# Trend analysis and price behaviour of cocoa in Kerala

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**Abstract**
Cocoa is one of the important plantation crops grown in India. The Mondelez International, formerly Cadbury, played a significant role in commercialising cocoa cultivation in India. At present, it is cultivated in Andhra Pradesh, Kerala, Tamil Nadu and Karnataka. The present study aims to find the trend in area, production and productivity of cocoa in Kerala during the period from 1978-79 to 2018-19. It also analyses the price behaviour of cocoa in four major markets of Kerala during the period from 2005-06 to 2021-22. The area, production and productivity of cocoa in Kerala indicated an increasing trend over the years. The increase in production of cocoa in Kerala could be attributed to the growth in productivity rather than area. The prices of cocoa in all the major markets of Kerala showed increasing trend during the period from 2005-06 to 2021-22. The prices in Kerala were found to be the lowest during the months from August to October, while the prices were highest during the months of April and May. The cyclical and irregular variations of cocoa prices in Kerala were found to be insignificant.

**Keywords:** Cocoa, Compound Annual Growth Rate, Trend, Seasonality

## Introduction

Cocoa is one of the important plantation crops cultivated around the world for its delicious beans.It is an important source of livelihood for nearly 50 million people in the world. Nearly 70 per cent of the global cocoa production is accounted by four major countries *viz*., Ivory Coast, Ghana, Nigeria and Cameroon.India is the 18$^{th}$ largest cocoa producer in the world (Statista, 2020). Cocoa was introduced to India with the establishment of the Mondelz International, formerly Cadbury in 1948 (Jayasekhar and Ndung'u, 2018). In India, it is mainly grown in the states of Andhra Pradesh, Kerala, Karnataka and Tamil Nadu. Andhra Pradesh is the leading cocoa producer in terms of area, production and productivity, while Kerala is second in terms of production and third in area (DCCD, 2020). In Kerala, nearly 13.4 tonnes of cocoa was produced from an area of 13,891 ha during 2018-2019 (GoK, 2019). In India, the demand of cocoa is growing at 15 per cent every year, but there is no corresponding increase in production (Nair, 2018). The present study analyses the major trends in cocoa cultivation in Kerala, as well as the price behaviour of cocoa in major markets of Kerala.

## Materials and Methods

The trends in area, production and productivity of cocoa were analysed using time series data collected from publications of Department of Economics and Statistics, Government of Kerala.The CAGRs of area, production and productivity of cocoa were worked out by fitting the exponential function of the form,

$Y_t = ab^t$

Where,

$Y_t$ = area, production and productivity of cocoa in Kerala

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*a*: intercept
*b*: slope
*t*: time period
Antilog was taken on both sides to transform the equation to log linear.

$log\ Y_t = log\ a + t\ log\ b$

$Y'_t = A + Bt$

$Y'_t = log\ Y_t$

A= log a
B= log b
CAGRs were estimated using the formula
CAGR= (antilog B - 1)*100
The value of slope coefficient(b) was found out using method of Ordinary Least Square.

*Price behaviour of cocoa – TCSI Analysis*

The price behaviour of cocoa was studied using the technique of classical time series model (Croxton et al.,1979; Spiegel, 1992).The time series analysis was used for studying the price behaviour of cocoa and a multiplicative model was used for analysis. The monthly prices of cocoa wet bean in four major markets,*viz.,* Muvattupuzha, Kothamangalam, Thodupuzha and Kattappana were sourced from Department of Economics and Statistics, Government of Kerala and The Cocoa and Cashew Journal, Directorate of Cashewnut and Cocoa Development were used for the analysis. The monthly prices of wet cocoa beans in Kerala were decomposed into four time series components *viz*., trend, seasonal, cyclical and irregular variations. Multiplicative model is indicated as,

$$Y(t) = T \times S \times C \times I$$

Y(t): Value of a variable at time t
T: Secular trend
S: Seasonal variation
C: Cyclical variation
I: Irregular variation

