Variations in Price of Potatoes in India: A Case Study of Four Years

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ABSTRACT - Vegetable growing has huge scope in a vast country like India. India is the second largest producer of vegetables in the world, producing more than 40 kinds of vegetables belonging to different groups. Potato is most widely grown vegetable crop in the country with a share of 21.03 percent in area and 26.60 percent share in production. India is the second largest producer of Potatoes in the world only next to China with 12 percent share in global production of potatoes. Uttar Pradesh holds the first rank in area and production of potatoes in the country with 31.98 percent share in production followed by West Bengal with 22.74 percent share. The maximum area sown under potatoes is during the Rabi season accounting for 93.30 percent of the total area under its cultivation. An attempt has been made to analyse the variations in prices of potatoes over the past four years. It has been found from the study that the average price of potatoes in the year 2017 was significantly low (₹ 905.24/ quintal) where as it was significantly highest in the year 2014 ((₹ 1664.90/ quintal). Furthermore, it is found that wholesale price of potato was highest in Chennai i.e. ₹ 2200/ quintal, where as wholesale price of potato was lowest in Delhi i.e. ₹ 900/ quintal.

Keywords: Area, Markets, Potato, Production, Export and Price

I. INTRODUCTION

India is the second largest producer of vegetables and fruits in the world now next only to China [1]. India leads the world in the production of banana, mango, guava, lemons and lime, papaya and okra [2]. Vegetable growing is an important constituent of horticulture. It has huge scope in a vast country like India. India is the second largest producer of vegetables in the world after China, producing more than 40 kinds of vegetables belonging to different groups. Major vegetables cultivated in India include potato, egg plants, tomatoes, cabbage, dry onions, cauliflowers, pumpkin, okra and green peas. The area under vegetables in the country has increased from 5593 thousand hectares in the year 1991-92 to 10290 thousand hectares in the year 2016-17. The production increased from 58532 thousand metric tonnes in 1991-92 to 175008 metric tonnes in the year 2016-17. The productivity increased from 10.47 metric tonnes/hectare in 1991-92 to 17.01 metric tonnes/hectare during the year 2016-17, displayed compound annual growth rate of 2.47 percent, 4.48 percent and 1.95 percent in area, production and productivity respectively. Over the past 26 years, the area under vegetables grew by 3.23 percent per annum and annual production by 7.65 percent [3].

Potato is most widely grown vegetable crop in the country with a share of 21.03 percent in area and 26.60 percent share in production. Onion occupies the second position amongst the vegetable crops both in terms of area and production with a share of 12.34 percent and 12.32 percent respectively followed by tomato with a share of 7.86 percent in area and 11.25 percent in production [4].

India is the second largest producer of Potatoes in the world only next to China with 12 percent share in global production of potatoes [5]. Potatoes represent bulk of the horticulture exports. During the year 2017-18, 283228.22 metric tonnes of potatoes worth ₹ 31003.11 Lakh were exported to other countries as compared to 255725.51 metric tonnes worth ₹ 44010.66 Lakh during the year 2016-17. Major export destinations for Indian potatoes include Nepal, Sri Lanka, Oman and Mauritius [6].

OBJECTIVES OF THE STUDY

- To examine the wholesale price of potato in different markets.
- To examine the status of area sown and production in major potato producing states of the country.
- To analyse the variations in wholesale price of potato over the study period

II. METHODOLOGY

The present study is based on secondary data. The secondary data have been collected from various official

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sources like Ministry of Agriculture, Horticulture Statistics Division, Department of Agriculture, Cooperation and Farmers Welfare (Government of India), Central Statistics Office, Ministry of Statistics and Programme Implementation (Government of India), Ministry of Finance, Department of Economic Affairs, Economic Division (Government of India), Further various published research papers, books, periodicals, reports, magazines, newspapers, and websites have also been used for the study.

STATISTICAL ANALYSIS

Collected information was analyzed with the help of SPSS programming and Excel. Statistical package for social science (SPSS) adaptation 23.0 for windows 8.1 was used for data examination and hypothesis testing. The statistical techniques used in this study are Average, Compound Annual Growth Rate, Analysis of variance (ANOVA) and Duncan test.

