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Changes in Prices and Arrivals of Major Oilseed Crops in APMC Amreli (Gujarat): An Empirical Analysis

A.S. Dudhat, Pushpa Yadav, A.P. Prajapati

Department of Agricultural Economics and Statistics, College of Agriculture,
Junagadh Agricultural University, Mota Bhandariya, Amreli-365 610, Gujarat, India.

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ABSTRACT

The price volatility has been the main centre of attention for policy planners. This study therefore, aims to examine the changes in price and arrivals of major oilseeds of APMC, Amreli (Gujarat) analyzing monthly time series data of last twenty years. The findings emerged from the study revealed that the month wise and year wise highest changes were observed for the groundnut (semi spreading), followed by sesamum (white). Month wise severe changes were observed in the price of sesamum (white), while year wise severe changes were observed for the sesamum (black). On the basis of adjusted R^2, price model of semi-spreading groundnut was found to be the best fit among all the models.

Key words: APMC, Arrivals, Estimate, Model, Oilseeds, Prices, Trend line.

INTRODUCTION

Gujarat ranks third in total oilseed production, while first in groundnut production in the country (www.gktoday.in). Amreli is one of the leading districts of Gujarat for oilseed production. The price fluctuations in agricultural commodities is a common phenomenon due to their seasonal nature of production, wide ecological imbalances and seasonal demand for agricultural commodities. Agriculture is characterized by wide variations in the output of crops which subsequently lead to larger variation in market arrivals. Fluctuations in market arrivals largely contribute to price volatility of agricultural commodities. There is need to have an understanding of the price behaviour of oilseed crops over time at micro level. Agriculture is being a biological industry and mostly depends on the monsoon, supplies of oilseed commodities which are uncertain and this uncertainty in supply leads to fluctuations in prices. These fluctuations in prices of oilseed commodities are greatest obstacle in the way of agricultural development. The knowledge on the interrelations between the arrivals and prices of oilseed crops is required for assessing the extent of price fluctuations over time. The analysis of arrivals and prices over time is important for formulating a sound agricultural price policy. The study of arrival and prices helps the farmer to find out the best time for marketing of oilseed crops to secure higher price for their produce. Thus it helps them to take decision regarding “when to sale?” so as to obtain maximum price.

Many attempts have been made for the study of changes in prices and arrivals of various agricultural commodities in India, but in Gujarat and particularly, at district level, little emphasis has been given on such type of studies. The APMC Amreli started in 1953 is the oldest in the Saurashtra region and recently it’s new market yard earned praise from all the stakeholders. The new market yard costing Rs. 125 crore, has 10 auction sheds of 25000 square feet each, farmers’ training centre, grading facilities, guest house *etc*., but all these have been done without any state support is the uniqueness of this APMC. The present study was therefore undertaken with a view to examine the arrivals and prices of major oilseed crops in APMC, Amreli. Changes in arrivals and prices were estimated by using appropriate statistical technique with the following objectives.

1. To examine the relative changes in arrival and prices of major oilseed commodities in APMC Amreli.
2. To formulate linear prediction models for arrivals and prices of major oilseed commodities.

MATERIALS AND METHODS

The present study was based on the prices and arrivals of major oilseed commodities of the APMC, Amreli. The data pertain to a period of 20 years *i.e.* from 1997-98 to 2016-17. The secondary data pertaining to prices and arrivals of major oilseed commodities *viz*. groundnut, sesamum and castor were collected from Agriculture Produce Market Committee, (APMC), Amreli. The major oilseed commodities for the present study were selected on the basis of average quantity of arrival in APMC, Amreli market.

Month wise and year wise mean, range and standard deviation of arrivals and prices of selected oilseeds were computed for relative comparison. The statistical measures used are given below.

Arithmetic mean $$\overline{X} = \frac{\sum_{i=1}^{n} X_i}{n}$$

*Corresponding author's E-mail: dudhatashok1963@gmail.com

Range = Highest value - Lowest value and Standard deviation (S),

$$S = \sqrt{\frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{n-1}} \quad \text{or} \quad S = \sqrt{\frac{\sum_{i=1}^{n} X_i^2 - \frac{(\sum_{i=1}^{n} X_i)^2}{n}}{n-1}}$$

Where,

Xi = Arrival or Price variable and $\overline{X}$ = Arithmetic mean for fitting a trend line, following regression equation was used for all the selected oilseed crops.