## Results and Discussion

*Trend in area, production and productivity of cocoa in Kerala*

In this study an attempt was made to explain the trend in area, production and productivity of cocoa in Kerala during the period from 1978-79 to 2018-19. The area under cocoa cultivation increased from 10,500 ha in 1978-79 to 23,381 ha in 1981-82. Thereafter, with the fall in prices of cocoa in the international market, the area under cocoa cultivation in Kerala declined drastically till 1994 and it gradually increased to 13,891 ha in 2018-19.The production of cocoa remained low during the period from 1978 to 2006 and from 2006, an

Table:1. Compound Growth Rates in area, production and productivity of cocoa in India (Per cent per annum)

| Particulars | Growth Rate | $R^2$ |
|---|---|---|
| Overall period (1978 to 2018) | | |
| Area | -0.51 | 53 |
| Production | 4.09 | 78 |
| Productivity | 4.63 | 78 |
| Period I (1978 to 1990) | | |
| Area | -2.10 | 47 |
| Production | 13.64 | 85 |
| Productivity | 16.09 | 86 |
| Period II (1990 to 2018) | | |
| Area | 2.49 | 77 |
| Production | 5.18 | 86 |
| Productivity | 3.05 | 75 |

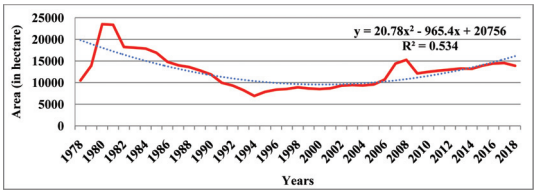


Figure 1: Trend in area under cocoa in Kerala

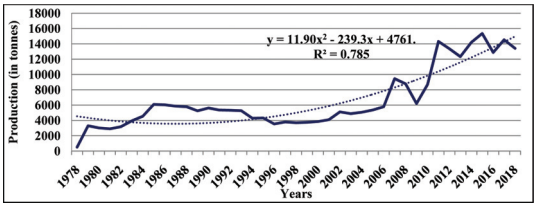


Figure 2: Trend in production of cocoa in Kerala

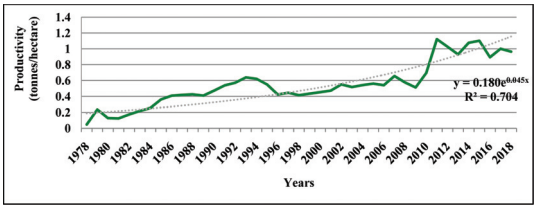


Figure 3: Trend in productivity of cocoa in Kerala

increase in production was noticed. The production of cocoa in Kerala had a significant increase from 3.53 tonnes in 1996-97 to 13.4 tonnes in 2018-19. The productivity of cocoa increased from 0.047 tonnes/ha in 1978-79 to 0.97 tonnes/ha in 2018-19. Polynomial functions of the order two were found to be the best fitted trendline for area and production with the R square value of 53 per cent and 78 per cent respectively. An exponential function was fitted for the trend in productivity with an R squared value of 78 per cent.

*Growth rates of area, production and productivity of cocoa*

The growth rate of a variable may be defined as the rate of change per unit of time, usually in a year. The exponential growth model was fitted for the time series data on area, production and productivity of cocoa. The entire period (1978-2018) has been divided into 2 sub-periods namely Period I (1978-1990) and Period II (1990-2018). For the two sub-periods as well as for the entire period, the compound growth rates in area, production and productivity of cocoa in Kerala were estimated.

