

# The trend in area, production, productivity of cashew nut in

India

With special reference to Kerala.

## ABSTRACT

**Aims:** Cashew is one of the most valuable processed nuts on global commodity markets and has the potential to generate employment and revenue for developing countries. India is the second largest exporter of cashew kernels in the world and earns a sizeable amount of foreign exchange. In India, cultivation of cashew is confined to Kerala, Karnataka, Goa and Maharashtra along the west coast and Tamil Nadu, Andhra Pradesh, Orissa and West Bengal along the east coast. Cashew trees tend to be grown on marginal and less fertile land and may continue to produce for many years without the intensive inputs and labour that other crops require. Considering the promising future of the cashew market, the study aimed to analyse the trend and pattern of the cashew area, production and productivity in Kerala.

**Methodology:** For the purpose of the study, secondary data were collected for the period of 2000 – 2020 (20 years) from authenticated source like Ministry of Agriculture and Farmers Welfare.

**Results:** The study highlighted there is a continuous decline in area under cultivation. However, a proportionate decrease in production, that will results in a stable productivity.

**Conclusion:** The easiest way to overcome the situation is to bring more area under cashew by encouraging farmers to adopt cashew cultivation in their lands and also in homesteads, barren lands under the procession of government and public sector undertaking, and if they are replanted with high-yielding varieties, the production could be enhanced. If it happens in the future, definitely Kerala will occupy the top place in the production of cashew in India.

**Key words:** Area, Compound annual growth rate, Production, Productivity, and Trend.

## INTRODUCTION

The cashew (*Anacardium occidentale* L), popularly known as the "miracle nut," is one of the most valuable processed nuts sold on global commodities markets, as well as a significant cash crop. It has the potential to be a source of income for cashew producers, to empower rural women in the processing industry, to create jobs, and to earn foreign revenue through exports. (Kulkarni, 2012). Cashew is a very

lucrative and nutrient-dense crop. The cashew tree is said to have originated in Brazil and has since spread around the world, mostly for soil conservation, afforestation, and wasteland development. The term 'cashew' comes from the Brazilian word 'acajaiba' and the Tupi word 'acaju,' which the Portuguese shortened to 'caju,' and is known in India as 'kaju.' It's called 'Paragi Andi' in Kerala, which means foreign nut, 'Lanka Beeja' in Orissa, which suggests it came from Sri Lanka, and 'Mundiri' in Tamil Nadu, which refers to the nut's form. Cashew trees are mostly grown in Asia, Africa, and Latin America. (Ashalatha, 2000). India and Vietnam, as well as Indonesia, the Philippines, Malaysia, Thailand, and Sri Lanka, are key producers in the Asiatic zone. Nigeria, Côte d'Ivoire, and Tanzania, as well as Benin, Guinea Bissau, Mozambique, Ghana, Senegal, and Madagascar, are the top producers in the African zone. Brazil, together with Columbia, Costa Rica, Honduras, and Salvador, are the leading producers in the Latin American zone (Pillai and Santha, 2008).

The Portuguese brought cashew to India's Malabar Coast in the 16th century, and the Malabar Coast acted as a dispersal point for cashew to other parts of the nation and Southeast Asia. Cashew was once primarily thought of as a crop for afforestation (Chandrasekaran, G. and Jeyakumar, 2014). It has become a crop of significant economic and commercial significance due to its ability to adapt to a variety of agro-climatic conditions. Cashew occupied 8.68 lakh hectares in the nation in 2007-08, with a yield of 6.65 lakh MT (Singh, 2002). Cashews are mostly produced in India's coastal states. It is grown on the west coast in Kerala, Karnataka, Goa, and Maharashtra, and on the east coast in Tamil Nadu, Andhra Pradesh, Orissa, and West Bengal (Abdul Salam et.al, 1991)..

Kannur, Kasargod, Malappuram, Palakkad, and Kollam are the major districts in Kerala where cashews are grown. In 2018, Kerala's total cashew area and production were 82,000 hectares and 88,000 metric tonnes, respectively, with a productivity of 1.06 metric tonne per Hectare. (Agricultural Statistics 2018-2019). Kannur district ranked highest in cashew output, accounting for 67.6percent of total production, followed by Kasargod and Kollam. (Sisili, 2018). Despite the fact that Kerala is fifth in cashew production in India, it is first in processing and exporting, followed by Tamilnadu, Karnataka, and Andhra Pradesh. (Binu, 2018). However, from the year 2013, both the area and production of cashews in Kerala have been steadily declining. (Annual Report of CEPCI, 2018). In this case, the study's goal is to analyse the trend in cashew area, production, and productivity in Kerala in order to determine the cashew's growth rate and, if necessary, to make recommendations for improvement.

