Determinants of Price of Mustard Seed and Mustard Oil in Domestic Markets of India

** Dinesh Chand Meena*
*** O. P. Singh*
**** Maina Kumari*

Abstract

India imports about half of its domestic consumption needs of edible oils. Among the different edible oilseeds grown in India, mustard occupies an important position as a large proportion of the Indian population consumes it as a vegetable oil. The farmers' decision regarding area allocation under oilseed crops is largely influenced by the prices of oilseeds. The study attempted to find the determinants of price of mustard seed and mustard oil in the domestic markets of India. A multiple linear regression analysis was fitted for the time series data. The results revealed that there was a positive and significant relationship between prices of sesame seed and mustard seed as well as between prices of soya oil and mustard oil. Therefore, it was concluded that sesame seed and soya oil were the close substitutes of the mustard seed and mustard oil respectively in the selected markets.

Keywords : **determinants of price, multiple regression, prices of substitute crops, mustard seed, mustard oil**

Paper Submission Date : January 10, 2014; Paper sent back for Revision : May 20, 2014 ; Paper Acceptance Date : June 9, 2014

India is amongst the largest producers and consumers of vegetable oils in the world. The Indian vegetable oil economy is the fourth largest economy in the world next to USA, China, and Brazil. Oilseeds play the second most important role in the Indian agricultural economy next to food grains in terms of area and production. The total oilseeds area, production, and productivity were 22.7 million hectares, 18.4 million tonnes, and 810 kg per hectare, respectively during 2000-01, which increased to 26.44 million hectares, 29.46 million tonnes, and 1135 kg per hectare during 2011-2012 (Narayan, Chauhan, & Chauhan, 2011).

The mustard crop occupies an important position in the Indian farming system. India ranks third in the production of mustard in the world, contributing about 16% to the world's total production. In 2011-12, the area, production, and yield of mustard were 5.92 million hectares, 6.78 million tonnes, and 1145 kg per hectare, respectively. It is grown widely in seven major Indian states, that is, Rajasthan, Uttar Pradesh, Haryana, West Bengal, Madhya Pradesh, Gujarat, and Assam, accounting for 92% of total mustard production in the country. Rajasthan occupies the first position in area and production of mustard in the country, which accounted for 42.30% and 43.81% respectively during the year 2011-2012. The total area under mustard cultivation in Rajasthan was 2.50 million hectares, and production was 2.97 million tonnes during 2011-2012.

The price system is a powerful tool to transmit essential economic information and stimulate appropriate decisions to producers and consumers. Price is the most important determinant of profit or loss in the farm

* *Scientist (Agril. Economics),* Central Soil and Water Conservation Research & Training Institute, Research Centre, Agra-282 006, Uttar Pradesh. E-mail : dineshbhu195@gmail.com

** *Assistant Professor of Agricultural Economics,* Department of Agricultural Economics, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221 005, Uttar Pradesh. E-mail : ompsingh@gmail.com

*** *Research Scholar,* Department of Agricultural Economics, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221 005, Uttar Pradesh. E-mail : maina.meena1309@gmail.com

enterprise. In a farm enterprise, the time factor is very important because crops are grown in one season and are harvested in another season. This long gestation period exercises a significant influence on price determination. Therefore, the prices prevailing during the marketing of farm produce are of great importance. It is an established fact that despite varying food habits, consumers change their consumption patterns to close substitutes in response to an increase or decrease in the price of a particular commodity. Any shortage in one commodity in the market leads to an increase in the demand for another, which will be reflected in the increase in the price of that particular substitute. Therefore, it becomes essential to know how the movements in the prices of one substitute are transmitted to another. An understanding of transmission of price signals from one commodity to another and their degree of association is vital to the implementation of price stabilization of commodities.

Realizing the importance of mustard in the domestic markets, this study attempted to identify the determinants of price of mustard seed and mustard oil in the domestic markets of India.

Methodology

Data and Sources : The study is based on secondary sources. The data related to domestic prices of mustard seed, mustard oil, soybean, soya oil, groundnut seed, groundnut oil, sesame seed, and crude palm oil were collected from the selected Agricultural Produce Market Committees (APMCs) for the period of 2004 to 2012.

Three major markets of mustard seed, that is, Alwar, Jaipur, and Sri Ganganagar, and Jaipur market for mustard oil were selected from Rajasthan state. Besides these markets, the Indore market of Madhya Pradesh for soybean seed and soya oil, Junagarh market for groundnut seed and groundnut oil, and Rajkot market for sesame seed were also selected. The selection of the markets was done on the basis of maximum quantity of arrivals and availability of secondary data.

Analytical Tools : Multiple regression analysis was carried out to find out which factors had a greater influence on deciding the price movement of mustard seed and mustard oil prices in selected Indian markets.

