

Market Arrival and Price Behaviour of Potato in Agra District of Uttar Pradesh

Dhiraj K. Singh¹, Pynbianglang K² and N.K. Pandey³

^{1&3} Division of Social Sciences, ICAR-Central Potato Research Institute, Shimla, HP, India

²ICAR-Central Potato Research Station, Patna, Bihar, India

Corresponding author: dhirajextension@gmail.com

ABSTRACT

Potato is the major vegetable of India. Variation in output of potato over the years leads to wide fluctuation in its price exposing the growers to a high risk situation. To cope with this, information on potential market and quantum of arrivals and prices of potato in different months of year is necessary for farmers. The current study attempted to analyze the variation in arrivals and prices of potato in highest potato producing district of Uttar Pradesh *i.e.* Agra. Time series data for last 10 years on area and production as well as market arrivals and prices of potato was collected from various government organizations. The findings indicated that the annual growth rates in area and production of potato during last ten years were significant and positive. However in case of productivity, it was insignificant and negative. The annual compound growth rates of arrivals were comparatively higher than that of market price. Inter-year variations in market arrivals and prices of potato were observed. The monthly arrival of potato was highest in the month of January and lowest in the month of October. Accordingly, the market price was highest during October-November and lowest in the month of February. The seasonal index of arrival showed that the arrivals were low during June to November and higher during December to May. The results confirmed that there were both negative and positive relationships across months between market arrivals and prices in terms of correlation coefficients.

Keywords: Price behavior, monthly variability, coefficient of variation, seasonality, potato, Uttar Pradesh

Vegetables are very important component of human diet. They are the major source of vitamins and minerals for health life style. As per dietary guidelines of Indian Council of Medical Research (ICMR), an adult individual should consume at least 300 g of vegetables in a day which include 50 g green leafy vegetables, 50 g root and tubers and 200 g other vegetables (ICMR, 2011). India is the 2nd largest vegetable producer of the world only behind China. During the year 2014-15, India produced 162.9 million t of vegetable from an area of 9.4 million ha with an average productivity of 17.3 t/ha. As per Vision 2050 document of Indian Institute of Vegetable Research, Varanasi, India will require 375 million t of quality vegetable in 2050 which would need nearly 15 million ha area

with an average productivity of 25 t/ha (IIVR vision 2050, 2015). Supply of most of the vegetables is variable especially due to short growth period & higher perishability. The output variation leads to fluctuation in its price making it more risky for vegetable growers. Potato is the most important vegetable of the country contributing to the extent of 21% in terms of area under vegetable cultivation & 25.5% of total production of vegetable (Indian horticulture Database, 2014). India is the 2nd largest potato producing country of the world. Potato production in India stood at 45.95 million t during 2014-15 (Directorate of Economics and Statistics, 2016). Among Indian states, Uttar Pradesh is the highest potato producing state followed by West Bengal and Bihar. Agra district of Uttar Pradesh has

taken over as having highest potato production in state with annual production of 14.42 lakh tones.

Marketing of Potato is a major concern for farmers because of volatile nature of its price. Many studies have shown that every alternate year, potato prices fall due to glut situation in the market. Inadequate marketing infrastructure and more number of intermediaries between producer & consumer result in high marketing cost which lowers the farmers' profitability. Lack of information on potential market as well as arrival & price behaviour of potato further worsen this situation for vegetable growers. Therefore, market intelligence on potential market and quantum of arrival and price of potato in different months of year is necessary for farmers. Keeping this in view, current study was attempted to analyze the variation in arrival and price of potato in Agra market of Uttar Pradesh during last 10 years.

