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Research Article

PREDICTION OF TUR PRODUCTION IN ANDHRA PRADESH USING ARIMA MODEL

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ABSTRACT

This paper attempts to predict the future production of Tur (Red gram), cultivated and consumed in Andhra Pradesh. Considering the data of Tur production during the tenure of 1966-2012, ARIMA method, one of the basic time series analysis models is employed here to forecast the production of Tur up to the year 2017 by utilizing the most popular computer statistical package namely, SPPS. The best-predictied model has been selected based on the maximum R^2, minimum Bayesian Information Criterion (BIC) and Maximum Absolute Percentage Error (MAPE). It has been found that ARIMA (2 1 2) model is fit to describe the Tur production data of Andhra Pradesh used here.

INTRODUCTION

Tur is popularly known as red gram, yellow dhal, pigeon pea, arhar etc. It is known by more than 350 names. This crop ranks fourth in importance among the pulses in the world. Tur is grown all over the tropics, subtropics and warmer equatorial regions of Asia, East Africa and Central America. The worldwide production of Tur is 4.105(million tons), where its major production is localized in India, Myanmar, Kenya, Malawi, Uganda, Tanzania.

Tur is an important pulse crop which is known as Red gram, Arhar and pigeon pea in India. This crop is widely grown in India. India is the largest producer and consumer of Tur in the world. India alone occupies three- fourth of the global harvested area and contributes almost smilar share in production Tur is the second most important pulse crop after chickpea in India. It produces 3.076 (million tons). India contributes highest (74 percent) to the total Tur production in the world. In India, Maharashtra is the largest producer of Tur followed by Karnataka, Uttar Pradesh, Andhra Pradesh, Gujarat and Madhya Pradesh, these six major states together produces 89% of the production in the country.

Andhra Pradesh is one of the important states producing the Tur crop, it is the fourth largest producer of Tur. Most farmers have shifted from the cultivation of paddy to the cultivation of commercial crops and the result is that almost every farmer is now into growing pulses. The production of pulses gone up during 2003-04. Andhra Pradesh now supplies Tur to Orissa, west Bengal and Assam. Tur has become a major crop for farmers under the Krishna delta, for the past six decades. Tur productivity in Andhra Pradesh was around 600 kg per ha which was around 10.95%.

MATERIALS AND METHODS

The time series data was obtained from Directorate of Economics and Statistics, Andhra Pradesh (http://eands.dacnet.nic.in/). Most of the time series data commonly use the forecasting models like linear and non linear models.

In this study ARIMA model was used and identified the significant parameters using Box-Jenken's methodology. The ARIMA (p d q) model is churn of autoregressive (AR) and moving average (MA) models show that there is a relation between observed value and expected value and residuals respectively. The Box-Jenken's methodology was applied for time series data identified best ARIMA models and their residual analysis used MAPE analysis. For evaluating the adequacy of AR, MA and ARIMA process, various consistent measures like R^2 and Bayesian Information Criterion (BIC) were used.

The time series data follows the Box-Jenkins (1970) methodology for modeling, generally known as ARIMA. Let Yt be a discrete time series variable which takes different variable over a period of time. The corresponding AR (p) model of Y_t series, which is the generalization of the autoregressive model, is expressed as;

AR (p); $Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} \ldots\ldots\ldots\ldots + \alpha_p Y_{t-p} + \mu_t$ ----------(1)

MA (q) is moving average process is expressed as

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MA (q); $Yt = \alpha_0 \quad \beta_1 \mu_{t-1} \quad \beta_2 \mu_{t-2} \quad \ldots\ldots\ldots\ldots \beta_q \mu_{t-q} + \mu_t$ ------(2)

The general form of ARIMA model (p d q) is

$Yt = \alpha_0+\alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} \ldots\ldots\ldots\ldots +\alpha_p Y_{t-p} \quad \beta_1 \mu_{t-1} \quad \beta_2 \mu_{t-2} \quad \ldots\ldots\ldots\ldots \beta_q \mu_{t-q} + \mu_t$

Diagnosis of the Model

The model is diagnosed using the Ljung-Box Q statistics to check the overall adequacy of the model. The Q statistic is

$$Q_n = nr(nr+2)\sum_{l=1}^{n} \frac{r1^2(e)}{nr-l}$$

where r1 (e) is the residual autocorrelation at lag l; nr is the number of residuals, n is the number of time lags includes in the test. For the model to be adequate, p-value associated with Q statistics should be large (p-value>α).