## **MATERIALS AND METHODS**

For the purpose of the study, secondary data were collected for the period of 2000 – 2020 (20 years) from authenticated source like Ministry of Agriculture and Farmers Welfare.

## Application of statistical tools

### Growth Rate

The growth rate method is a simple tool to calculate the growth of time series data. The growth rate is calculated by subtracting the past value from the present value, and the result obtained is divided by the past value. The growth rate is converted to a percentage by multiply the growth rate by 100.

$$\text{Growth rate} = \left[ \frac{\text{Present value} - \text{Past value}}{\text{Past value}} \right] * 100$$

### Annual Growth rate (AGR)

The Average Annual Growth Rate is the average increase or decrease in the value over a specified period of time. The Average Annual Growth Rate is determined by taking the numerical mean of specified year to year growth rates.

$$\text{Annual Growth Rate} = [(\text{growth rate})_y + (\text{growth rate})_{y+1} + \dots + (\text{Growth rate})_{y+n}] / N$$

Where:

- Growth Rate (y) – growth rate in year 1
- Growth rate (y+1) – growth rate in the next year
- Growth rate (y+n) – growth rate in the year “n”
- N - Total number of periods.

### Compound Annual Growth Rate (CAGR)

Compound Annual Growth rate is the most commonly used measure of growth rate for the study of growth performance and thereby the export performance. The compound annual growth rate is estimated using:

$$\text{CAGR} = (V_{\text{final}} / V_{\text{begin}})^{1/t} - 1$$

Where:

- $V_{\text{begin}}$  – beginning value
- $V_{\text{final}}$  – final value
- t- Time in years

### Co-efficient of Variation (CV)

The coefficient of variation is a statistical tool that represents the ratio of the standard deviation to mean. It is a statistical tool for comparing the degree of variation from one data to another.

$$CV = (\sigma/\bar{X}) \times 100$$

**Where:**

- CV is the coefficient of variation,
- $\bar{X}$  is the mean,
- $\sigma$  is the standard deviation.

### **Standard deviation (SD)**

Standard Deviation is the measure of the dispersion of a set of data from its mean. It measures the absolute variability of a distribution; the higher the variability, the greater the standard deviation.

$$\sigma = \sqrt{\sum(x - \bar{x})^2/n}$$

**Where:**

- X is the variables,
- $\bar{x}$  is the arithmetic mean,
- n is the number of observations.

### **Cuddy Della Valle Index**

The instability index is the analytical tool to find the instability or fluctuations in any time series data. Instability analysis in export quantity and value of cardamom is studied using instability measures such as Cuddy Della Valle Index and Coefficient of Variation. Cuddy Della Valle index is used to measure instability in data. This index de-trends the coefficient of variation when it over-estimated and gives a clear direction of instability. The formula for CDVI as follows:

$$CDVI = CV \sqrt{1 - R^2}$$

Where CDVI is the instability index (in percent), CV is the coefficient of variation (in percent) defined as the ratio of the standard deviation to its mean, and  $R^2$  is the adjusted coefficient of determination. A low-value index indicates low instability.

### **Ordinary least square regression analysis**

Ordinary least square regression is commonly named linear regression (simple or multiple), one of the most frequently used statistical methods. Regression analysis is a quantitative method used to test the type of relationships between a dependent variable and one or more independent variables. The basic form of the regression model includes unknown parameters, independent variable, and dependent

variable. The regression equation is used to predict 'y' when the value of 'x' is given. Both 'y' and 'x' are two sets of measures of a sample size of 'n'. The linear regression equation is

$$y = a + bx$$

$$b = \frac{n\sum xy - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

$$a = \frac{\sum y - b \sum x}{n}$$

**Where,**

- y = dependent variable
- a = constant of equation
- b = slope of the regression equation
- x = independent variable
- n = number of observations.

