 lakhs, cold chain projects that use automated handling equipment might receive a 40% subsidy.
- **Development Commissioner Micro, Small and Medium Enterprises (MSME):** The Small-Scale Industries (SSI) Technology Promotion and Upgrading Scheme is this. The Credit Linked Capital Subsidy Scheme (CLCSS) offered by DC MSME provides MSEs with a 15% subsidy on their investments in plant and machinery. A maximum of ₹1 crore can be spent in machinery and plants, and the highest grant amount is ₹15 lakhs.
- **Venture Capital by Small Farmer Agri-Business Consortium (SFAC):** Agribusiness companies can receive venture capital funding from SFAC in the form of equity. Either ₹50 lakhs or 26% of the promoter's equity is typically the amount of SFAC support. Following the repayment of the term loan, the venture capital will be returned to SFAC. Investment funds are offered by SIDBI

Venture Capital Ltd. (SVLC) Funds. The Smaridi Fund, one of the programs through which the SVLC supports MSMEs, has a capital of ₹450 crores provided by the Department for International Development (DIFD) UK and SIDBI. After seven years, the assistance, which ranges from ₹5 to ₹25 crores, would be paid back in equity and convertible securities.

- **Ministry of Micro, Small, and Medium Enterprise:** A budget of 210 crores has been allocated by the Ministry of MSME under its initiative for the Promotion of Innovation, Entrepreneurship and Agro-Industry to foster innovation and entrepreneurial culture at the local level.

**Table 1 Tamil Nadu Banana Market information**

Expanding Areas	Coimbatore, Erode, Thoothukudi, Tirunelveli, Trichy, Vellore, Kanyakumari and Karur districts
Tamil Nadu's Principal Markets	Trichy, Coimbatore, Theni
Preferred Types & Mixtures	Grand Naine, Dwarf Cavendish, Robusta, Rasthali, Poovan, Nendran, Red Banana, Ney Poovan, Pachanadan, Monthan, Karpuravalli
Grade Level Details	The hands are graded based on the number and size of fingers in each hand. Overripe and injured fruits are discarded. Banana is sent to the local market as bunches.

Source: TNAU AGRITECH PORTAL

### 1.5 Objectives of the study

- To analyse the growth & instability of production and market for bananas in Tamil Nadu.

### 2.0 Review of Literature

Bairwa et al. (2012) examined the development, performance, and instability of important fruit crops in the face of dwindling resource bases and dangerous horticulture. The Cuddy-Della Valle Index was used to calculate the Growth Rate Compound and Index of Instability. Despite fruit productivity being relatively stable over the previous decade, the study found that fruit production and area roughly quadrupled between 1991 and 2008. The output of papaya, sapota, grapes, and citrus is increasing more quickly. Production variability has been higher for bananas, citrus, mangoes, papayas, litchi apples, and sapotas, while production instability has been higher for bananas, papayas, and litchi apples.

The development patterns of the major crops and the level of instability as assessed by the Cuddy Della Valle index and Coppock's instability index were studied by Anjum and Madhulika (2018). Production, agricultural output, and growth pattern varied throughout time in the region. The production growth rate showed a range of variances for a variety of crops. According to both indices, area instability first declined before rising in the third period, but production instability grew over the course of the full crop.

In their 2019 study, Nagpure et al. examined the performance of the Indian banana trade using the Cuddy Della instability index, compound growth rate, and competitiveness optimization of the commodity's nominal protection coefficient (NPC). Throughout all of the years, the growth rate of banana imports was large and positively correlated with the quite excellent rate of expansion in banana exports from India. This was revealed during the first phase of the research, when 8.76% of imports grew at a high pace. Because of their increasing export competitiveness over time, bananas have an export advantage, according to the NPC research.

Rathod et al. (2020) examined trends in area, output, and productivity in Maharashtra, India, as well as worldwide. A number of horticultural database issues at the National Horticulture Board of the Department of Agriculture and Cooperation provided the secondary data. to investigate how the acreage, productivity, and output of bananas have expanded in the state, India, and globally during the course of the 57-year research period. The results of the study indicated that the compound annual growth rates of bananas for area and production during the whole period of 1960–2017 showed a significant rise for the world, India, and Maharashtra, respectively.