1. Average was calculated to examine the whole sale price of potato in different markets of India

$$\textbf{Average} = \frac{1}{n} \times \sum_{i=0}^{n} x_i$$

Where, A = average
n = the number of terms
X_i = value of each individual item in the list of numbers being averaged

2. Compound Annual Growth Rate (CAGR)

The compound annual growth rate was calculated the growth in area, production and productivity of vegetables in India over the past 26 years (1991-92 to 2016-17). CAGR is a simple measure to find out the year-wise increase and decrease in the variables under study. The compound annual growth rate is a number that represents a steady level of growth from the initial value to an ending value as it determines the average of year to year growth rate for time series data. It is expressed in the following form.

$$\textbf{CAGR} = \left(\frac{Y_t}{Y_{t-1}}\right)^{\frac{1}{N}} - 1 \times 100$$

Where, Y_t = Value of Current year
Y_{t-1} = Value of Base year
N = Number of Years

3. Analysis of variance (ANOVA)

ANOVA was used to examine the variation in whole sale prices of potato in India between different months and years. ANOVA is a parametric statistical technique used to compare means and relative variance between different groups. ANOVA is used when there are more than two groups within the each dimension. It is expressed in the following form.

$$SS_w = \sum d^2_1 + \sum d^2_2 + \sum d^2_3 + \sum d^2_4 + \ldots\ldots\ldots\ldots\ldots\ldots \sum d^2_n$$

Where, d = deviation of every raw score of a category from its sample mean

$$SS_b = S\,[(\bar{X} - \bar{X_t})^2_{xn}]$$

Where, $\bar{X}$ = any sample mean
$\bar{X_t}$ = total mean
n = number of scores
SS_b = sum of squares between groups
SS_t = total sum of square of variations.
$SS_t = SS_b + SS_w$

Alternatively,

$SS_t = S\,(X - X_t)^2$
X = a raw score in any sample
X_t = the total mean
SS_t = the total sum of squares

4. Duncan

Duncan test was conducted to compare the significant difference in whole sale price of potato in India over the study period of 4 years. Duncan test is a multiple comparison procedure developed by David B. Duncan in 1955. Duncan test is used to identify homogenous subsets of means that are not different from each other and uses the standardized range statistic q, to compare sets of means at an alpha level of 0.05. It is expressed in the following form.

$$R_p = S_e r_p \sqrt{\frac{1}{n}}$$

Where, Standard error $S_e = \sqrt{\frac{\sum(SS)}{K\,(n-1)}}$ and $SS = \sum x^2 - \frac{(\sum x)^2}{n}$

K = number of groups
N = number of observation of each group
r_p = least significance standardized range or values of significance level.

III. DATA ANALYSIS AND INTERPRETATION

Table 1.1: Status of the Area Sown and Production in Major Potato Producing States – 2016-17
Area in Thousand Hectares

Production in thousand tonnes

Productivity in tonnes/ hectare

State	Kharif	Late Kharif	Rabi	All Seasons Total	Production	%age Share	Productivity
Uttar Pradesh	__	__	614.350	614.350	15543.00	31.98	25.30
West Bengal	__	__	422.500	422.500	11052.60	22.74	26.16
Bihar	__	__	320.482	320.482	6377.71	13.12	19.90

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Madhya Pradesh	__	__	162.267	162.267	3461.09	7.12	21.33
Gujarat	__	__	122.528	122.528	3797.82	7.81	31.00
Punjab	__	97.566	__	97.566	2423.00	4.99	24.83
Chhattisgarh	4.420	__	39.660	44.080	678.57	1.40	15.39
Karnataka	19.659	__	12.701	32.360	507.64	1.04	15.69
Total	**24.079**	**97.566**	**1694.488**	**1816.133**	**43,841.43**	**90.20**	24.14

Source: Horticulture Statistics Division, Department of Agriculture, Cooperation and Farmers Welfare [7]

An illustration of area sown in different seasons and production in major potato producing states during the year 2016-17 is presented in table 1.1. It is obvious from the table that Uttar Pradesh holds the first rank in area and production of potatoes in the country with 31.98 percent share in production followed by West Bengal with 22.74 percent share in production, Bihar (13.12 percent), Gujarat (7.81 percent), Madhya Pradesh (7.12 percent), Punjab (4.99 percent), Chhattisgarh (1.40 percent) and Karnataka with 1.04 percent share in production. Gujarat has recorded the highest productivity in case of potatoes with 31.00 tonnes/hectare followed by West Bengal (26.16 tonnes/hectare), Uttar Pradesh (25.30 tonnes/hectare) and Punjab (24.83 tonnes/hectare).