Regression analysis helps to validate whether the predictor variables are good enough to help in predicting the dependent variable. The independent variable is a good predictor of the dependent variable when the coefficient of determination is high. The coefficient of determination,  $R^2$ , is percentage variation in y explained by x- variables. The value of  $R^2$  lies between 0 and 1. If  $R^2$  is high, it indicates that the higher amount of variability is explained by the model.

$$R^2 = 1 - (\text{RSS}/\text{TSS})$$

$$= \frac{\sum (y_i - \hat{y}_i)^2}{\sum (y_i - \bar{y})^2}$$

**Where,**

- $y_i$  = actual y value
- $\hat{y}_i$  = predicted value of y
- $\bar{y}$  = mean of y
- RSS – Residual sum of square
- TSS – Total sum of square

The adjusted R-squared is an improved version of R-squared, which shows whether adding additional independent variables or predictors improves the regression model or not. A lower adjusted R-squared value denotes that the additional predictor variables do not add value to the model.

$$\text{Adjusted } R^2 = 1 - \frac{(1 - R^2)(N - 1)}{N - k - 1}$$

## N-K-1

Where,

- $R^2$  – sample R – squares
- K- Number of independent variables
- N – Total sample size.

## RESULTS AND DISCUSSIONS

### Trends in area, production, the productivity of cashew in Kerala

In Kerala, the area under cultivation and output has nearly halved in the previous 20 years, while productivity has continuously fallen. The following table shows the area, production, and productivity in Kerala:

**Table 1 Growth analysis of area, production, productivity of cashew in Kerala 2000- 2020**

Years	Area (In'000 Hectare)	Annual growth rate of area (in Percentage)	Production (In'000 MT)	Annual growth rate of production (in Percentage)	Productivity (In MT/Hectare)	Annual growth rate of productivity (in Percentage)
2000-2001	120		76		0.6	
2001-2002	120	0	87	14.47	0.7	16.67
2002-2003	120	0	94	8.05	0.8	14.29
2003-2004	101	-15.833	95	1.06	0.9	12.50
2004-2005	102	0.990	64	-32.63	0.6	-33.33
2005-2006	80	-21.569	67	4.69	0.8	33.33
2006-2007	80	0.000	72	7.46	0.9	12.50
2007-2008	84	5.000	78	8.33	0.9	0.00
2008-2009	70	-16.667	75	-3.85	1.1	22.22
2009-2010	72	2.857	66	-12.00	0.9	-18.18
2010-2011	78	8.333	71	7.58	0.9	0.00
2011-2012	82.9	6.282	74	4.23	0.9	0.00

2012-2013	84.88	2.388	76.96	4.00	0.9	0.00
2013-2014	84.9	0.024	80.1	4.08	0.9	0.00
2014-2015	84.5	-0.471	80	-0.12	0.9	0.00
2015-2016	87	2.959	72	-10.00	0.8	-11.11
2016-2017	90.87	4.448	83.98	16.64	0.92	15.00
2017-2018	92.81	2.135	88.18	5.00	0.95	3.26
2018-2019	96.65	4.137	82.89	-6.00	0.85	-10.53
2019-2020	90.65	-6.208	87.03	4.99	0.96	12.94

**Source:** Ministry of Agriculture and Farmers Welfare, Govt. of India.

Table 1 show that the area, production, and productivity of cashews in Kerala have been varying as farmers have migrated to more lucrative crops such as rubber and other plantations. The table reveals that the area under cultivation was 120 thousand hectares in 2000-2001, but that it has decreased to 70 thousand hectares in 2008-09, implying that roughly half of the cashew farming area has transferred to other uses. In 2008, the area used for cashew farming was quite low, and Kerala had enormous tracts of unplanted cashew fields (Sisily, 2018). Unlike in Maharashtra, where cashew was promoted with state government help, there are no incentives for this crop in Kerala like there are for other plantation crops. Farmers are discouraged from cultivating cashew as a result of this. The fall in cultivation area is mostly due to land scarcity, current land ceiling rules, and the continuous rejection of cashews plantation status. During the research period, the area under cultivation in Kerala has been declining (Mahantesh, 2018). Between 2010 (8 percent) and 2020 (-6.20 percent), the area showed high percent growth, with a fall of less than 14 percent. After 2009, the amount of land under cultivation decreased dramatically. According to Sisily's literature (2018), this is mostly due to challenges experienced by farmers, such as a lack of innovations to meet rising needs and an inability to update systematic and scientific development plans in the cashew industry. Many farmers have switched their crops to other crops, and some places have become uncultivable as a result of the fall in area under cultivation. Pests and diseases such as the tea mosquito, the cashew stem and root borer, insufficient storage of dried nuts, and climate change have resulted in low quality and immature crops, and continuing losses have resulted in moving cashew production to other countries (Veeranjaneya, 2018).

