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Shift in the Area under Arecanut in Kerala and Variability in Arecanut Production

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INTRODUCTION

Each homestead in Kerala had a large arecanut farm just near the house in earlier days. This acted like an umbrella by controlling the direct fall of sunlight over the house as well as ground. More over holding water during rainfall and irrigation during summer days helped to maintain the ground waterlevel in those years. Arecanut has a lot of uses even in small scale industries. Areca are used in medicine as a germicide, used for extraction of butter, as an ingredient for black ink preparation and bi-products like sheath, husk etc. are yet to be tapped to the fullest extent. In this scenario a study was conducted to know the change in area and production of arecanut in Kerala as its price is ready to increase recently.

Review of Literature

Lots of review materials are available in forecasting crop production using ARIMA modeling. Saeed N. (2000) found that the best model for forecasting of wheat production in Pakistan was ARIMA (2, 2, 1). Forecasting sugarcane production in India was done using ARIMA (2, 1, 0) model by Mandal, B.N. (2004). Carpio, C.E.B.S. (2002) explained the production response of cotton in India, Pakistan, and Australia using ARIMA (1,0,0) model. Price of oil palm was predicted efficiently using ARIMA (2,1,0) model (Nochai et al. (2006). ARIMA model for forecasting wholesale price of oil palm was ARIMA (1,0,1) and pure oil price of oil palm was ARIMA (3,0,0). Sen, L.K. (2000) found that time series modeling of Black Banana price could be done using ARIMA (1,0,0). Unnikrishnan (2009) explained the advantage of ARIMA and cointegration models for the forecasting of major crop production in Kerala. Unnikrishnan and Ajitha (2010) explained the advantage of ARIMA and cointegration models for the forecasting of Coconut and Rubber. Unnikrishnan and Sunil (2020) used ARIMA models for forecasting of banana production in Kerala.

Ghosh and Prajneshu, (2003), have studied the price fluctuation of onion; Paul et al. (2009) have studied the fluctuation of export price of spice. Chandran and Pandey (2007) have studied the seasonal fluctuation of potato price in Delhi. Works related to estimation of area and production of arecanut using ARIMA models were found rare.

MATERIALS AND METHODS

A stationary ARIMA (p, d, q) process is defined by the equation

$$Y_t = \varphi_1 Y_{t-1} + \varphi_2 Y_{t-2} + \ldots + \varphi_p Y_{t-p} - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} - \ldots - \theta_q \varepsilon_{t-q} + \varepsilon_t$$

where ε_t's are independently and normally distributed with zero mean and constant variance σ^2, for t = 1, 2, …, n. The values of p and q, in practice lie between 0 and 3.

The best model was selected by diagnostics such as Coefficient of determination (R^2), Akaike Information Criteria (AIC) / Bayesian Information Criteria (BIC), Portmonteau tests - Box Pierce or Ljung-Box Q-tests, the Percentage Forecast Inaccuracy (PFI), Root Mean Square Error (RMSE), Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE). For a good model the R^2 will be sufficiently large, RMSE, MAE, MAPE will be as small as possible. Normalized Bayesian Information Criteria is another test for accuracy of the model. The model has AIC/BIC smallest is the best model for forecasting purposes.

RESULTS AND DISCUSSION

ARIMA (0,1,0) was identified as the best model for forecasting the area under arecanut with an R^2 of 0.93 indicating 93% of the variation in the data can be explained through this model. The model was $y_t = y_{t-1} + 532$. The MAPE was also very low with 4.5%.