The multiple regression equation for prices of mustard seed in the Alwar market is as follows :

$$Y = b_o + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \varepsilon \quad \text{----------(1)}$$

where,
Y = price of mustard seed in Alwar market (Dependent variable).
Independent variables are X_1 = price of soybean seed in Indore market , X_2 = price of sesame seed in Rajkot market, X_3 = price of groundnut seed in Junagarh market , X_4 = price of mustard seed in Jaipur market , and X_5 = price of mustard seed in Sri Ganganagar market ; b_1, b_2, b_3, b_4, b_5 are regression coefficients and b_o is a constant ; ε is an error term.

Multiple regression equation for prices of mustard seed in the Jaipur market is as follows :

$$Y = b_o + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \varepsilon \quad \text{----------(2)}$$

where,
Y = price of mustard seed in Jaipur market (Dependent variable).
Independent variables are X_1 = price of soybean seed in Indore market, X_2 = price of sesame seed in Rajkot market , X_3 = price of groundnut seed in Junagarh market , X_4 = price of mustard seed in Alwar market, and X_5 = price of mustard seed in Sri Ganganagar market ; b_1, b_2, b_3, b_4, b_5 are regression coefficients and b_o is a constant ; ε is an error term.

The multiple regression equation for prices of mustard seed in the Sri Ganganagar market is as follows :

$$Y = b_o + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \varepsilon \text{ ----------(3)}$$

where,
Y = price of mustard seed in Sri Ganganagar market (Dependent variable).
Independent variables are X_1 = price of soybean seed in Indore market, X_2 = price of sesame seed in Rajkot market, X_3 = price of groundnut seed in Junagarh market, X_4 = price of mustard seed in Alwar market, and X_5 = price of mustard seed in Jaipur market; b_1, b_2, b_3, b_4, b_5 are regression coefficients, and b_o is a constant; ε is an error term.

The multiple regression equation for prices of mustard oil in the Jaipur market is as follows :

$$Y = b_o + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \varepsilon \text{ ----------(4)}$$

where,
Y = price of mustard oil in the Jaipur market (Dependent variable).
The independent variables are X_1 = price of soy oil in the Indore market, X_2 = price of crude palm oil in the Kandla market, X_3 = price of groundnut oil in the Junagarh market, X_4 = price of mustard seed in the Jaipur market; b_1, b_2, b_3, b_4 are regression coefficients, and b_o is a constant; ε is an error term.

Results and Discussion

Impact of Various Factors on the Prices of Mustard Seed in the Alwar Market : The multiple linear regression function was fitted for time series data to find out the impact of groundnut seed prices of Junagarh market, soybean seed prices of Indore market, and mustard seed prices of Jaipur and as well as Sri Ganganagar markets on the prices of mustard seed in the Alwar market, and the results are presented in the Table 1.

The analysis confirms that there is a significant relationship between sesame prices of Rajkot market and mustard seed prices of Jaipur market. A non-significant relationship is observed between the soybean seed prices of Indore market, groundnut seed prices of Junagarh market, and mustard seed prices of Sri Ganganagar market. The model explains 98.6% of the variation by the selected independent variables as indicated by R^2 value of 0.986.

The results suggest that the prices of mustard seed in Jaipur market have a greater impact on the prices of mustard seed in Alwar market (Table 1). The coefficient of mustard seed in Jaipur market and prices of sesame seed in Rajkot market are found to be positive and statically significant. The positive coefficient of these factors

Table 1. Impact of Various Factors on the Price of Mustard Seed in the Alwar Market

Factors	Coefficients	Standard Error	*t* - Stat	*P* - value
Intercept	0.3220	0.1795	1.7941	0.0738
Soybean seed prices (Indore market)	0.0004	0.0149	0.0248	0.9802
Sesame seed prices (Rajkot market)	0.0123**	0.0041	2.9613	0.0033
Groundnut seed prices (Junagarh market)	0.0060	0.0087	0.6832	0.4950
Mustard seed prices (Jaipur market)	0.9610*	0.0653	14.7074	0.0000
Mustard seed prices (Sri Ganganagar market)	-0.0188	0.0733	-0.2563	0.7979
R^2 = 0.986**				

Note: * & ** Significant at 1% and 5% level of probability

Table 2. Impact of Various Factors on the Price of Mustard Seed in the Jaipur Market

Factors	Coefficients	Standard Error	*t* Stat	*P* - value
Intercept	-0.4619*	0.1173	-3.9397	0.0001
Soybean seed prices (Indore market)	0.0009	0.0099	0.0903	0.9281
Sesame seed prices (Rajkot market)	0.0004	0.0028	0.1315	0.8955
Groundnut seed prices (Junagarh market)	0.0009	0.0099	0.0903	0.9281
Mustard seed prices (Alwar market)	0.4260*	0.0290	14.7074	0.0000
Mustard seed prices (Sri Ganganagar market)	0.6567*	0.0316	20.7857	0.0000
R^2 =0.994*				