The simple, linear, least squares regression is written in the form

$$Y = \alpha + \beta X + \varepsilon$$

Where,

Y (arrival or price), the dependent variable, is a linear function of X (time), the independent variable. The parameters α and β characterize the population regression line and ε is the randomly distributed error term. The regression estimates of 'a' and 'b' will be derived using principle of least squares. In applying least squares, the sum of the squared regression errors will be minimized; our regression errors equal the actual dependent variable minus the estimated value from the regression line. If Y represents the actual value and $\hat{Y}$ the estimated value, then their difference is the error term, e. Least squares regression minimizes the sum of the squared error terms. The simple regression line will yield an estimated value of Y *i.e.* $\hat{Y}$, by the use of the sample regression:

$$\hat{Y} = a + bX + e$$

In the estimation, 'a' is the least squares estimate of 'α' and 'b' is the estimate of 'β'. Thus, 'a' and 'b' are the regression constants that can be estimated. Estimated regression model can act as a linear trend model. Estimated regression models were formulated for all the major oilseed commodities.

RESULTS AND DISCUSSION

1. The relative changes in arrival of selected oilseed commodities (Summery statistics)

In order to examine the relative comparison, month wise and year wise mean, standard deviation, minimum arrival (Qtl.), maximum arrival (Qtl.) and range of arrivals have been calculated and presented in Table 1(A).

The data on summary statistics presented in Table 1(A) revealed that the highest mean arrival (monthly and annually) was observed for the groundnut (semi-spreading), followed by sesame (white), while the lowest mean arrival was noticed for the castor. It is pertinent to note that there exists a wide range of variation not only between the oilseeds bus also between two different species within the same commodity. Highest monthly and annual standard deviation indicated that highest monthly and annually changes were occurred for the groundnut (semi- spreading), followed by sesamum (white). There were little changes for the castor. Generally, maximum arrivals were observed in the month of October-November. Tarpara V.D. (2011) also reported the highest arrival of oilseed commodities during October-November in his study of price behaviour of major oilseed crops in Gujarat.

Table 1(B) revealed that maximum monthly arrival was observed for the groundnut (semi-spreading), followed by sesamum (white), while minimum monthly arrival was observed for the groundnut (bunch) and sesamum (black), followed by castor and sesamum (white). Maximum annual arrival was observed for the groundnut (semi-spreading), followed by sesamum (white), while minimum annual arrival

Table 1 (A): Mean and standard deviation of arrival of selected oilseed commodities. (Qtl.).

Oilseeds	Mean		Std. deviation	
	Monthly	Annual	Monthly	Annual
Groundnut (Bunch)	1253	14657	2463.92	16608.21
Groundnut (Semi- spreading)	11380	131856	11793.93	80126.78
Sesamum (White)	6435	76038	7049.52	51747.25
Sesamum (Black)	1370	16074	1795.37	15156.17
Castor	1238	14578	1452.06	10573.59

Table 1 (B): Maximum arrival, minimum arrival and range of selected oilseeds (Qtl.).

Oilseeds	Maximum arrival (Qt.)		Minimum arrival (Qt.)		Range	
	Monthly	Annual	Monthly	Annual	Monthly	Annual
Groundnut (Bunch)	14999 (Nov, 1997-98)	59106 (1997-98)	2 (Feb,2008-09)	1034 (2016-17)	14997	58072
Groundnut (Semi spreading)	72003 (Jan, 2001-02)	316007 (2001-02)	81 (Aug,2016-17)	36335 (2012-13)	71922	279672
Sesamum (White)	37730 (Oct, 2001-02)	243650 (2001-02)	5 (Aug,1997-98)	16768 (2007-08)	37725	226882
Sesamum (Black)	10050 (Nov, 1998-99)	55144 (2001-02)	2 (Aug,1997-98)	2124 (2007-08)	10048	53020
Castor	11169 (Apr, 2012-13)	47681(2012-13)	4 (Nov,2010-11)	4233 (2003-04)	11165	43448

N.B.: Figures in parentheses indicate the month and year for the respective values.

was observed for the groundnut (bunch), followed by sesamum (black). It was noted that maximum monthly and annual arrivals of groundnut (semi-spreading) was found in the year 2001-02 which was just before the introduction of Bt. cotton. Highest range of monthly and annual arrival was observed for the groundnut (semi-spreading), followed by sesamum (white).

