



Research Article

BENEFITS OF PRICE FORECAST TO CASTOR GROWERS IN GUJARAT

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Abstract- The present study was undertaken to analyze the impact of price forecasts of castor released by Agriculture Market Intelligence Centre (AMIC) of Junagadh Agricultural University, Junagadh in crop year 2013-14. Monthly time series data on wholesale prices of castor for the period 1990 to 2013 were obtained from Patan APMC for price forecast. Various time series models were applied to analyze the data. ARIMA (0,1,2) model was found the best fitted model with lowest MAPE value and hence price was forecasted using this model. Finally a market advisory was prepared and released through different mass media like news papers, voice SMS, farmers trainings and university website. To study the impact of price forecast, all the 30 farmers (targeted farmers) who attended the training conducted by AMIC of JAU, Junagadh were aware with price forecast and adopted the price forecast suggestions. Further 30 non targeted farmers selected were those who were not training participants. The price forecasted for months from March to May, 2014 was Rs. 3800 to 4300 per quintal and farmers were suggested to store castor and sell after May, 2014. On an average 2.72 ha area was operated under castor by sample farmers. An incremental income realized to the extent of Rs. 35826 per hectare by the farmers who sold their produce after May, 2014.

Keywords- Forecast, ARIMA model, MAPE, ACF, PACF.

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Introduction

Castor plant is a tropical plant that belongs to the *Euphorbiaceae* family and is grown for its non-edible oilseed. It is commercially very important to the world. It is cultivated in different countries on commercial scale, of which, India, China and Brazil are major castor growing countries accounting for 90 per cent of the world's production. The castor seed oil cake is very useful manure to the crops. The oil obtained from the seeds of this plant is a very useful raw material in many industries like soap, surface coatings, cosmetics, pharmaceuticals, perfumes, greases and lubricants etc. Also the oil is used in a large number of medicines. Castor is generally grown for oil-yielding seeds. The oil content of the seeds varies from 35-58 per cent in different varieties, the average being about 48 per cent. In 2011-12 India record the highest castor seeds production of about 22.95 lakh tonnes. Gujarat, Rajasthan and Andhra Pradesh are major castor producing states in India. Gujarat had the highest area under castor, the highest production for the three consecutive years i.e. in 2011-12, 2012-13 and 2013-14, followed by Rajasthan and Andhra Pradesh. The area and production in Gujarat was 6, 27, 000 hectares and 12, 87,900 tonnes, respectively in 2013-14. The area and production in India was 10, 63,200 hectares and 17,26,500 tonnes, respectively in 2013-14. The major trading centers of castor and its derivatives in Gujarat are Rajkot, Ahmadabad, Gondal, Patan, Disa, Kadi, Dhanera and Yemignoor in Andhra Pradesh.

Materials and Methods

Sampling design

To view the benefits of price forecast to the farmers in Gujarat state, Halvad taluka of Surendranagar district was selected purposely for impact study because of

large area under castor cultivation and good market availability. Eight villages were selected of which four were selected purposely for targeted farmers; those were earlier trained regarding market information and intelligence (NAIP - AMIC project) and four randomly of non- targeted farmers. A total of 60 castor growing farmers interviewed comprising 30 targeted and 30 non-targeted from these villages. The information required for the study was collected from the sample farmers through personal interview using a pre-tested, structured schedule of inquiry. The primary data under investigation pertain to the agricultural year 2013-14.

Statistical tools

The ARIMA models were employed for the price forecast of castor. The statistical time series forecasting was performed by using SPSS 19 software.

