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Prediction of Oilseeds production in India using ARIMA Model

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Abstract

Commercial crops occupy a separate share in business market across the world. Oil seeds in India, play a major role sharing 14% of the total area of production. Gujarat being the second leading producer in Oil seeds makes the leading contribution in market and in manufacturing huge quantity of paints, soaps, etc. The cattle-feed and manure procedures takes the remains of the oil seeds after the oil extraction process. As an urge of understanding the pattern of the production of Oil seeds, this study makes use of the statistical technique applied over a time series data of Oil seed production over a particular set of years. "Auto Regressive Integrated Moving Average" model is used here for the forecasting of the Oil seeds through which a trend graph is generated.

Keywords: *ARIMA Models, Time series Analysis, Trend line.*

I. INTRODUCTION

Predicting is one of the most required tool for many kind of people since there is a need of taking valuable decision and suitable strategy about the future works to be proceeded in almost all the fields. Crop production in India take a major part in the field of agriculture. Predicting the production of a crop hits the necessity of an investor to have a better view of the upcoming situation.

Production of Oil seeds in India include most of the types such as groundnut, castor seed, rapeseed and mustard, linseed, Soybean, safflower, Niger seed and sun flower. Major production of Oil seeds around the world are being processed and distributed through various places in India. Thus the export rate is obviously getting higher these days which makes India the second largest producer over groundnut. India also leads in Rapeseed production after Canada and China.

Primary sources include Groundnut, Rapeseed (Mustard), Soybean, Sunflower, Sesamum, Niger seeds, Safflower, Castor and Linseed. Secondary sources include Coconut, Cottonseed, Rivebran, Solvent Extracted Oils and oils from Tree and forest origin.

Primary sources cover around 60 MT of the total demand, while secondary cover 29 MT, thus making domestic supply to meet around 89 MT of the total domestic supply to meet around 89MT of the total domestic demand. Of this, around 5 MT is exported or used in industries. The Net domestic availability of Edible Oils thus remains around 86.37 MT and rest is met through imports. In 2015-16, India imported 148.20 million tons of edible oils. Thus, India has an alarming level of import dependency on oil.

Fifty percent of the major Oil seeds produced in India is Groundnut also called Rabi crop. The

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tropical climatic conditions prohibits its growth to stand as a predominant crop. The necessity for the survival of the crop need 20 to 30 degree Celsius temperature with 50 to 75 cm rainfall. This crop sustains in most of the critical situations but needs dry winter to ripe.

The next major oil seed cultivated is Mustard which is grown extensively after Groundnut. They extend in species of three varieties, which are cultivated the most. Oil which comprises of 45 – 50 % for cooking and for medicine manufacturing.

Mustard is second most important oil seed crop of India after Groundnut. This planet belongs to cabbage family (Brassica) and farmers in India mainly grow three species of mustard. The Sesamum seed comprises of 45 to 50 per cent oil used for cooking purposes and for manufacturing perfumery and medicines. India has the world's largest producer of this crop accounting for one-third of the world production. Castor seed comprises 50 per cent oil. It is mostly used in industries. India produces a very small fraction of palm oil but is one of the largest consumers. Import of Palm oil from Indonesia is the requirement of most of the people in India.

II. REVIEW OF LITERATURE

Day by day, numerous approaches based on time series data are being revealed by many researchers. This has a breakthrough in extending several applications in data sets related to time periods which shows results which suits the necessity of the present life problems.

'An Introductory study on Time Series modelling and forecasting' (RatnadipAdhikari et al., 2013) gives the usage of ARIMA model for the linear time series forecasting technique and some non-linear stochastic models. Most of these studies directly apply the linear strategies to get the results but do not focus on the relationship among those variables involved.

The method of ARIMA also extends giving required results over the wind-pace data by the value of correlation co-efficient and its distribution of data (Yunus et al., 2016) over a particular time period. (Vaccaro et al., 2015) suggests ARIMA model in hybrid architecture for electricity price forecasting (Liu et al, 2015) implements ARIMA model in the software program reliability boom section.

In addition to this, researchers have been developing predicting models such as Regression models, exponential curves, GARCH approaches and others. However, only some related works that has used ARIMA model in predicting stock market data for more details refer to (Meyler et al., 1998; Javier et al., 2003; Khashei et al., 2009; Khasheiet. al., 2012; Lee & Ho, 2011; Wang, 2011). Whereas, some models have been used up in the prediction of Agricultural crops. 'A Survey on ARIMA forecasting using Time series model (AshaFarhath.Z., et al., 2016)

III. MODELS USED IN THE STUDY

Auto-Regressive Integrated Moving-Average model are used for the data which involves the production values of Oil Seeds in India. ARIMA which is a grouping of Auto-regressive (AR) Model along with a Moving Average (MA) Model.