Data Base and Methodology

Agra district of Uttar Pradesh was purposively selected for this study because it is the highest potato producing district of Uttar Pradesh. The district produced nearly 1417 thousand tones of potato from an area of 55.9 thousand ha during the year 2012-13 (Horticultural statistics at a glance, 2015). Agra district also has a cold storage capacity of around 2.2 million tones, which is about 7% of the total cold storage capacity in the country and more than in the whole of Punjab (Potato PRO, 2012). Almost all of them are used to store potatoes. Secondary time series data on market arrival and price of potato for the period of 2006-2015 was collected from the database of National Horticulture Research Development Foundation. Year wise data on area, production and yield for Agra district was collected from website of Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, Govt. of India. Data was analyzed with a view to compute periods, growth rate and relationship held them in between. To examine the correlation between annual arrival and annual mean price as well as monthly arrival and monthly mean price of potato, correlation coefficient 'r' as a means of market efficiency was calculated with the help of following formula:

$$r = \frac{\Sigma xy - \frac{(\Sigma x)(\Sigma Y)}{N}}{\sqrt{\left[\left(\Sigma X^2 \right) - \frac{(\Sigma X)^2}{N} \right] \left[\left(\Sigma Y^2 \right) - \frac{(\Sigma Y)^2}{N} \right]}}$$

Where,

X= Monthly mean prices of potato in Rs/quintal

Y= Monthly mean arrival of potato in quintals

N= Number of observation or time in number of years

RESULTS AND DISCUSSION

Area, production and yield of potato in Agra market

The area, production and yield of potato in Agra district of Uttar Pradesh during 2004-05 to 2013-14 is given in Table 1. The Annual Compound Growth Rate (ACGR) was estimated and found to be positive and significant at one percent level of significance for both area and production of potato in the district. ACGR was 7.7% for area and 7.1% for production of potato. It can be observed that the area under potato in last 10 years has nearly doubled. The production of potato has also increase significantly. However, ACGR for productivity was found to be negative (-0.6 %) but insignificant. This indicated that increase in annual production was mainly due to increase in the area under potato cultivation in the district. Pandey *et al.* (2005) reported that there was a decline in annual compound growth rates (ACGRs) of potato productivity in UP from 1980 onward and negative ACGRs of potato productivity from 2000 onwards due to increasing tendency of farmers to early harvest crops for adjusting third crop in yearly cropping. Similar findings were also observed by Kaur (2015) and Bhajantri (2011) in Punjab and Karnataka respectively.

Thus, the negative growth in productivity is a cause of concern in Agra district. This may be due to lack of awareness and adoption of improved technologies for potato production by the farmers of district. Thus, extension activities need to be strengthened for dissemination of high yielding varieties and package of practices to potato growers in the district. This will increase the rate of adoption thereby increasing productivity of potato.

Table 1: Area, Yield and Production of Potato in Agra district of Uttar Pradesh

Year	Area (Ha)	Production (Tonnes)	Yield (Tonnes/Ha)
2004-05	31616	880000	27.83
2005-06	39800	983936	24.72
2006-07	37453	871082	23.26
2007-08	38149	960058	25.17
2008-09	51772	1249310	24.13
2009-10	55230	1388096	25.13
2010-11	63851	1690072	26.47
2011-12	60924	1431105	23.49
2012-13	55879	1416980	25.36
2013-14	60110	1441979	23.99
ACGR (%)	7.7**	7.1**	-0.6 ^{NS}

Source: Directorate of Economics and Statistics, Govt. of India

ACGR= Annual compound growth rate, **significant at 1% level of significance, NS=non-significant.

Trends in Arrivals and Prices of Potato in Agra Market

The variability in arrivals and prices of potato in Agra market from the year 2006 to 2015 was analyzed and depicted in Table 2. Results revealed that the market arrival was highest in the year 2013 with a mean of 4.46 lakh quintals and lowest in the year 2006 (49.62 thousand quintals).

Table 2: Yearly variability in arrivals and prices of potato in Agra market during the period 2006-2015

Years	Arrivals		Prices	
	Mean Arrival (q)	C.V. (%)	Mean Price (₹/q)	C.V. (%)
2006	49622.38	20.74	488.75	24.68
2007	156808.3	31.75	539.00	32.66
2008	260079.8	16.58	311.75	13.99
2009	191250.7	30.03	753.83	47.35
2010	273749.2	32.15	461.25	19.58
2011	221010.1	14.97	425.92	18.81
2012	248563.2	64.98	811.92	37.35
2013	446633.3	42.01	890.33	25.73
2014	330710.3	58.21	1345.58	37.90
2015	403742.7	30.48	611.25	27.32
ACGR (%)	18**	—	8.7 ^{NS}	—

Source: National Horticultural Research and Development Foundation, New Delhi.