ARIMA Model

A new generation forecasting tool, popularly known as the Box-Jenkins (ARIMA) model was used to measure the relationships existing among the observations within the series. Box-Jenkins time series model written as ARIMA (p, d, q) was first popularized by Box-Jenkins. The acronym ARIMA stands for "Auto-Regressive Integrated Moving Average". Lags of the differenced series appearing in the forecasting equation are called "auto-regressive" terms, lags of the forecast errors are called "moving average" terms, and a time series which was differenced to be made stationary is said to be an "integrated" version of a stationary series. Random-walk and random-trend models, auto-regressive models and exponential smoothing models (i.e., exponential weighted moving averages) are all special cases of ARIMA models. It was first given by Box and Jenkins (1970), was

frequently used for discovering the pattern and predicting the future values of time series data. While Slutzky (1973) used the moving average model. Ansari and Ahmed (2001) applied ARIMA modeling for time series analysis of world tea prices and industrialized countries export prices. Nochai and Titida (2006) used ARIMA model for forecasting oil palm prices. Punitha (2007) used ARIMA model to forecast the arrivals and prices of maize and groundnut in Hubali and Devangere markets in Karnataka. ARIMA modeling consists of four operational steps: (i) Identification (ii) Estimation (iii) Diagnostics and (iv) Validation.

The important point to note is that to use the Box-Jenkins methodology, we need either a stationary time-series or a time-series that is stationary after one or more differencing. In ARIMA terms, a time series is a linear function of past actual values and random shocks, that is,

$$Y_t = f(Y_{t-k}, e_{t-k}) + e_t,$$

Where, $k > 0$

In ARIMA model, we do not have a forecasting model a priori before model identification takes place. ARIMA helps us to choose "right model" to fit the time series. A good number of applications of ARIMA model can be found in Bhardwaj et al. (2014), Paul et al. (2013, 2014), Paul and Das (2010) etc.

The tabular analysis was done to estimate the benefits obtained by farmers due to price forecast of castor.

Results and Discussion

Time series analysis includes the statistical analysis and interpretation of time series data of monthly average price of castor crop.

Price Forecast

The price forecast of castor was done for the period of March-2014 to May-2014 by using the time series data of monthly wholesale price of castor from Patan APMC of Gujarat from October-1990 to February-2014. Both non-seasonal and seasonal models of ARIMA were employed to forecast the price of castor for the mention period and the best result was obtained in non-seasonal model of ARIMA. The best fitted model was selected from the following ARIMA models viz., ARIMA (1,0,0), ARIMA (1,1,0), ARIMA (1,1,1), ARIMA (0,1,1), ARIMA (0,0,1), ARIMA (1,0,1) and ARIMA (0,1,0) on the basis of Mean Absolute Percentage Error (MAPE) criteria. The best fitted model found was ARIMA (0, 1, 2) based on MAPE value criteria.

Detail of the best fitted model ARIMA (0,1,2) is presented in [Table-1]. It was found that observed R-square obtained was 97.10 per cent and stationary R-square was 0.016. The MAPE (Mean Absolute Percentage Error) was found to be 5.39. The goodness of fit of the model was decided based on the MAPE value i.e., smaller value of MAPE indicates better fit. The value of MAE (Mean Absolute Error) obtained was 103.90 and the value of Normalized BIC was found to be 10.39. The forecasted prices by ARIMA (0,1,2) model were 3927.85 Rs./qtl., 3952.53 Rs./qtl. and 3960.26 Rs./qtl. The price forecast (pre-harvest) released by Department of Agricultural Economics of Junagadh Agricultural University in February 26, 2014 stated that during March to May, 2014 price may remain in the range of Rs. 760 to 860 per 20 kg (3800 to 4300 Rs/qtl). In addition to this, the traders' survey of Patan APMC was also carried out and it was considered along with other criteria while forecasting the price of castor for post harvest period. The image of trend lines of observed, fit and forecasted price series is presented in [Fig-1].

Table-1 The Model Summary of ARIMA (0, 1, 2) Model

R-square	MAPE	MAE	Normali-zed BIC	Statio-nary R ²	Forecasted Price by Model (Rs./qtl)	
0.97	5.39	103.9	10.39	0.016	Mar. 2014	3927.85
					Apr. 2014	3952.53
					May. 2014	3960.26

Note: Best-Fitting Models according to MAPE (smaller value of MAPE indicates better fit).