Highest arrival was noticed for the semi-spreading groundnut, followed by sesamum (white). Increasing trend in arrivals was observed for the groundnut (semi-spreading) from 1997-98 to 2001-02 *i.e*. just before the introduction of Bt cotton, then it started decline. Similar pattern was found in case of the arrivals of bunch type groundnut too. There was no systematic trend in arrivals in case of sesamum (black) and castor. Little arrival was observed for the castor due to less sowing area in the district (Fig 1).

2. The relative changes in price of selected oilseed commodities (Summery statistics)

For the relative comparison, month wise and year wise mean, standard deviation, minimum price (Rs/Qtl.), maximum price (Rs/Qtl.) and the range of oilseed prices during 20 years have been calculated and presented in Table 2(A) and 2(B).

It can be observed from Table 2(A) that the highest mean of monthly and annually prices were observed for the sesamum (black), followed by sesame (white), while lowest

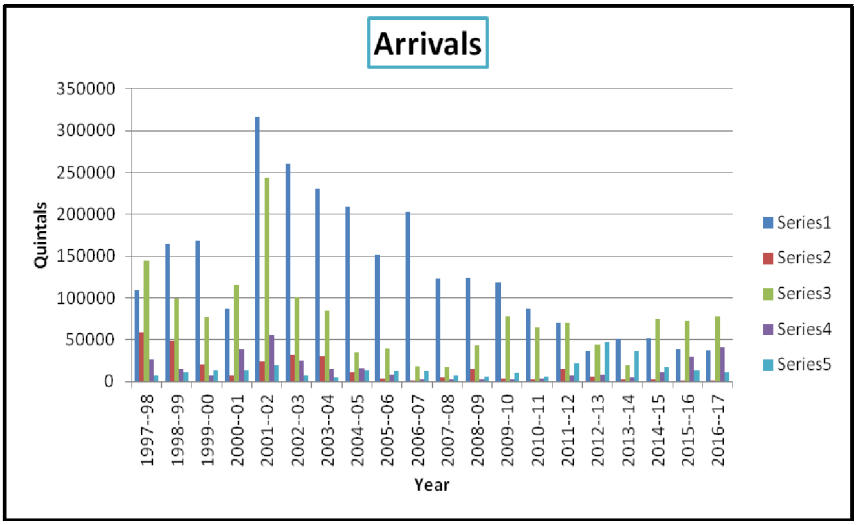

Fig 1: Comparison of arrivals of selected oilseeds.
Series 1: Groundnut (semi-spreading), Series 2: Groundnut (bunch), Series 3: Sesamum (white), Series 4: Sesamum (black), Series 5: Castor.

Table 2 (A): Mean and standard deviation of prices of selected oilseeds (Rs/Qtl.).

Oilseeds	Mean		Std. deviation	
	Monthly	Annual	Monthly	Annual
Groundnut (Bunch)	2498	2511	1102.31	1117.18
Groundnut (Semi- spreading)	2561	2558	1123.39	1113.58
Sesamum (White)	5179	5177	3065.39	3021.89
Sesamum (Black)	6447	6426	3980.62	3953.26
Castor	2329	2326	1032.52	1024.78

Table 2 (B): Maximum price, minimum price and range of selected oilseeds (Rs/Qtl.).

