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Arrival and Price Behaviour of Major Mustard Markets in Haryana

Jitender Kumar Bhatia[1], Dalip Kumar Bishnoi[2], Atul Dhingra[3] and Parveen Kumar Nimbrayan[4]*

[1,3,4]Directorate of Human Resource Management, [2]Department of Agricultural Economics, CCS Haryana Agricultural University, Hisar-125004, Haryana, India
*Corresponding authors email id: parv2509@hau.ac.in

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ABSTRACT

The market arrival and price behaviour of major mustard markets in Haryana during the pre-e-NAM (2010-2016) and post-e-NAM (2017-2021) periods was studied. In Haryana, e-NAM was implemented in 2016 but after adoption, its impact was shown in 2017. Results revealed that arrivals of mustard increased during pre e-NAM period in two selected markets, whereas, prices of mustard were found to be increased in Sirsa market while it decreased in Rewari market. In post e-NAM period, arrival and prices of mustard found to be decreased in both the markets. It was found that adoption and awareness about e-NAM was found higher in case of Sirsa market as compared to the Rewari market. Both Sirsa and Rewari markets were found spatially integrated in both pre as well as post e-NAM period. The Granger causality test in the post-e-NAM period demonstrated that mustard prices in Sirsa market were having a unidirectional causation on the prices in Rewari market, however there was no causality link between mustard prices in both markets in the pre-e-NAM time.

INTRODUCTION

To ensure the availability of critical inputs in order to increase the productivity to achieve self-sufficiency in oilseed sector is stressed. One of the most commercially significant agricultural crops is the *Oleiferous brassica* species, sometimes known as rapeseed-mustard made up of eight different varieties, including toria, yellow sarson, brown sarson, gobhi sarson, karan rai, black-mustard, and taramira. It is a collection of oilseed crops that ranks second in importance in the Indian economy after groundnut. In the year 2020, the world's estimated rapeseed-mustard area, output, and yield were 35.98 million hectares, 72.77 million tonnes, and 2039 kg/ha, respectively. India accounts for 21.13 per cent of total acreage and 12.61 per cent of total output globally (FAO, 2020). Rapeseed and Mustard are grown as a Rabi crop in Rajasthan, Uttar Pradesh, Madhya Pradesh, Haryana, West Bengal, and Punjab in India. Haryana ranks fourth in area and second in production (Agricultural Statistics at a Glance, 2020). The area of mustard in the state increased from 0.51 million hectares to 0.61 million hectares and production from 0.95 million tonnes to 1.29 million tonnes during the period from 2010-11 to 2018-19 (Statistical Abstract of Haryana, 2019-20). Although productivity is increasing but to ensure the availability of critical inputs in order to increase the productivity to achieve self-sufficiency in oilseed sector is stressed (Kumar et al., 2018). Socio economic factors and knowledge level about different production recommendations significantly affected the attitude of respondent farmers towards cultivation of rapeseed mustard crop (Kumar et al., 2020). With the increase in demand of mustard oil and mustard cakes in the country as well at international level, it became highly remunerative crop for the farmers. National Agriculture Market (e-NAM) is an electronic trading portal started by the central government on 14th April, 2016 on pilot basis in 21 mandis at national level in which 4 mandis were covered from Haryana state. After that 1st phase, another 50 and 20 markets were included in e-NAM during the years 2018 and 2021, respectively. At present, there are total 81 APMC are integrated with e-NAM. The adoption of e-NAM in farmers, commission agents, trader and other stakeholders is increasing with

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time. In Haryana more than 27 lakh farmers, nearly 25 thousand commission agents, nearly 13 thousand traders and other stakeholders joined with e-NAM till 28th, Feb. 2022 (e-NAM). This level of adoption and awareness will definitely fulfil the objectives of e-NAM in the state. As such the study was conducted to understand market behaviour, patterns and linkages between commodity arrivals and prices.

METHODOLOGY

The whole study was divided into two group *i.e.* Pre e-NAM (2010-2016) and Post e-NAM (2017-2021). Agriculture Produce Market Committees (APMCs) of Sirsa and Rewari markets, Haryana State Agricultural Marketing Board (HSAMB), Panchkula, and Agricultural Marketing Information Network (AGMARKNET) provided the required monthly data on wholesale prices and market arrivals of mustard. Seasonal indices were created using the twelve-month ratio to moving average approach to quantify seasonal fluctuations in pricing and arrivals. Intra-year price increase (IPR) and coefficient of average seasonal price variation (ASPV) were used to calculate the magnitude of seasonal price fluctuation (Mahalle et al., 2015).

Rapsomanikis et al., (2006) provided a thorough assessment of methodologies for analysing market integration and price transmission, which aided in the refinement of the methodology utilised in this study. The unit root in a time series sample is tested using the Augmented Dickey-Fuller test (ADF). The ADF test's autoregressive version with a drift component is provided by:

$$\Delta p_{it} = a_0 + \gamma p_{it-1} + \sum_{i=2}^{n} \beta_i \Delta p_{it-j+1} + \varepsilon_t$$

Where, p_{it} is the price in market i at the time t, $\Delta p_{it} = (p_{it} - p_{it-1})$ and α_0 is the intercept or drift term.