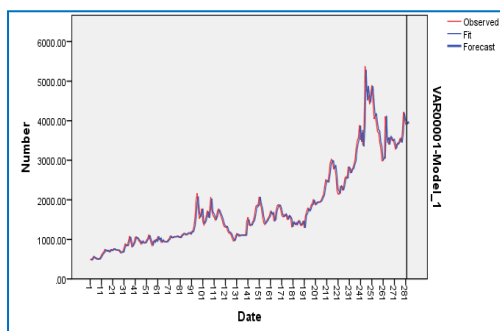


Fig-1 Price Series Chart

Residual ACF and Residual PACF

The graphs of autocorrelation function and partial autocorrelation function of ARIMA (0,1,2) model are given in [Fig-2]. It can be observed from the figure that price series was found stationary as it has not shown continuous declining trend.

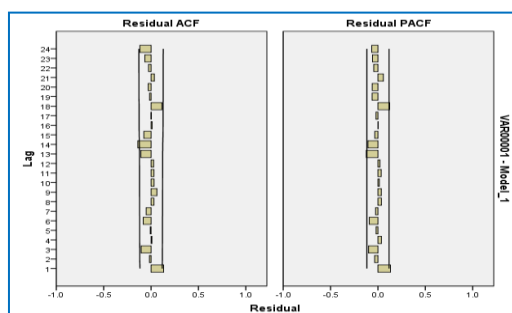


Fig-2 Residual ACF and Residual PACF of ARIMA (0,1,2) Model

Impact of price forecasts

In Gujarat castor is mainly grown in North Gujarat and Kutch, where land holding is higher than the average (2.02 ha) of the state. The production and price related information pertaining to the respondent farmers are presented in the [Table-2]. The average land holding size of targeted farmers was reported 5.19 ha and in case of non-targeted farmers it was 5.54 ha, with an average of 5.37 in case of all the 60 sample farmers. The average operated holding of targeted, non-targeted and all farmers under castor was 3.07, 2.37 and 2.72 ha., respectively. Most of the sample farmers had irrigation facilities and most of the areas of castor were under irrigation. The total castor production was 3, 26,100 kg, 2, 36,600 kg and 5, 62,700 kg for targeted, non-targeted and all sample farmers, respectively. The average price received by targeted farmers during season 2013-14 varied from Rs.786.83 to Rs. 897.67 per 20 kg and in case of non-targeted farmers during same season varied from Rs. 788.37 to Rs. 848.67 per 20 kg. The average price received by all the sample farmers (targeted + non-targeted farmers) during 2013-14 varied from Rs. 787.60 to Rs. 873.17 per 20 kg.

At the price forecast (pre-harvest) of castor by Market Intelligence Centre of Junagadh Agricultural University during 2013-14 informed to all farmers that the prices of castor during March to May, 2014 may remain in the range of Rs. 760 to 860 per 20 kg (3800 to 4300 Rs/qtl) during harvesting period. Based on this analysis, farmers were suggested to store castor and sell after May, 2014 taking their own decision, keeping the above situation in view.

It may be observed from Table that 1,998.40 quintal of castor was retained after May, 2014 by 30 sample targeted farmers, followed by 1,366 quintal castor was retained by 30 non-targeted farmers and 3,364.40 quintal castor was retained by all 60 sample farmers. During the harvesting period March to May, 2014 the average price received by sample was Rs. 3938 per quintal, which increased then after as per forecast and the 60 sample farmers realized Rs. 4365.85 per quintal of their stored quantity of 3,364 quintal. The farmers gained more profit of Rs.

427.85 per quintal. The incremental income realized by sample farmers was estimated by taking the difference between period of March, 2014 to May, 2014 and after May, 2014. The total incremental income realized by targeted, non-

targeted and all farmers were Rs. 39, 97,210/-, Rs. 18, 49,600 and Rs. 58, 46,810, respectively.