The production was 76 thousand MT in 2000-01 and 64 thousand MT in 2004-05, a reduction of twelve percent in just five years. According to Sisily's 2018 study report, production has decreased dramatically owing to a scarcity of high-yielding variety seeds as well as tree senility. Kerala, on the other hand, contains large sections of cashew plantations that have yet to be replanted. As a result of the poor productivity per hectare, output has decreased; a key reason for the unpredictability of cashew agriculture

is that over 70percent of the cashew trees in the state are old, native types that begin fruiting late in the season. Climate change has an impact on cashew production as well. Seedlings of poor grade derived from poor quality raw nuts. In recent years, several attempts by cashew export promotion organisations to improve the production of high-quality cashews have resulted in a small rise in output.

During the study period, production fluctuates as well. The lowest productivity was achieved in 2004-2005 (-33.33 percent), while the highest productivity was registered in 2008. (22.22 percent). According to Veeranjaneya literature (2018), productivity declined in 2018 as a result of a combination of severe rainfall and high relative humidity during blooming, which resulted in flower and fruit loss as well as fungal infections. Bug and stem borer infestations in cashews resulted in lower yields, and the multiplication procedures, as well as the seedlings employed for plantation expansion, were done in an unprofessional way. According to Sisily's 2018 study report, the investment in growing a cashew plantation is relatively low, but the return is beneficial. The percentage gain in productivity has been nil for many years. Following 2018, steps were taken to increase production by commercialising cashew as a plantation crop, finding new markets, strengthening non-traditional markets, and adding value to the product through processing and branding improvements. The government's attempts to extend the area under cashew cultivation in the state while also achieving greater output through vertical growth by cultivating High Yielding Varieties (HYV) of cashew have enhanced productivity in the year 2020. (KSACC,2020).

**Table 2 Growth in area, production, and productivity of cashew in Kerala 2000 to 2020**

	Area	Production	Productivity
Average Annual growth rate (AAGR)	-1.12	1.367	3.661
Compound Annual Growth Rate (CAGR)	-1.465	-91.278	-99.979
Standard Deviation (SD)	14.938	8.844	0.118
Mean (Average)	91.108	78.507	0.859
Co-efficient of Variation (CV)	16.396	11.266	13.758
R <sup>2</sup>	0.007	0.209	0.293
Adjusted R <sup>2</sup>	0.007	0.165	0.253
Cuddy Valle Instability Index (CDVI)	16.338	10.28	11.89

**Source:** (figures are the researcher's calculation based on the data collected from Ministry of Agriculture and Farmers Welfare, Govt. of India).

The growth performance of cashew in terms of area, production, and productivity was analysed by computing the Compound Annual Growth Rate (CAGR), and Average Annual Growth Rate (AAGR). CAGR is the mean annual growth over a specific time, and it represents one of the most accurate ways to

determine the rise or fall in value over time. AAGR determines long-term trends. From table 1, it can be concluded that the compound annual growth rate of the area of cashew cultivation shows a negative growth of 1.12 percent, which indicates no growth in the area from 2003 – 2004 to 2019-2020. The CAGR of the production of cashew is -91.27 percent, and productivity is -99.97 percent whereas, the AAGR of production is 1.367 percent and productivity is 3.661 percent. It is observed that the average area during the study period is 91.108 (in'000 Hectars), but only the first ten years having an area of cashew is above the average. The average production and productivity of cashew are 78.50 MT and 0.85 MT/ha, respectively. From 2000-2001 to 2009-2010, cashew production is below the average production. Likewise, productivity until 2010-2011 is below the average value. The decline of cashew cultivation in the state includes the pronounced seasonality of the cashew production cycle, high sensitivity of yield to weather conditions, unattractive prices, land ceilings for cashew plantations (which existed until recently), senility of the trees, and the non-agricultural orientation of landowners were found as the major reasons for the decline of cashew cultivation in the state (Mahantesh, 2018).