The joint hypothesis to check the presence of unit root is: H_0: $\gamma = \alpha_0 = 0$ using φ_0 statistic. Failure of the rejection of null hypothesis means that the series is non-stationary.

The Johansen (1988) maximum likelihood estimator was chosen over the Engle and Granger (1987) two-step technique for co-integration analysis. The Johansen technique is a multivariate version of the Dickey-Fuller test, and it has the following formulation:

$p_{it} = A_1 p_{it} + \varepsilon_t$
so that
$\Delta p_{it} = A_1 p_{it} - p_{it-1} + \varepsilon_t$
$\Delta p_{it} = (A_1 - 1) p_{it-1} + \varepsilon_t$
$\Delta p_{it} = \Pi p_{it-1} + \varepsilon_t$

Where, p_{it} and ε_t are (n×1) vectors; A_1 is an (n×n) matrix of parameters; I is an (n×n) identity matrix; and Π is the (A_1-1) matrix.

The number of co-integrating vectors is equal to the rank of the (A_1-1) matrix. The most important thing to look for is whether (A_1-1) contains all zeros or not. If it does, all of the $\{p_{it}\}$ in the preceding VAR are unit root processes, and one linear combination of them is stationary, implying that the variables are not co-integrated. The number of independent co-integrating vectors equals the rank of the matrix Π.

The presence of a co-integrating connection between the price series was determined using the trace test. The following statistics were used to test for the number of characteristic roots that are insignificantly different from unity using the estimations of the characteristic roots:

$$\lambda_{trace}\ (r) = -T \sum_{j=r+1}^{n} ln\ (1 - \grave{\lambda_j})$$

Where, λ_j is the estimated values of the characteristic roots (eigen values) derived from the estimated Π matrix.; and T is the number of valid observations.

After determining that two markets were co-integrated using the Johansen approach, we used Granger (1969) causality tests to determine the order and direction of short-term and long-term equilibrium linkages. The following tests were used to see if market p 1 Granger caused market p 2 or vice versa:

$$p_{it} = c \sum_{j=1}^{n} (\emptyset\, p_{1t-j} + \delta_j p_{2t-j}) + \varepsilon_t$$

The Granger causality was tested using a simple test of the joint significance of δ_j. i.e.

$$H_{0:}\ \delta_1 = \delta_2 = \ldots \delta_n = 0.$$

RESULTS AND DISCUSSION

Adoption of e-NAM in major mustard markets

Stakeholders are very important for successful implementation of the e-NAM in APMC's. In Sirsa and Rewari APMC's stakeholder status is presented in Table 1. In the Sirsa market, the number of farmers registered with e-NAM were 6 times higher as compared to the Rewari market which shows higher adoption of e-NAM by farmers in the Sirsa market. In case of traders and commission agents, higher adoption was found in Sirsa market as compared to Rewari market.

Table 1. Stakeholders status of major mustard markets

Markets	Farmers	Traders	Commission Agent
Sirsa	179726	413	791
Rewari	28379	214	259

Trends in arrivals and prices of mustard

Table 2 shows the trends of arrival and prices of mustard during the pre e-NAM and post e-NAM period in Sirsa and Rewari market. Arrivals of mustard have increased during pre e-NAM period in both the market. Whereas, prices of mustard were found to be increased in Sirsa market while it was decreased in Rewari market. In post e-NAM period, arrival and prices of mustard were observed decreasing trend in both the markets.

Prices and arrivals seasonality of mustard

Table 3 shows the seasonal changes in mustard prices in the pre e-NAM and post e-NAM periods. The data demonstrated that during the pre-e-NAM period, indices of seasonal price fluctuation in Sirsa Market were greatest in August and October to December, whereas it was highest in Rewari Market from June to December. In post e-NAM period, in Sirsa market, indices of seasonal prices were observed highest in January, April to June and August while

Table 2. Trends in prices and arrivals of mustard in major wholesale markets of Haryana

Markets	Pre e-NAM		Post e-NAM	
	Coefficient of linear trend		Coefficient of linear trend	
	Change in price (Rs/q/year)	Change in arrival (q/year)	Change in price (Rs/q/year)	Change in arrival (q/year)
Sirsa	y = 281.17x + 2038.9	y = 0.2859x + 401.11	y = -615.83x + 4914.2	y = -79.867x + 939.45
Rewari	y = 247.94x + 2251.9	y = -214.5x + 2281.6	y = -1076x + 5441.8	y = -328.81x + 1361.7

Table 3. Monthly prices and arrivals seasonal indices of selected mustard markets in Haryana

