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## Growth and Instability in Area, Production, and Productivity of Cassava (*Manihot esculenta*) in Kerala

Neethu S. Kumar  
[neethukumar9@gmail.com](mailto:neethukumar9@gmail.com)  
College of Agriculture, Vellayani,  
Kerala

Brigit Joseph  
[brigitstat@gmail.com](mailto:brigitstat@gmail.com)  
College of Agriculture,  
Vellayani, Kerala

Muhammed Jaslam P. K  
[pkjaslamagrico@gmail.com](mailto:pkjaslamagrico@gmail.com)  
College of Agriculture, Vellayani,  
Kerala

### ABSTRACT

*Cassava is a major tuber crop cultivated in Kerala, as a sole crop or as a mixed crop, mainly cultivating in homesteads and primarily used for household consumption. The share of cassava area in Kerala to all India area declined from 85.57 to 45.5 per cent in 2001-02. With the introduction of short duration varieties, there was an increase in productivity. Trend and Instability analysis in the area, production and productivity of cassava for a period of 25 years were carried out. The estimated trends in the area, production, and productivity of cassava, using semi log function revealed that there was a significant decline in an area with a compound annual growth rate of 1.37 %, the non-significant decline in production by -0.02 % and a significant increase in productivity by 1.3 %. Cuddy-Della Valle index provides the best estimates and instability was found to be more in productivity (4.04 %).*

**Keywords:** *Cassava, Trend and Instability Index.*

### 1. INTRODUCTION

Cassava (*Manihot esculent* Crantz.) is an important tuber crop which is mainly cultivated in the tropic and sub tropic regions of the world over a wide range of soil and environmental conditions. It was believed to have originated from Brazil introduced into India by the Portuguese during the 17<sup>th</sup> century which was now cultivated in about thirteen states of India with major production in the South Indian states of Kerala (142,000 ha ) and Tamil Nadu (65,700 ha). Cassava is a major tuber crop cultivated in Kerala, as a sole crop or as a mixed crop, mainly cultivating in homesteads and primarily used for household consumption. Even though it is a remunerative crop, its importance has declined over the years with a shrink in land under cultivation. The share of cassava area in Kerala to all India area declined from 85.57 to 45.5 per cent in 2001-02. In the sixties, 90 per cent of all India production was from Kerala, but it was reduced to 37.9 per cent in 2001-02. With the introduction of short duration varieties, there was an increase in productivity, but not up to the level of Tamil Nadu and north eastern state Meghalaya. In this context, it is better to have an idea about the present status in the area, production and productivity of cassava in Kerala.

### 2. MATERIALS AND METHODS

The present study is based on the data pertaining to the area in ha, production in tones, productivity in kg ha<sup>-1</sup> and price in rupees of cassava for a period of 25 years (1991-2016). Data was collected from the publications of Department of Economics and Statistics, Thiruvananthapuram, Kerala to elicit the trends and instability in area production, productivity, and price of cassava.

Trend analysis in the area, production, productivity and price of cassava was studied using compound annual growth rate (CAGR). The compound annual growth rate was estimated using the exponential function of the following form

$$y = a b^t e$$

Take the logarithm, it becomes  $\log y = \log a + t \log b + \text{error}$ , and it can be written as

$$\ln(Y) = \ln(b_0) + b_1 t$$

Where,  $t$  – is used to represent the time variable,  $Y$ - variable for which growth rate is calculated and  $b_1$ - regression coefficient of  $t$  on  $Y$ .

The Compound Annual Growth Rate (CAGR) is obtained as

$$\text{CAGR (\%)} = (\text{Antilog } b_1 - 1) \times 100$$

Instability analysis in the area, production, productivity and price of cassava was studied using three measures of instability such as Coefficient of Variation, Cuddy-Della Valle index and Coppock's index.

$$\text{Coefficient of Variation (C.V)} = \frac{\text{standard deviation}}{\text{mean}} * 100$$

Even though Coefficient of Variation (C.V) is the simplest measure of instability, it over-estimates the level of instability in time-series data which are characterized by long-term trends. The Cuddy Della Valle Index de-trends the annual price and shows the exact direction of the instability (Cuddy and Della Valle, 1978). Hence, it is a better measure to capture instability in agricultural production and prices. A low value of this index indicates low instability in prices and vice-versa. The Cuddy-Della Valle index corrects the CV as:

**Cuddy - Della Valle Instability Index (%)** =  $C.V \times \sqrt{(1 - \bar{R}^2)}$  Where,  $C.V$  is the Coefficient of Variation in per cent, and  $\bar{R}^2$  is the coefficient of determination from a time trend regression adjusted for its degrees of freedom.