RESULTS AND DISCUSSIONS

Preceding 46 years (1966-2012) production data used for this model. Various methods and literature are studied to judge the appropriate model, the best model has been selected based on the maximumR^2, minimum Bayesian information criterion (BIC) and maximum absolute percentage error (MAPE). It has been found that ARIMA (2 1 2) model is the best fit for the Tur production data. (Table: 1)

Table 1 Time Series models in Production of Tur in Andhra Pradesh

Time series models	R^2	MAPE	BIC
ARIMA(1,0,0)	0.627	34.597	7.794
ARIMA(1,1,0)	0.759	27.399	7.510
ARIMA(1,1,1)	0.781	27.111	7.520
ARIMA(1,0,1)	0.730	34.037	7.706
ARIMA(1,0,2)	0.776	30.305	7.627
ARIMA(1,2,1)	0.758	28.965	7.649
ARIMA(1,2,0)	0.442	39.396	8.373
ARIMA(2,2,2)	0.833	27.978	7.499
ARIMA(2,1,2)	0.838	26.142	7.440
ARIMA(2,2,1)	0.792	28.666	7.611

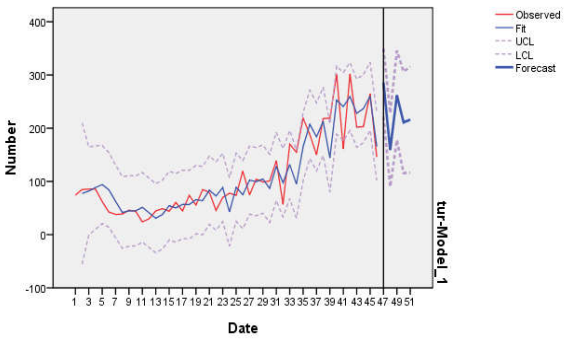

Figure 1 Forecasted trend of Tur production (thousand tonnes)

After the identification of the model and its accuracy check, the ARIMA model (2 1 2) is used here to forecast the production of Tur in the coming years, here we used the identified to forecast the production of Tur (Red gram). The forecasting results are presented in (figure: 1). The 95% confidence interval regarding the forecasting capability of the model is the goodness of fit because the actual production values are near to the expected values. The expected production of Tur for the year 2017 was 216.1 (thousand tonnes), with lower and upper limits of 116.5 and 315.7 thousands of tones respectively. (Table: 2)

Table 2 Predicted values of Tur Production by ARIMA (2,1,2) with control limits

Years	Actual (thousand tons)	Predicted (thousand tons)	95% LCL	95% UCL
2005	219	144.3	80.3	208.3
2006	301	252.7	188.7	316.7
2007	161	240.6	176.6	304.6
2008	302	259.5	195.5	323.5
2009	202	228.1	164.1	292.1
2010	203	236.8	172.8	300.8
2011	265	260.1	196.1	324.1
2012	146	165.6	101.6	229.6
2013		285.7	221.7	349.7
2014		159.2	90.1	228.3
2015		261.8	178.1	345.5
2016		211.1	115.8	306.3
2017		216.1	116.5	315.7

CONCLUSION

In this study we provided forecasts for the production of Tur in Andhra Pradesh on yearly basis for the period of 2013-2017, using the ARIMA model. This model is very useful in prediction of Tur production for future trends. The forecasted values and observed values are very closer to each other. The coefficient of determination was 83.8%, Bayesian Information Criterion was 7.44% and Maximum Absolute Percentage Error was 26.14%. These projections help the government sectors to make polices regarding relative price structure, production trend patterns.

References

1. Kuo s. huang (2000) Forecasting consumer price indexes for food: a demand model approach food and rural economics division, technical bullet no.1883.economics research service/usda: 1-9.
2. Sivaramane N. Mathur V (2010) Forecasting of rice exports from India: An application of Box-Jenkins methodology. Agric Situation India 67 321.325.
3. Joseph M. Awika (2011) Major cereal grains production and use around the world. American chemical society: 1-13.
4. Bianchi, L., Jarrett, J.E. and Hanumara, R.C. (1998) Ananalysis of Forecasting for telemarketing centers, *International Journal of Forecasting*, 14 (4) 497-504.
5. Prasad H chandra R pareek RPand kumar N (2005). *Indian journal of pulses research* 15:131-135.
6. Directorate of Economics and statistics, Ministry of Agriculture, Govt. of India.
7. Iqbal, N., Bakhsh, K., Maqbool, A and Ahamad, A.S. 2005. Use of the ARIMA model for forecasting wheat area and production in Pakistan. *Journal of Agriculture and Social Sciences*. 1 (2): 120-122.
8. Kaul, S., Ghasi, R. (2007). An Assessment of Impact Climate on Rice Production in India. *Journal of Indian Society of Agricultural Statistics*. 61(3):313-327.
9. Dubey SK (1997). *Journal of Indian society of soil science* 45:506-507.
10. Namdev SL and Gupta SC (1999).crop research 18:9-23.