Month	Seasonal Index – Price (%)							
	Pre e-NAM				Post e-NAM			
	Sirsa		Rewari		Sirsa		Rewari	
	Prices	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices	Arrivals
January	94.86	5.00	98.33	16.29	102.26	4.47	107.37	10.83
February	96.78	12.04	90.60	17.73	96.28	2.17	102.05	2.05
March	94.01	154.45	88.12	127.45	96.39	79.50	106.11	124.90
April	87.85	696.34	90.56	676.01	105.72	652.01	107.76	423.73
May	90.99	222.94	99.38	170.87	104.48	375.89	100.41	146.95
June	93.05	48.49	102.13	42.77	104.67	26.59	96.32	25.26
July	98.91	17.97	100.36	67.16	94.91	12.76	96.69	66.05
August	110.44	12.03	107.09	10.14	100.12	10.62	97.24	47.02
September	99.15	13.96	102.29	20.01	98.99	7.41	97.49	52.37
October	100.91	8.00	103.67	25.55	89.81	14.52	95.48	28.92
November	116.94	5.98	110.76	8.96	101.77	10.21	97.86	22.92
December	116.11	2.80	106.72	17.04	104.59	3.85	95.23	248.98

in Rewari market, seasonal prices were higher from January to May month. Table 3 further shows the seasonal fluctuation in mustard arrivals in Haryana's designated marketplaces. During the pre e-NAM period, arrivals were greater in the months of March and May, but remained lower in the months of October and January in the Sirsa and Rewari markets. Whereas, in post e-NAM period, arrival of mustard was found to be highest in the months of April and May in Sirsa market and during the March and May in Rewari market. Similar results were observed by Wadke (2013) in their study.

Seasonal movement in prices of mustard

The intra-year price rise (IPR) of mustard has had significant consequences for producers, merchandisers, and consumers over the years. The intra-year variations in mustard prices ranged between 25.69 to 33.11 and 13.16 to 17.72 per cent per cent during the pre e-NAM as well as post e-NAM period in Sirsa and Rewari markets of Haryana, respectively (Table 4).

The pre-e-NAM period's average seasonal price variation (ASPV) varied from 22.77 to 28.41 per cent, whereas the post-e-NAM period's ASPV was between 12.35 and 16.27 per cent. Intra-year changes in mustard prices, as well as average seasonal price variations, may have significant ramifications for pricing and yearly mustard production decisions.

Market integration

The Augmented Dickey Fuller (ADF) test was used to investigate market integration, and the findings are shown in Table 5. The ADF values in the pre-e-NAM period were lower than the crucial values at the 1 per cent level, indicating that the price series were free of unit root effects. This meant that at the ADF levels, the price series were stationary. The ADF values were greater than the critical values at the 1 per cent level after e-NAM, showing the presence of a unit root in the series and non-stationary nature of the data. The ADF values in the Rewari market were smaller than the crucial values at the 1 per cent level of significance, indicating

Table 4. Descending order of mustard markets according to IPR and ASPV

Market	IPR (%)		Market	ASPV (%)	
	Pre e-NAM	Post e-NAM		Pre e-NAM	Post e-NAM
Sirsa	33.11	17.72	Sirsa	28.41	16.27
Rewari	25.69	13.16	Rewari	22.77	12.35

Table 5. Market integration of mustard prices in different markets of Haryana

Market	Pre e-NAM			Post e-NAM		
	Level series	First Difference	Critical value	Level series	First Difference	Critical value
Sirsa	-5.7830	-10.4406	-3.5133	-3.0740	3.20	-3.5503
Rewari	-4.8341	-7.1788		-3.3122	-6.4127	

Table 6. Results of multiple co-integration analysis

Hypothesized	Pre e-NAM			Post e-NAM		
No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Eigenvalue	Trace Statistic	0.05 Critical Value
None*	0.2239	26.2509	15.4947	0.1725	15.6548	15.4947
At most 1*	0.0836	6.7283	3.8414	0.1532	7.32017	3.8414

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

that the price series were free of the effects of unit root, but not in the Sirsa market. Except for Sirsa, this meant that the price series were stagnant at the first difference level.

Johansen's multiple co-integration test was used to establish the long-run connection between the price series of both markets in the pre-e-NAM and post-e-NAM periods, with the findings reported in Table 6. The findings demonstrated that both markets, Sirsa and Rewari, were co-integrated at a 1 per cent level of significance, meaning that the selected mustard markets had a long-run equilibrium connection and that co-integration occurred between them. The findings of the pair-wise Granger causality test in the pre-e-NAM and post-e-NAM periods revealed that there was a unidirectional causation in the pricing of Rewari in the post-e-NAM era, but there was no causality in both markets in the pre-e-NAM time.

CONCLUSION

In Haryana, the empirical investigation discovered an unbalanced trend in pricing for distinct marketplaces. According to the study's findings, mustard arrivals in both Sirsa and Rewari marketplaces rose during the pre-e-NAM timeframe. Whereas, prices of mustard were found to be increased in Sirsa market while it was decreased in Rewari market. In post e-NAM period, arrival and prices of mustard found to be decreasing trend in both the markets. The ASPV and IPR of prices have been delivered similar ranks to the different markets. Both Sirsa & Rewari markets have been found spatially integrated in both pre e-NAM and post e-NAM period. Granger causality test in in post e-NAM period shows Sirsa market price has a unidirectional causality on the prices of Rewari while in pre-e-NAM period there is no causality in both markets. Further strengthening of a single, uniform economic market in the area, and the country as a whole, necessitates the development of physical infrastructure, market information and communication technologies, and well-defined, transparent agricultural policies and market measures in the state.

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