Oilseeds	Maximum price (Rs/Qtl.)		Minimum price (Rs/Qtl.)		Range	
	Monthly	Annual	Monthly	Annual	Monthly	Annual
Groundnut (Bunch)	5540 (May,2016-17)	4552 (2012-13)	1175 (Oct,1997-98)	1342 (2000-01)	4365	3210
Groundnut (Semi- spreading)	5505 (Aug,2012-13)	4706 (2012-13)	1125 (Oct,2001-02)	1351 (2000-01)	4380	3355
Sesamum (White)	16430 (Nov,2013-14)	13158 (2013-14)	1700 (Nov,1997-98)	2056 (2001-02)	14730	11102
Sesamum (Black)	20380 (Feb,2013-14)	14604 (2013-14)	1650 (Nov,1997-98)	2002 (2000-01)	18730	12602
Castor	5105 (Feb,2010-11)	4042 (2011-12)	900 (Apr,2000-01)	1062 (2000-01)	4205	2980

N.B.: Figures in parentheses indicate the month and year for the respective values.

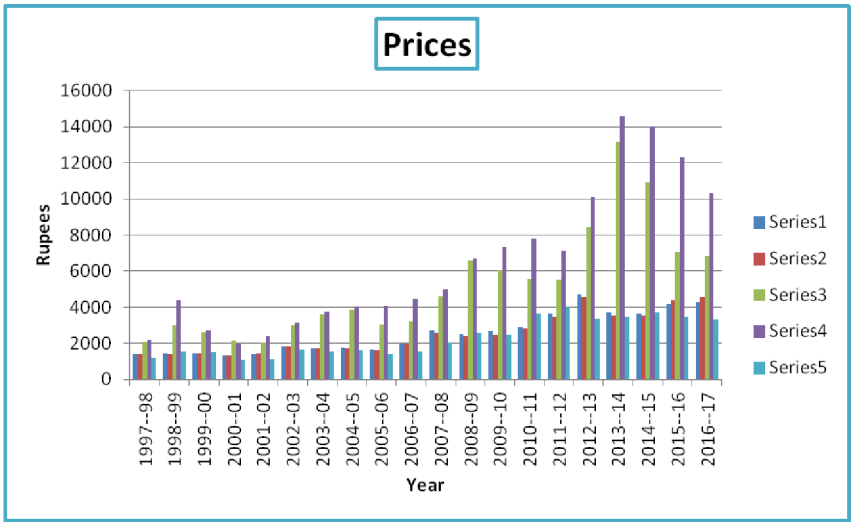

Fig 2: Comparison of prices of selected oilseeds.
Series 1: Groundnut (semi spreading), Series 2: Groundnut (bunch), Series 3: Sesamum (white), Series 4: Sesamum (black), Series 5: Castor.

mean for the monthly and annual prices was noticed in case of castor, followed by groundnut (bunch). Highest monthly and annually changes in price were observed for sesamum (black), followed by sesamum (white), since highest monthly and annual standard deviation were observed for sesamum (black), followed by sesamum (white). Little changes in price were noted for the castor.

A perusal of Table 2(B) revealed that maximum monthly and annual price were observed for the sesamum (black) *i.e*. Rs.20380/Qtl and Rs 14604/Qtl in Feb, 2013-14, followed by sesamum (white), while minimum monthly and annual price were observed for the castor in the year 2000-01. Amreli is one of the major districts in Gujarat, producing sesamum (black). Interestingly, volatility in monthly and annual prices computed on the basis of 20 years data, was found to be highest in sesamum (black), followed by sesamum (white). The lowest monthly and annual ranges were found in case of castor crop. Kalyankar and Shelke (1999) also reported similar findings for their study on sunflower in Parbhani district of Maharashtra.

An increasing trend was observed in prices of all the major oilseed commodities (Fig 2). Highest price was observed for the sesamum (black) than all other oilseed commodities. Highest prices of sesamum (black) and sesamum (white) were noted in the year 2013-14. It was also seen that the trend of increase in prices of castor, groundnut (bunch) and groundnut (semi-spreading) were relatively less compared to sesamum (black) and sesamum (white).

3. Formulation of arrival and price prediction models of selected oilseed crops

It is revealed from Table 3(A) that there was no valid estimated linear regression model among all the models for arrival of all the major oilseed commodities as can be seen from the value of adjusted R^2 for all the estimated models. The prediction based on the lower value of adjusted R^2 cannot serve the purpose.