The growth rates in area, production and productivity of cocoa in Kerala showed that, during the entire period under study, area exhibited a negative growth rate of -0.51 per cent while production exhibited a positive growth in production of 4.09 per cent, which could be attributed to the growth in productivity of 4.63 per cent per annum. During period I, the growth rates in area was negative (-2.10), whereas the growth rates in production and productivity were positive with values 13.64 and 16.09 per cent respectively. In 1980-81, the cocoa price in international market crashed and the procurement of cocoa beans from farmers in India by Cadbury was almost stopped. Also, the prices of cocoa remained low during the period from 1986 to 1990. As a result, the farmers withdrew from cocoa cultivation by cutting down the cocoa trees. These factors could have resulted in decline in area during period I. In contrast to period I, positive growth rates in area, production and productivity with CAGR values of 2.49 per cent, 5.18 per cent and 3.05 per cent were observed during period II. The increase in area after 1990s could be due to the impact of area expansion scheme launched by Government of India and Government of Kerala in 2005. However, the overall growth rate in area was found to be negative for the study period. The improvement in production and productivity of cocoa in Kerala after 1994 could be due to the influence of research activities under Central Plantation Crops Research Institute (CPCRI) and KAU-Cadbury research project launched during 1970 and 1979 respectively. Hence, an overall decrease in area and increase in production and productivity is noticed during the entire study period. Even with a decrease in area under cocoa, the production exhibited a growth because the decline in area was more than offset by the growth in productivity during the period.

*Price behaviour of cocoa in Kerala*

The behaviour of wet cocoa bean prices in four major markets of Kerala, *viz.*, Muvattupuzha, Kothamangalam, Kattappana and Thodupuzha during the period from 2005-06 to 2021-22 were analysed. The price data was decomposed into the trend, seasonal, cyclical and irregular components.

*Trend*

The wet cocoa bean prices in all the markets under study showed an increasing trend during the period from 2005 to 2021. It could be observed from the plots that the trend in prices revealed a similar pattern for all the markets. In all of the markets

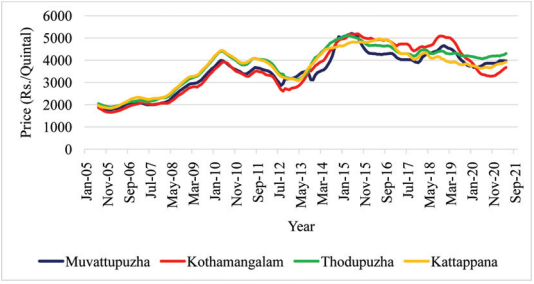


Figure 4: Trend in prices of wet cocoa beans in major markets of Kerala (2005-06 to 2021-22)

studied, the prices were found regularly prevailing high after an interval of time, usually between two to four years. It also exhibited a cyclical behaviour with cycles of five to six years duration.

*Seasonal variation*

The seasonal variations showed a similar pattern in all the markets. The highest prices prevailed during February in Muvattupuzha and Kattappana markets, whereas in all the other markets, highest prices were observed during May. The prices exhibited a declining pattern from June onwards and attained the lowest values during the months from August to October. Thereafter, the prices started increasing and attained peak values by April-May. The changes in supply, variations in quality of the produce and price changes in the international markets due to changes in market fundamentals could be considered as the factors responsible for the seasonal variations in prices. During the summer months, the production will be comparatively low and hence the market supply will also be less. Even then the beans fetch higher prices during these months because of the higher recovery percentage during these months. The flowering and pod formation are the highest during the period from June to October and hence the supply is also high during these months. Because of the higher moisture content in the pod during these months, the recovery percentage will be less and hence, they fetch only low prices.

*Cyclical variation*

The cyclical variations were not found to be dominant in any of the markets under the study. Most of them were short and frequent cycles of varying durations.