$Y_t = I + \omega_1 Y_{t-1} + \omega_2 Y_{t-2} + \ldots + \omega_p Y_{t-p} + e_t - e_1 e_{t-1}$ is the model equation of an ARMA Model in time series $\{Y_t\}$ $\omega_p(B)(1-B)^d Y_t = e_0 + e_q (B)\, e_t$ gives the ARIMA model (p,d,q) which denotes the orders of Autoregressive and moving averages.

IV. FINDINGS AND CONCLUSIONS

Observing the data of the Oil seed production, suitable graphs are being shown as follows in which plotting of the production of Oil seeds is being done, which is shown in Graph 1. The plotting is found to be increasing which shows the increase in usage of Oil seeds. The second graph shows the steady pattern plotted from the first differences of the Oil seed production.

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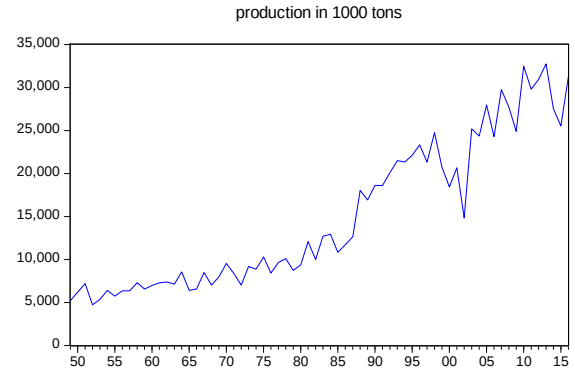

Figure 1

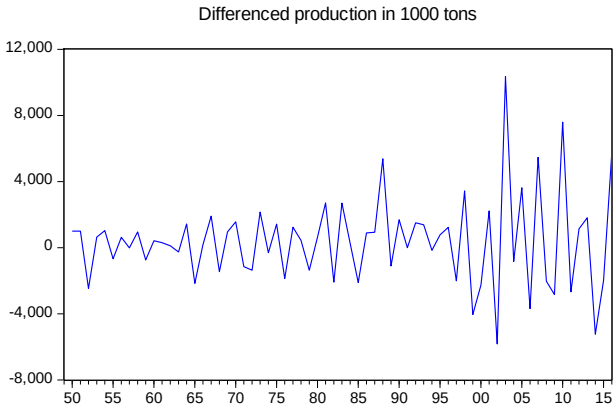

Figure 2

The auto correlation data in Table 1 indicates that our data is not stationary. Through Table 2, which shows the Auto correlation of first difference we find the data as a stationary one.

Table 1

Autocorrelat...Partial Correlation		AC	PAC	Q-Stat	Prob
	1	0.914	0.914	59.289	0.000
	2	0.894	0.358	116.91	0.000
	3	0.861	0.064	171.13	0.000
	4	0.796	-0.238	218.22	0.000
	5	0.752	-0.072	260.94	0.000
	6	0.710	0.050	299.65	0.000
	7	0.654	-0.034	333.04	0.000
	8	0.609	-0.036	362.48	0.000
	9	0.573	0.045	388.96	0.000
	10	0.516	-0.084	410.84	0.000
	11	0.479	-0.001	430.04	0.000
	12	0.441	0.013	446.61	0.000
	13	0.414	0.115	461.45	0.000
	14	0.370	-0.109	473.50	0.000
	15	0.369	0.175	485.73	0.000
	16	0.327	-0.128	495.49	0.000
	17	0.304	-0.021	504.09	0.000
	18	0.259	-0.245	510.50	0.000
	19	0.213	-0.065	514.89	0.000
	20	0.176	0.007	517.95	0.000
	21	0.121	-0.065	519.44	0.000
	22	0.083	0.011	520.15	0.000
	23	0.038	-0.005	520.30	0.000
	24	-0.011	-0.110	520.32	0.000
	25	-0.059	-0.052	520.70	0.000
	26	-0.095	0.014	521.72	0.000
	27	-0.133	0.130	523.76	0.000
	28	-0.164	-0.064	526.96	0.000

Table 2

Autocorrelatio...Partial Correlation		AC	PAC	Q-Stat	Prob
	1	-0.484	-0.484	16.376	0.000
	2	0.075	-0.207	16.775	0.000
	3	0.073	0.023	17.162	0.001
	4	-0.163	-0.130	19.112	0.001
	5	0.020	-0.162	19.141	0.002
	6	0.016	-0.093	19.160	0.004
	7	0.139	0.183	20.655	0.004
	8	-0.203	-0.079	23.879	0.002
	9	0.135	-0.037	25.341	0.003
	10	-0.049	-0.021	25.533	0.004
	11	-0.124	-0.116	26.808	0.005
	12	0.002	-0.238	26.808	0.008
	13	0.128	0.006	28.200	0.008
	14	-0.112	-0.045	29.287	0.010
	15	0.244	0.268	34.602	0.003
	16	-0.183	-0.045	37.645	0.002
	17	0.127	0.158	39.126	0.002
	18	-0.087	0.047	39.840	0.002
	19	-0.034	0.006	39.949	0.003
	20	0.112	-0.002	41.180	0.004
	21	-0.108	0.010	42.356	0.004
	22	0.048	-0.152	42.593	0.005
	23	-0.000	0.031	42.593	0.008
	24	0.056	0.075	42.926	0.010
	25	-0.089	0.130	43.796	0.011
	26	0.028	0.029	43.884	0.016
	27	-0.059	-0.055	44.293	0.019
	28	0.015	-0.060	44.320	0.026