Note: * Significant at the 1% level of probability

Table 3. Impact of Various Factors on the Price of Mustard Seed in the Sri Ganganagar Market

Factors	Coefficients	Standard Error	*t* Stat	*P* - value
Intercept	0.7531*	0.1327	5.6741	0.0000
Soybean seed prices (Indore market)	0.0116	0.0115	1.0074	0.3145
Sesame seed prices (Rajkot market)	0.0608*	0.0058	10.4826	0.0000
Groundnut seed prices (Junagarh market)	-0.0036	0.0032	-1.0957	0.2741
Mustard seed prices (Alwar market)	-0.0112	0.0437	-0.2563	0.7979
Mustard seed prices (Jaipur market)	0.8843*	0.0425	20.7857	0.0000
R^2 = 0.995 *				

Note: * Significant at the 1% level of probability

implies that increase in prices of sesame seed in the Rajkot market increases the prices of mustard seed in the Alwar market.

↳ **Impact of Various Factors on the Prices of Mustard Seed in the Jaipur Market :** The multiple linear regression analysis was fitted for the time series data to find out the impact of groundnut seed prices of Junagarh market, soybean seed prices of Indore market, and mustard seed prices of Alwar and Sri Ganganagar markets on the prices of mustard seed in the Jaipur market.

The results of the regression analysis reveal a significant relationship with the mustard seed prices of Alwar and Sri Ganganagar markets. However, the results reveal a non-significant relationship with the soybean seed prices of Indore market and groundnut seed prices of Junagarh market. The model explains 99.4% of the variation by the independent variables considered as indicated by the R^2 value of 0.994 (Table 2).

The results suggest that the coefficients of prices of mustard seed in the Alwar and Sri Ganganagar markets are positive and significant at the 1% level of significance, depicting that the prices of mustard seed in these markets have a greater impact on the prices of mustard seed in the Jaipur market.

↳ **Impact of Various Factors on the Prices of Mustard Seed in the Sri Ganganagar Market :** Multiple linear regression was carried out using time series data to find the impact of groundnut seed prices of Junagarh market, soybean seed prices of Indore market, and mustard seed prices of Alwar and Jaipur markets on the prices of mustard seed in the Sri Ganganagar market.

The results confirm that there is a significant relationship between mustard seed prices of Jaipur market and sesame seed prices of Rajkot market, but a non-significant relationship exists with the soybean seed prices of Indore market, groundnut seed prices of Junagarh market, and mustard seed prices of Alwar market. The model explains 99.5% of the variation by the independent variables considered, as indicated by R^2 value of 0.995 (Table 3).

Table 4. Impact of Various Factors on the Price of Mustard Oil in the Jaipur Market

Factors	Coefficients	Standard Error	*t* Stat	*P* -value
Intercept	0.5439	0.7503	0.7249	0.4690
Soya oil prices (Indore market)	0.4553*	0.0295	15.4174	0.0000
Crude Palm oil prices (Kandla market)	0.0020	0.0065	0.2994	0.7649
Groundnut oil prices (Junagarh market)	-0.0296**	0.0148	-1.9996	0.0464
Mustard seed prices (Jaipur market)	1.1606*	0.0462	25.1094	0.0000
R^2 = 0.976*				

Note: * & ** Significant at the 1% and 5% level of probability

The results suggest that prices of mustard seed in the Jaipur market have a greater impact on the prices of mustard seed in the Sri Ganganagar market. The coefficients of mustard seed in Jaipur market and prices of sesame seed in Rajkot market are found positive and statically significant. The positive coefficient of these factors implies that increase in prices of these factors would result in an increase in prices of mustard seed in the Sri Ganganagar market. Similar results were obtained by Kumar, Lakshmi, and Raju (2001).

Impact of Various Factors on the Prices of Mustard Oil in the Jaipur Market : The results of the multiple linear regression of soya oil prices of Indore market, groundnut oil prices of Junagarh market, crude palm oil prices of Kandla market, and mustard seed prices of Jaipur market (independent variables) to the mustard oil prices of Jaipur market (dependent variables) are presented in the Table 4.

About 97.6% of the variation in mustard oil prices of the Jaipur market is explained by these independent variables. The results clearly indicate that is a significant relationship between soybean oil prices of Indore market, groundnut oil prices of Junagarh market, and mustard seed prices of Jaipur market ; however, there is a non-significant relationship with the crude palm oil prices of Kandla market. Hence, the market is volatile as a result of import substitution due to high demand of edible oil in the domestic market.