Using time series from 1950–1951, 2015–2016, and 2016, Anbarassan et al. (2021) examine the productivity and growth rate of bananas in Tamil Nadu and India. The trends are analyzed by computing the compound growth rate. In Tamil Nadu, the area, productivity, and production of bananas increased at respective rates of 2.04, 4.38, and 4.96. India and Tamil Nadu had almost identical rates of increase in area and output, but there was a notable difference in productivity growth rates, with India growing at 1.85% and Tamil Nadu growing at 4.96%.

From 2004–05 to 2018–19, Devaraj (2021) studied the performance of grape growth in the state of Karnataka during a fifteen-year period. The study found that grapes had the highest rates of growth in terms of area under cultivation, productivity, and production each year. The state's performance is marginally superior to that of India overall. The output, area instability, and productivity indices are all a little below the national average for India. The study's overall findings indicate that the State may still boost grape output by implementing the right production technology.

The trend, growth, and stability of bananas throughout the decade periods in Tamil Nadu and India were examined by Sathiya et al. in 2022. To assess the data, the study used the Coppock, Cuddy-Della Valle, and instability indices. Due to a mix of socioeconomic problems impacting fruit producers and climate change, banana production and area have decreased during the past five years. The area used to cultivate bananas in Tamil Nadu shrank when compared to the base year (2009–10). While output and productivity growth rates were positive throughout India, they were negative in Tamil Nadu, with the exception of productivity. The decrease in banana production was shown to be caused by the region and its relationships with other regions.

India's primary fresh fruit and vegetable crops were examined by Priyanka and Kerur (2023) in terms of their acreage, production, and growth patterns. CAGR and the instability index are used. The results pertaining to fresh fruits indicated that the other fresh fruits had the largest region with a favorable and significant development rate. based on indicators of instability that quantify changes in the size, productivity, and output of farmland. One of the freshest veggies, garlic, grew at a good and notable pace and had the biggest production and area.

### **3.0 Methodology**

Secondary data from the Department of Horticulture, the National Horticulture Board, the Ministry of Agriculture and Farmer Welfare, and the Government of Tamil Nadu plantation crops formed the basis of

the study from 2012–2013 to 2022–2023. This study included two important statistical techniques: compound annual growth (CAGR) and stability analysis (CV). One indicator of the past performance of an economic variable is growth. They are often used as a summary of patterns in time series data. As a measure of variability, an instability indicator is developed to examine the variability (CV) in banana output.

### Compound annual growth rate

Time series data on banana area, production, and productivity in India and Tamil Nadu were gathered from government papers, NHB Publications (2011–2023), and Horticultural Statistics at a Glance (2012–2021) for the years 2012–2013 to 2022–2023. Through the use of the exponential function model, the annual compound growth rates for banana area, production, and productivity in Tamil Nadu, India, are determined.

### Index of instability:

To study the variability in the area and production of grapes, an index of instability was developed as a measure of variability. Cuddy and Della's (1978) formula are applied to get the index of instability. When  $R^2$  is significant, the coefficient of variation is multiplied by the square root of the difference between the unity and coefficient of multiple determinations ( $R^2$ ).

$$\text{Index of instability} = (\text{SD} / \text{MEAN}) \times 100 \times \sqrt{1 - R^2}$$

## 4.0 Analysis and Discussion

In the past several years, Tamil Nadu's banana-growing area has grown; from 4.18 thousand hectares in 2010–11 to 7.52 thousand hectares in 2022–2023, the area under crop has expanded. The whole production of bananas increased to 6,834.14 thousand tons between 2010–11 and 2022–23. The reason for this massive increase in output was climate conditions that are favorable for bananas and Tamil Nadu banana processing. Also, a remarkable yield was estimated with the help of the State Horticultural Department of the Tamil Nadu government and the growing demand for bananas in the area.

**Table 2: Area, Production and productivity of Banana in Tamil Nadu**

Year	Area (in '000 Ha)	Production (in '000 MT)	Productivity (in MT/HA)
2010–11	125.4	8253	65.8
2011–12	130.4	6736.4	51.7
2012–13	111.4	5136	46.1
2013–14	118.04	5650	47.9
2014–15	95.24	4148	36
2015–16	94.61	4332	45
2016–17	94.98	3499	37
2017–18	82.63	3205	39
2018–19	85	3154	37.1
2019–20	92.41	3987	43.1
2020–21	98	3896	40.8
2021–22	102.18	3954	38.6

2022–23	109.7	4522.6	41.2
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Source: Horticultural Statistics at a Glance – Ministry of Agriculture & Farmers Welfare, India. And National Horticulture Board & Department of Horticulture, Government of Tamil Nadu.