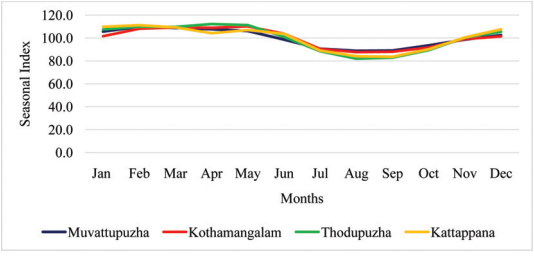


Figure 5: Seasonal variations in prices of wet cocoa bean in major markets of Kerala

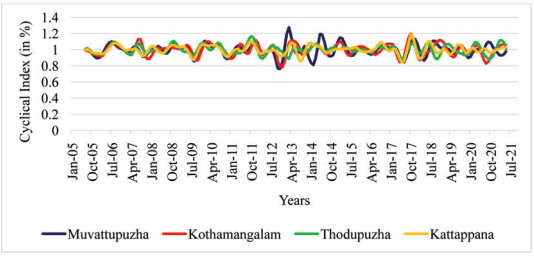


Figure 6: Cyclical variations in prices of wet cocoa beans in major markets of Kerala

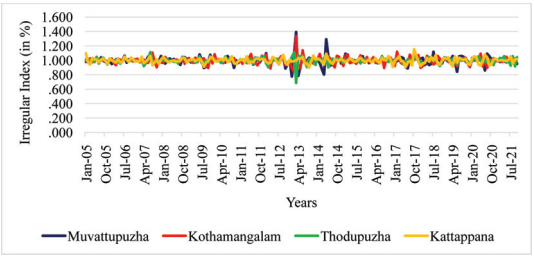


Figure 7: Irregular variations in price of wet cocoa beans in major markets of Kerala

The irregular variations were found to be less prevalent in all the markets under the study.

## Conclusion

The area, production and productivity of cocoa in Kerala have exhibited increasing trends over the years. The study indicated that the increase in production of cocoa in Kerala was contributed by growth in productivity rather than area. Increasing trends in prices of cocoa were observed in all the major markets of Kerala. Seasonality could be clearly identified in prices of cocoa, where as the presence of cyclical and irregular components were insignificant.

The behaviour of the prices need to be communicated to the farmers through effective market intelligence system so that the farmers can make informed decisions on selling the commodity. Cocoa is found to be a highly price volatile commodity and at present, no Minimum Support Price (MSP) or government procurement exist for cocoa. Hence, the farmers are forced to sell the produce to private companies. They are unaware of the pricing mechanism and are forced to sell cocoa

at the rates determined by the market intermediaries. If MSP is announced and procurement is made by the government, it will help the farmers to earn remunerative prices.

## References

Croxton, F. E., Cowden D. J. and Klein, S. 1979. *Applied General Statistics*. Prentice Hall of India, New Delhi, India. 754p.

DCCD [Directorate of cashewnut and cocoa development]. 2020. Cocoa area, production and productivity [On-line]. Available: https://www.dccd.gov.in/Content.aspx?mid=1072&tid=1 [9 Dec 2021].

GOK [Government of Kerala]. 2019. Agricultural Statistics 2017-18 [on-line]. Available: http://www.ecostat.kerala.gov.in/images/pdf/publications/Agriculture/data/2017-18/ rep_agristat_ 1718.pdf[10 Dec 2019].

Jayasekhar, S. and Ndung'u.I. 2018. Review of economic history of cocoa with special reference to India. *J. Plant. Crops*, 46(2):133-138.

Nair, G. K. 2018. Cocoa output up 46% but meets only a fourth of the demand. *The Hindu Businessline,* April 10, 2018 [On-line]. Available at: https://www.thehindubusiness line.com/economy/agri-business/cocoa-output-up-46-but-meets-only-a-fourth-of-the-demand/article23495637.ece [21 Mar 2020].

Spiegel, R. M. 1992. *Theory and Problems of Statistics* (2nd Ed.). McGraw-Hill International, Singapore, 504p.

Statista. 2020. Global cocoa production in 2018/19 and 2020/21 by country [On-line]. Available: 20https://www.statista.com/statistics/263855/cocoa-bean-production-worldwide-byregion. [10 Nov 2021]

Thompson, J. E. S. 1956. Notes on the use of cocoa in Middle America. In: *Notes on Middle American Archaeology and Ethnology.* Department of Archaeology, Carnegie Institution of Washington, pp. 95-116.