ACGR= Annual compound growth rate, C.V. = Coefficient of Variation

However, there had been inter-year variations during the period under study. The variation was highest in the year 2012 (64.98%) and lowest in the year 2011 (14.97 %). The result also indicated that the market price was highest in the year 2013 with an average price of ₹ 1345.58/q and lowest in the year 2008 (₹ 311.75/q). In case of price variability also, it was seen that there were inter-year price fluctuations. The variation was highest in the year 2009 (47.35%) and lowest in the year 2008 (13.99%). The price fluctuations brought a great deal of discomfiture to both poor farmers and consumers (Kumar *et al.*, 2006). The annual compound growth rate (ACGR) of annual arrivals was significant at the rate of 18 per cent per annum. The ACGR of prices was also positive at 8.7% per annum but not significant.

Monthly Variability in Arrivals and Prices of Potato in Agra Market

The monthly variability in arrivals and prices of potato in Agra market is presented in Table 3. It can be seen that the mean monthly arrival of potato drastically increased from 2.14 lakh quintals in November to 3.38 lakh quintals in December. This may be due to the fact that large number of farmers in Uttar Pradesh began to harvest their potato crop during December. The mean arrival was highest in the month of January (3.67 lakh quintals) and lowest in the month of October with only 2.01 lakh quintals. The finding also indicated that the mean market price was highest in November at ₹ 902/q which corresponded with the time when arrival was low in the market. The lowest mean price occurred in the month of February (₹ 412/q) when there is glut condition in the market due to harvesting of produce. The variation in prices was highest in October (58.14 %) and lowest in the month of March (34.72 %). Similar pattern was also observed by Dhakre and Bhattacharya (2014) in their study of price behavior of potato in Agra market.

Seasonality in market arrivals and prices of potato

The seasonal indices of arrivals and prices of potato in Agra market for last ten years were calculated and depicted (Table 4). Results revealed that the arrival was low during the month of June to November. The minimum arrival was in October with the arrival

Table 3: Monthly variability in arrivals and prices of potato in Agra market during the period from 2006-2015

Months	Arrivals		Prices	
	Mean arrival (q)	C.V. (%)	Mean Price (₹/q)	C.V. (%)
January	367638	70.69	421	46.71
February	311176	54.04	412.1	40.54
March	317303	63.45	474.2	34.72
April	318603	59.76	533.9	45.35
May	293064	54.98	640.9	47.97
June	271650	48.57	710.9	48.35
July	242373	44.09	785.0	48.48
August	249255	44.43	798.7	55.07
September	229221	42.83	809.6	57.39
October	201980	41.95	889.4	58.14
November	214419	34.93	902.2	56.70
December	338129	50.04	589.6	48.07

Source: National Horticultural Research and Development Foundation, New Delhi

C.V. = Coefficient of Variation

index of 72.25. The arrival was more in another six months from December to May. The arrival suddenly increased in the month of December and reached maximum in the month of January with the arrival index of 131.50. It can be noticed from the table that there is an inverse relationship between the arrivals and prices of potato in Agra market. During the month of December to May when there was more arrivals of potato in the market, the price was comparatively lower.

Table 4: Seasonal Indices of arrivals and prices of potato in Agra market during the Period 2006-2015

Months	Arrival Index	Price Index
January	131.50	63.41
February	111.31	62.07
March	113.50	71.42
April	113.96	80.41
May	104.83	96.53
June	97.17	107.07
July	86.70	118.23
August	89.16	120.29
September	81.99	121.94
October	72.25	133.95
November	76.70	135.88
December	120.95	88.80

C.V. = Coefficient of Variation

The lowest price index was in the month of February. Similar findings were also observed by Dhakre and Bhattacharya (2014) and Chandran and Pandey (2007) in their study of price behavior in Agra and Delhi market respectively.