Table 3		t-value	Prob.*
Augmented DF test statistic		-0.169549	0.9365
Critical values:	1 percent	-3.533204	
	5 percent	-2.906210	
	10 percent	-2.590628	

*MacKinnon (1996) one-sided p-values.

Table 4		t-value	Prob.*
Augmented DF test statistic		-13.56034	0.0000
Critical values:	1 percent	-3.533204	
	5 percent	-2.906210	
	10 percent	-2.590628	

*MacKinnon (1996) one-sided p-values

The following table shows the ARIMA Model and its outputs.

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Table 5

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17041.84	9441.261	1.805039	0.0758
AR(1)	0.992507	0.021707	45.72376	0.0000
MA(1)	-0.447008	0.093141	-4.799258	0.0000
SIGMASQ	5802800.	849832.3	6.828171	0.0000

R-squared	0.920435	Mean dependent var	14991.65
Adjusted R-squared	0.916705	S.D. dependent var	8603.481
S.E. of regression	2483.037	Akaike info criterion	18.57724
Sum squared resid	3.95E+08	Schwarz criterion	18.70780
Log likelihood	-627.6260	Hannan-Quinn criter.	18.62897
F-statistic	246.7905	Durbin-Watson stat	2.124015
Prob(F-statistic)	0.000000		

Inverted AR Roots	.99
Inverted MA Roots	.45

Forecasting:

The production data of Oil seeds from 1949 to 2014 help to forecast the values as shown. The following graph shows the forecasted pattern of Oilseeds.

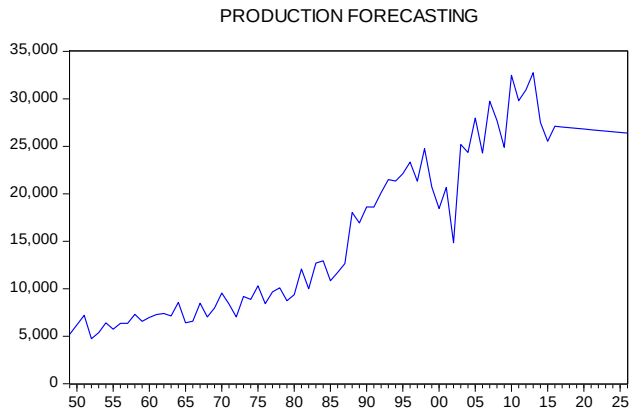

Figure 3

Oil seeds production data:

Year	Production of Oil seeds (1000 tons)	Year	Production of Oil seeds (1000 tons)
1949	5200	1968	7028
1950	6200	1969	7975
1951	7200	1970	9540
1952	4730	1971	8393
1953	5370	1972	7033
1954	6400	1973	9181
1955	5730	1974	8873
1956	6360	1975	10299
1957	6350	1976	8428
1958	7300	1977	9662
1959	6560	1978	10101
1960	6980	1979	8739
1961	7280	1980	9373
1962	7390	1981	12080
1963	7130	1982	9995
1964	8560	1983	12691
1965	6400	1984	12946
1966	6575	1985	10831
1967	8478	1986	11720

Year	Production of Oil seeds (1000 tons)	Year	Production of Oil seeds (1000 tons)
1987	12655	2006	24289
1988	18034	2007	29755
1989	16924	2008	27719
1990	18609	2009	24882
1991	18600	2010	32477
1992	20107	2011	29799
1993	21496	2012	30940
1994	21338	2013	32749
1995	22107	2014	27511
1996	23329	**2015**	**25521**
1997	21320	**2016**	**31276**
1998	24750	**2017**	**22548.8**

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1999	20710	**2018**	**22507.54**
2000	18440	**2019**	**22466.58**
2001	20662	**2020**	**22425.94**
2002	14834	**2021**	**22385.6**
2003	25186	**2022**	**22345.55**
2004	24354	**2023**	**22305.81**
2005	27978	**2024**	**22266.37**

CONCLUSION

The application ARIMA Model is being applied for the production data of Oil seeds in India. The above table shows the projected value of Oil seeds up to the year 2024. This projection reveals that the production of these seeds will be stable in the upcoming years.

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