From Table 2, it is understood that in the year 2010–11, the production of bananas was 8253 thousand mt with a productivity of 65.8 mt/ha for the same period in Tamil Nadu. Production in Tamil Nadu decreased from 2016–17 to 2021–22. Production increased to 4522.6 thousand mt/ha in 2022–2023 with a productivity of 41.2 mt/ha, covering 109.7 thousand ha. Nevertheless, due to a lack of chain management concepts, a poorly managed supply chain, and intermediaries controlling the market, this productivity boost was only modest and unimpressive.

### Growth rate and Instability

The area, productivity, and production of bananas during a thirteen-year period were examined in order to assess their instability. Instability metrics such as the coefficient of variation. findings from the Cuddy-Della Valle index calculation. The fundamental coefficient of variation (CV) is used to quantify volatility in agriculture, although it often include a trend component, which raises the level of instability in time series data that is characterized by long-term trends. This problem was circumvented in this work by using the Cuddy-Della instability measure, which corrects the coefficient of variance. Compared to other instances, Tamil Nadu's production factor instability was higher, and the area clearly shows volatility for India.

**Table 4: Growth & Instability in Area, Production and Productivity of Bananas in Tamil Nadu**

	Area	Production	Productivity
	Tamil Nadu	Tamil Nadu	Tamil Nadu
<b>Compound Annual Growth Rate %</b>	<b>(-4.5)</b>	<b>(-1.024)</b>	<b>(-3.5)</b>
<b>Average</b>	<b>103.0762</b>	<b>4651.769</b>	<b>43.79231</b>
<b>Standard Deviation (SD)</b>	<b>14.31993</b>	<b>1416.483</b>	<b>7.786819</b>
<b>Co-efficient of Variation (CV) %</b>	<b>13.89257</b>	<b>30.45042</b>	<b>17.78125</b>
<b>R<sup>2</sup></b>	<b>0.591</b>	<b>0.3541</b>	<b>0.4808</b>
<b>Instability Index %</b>	<b>8.9</b>	<b>24.5</b>	<b>12.81</b>

The acreage, productivity, and output of bananas in Tamil Nadu and India are shown in Table 4 along with their compound growth rate. It clearly shows that the banana growth rates in Tamil Nadu were negative -4.5, -1.02, and -3.5 for area, productivity, and production, respectively. Tamil Nadu's banana production CAGR has been dropping, based on the statistics. Additionally, the production's growth rate is negative. This implies that in order to produce a substantial amount of product, the State must increase its capacity. Despite a drop at the state level and a gain in the area under vine and production in India, the CAGR in

productivity per hectare has shown a negative growth in Tamil Nadu. The equivalent coefficients of variation in production for Tamil Nadu are 30.45%.

## **5.0 Conclusion**

The growth pattern and instability of the banana were examined in this study using the Cuddy Della Valle index and compound growth rate. Over time, the area's growth pattern, productivity, and banana output all changed. The area growth rate of India, on the other hand, was marginally rising, while Tamil Nadu's was continuously falling. Negative growth rates were seen in Tamil Nadu's banana-growing area. In the same way, India's output growth rate fluctuated during the study period. Production instability has been increasing over time. The similar conclusion on the volatility of productivity has been found by the index. The fluctuations in production have gone up and down. In Tamil Nadu, the region's level of instability has been steadily decreasing over time. The study does an empirical investigation of the productivity variability and production performance of bananas in Tamil Nadu, India, in order to empower the State to choose suitable measures to maintain or improve output and lower productivity variability. Determining the growth trend of area, output, and productivity is the aim. The adoption of appropriate rules, such as advance contracts and insurance, should be used to reduce production risk in order to promote sustainable banana production in Tamil Nadu. It is necessary to develop high-yielding cultivars that are disease and pest resistant because the State's banana output has lately stalled.

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