Table-2 Production and price details of retention of the sample farmers

Sr. No.	Particulars	Targeted Farmers	Non-targeted Farmers	All Farmers
1.	Average size land holding (ha)	5.19	5.54	5.37
2.	Average operated holding under castor (ha)	3.07	2.37	2.72
3.	Total production during year 2013-14 (Qtl.)	3,261	2,366	5,627
4.	Average price received during 2013-14			
4a.	Price of quantity sold during March to May- 2014 (Rs./qtl)	3934.15	3941.85	3938.00
4b.	Price of stored quantity after May-2014 (Rs./qtl.)	4488.35	4243.35	4365.85
5	Quantity retained beyond May-2014 (Qtl.)	1,998.40	1,366.00	3,364.40
6.	Total income realized at the pre forecast (Rs.)	49,66,145	39,41,500	89,07,645
7.	Total income realized at the post forecast (Rs.)	89,63,355	57,91,100	1,47,54,455
8.	Total incremental income realized (7-6) (Rs.)	39,97,210	18,49,600	58,46,810
9.	Incremental income realized (Rs./ha.)	43,447.93	25,977.53	35826.04

The incremental income on per hectare basis realized by targeted farmers was Rs. 43447.93, by non-targeted farmers Rs. 25,977.53 and for total sample farmers it was Rs. 35,826.04. The farmers gained more profit of Rs. 427.85 per quintal. The incremental income realized by 60 sample farmers was Rs. 35,826 per ha. Each sample farmer gained additional income of Rs. 23,983.

The wholesale price (WSP) in major castor market also confirmed the same. As sown in [Table-3], the WSP was ruling around Rs. 3800 per quintal in major market at harvesting during March to May, 2014 increased to around Rs. 4100 per quintal in June and further to Rs. 4250 per quintal in October, 2014. Thus farmers gain on an average more Rs. 300 to 400 per quintal who has stores castor as per advice of JAU, Junagadh and sold during June to October, 2014. Better quality seeds might have obtained higher prices than the WSP.

Table-3 Castor WSP at harvest in Major APMCs of Gujarat in 2013-14 (Rs/qtl)

Month	Bhuj	Deesa	Mehsana	Patan	Tharad	Avg. of five markets
Mar-2014	39.3	3970	4005	3959	3998	3967
Apr.- 2014	3745	3787	3823	3806	3831	3798
May-2014	3670	3692	3773	3763	3769	3733
Jun.- 2014	3890	3985	3982	4014	4014	3977
Jul.- 2014	4039	4144	4120	4140	4170	4123
Aug.- 2014	4022	4125	4026	4050	4072	4065
Sep.- 2014	3955	4092	4057	4093	4078	4055
Oct.- 2014	4180	4316	4273	4241	4260	4254

Sources of price forecast information

The sources of accessing price forecast and other market related intelligence by the sample respondents during the crop season 2013-14 is depicted in [Table-4]. It may be clearly seen that most of the farmers about 62 per cent obtained information about price forecast by news papers. The targeted 30 were in contact with field assistance of CCS scheme. About 38 per cent have also got information from friends and fellow farmers followed voice SMS and telephonic contact with scientist.

Table-4 Sources of accessing price forecast by sample farmers (n=60)

Sr. No.	Sources of Information	No. of farmers
1	Farmers' training & CCS scheme assistance	30 (50.00)
2	News paper	37 (61.67)
3	Voice SMS	9 (15.00)
4	TV	4 (6.67)
5	Others (friends and fellow farmers, etc.)	23 (38.33)
6	By telephonic contact with scientist	2 (3.33)

Note: Figures in the parentheses indicate percentage to total farmers

Conclusion:

Gujarat is the leading producer of castor in the country with nearly 75 per cent of

the output, followed by Andhra Pradesh and Rajasthan. India is the largest producer of castor seed and oil. It contributes about 18 lakh tonnes of castor seed with an approximate of 75 per cent share and 7 lakh tonnes of castor oil in the world total production. Market Intelligence Centre of JAU in February, 2014 suggested farmers to store castor and sell after May, 2014.

The average operated holding under castor by sample farmers was 2.72 ha per farmer. The total castor production of 60 sample farmer reported was 5,627 quintals. During the harvesting period (i.e. March to May, 2014), the average price received by sample was Rs. 3938 per quintal, which increased then after as per forecast and the 60 sample farmers realized Rs. 4365.85 per quintal of their stored quantity of 3,364 quintal

Conflict of Interest: None declared

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