Instability was also analyzed using Coppock's index which is calculated as the antilog of the square root of the logarithmic variance using the following formula (Coppock, 1962)

$$\begin{aligned} \text{Coppock Index} &= (\text{Antilog}) \sqrt{(V \log - 1)} * 100 \\ V \log &= \frac{1}{(N-1)} \sum (\log p_{t+1} - \log p_t - M)^2 \\ M &= \frac{1}{(N-1)} \sum (\log p_{t+1} - \log p_t) \end{aligned}$$

Coppock instability index is a close approximation of the average year to-year percentage variation adjusted for trend and the advantage is that it measures the instability in relation to the trend in prices. A higher numerical value for the index represents greater instability.

### 3. RESULTS AND DISCUSSIONS

Trend analysis in the area, production, productivity and price of cassava for a period of twenty five years was studied using compound annual growth rate (CAGR).

#### Trend in Area

The estimated trend equation in the area of cassava using semi log function was  $\log Y = 5.16 - .0137 t$  with  $R^2$  of 95 per cent. CAGR obtained was -1.37 per cent which indicated that there was a significant decline in the area at the rate of 1.37 per cent per annum.

#### Trend in Production

The estimated trend equation in the production of cassava using semi log function was  $\log Y = 6.41 - .0002 t$  with  $R^2$  of 40 per cent. CAGR obtained was -.02 per cent which indicated that there was a non-significant decline in production at the rate of .02 per cent per annum.

#### Trend in Productivity

The estimated trend equation in productivity of cassava using semi log function was  $\log Y = 4.24 + .013 t$  with  $R^2$  of 96 per cent. CAGR obtained was 1.3 per cent which indicated that there was a significant increase in productivity at the rate of 1.3 per cent per annum.

#### Trend in Price

The estimated trend equation in the price of cassava using semi log function revealed was  $\log Y = 2.18 + .035 t$  with  $R^2$  of 92 per cent. CAGR obtained was 3.5 per cent which indicated that there was a significant increase in price at the rate of 3.5 per cent per annum.

**Table 1. Estimated Annual Compound Growth Rates In Area, Production, And Productivity of Cassava**

Characters	$\text{Log}(y) = a + b T + e_t$	R <sup>2</sup>	P value	CAGR
Area	$\log(\text{area}) = 5.16 - .0137t$	95	.0002	-1.37
Production	$\text{Log}(\text{production}) = 6.41 - .0002t$	40	.739	-.02
Productivity	$\text{Log}(\text{productivity}) = 4.24 + .013t$	96	.0004	1.3
Price	$\text{Log price} = 2.18 + .035t$	92	.0001	3.5

Instability analysis on the area, production and productivity of cassava for a period of 25 years was carried out. Instability measures such as coefficient of variation, Cuddy-Della Valle index, and Coppock index were determined and presented in table 2.

**Table 2. Measures of Instability in Area, Production, and Productivity of Cassava**

Measures of instability	Area	Production	Productivity	Price
CV	23.38	4.72	23.56	70.38
Cuddy-Della Valle index	3.98	.80	4.01	37.04
Coppock Index	10.63	10.59	10.41	11.99

The results of the analysis indicated that Cuddy-Della Valle index provides best estimates and instability was found to be more in productivity (4.04) followed by area (3.98) and production (0.80).

#### 4. CONCLUSION

The estimated trends in the area, production and productivity of cassava using semi log function revealed that there was a significant decline in an area with a Compound annual growth rate of 1.37 % annually, the non-significant decline in production by -.02 % and a significant increase in productivity by 1.3 %. Instability analysis in the area, production, and productivity of cassava shown that Cuddy-Della Valle index provides best estimates and instability was found to be more in productivity (4.04 %) followed by area (3.98 %) and production (.80 %).

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