The results show that prices of mustard seed in the Jaipur market have a greater impact on the prices of mustard oil in the Jaipur market (Table 4). The coefficients of mustard seed in the Jaipur market and prices of soya oil in the Indore market are found to be positive and significant at the 1% level of significance. The positive coefficients of these factors implies that increase in prices of these factors would result in an increase in the prices of mustard oil in the Jaipur market. The coefficient of prices of groundnut oil in the Junagarh market is found to be negative and statistically significant. This implies that increase in prices of groundnut oil in the Junagarh market would result in a decrease in prices of mustard oil in the Jaipur market.

The results clearly indicate a positive and highly significant relationship between mustard seed parameters to the spot prices of mustard oil in the domestic market. Normally, the prices of mustard oil reach the peak during November and December and after that, they either fall or remain stable during the other months of the year. From the above discussion, it can be concluded that there is a positive and significant relationship between mustard seed and mustard oil prices to the prices of other oilseeds, that is, groundnut, soybean, and crude oil palm. Thus, it is observed that the prices of substitute crops affect the prices of mustard seed and mustard oil directly in the domestic markets. It is also observed that the raw mustard seed is not much utilized ; however, demand mainly comes from the processing sector, thus affecting mustard to a large extent. Similar results were observed in the studies conducted by Nasurudeen and Subramanian (1995) and Kumar, Raju, and Lakshmi (2000).

Policy Implications

The program administrators and policy makers are always interested to know about the factors (prices of substitute crops) that have a greater influence on deciding the price movement of crops. The results revealed that there is a

positive and significant relationship between prices of sesame seed and mustard seed as well as between prices of soya oil and mustard oil. Therefore, it is concluded that sesame seed and soya oil are the close substitutes of mustard seed and mustard oil, respectively in the selected markets. The results would assist the policy makers in the formulation and implementation of policies regarding administered prices, and marketing and trade (export & import) of oilseed crops and edible oils . The results also suggest that the markets of oilseeds and edible oils need to be vertically integrated through a better policy framework to improve the market efficiency.

Conclusion

The significant contribution of this paper is that its results would be helpful in understanding of transmission of price signals from one commodity to another and their degree of association. A multiple linear regression analysis function was fitted for the time series data to analyze the impact of prices of other oilseed crops to the mustard seed and mustard oil prices. The results suggest complex relationships among mustard seed, groundnut seed, sesame seed, and soybean seed; mustard oil, groundnut oil, soya oil, and crude palm oil. Therefore, only analyzing the price behaviour of one commodity (while ignoring the impact of the prices of other substitutes) will not be meaningful for price stabilization purposes.

The results confirm that there exists a significant relationship between the factors considered for the mustard seed price indicating R^2 value of 0.986 in the Alwar market, 0.994 in the Jaipur market, and 0.995 in the Sri Ganganagar market. The results clearly indicate that there is a significant relationship between prices of mustard seed and prices of other oilseeds in the domestic markets. There is a significant relationship between prices of mustard oil and spot prices of other oils in the domestic market as indicated by R^2 value of 0.976. Normally, the prices of mustard oil reaches a peak during November-December and reaches a low point during March-April . It was also found that the raw mustard seed is not much utilized ; however, heavy demand mainly comes from the processing sector , thus affecting the mustard prices to a large extent.

Limitations of the Study and Scope for Future Research

Availability of secondary data and resources of the research forced us to select a limited area for the study. Hence, the results are largely applicable to those areas where similar conditions prevail. Multiple regression was used to find out the degree of association between price series. However, there are limitations to this measure such as spurious correlation and non-stationary nature of the price series. Therefore, alternative models could be used to get better results in further studies. We also suggest that similar studies should be taken up in detail for the other agriculture commodities (grains and pulses) to understand the market mechanisms (transmission of prices from one commodity to another and their degree of association) in a better way.

References

Kumar, K. N. R., Lakshmi, K.S., & Raju, V.T. (2001). Price response analysis of agricultural commodities in Anakapalle regulated market of Andhra Pradesh. *Agricultural Marketing, 44* (2), 17-19.

Kumar, K. N. R., Raju, V. T., & Lakshmi, K. S. (2000). Determinants of prices in regulated market under the Warangal Market Committee, Andhra Pradesh. *Agricultural Marketing, 43* (2), 14-15.

Narayan, P., Chauhan, M. S., & Chauhan, S. (2011). Oilseeds scenario in India. *Agriculture Today*, December, 40-43.

Nasurudeen, P., & Subramanian, S. R. (1995). Price integration of oils and oilseeds. *Indian Journal of Agricultural Economics, 50* (4), 624 - 633.