From Table 3(B), it is revealed that estimated linear regression models for prices of all the major oilseed commodities give better fit because of higher adjusted R^2. Estimated price models for the groundnut (semi-spreading) and groundnut (bunch) have high adjusted R^2 than other models, so price model of groundnut (semi-spreading) is the best fit model, followed by price model of groundnut (bunch).

Table 3(A): Estimated linear regression models for arrivals of all the selected oilseed crops.

Crop	Linear regression models	Adj R^2
Groundnut semi- spreading	$\hat{Y}$ = 227322.4 - 9092.04X	0.4201
Groundnut (bunch)	$\hat{Y}$ = 36616.49 - 2091.37X	0.5302
Sesamum white	$\hat{Y}$ = 118577.2 - 4041.36X	0.1708
Sesamum black	$\hat{Y}$ = 21717.49 - 537.495X	0.0440
Castor	$\hat{Y}$ = 7588.816 + 665.6556X	0.0908

Note: Arrival (Y) is dependent on time variable (X).

Table 3(B): Estimated linear regression models for prices of all the major oilseed crops.

Crop	Linear regression models	Adj R^2
Groundnut semi spreading	$\hat{P}$ = 716.5053+175.3376X	0.8603
Groundnut bunch type	$\hat{P}$ = 670.0684+175.303X	0.8541
Sesamum white	$\hat{P}$ = 789.0737+417.8692X	0.6509
Sesamum black	$\hat{P}$ = 153.4737+597.3692X	0.7880
Castor	$\hat{P}$ = 693.8158+155.4842X	0.7949

Note : Price (P) is dependent on time variable (X).

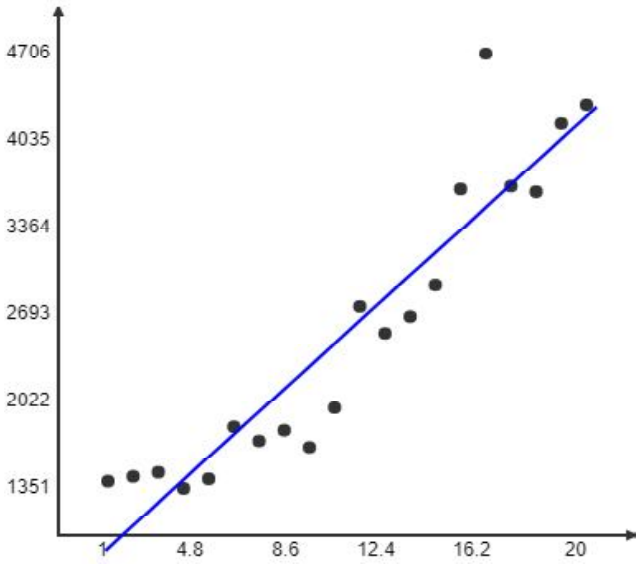

Fig 3: Line of best fit for price model of groundnut (semi-spreading). (Price variable in Rs./Qtl. on vertical axis and Time variable in year on horizontal axis.).

CONCLUSION

The major findings emerged from the study indicated that the peak period of oilseed arrivals in APMC, Amreli was observed during October to January, while minimum arrivals were observed in August *i.e.* off season. Highest monthly and annual mean arrivals were observed for groundnut (semi-spreading) as well as highest monthly and annual changes in arrival were also noted for the same crop.

Highest monthly and annual mean price and standard deviation were observed for the sesamum (black), followed by sesamum (white). Monthly and annual maximum price were also observed for the sesamum (black) in the year 2013-14, while lowest monthly and annual price were observed for the castor in the year 2000-01. The price variation persists over time despite substantial investments in rural roads and other market infrastructure is a cause of concern for the policy planners. To reduce India's on imported edible oils, the long term price policy for the oilseed crops has now become inevitable.

On the basis of adjusted R^2, arrival prediction models were noted poor fit due to seasonal fluctuation in arrivals of oilseed commodities, while price prediction models were observed better fit. Among all the models, price prediction model of semi spreading groundnut was the best fit model.

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