Standard Deviation measures how annual value varies from the expected value. The standard deviation of area and production is higher than cashew productivity; thus indicating the higher variability in cashew area and production. The SD of area and production is 14.9 and 8.8 respectively, whereas, the SD of productivity is 0.118. The productivity shows a lesser variability when compared to area and production. The higher value of SD indicates low precision and high variability.

The instability in the area, production, and productivity of cashew in Kerala during the period 2000-2001 to 2019-2020 is calculated using the coefficient of variation and Cuddy Della Valle Index. The coefficient of variation for the area is 16.396, while the production and productivity value showed higher instability with a value of 11.266 and 13.758 coefficient of variation. The average area during the study period is 91.108 (in'000 hectares), and the average value of production and productivity is 78.507 MT and 0.859 (MT/ Hectare) respectively. The Cuddy Valle Index of area, production, and productivity during the study period is 16.338, 10.28, and 11.89 percent, which indicates the instability is higher in the area. The standard deviation and instability are high in the area when compared to production and productivity.

## **CONCLUSION**

From the analysis it can be concluded that there is a continuous decline in area under cultivation. However, a proportionate decrease in production, that will results in a stable productivity. The demand for cashew nuts continues to rise in India and throughout the world. Cashew production is steadily declining in most districts, particularly in Kerala, compared to previous years. The simplest method to alleviate the issue is to encourage farmers to grow cashew on their fields, as well as in homesteads, barren areas under the control of government and public sector undertakings, and to replant them with high-yielding types. If this occurs in the future, Kerala will undoubtedly take the lead in cashew production in India.

## REFERENCES

Abdul Salam, M. Aravindakrishanan and Pushpalatha. "Recent Trends in Cashew Production Technology", Cashew Bulletin 28.5 Cochin: CEPC 1991, pp. 10-13.

Ashalatha. Export and trade performance of Indian cashew. M.Sc(Ag) Thesis, University of Agricultural Sciences, Bangalore. 2000. 104p.

Binu, B.J. 2018. Problems and prospectus of cashew based industry in Kerala. Econ. Dev. India. Swaranjali publications. 2018.

CEPCI [Cashew Export Promotion Council of India]. 2018. Annual Report 2017-2018. Cashew Export Promotion Council of India, Kollam, 10p.

Chandrasekaran, G. and Jeyakumar, M.R. A study on export potential of cashew from India - with special reference to Kerala. Int. J. Econ. Bus. Rev.2014. 2 (11):167-174.

GOI [Government of India]. 2020. Ministry of Agriculture and Farmers Welfare, Govt. of India. [on-line]. Available: <https://agricoop.nic.in/en>. [15 December 2021].

GOK [Government of Kerala]. 2018. Agricultural statistics 2018. [on-line]. Available:[http://ecostat.kerala.gov.in/images/pdf/publications/Agriculture/data/201819/rep\\_agristat\\_1819.pdf](http://ecostat.kerala.gov.in/images/pdf/publications/Agriculture/data/201819/rep_agristat_1819.pdf) [10 Dec. 2019].

Kulkarni, B.S., Ramachandra, V.A, and Patil, S.M. 2012. Trends in area, production, productivity of cashew in India- an economic analysis. Int. J. Commer. Bus.Manag. 5(2):128-133.

Mahantesh, N., Manjunatha, P. Trends in area, production, yield and export – import of cashew in India – an economic analysis. Int. J. Curr. Microbiol. Appl. Sci. 2018. 7(12): 1088-1988.

Patil, B.L. Production and export performance of cashew – an economic analysis. Int. J. of Comm. and Bus. Mangt. 2005. 5 (4): 28-32.

Pillai, Rajmohan and Santha, P. (2008). The world cashew industry, Rajan Pillai Foundation, Kollam (KERALA) INDIA.

Sisili, T. Analysis of cashew nut production in Kerala state. Int. J. Adv. Res. Innov. Ideas Educ. 2018. 3 (6):568-576.

Singh, H.P. (2002). Indian cashew: Issues and strategies, Kochi, DCCD, 2002.

Veeranjaneya, K.P., and Krishna, B. An economic analysis of cashew industry in India. Int.J. Manag. Stud. 2018. 4 (4):85-92.

UNDER PEER REVIEW