Relationships between Arrivals and Prices of Potato

The inter-relationship between monthly arrivals and monthly prices of potato in Agra market during last 10 years was calculated using correlation coefficient (r) and presented in Table 5.

Table 5: Correlation coefficient (r) between arrivals and prices of potato in Agra market during 2006-15

Sl. No.	Months	Correlation coefficient (r)
1	January	0.719*
2	February	0.776**
3	March	0.668*
4	April	0.094
5	May	-0.075
6	June	0.090
7	July	0.026
8	August	0.097
9	September	0.028
10	October	-0.078
11	November	-0.075
12	December	0.308

*Significant at 5% level of significance, **Significant at 1% level of significance

It can be observed that there was significant correlation between market arrivals and prices for the months of January, February and March. This may be due to regular supply of potato during these months because of harvesting season. During the other months of year, correlation between arrival and prices of potato was not significant.

CONCLUSION

This study examined the scenario of arrival and price of potato in Agra market during last 10 years. The area and production of potato during 2004-05 to 2013-14 in selected district significantly grew at the healthy rates of 7.7 and 7.1% per annum. But productivity need to be enhanced to increase the farmers' income from potato. The findings also showed that there had been inter-year variations in market arrivals and prices of potato in Agra market but both had positive growth rates. The monthly arrival of potato drastically increased in December and attained highest level in January while it was lowest in October. That's why, market price was higher during October and November and lowest in the month of February. The seasonal indices of arrivals and prices of potato showed that the arrivals were low during June to November and high during December to May. There was a significant relationship between market arrivals and prices during the months of January, February and March. In order to get more benefit from potato, farmers need to check potato price across the market and then sell their produce. Moreover, they can also store potato in cold storage during harvesting season when prices are very low and sell later on when prices begin to increase.

REFERENCES

- Bhajantri, S. 2011. Production, processing and marketing of potato in Karnataka – An economic analysis. Project report submitted to the University of Agricultural Sciences, Bangalore in partial fulfillment of the requirements for the degree of Master of Business Administration.
- Chandran, K.P. and Pandey, N.K. 2007. Potato price forecasting using seasonal ARIMA approach. *Potato J.* **34**(1-2): 137-138.
- Dhakre, D.S. and Bhattacharya, D. 2014. Price Behaviour of Potato in Agra Market - A Statistical Analysis. *Indian Res. J. Ext. Edu.* **14**(2): 12-15.
- Directorate of Economics and Statistics. A pocket book of Agricultural Statistics 2015, Dept. of Agriculture Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India, 2016.
- Horticultural Statistics at a Glance. Horticulture Statistics Division, Deptt. of Agriculture cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India, New Delhi, 2015.
- ICMR. Dietary guidelines for Indians-A manual, National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India, 2011.
- IIVR Vision 2050. ICAR-Indian Institute of Vegetable Research, Varanasi, Uttar Pradesh, 2015.
- Indian Horticulture Database. Eds Mamta Saxena and Chander P Gandhi, National Horticulture Board, Ministry of Agriculture, Govt. of India, 2014.
- Kaur, A. 2015. An economic analysis of seed management and marketing of potato in Punjab. Dissertation submitted to the Punjab Agricultural University, Ludhiana in partial fulfillment of the requirements for the degree of doctor of philosophy in Agricultural Economics.
- Kumar, V., Sharma, H.R. and Sharma, R.K. 2006. Market arrivals and price behaviour of potato – A study of four metropolitan markets. *Indian J Agril Mktg.*, **20**: 78-89.
- National Horticultural Research and Development Foundation (NHRDF). Database available from URL <http://www.nhrdf.org/en-us/DatabaseReports>
- Pandey, N.K., Rana, R.K., Pandit, A. and Chandran, K.P. 2005. Contribution of Uttar Pradesh towards Indian potato, *Potato J.* **32**(3-4): 121-122.
- PotatoPRO. How Agra became India's cold storage hub and what impact it has on price of potatoes; 2012. Available from URL <http://www.potatopro.com/news/2012/how-agra-became-indias-cold-storage-hub-and-what-impact-it-has-price-potatoes>.

