Original research Article

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: among the total area (1125'000 ha) and production the (703'000 MT) in India, Kerala contributed only 8.5 percent area and 12.37 percent of production in the last year (2020). The trend in area, production and productivity shows a negative compound annual growth rate during the study period. This is mainly because; many of the farmers have shifted their crops to other lucrative crops like rubber and other plantations. As they found that these crops are profitable than cashew, moreover, compared to plantation crops, cashew still confined mostly to marginal and poor fertile lands and is considered as a wasteland crop and the recommended package of practice is not followed. This result in lowering the production and the productivity

Conclusion: Farmers will benefit if they tap the opportunities of increasing demand of cashew in India and at the world level with the government support. The government may provide subsidy to farmers, to replant the aged plants with high yielding varieties which will in turn result in high productivity. As the expansion of area under cashew cultivation is difficult to achieve due to little wasteland is available and on better soil (Vernon, 1997), the homesteads and barren lands under the possession of government can be utilised for the cashew cultivation. This will help to restore the top position by the Kerala state, in the production of cashew nut 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.

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

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:

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

Where:

- V_{begin} – beginning value
- V_{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 = $(\sigma/X)^{-}$* 100

Where:

- CV is the coefficient of variation,
- $\overline{X}$ is the mean,
- σ 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.

$$\sigma = \sqrt{\Sigma(x - x)2}/n$$

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.. 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

$$y = a + bx$$

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

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

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.

$$R^2 = 1 - (RSS/TSS)$$

$$= \frac{\Sigma(yi-yi)^2}{\Sigma(\bar{y}i-yi)^2}$$

Where,

- yi = actual y value

- i = predicted value of y
- y i = 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.

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

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 depicts the area, production, and productivity of cashew in Kerala over the last 20 years and its growth rate. The area under cashew nut in Kerala shows a fluctuating trend from the year 2000 to 2020. From the table, it can be inferred that during 2000- 2003 shows the highest area under cultivation in Kerala. In 2003 – 2006 shows a decreasing trend in the growth rate of -15.83 percent and -21.56 percent respectively. The decline in the area is attributed to the pressure on land and the existing land ceiling laws (Sisily, 2018). Due to the pressure on land, farmers started to use wasteland for cashew planting, which increases the growth rate by 5 percent in the year 2007-2008.The area for cashew was declined after 2008-2009 because cashew cultivated farmers faced a lot of problems like lack of innovations to congregate the emerging demands and ineptitude to update the systematic and scientific development programs in the cashew sector (Sisily, 2018). During 2009-2011 the area under cashew cultivation shows an increasing trend, due to the less investment cost in raising the cashew plantation. In the year 2011-2015, the area shows a declining trend, due to endemic disease and pests and the price level (Mahantesh, 2018). The table shows positive growth in the year 2015- 2017 due to the improved management adopted by the farmers in Kerala. From the year 2017 (2.13 percent) to 2020 (-6.2 percent)

the area shows a declining trend due to many of the farmers have shifted their crops to other lucrative crops like rubber and other plantations (Krishna, 2021).

Production of cashew nut broadly depends on cashew area, yield rate, the area under fruit-bearing trees, age of plantations, and breed of plantations. During the study period of 2000 – 2020, cashew production shows a fluctuating trend. The percent growth of the production in the year 2000 – 2005 shows a declining trend due to the lack of high yielding variety seeds and unlike certain states like Maharashtra, where cashew was promoted with State Government support, in Kerala, there is no incentives were given to this crop as other plantation crops. This had also become a dissuading factor for farmers to cultivate cashew (Kulkarni, 2012).2005- 2008 shows positive growth in cashew production, 4.69 percent, and 8.33 percent respectively. Due to the low-yielding varieties and climate change have resulted in the poor quality cashew nuts were the reason for declining the cashew production in the year 2009- 2016 (Veeranjaneya, 2018). From the table, it can be inferred that the growth of cashew production in 2018-2019 shows a negative growth rate of -6.0 percent. Fluctuations are more in production due to floods, landslides, and also the fluctuations in the price level (Krishna, 2021). The initiatives by the cashew export promotion agencies to enhance the production of good quality cashews have also resulted in a slight increase in production in recent years.

Productivity seemed to be stable over the study period. The least recorded productivity of cashew nut was recorded in the year 2004-2005 (-33.33 percent) proportionate to a negative growth rate in production (-32.63 percent) in the same year. Whereas, 2008 -09 showed highest growth rate in productivity which may be due to availability of the most suitable climatic and soil conditions and agronomic practices of the farmers (Mahantesh, 2018). The productivity of cashew shows a decreasing trend in 2009- 2016 due to the excessive rainfall and high relative humidity with flowering may result in flower drop and fruit drop and fungal diseases (Sisily, 2018). After 2018, measures were taken to enhance production by developing cashew as a plantation crop on a commercial basis, exploring the new markets strengthening the non-traditional markets, and also adding value to the product by adding innovations in processing and branding them. This may have reflected in the productivity during the year 2020 resulted in the high productivity. The report of KSACC 2020, also stated that efforts undertaken by the government to enhance such as expanding the area under cashew cultivation in the state and simultaneously achieving better production through vertical expansion by increasing the productivity through the cultivation of High Yielding Varieties (HYV) of cashew.

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^2	0.007	0.209	0.293
Adjusted R^2	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 1.36 percent and productivity is 3.661 percent. It is observed that the average area during the study period is 91.10 (in'000 Hectare), 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.

Standard Deviation measures how annual value varies from the expected value. The standard deviation of area and production is higher than productivity of cashew; thus indicating the higher variability in area and production. The SD of area and production is 14.9 and 8.8 respectively, whereas, the SD of productivity is 0.11. 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 16.39, while the production and productivity value showed higher instability with a value of 11.26 and 13.75 coefficient of variation. The average area during the study period is 91.10 (in'000 hectares), and the average value of production and productivity is 78.50 MT and 0.85 (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 among the total area (1125'000 ha) and production the (703'000 MT) in India, Kerala contributed only 8.5 percent area and 12.37 percent of production in the last year (2020). The trend in area, production and productivity shows a negative compound annual growth rate during the study period. This is mainly because; many of the farmers have shifted their crops to other lucrative crops like rubber and other plantations. As they found that these crops are profitable than cashew, moreover, compared to plantation crops, cashew still confined mostly to marginal and poor fertile lands and is considered as a wasteland crop and the recommended package of practice is not followed. This result shows in lowering the production and the productivity. Farmers will benefit if they tap the opportunities of increasing demand of cashew in India and at the world level with the government support. The government may provide subsidy to farmers, to replant the aged plants with high yielding varieties which will in turn result in high productivity. As the expansion of area under cashew cultivation is difficult to achieve due to little wasteland is available and on better soil (Vernon, 1997), the homesteads and barren lands under the possession of government can be utilised for the cashew cultivation. This will help to restore the top position by the Kerala state, in the production of cashew nut 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]. Availabile: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.

KSACC [Kerala State Agency for the expansion of Cashew Cultivation].2020.KSACC home page[Online]. Available:http://cashewcultivation.org/new/index.html. [21-01-2021].

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.

Veron. 1997. Analysis of cashew production in Kerala. *Indian J. of Mktng*. 5(5): 15-20.