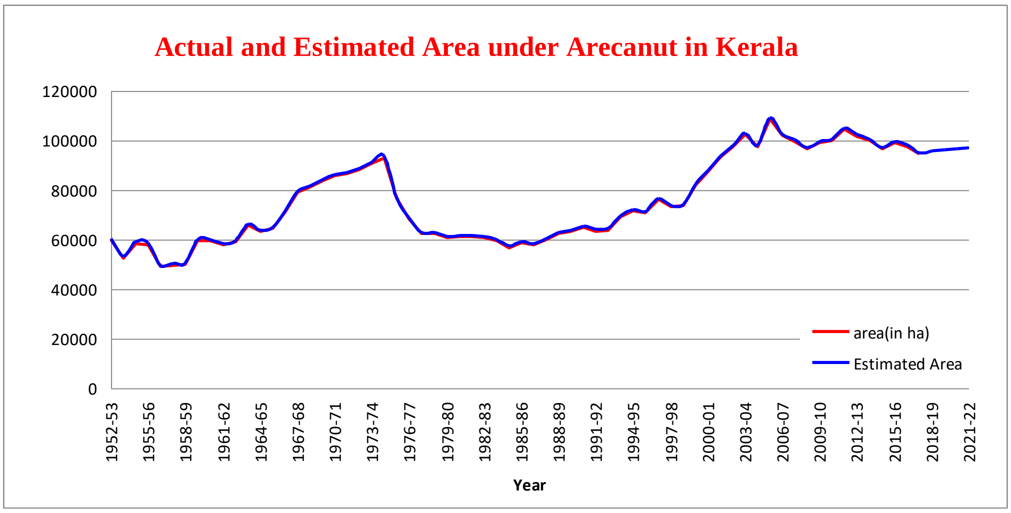

Fig. 1: Actual and Estimated data on area under Arecanut in Kerala

The actual and estimated area under arecanut in Kerala is as in fig. 1. The chart shows the forecasting power of the model as estimated values moves side by side with actual data.

In the case of production, ARIMA (3,1,0) was identified as the best with an R^2 of 0.933 indicating 93.3% of the variation in the data can be explained through this model. The model was $Y_t = Y_{t-1} + 0.46(Y_{t-2} - Y_{t-3})$ and the MAPE was also low with 8.3%. Fig. 2. shows the graphical representation of actual and estimated arecanut production in Kerala.

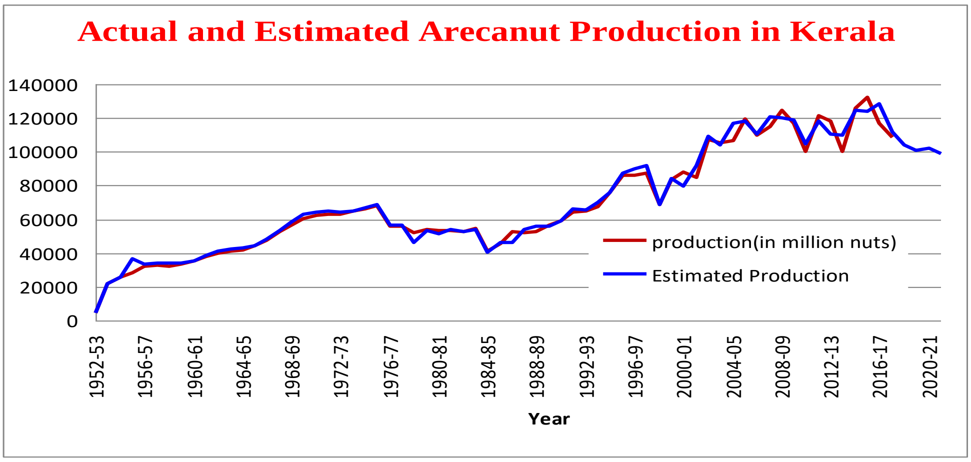

Fig. 2: Actual and Estimated data on arecanut production in Kerala

High price increase especially during seventies has encouraged more people to take up arecanut cultivation which resulted in high growth rate in area during that period. However subsequent steep fall in prices, shortage of skilled labourers and ever mounting cultivation costs have pushed arecanut growers, who enjoyed a respectable status here in the olden days, into a deep debt trap. While prices of manure and pesticides registered a steady rise over the years, successive governments have failed to provide adequate subsidy. Climbing charges have increased exorbitantly and skilled climbers are becoming extinct. There was an acute shortage of skilled labourers as new generation shy away from taking up the traditional job. Forecasted values for the next five years are given in Table 1.

Table 1: Estimated area and production of arecanut in Kerala for the next 5 Years

Year	Area	Production	Productivity
2018	95112	111520	1.230039
2019	95644	104334.8	1.318692
2020	96176	100504.8	1.413735
2021	96708	101887.2	1.515628
2022	97240	98580.7	1.624864

The forecasted area shows an increasing trend with a slight decrease in growth rate. The increased labour cost and maintenance of the crop by providing sufficient irrigation facilities make the crop of arecanut distress stricken. Even though the production of arecanut in Kerala contributes nearly 25% to the nation, the productivity is far below than that of the national level. The productivity of arecanut in the state is much less than the realizable yield. The major factor that influenced areca productivity is the highly fluctuating price.

CONCLUSION

ARIMA models were found to be excellent in making predictions using past data on area and production of arecanut in Kerala. ARIMA (0,1,0) was identified as the best model for forecasting area under arecanut and ARIMA(3,1,0) was identified as the best model for production. These models can be utilized for forecasting area and production in Kerala and for further planning purposes.

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