Table 1.1 further reveals that maximum area sown under potatoes is during the Rabi season accounting for 93.30 percent of the total area under its cultivation followed by late Kharif (5.37 percent) and Kharif (1.33 percent).

Table 1.2: All India Monthly Average Wholesale Prices of Potato – 2014 to 2017

(Prices in ₹ / Quintal)

Month	**2014**	**2015**	**2016**	**2017**	**Average**	**Percentage***
January	1227.6	1099.4	912.1	1009.1	1062.05	7.18
February	988.2	883.1	903.8	862.0	909.275	6.15
March	1145.4	783.1	962.2	745.2	908.975	6.15
April	1340.0	760.4	1274.2	756.3	1032.725	6.98
May	1491.9	888.0	1427.9	762.8	1142.65	7.73
June	1654.3	1071.9	1586.1	886.9	1299.8	8.79
July	1822.1	1048.2	1668.7	1219.6	1439.65	9.73
August	2048.8	1080.9	1829.5	1040.0	1499.8	10.14
September	2200.9	1083.4	1806.5	1086.6	1544.35	10.44
October	2250.6	1096.2	1483.5	802.4	1408.175	9.52
November	2198.7	1154.6	1612.5	866.4	1458.05	9.86
December	1610.3	963.5	944.9	825.6	1086.075	7.34
Total	**19978.8**	**11912.7**	**16411.9**	**10862.9**	**14791.58**	100.00

Source: AGMARKNET [8]

*Percentage indicated is percentage of the month's average price to average price of the year

Table 1.3: Months and Whole Sale Prices of Potato

ANOVA

Month	**Sum of Squares**	**Df**	**Mean Square**	**F**	**p-value**
Between Groups	2421975.236	11	220179.567	1.321	0.253
Within Groups	6001486.748	36	166707.965		
Total	8423461.983	47			

Source: Computed by Researcher from table 1.2

In order to examine the significant difference average monthly price of potatoes between 12 months of the year, the researcher applied one-way ANOVA. It has been found from the ANOVA table 1.3, that the calculated F value is less than the critical value at 5 percent level of significance; $F(11,36) = 1.321$, $p > 0.05$, indicating that there is no significant difference in average monthly wholesale price of potatoes between 12 months of the year.

After analyzing the table 1.2, it becomes clear that the average wholesale price of potato is highest in the month of September with average of ₹ 1544.35/quintal over the study period of four years i.e. between 2014 and 2017 with 10.44 percentage share of the yearly average price followed by August ₹ 1499.8/quintal (10.14 percent), November ₹ 1458.05/quintal (9.86 percent), July ₹ 1439.65/quintal and October ₹ 1408.175/quintal (9.52 percent).

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Table 1.4: Years and Whole Sale Prices of Potato

ANOVA

Year	Sum of Squares	Df	Mean Square	F	p-value
Between Groups	4437930.402	3	1479310.134	16.331	.000
Within Groups	3985531.581	44	90580.263		
Total	8423461.983	47			

Duncan

Year	N	Subset for alpha = 0.05		
		1	2	3
2017	12	905.24		
2015	12	992.73		
2016	12		1367.66	
2014	12			1664.90
Sig.		**0.480**	**1.000**	**1.000**

Means for groups in homogenous subsets area displayed

Source: Computed by Researcher from table 1.2

In order to find out the significant difference in average whole sale price of potato with respect to four years of our study period, one-way ANOVA statistic was carried out. It has been found from the ANOVA table 1.4, that calculated F value is greater than the table value at 5 percent level of significance; F (3,44) = 16.331, p < 0.005. Since the p value is less than our chosen significance level $\alpha = 0.05$, thereby concluding that there has been significant difference in the average monthly price of potatoes between the study period of four years.

The results from the one-way ANOVA do not indicate which year differs significantly from other year in terms of average monthly price. Hence, the multiple comparison Duncan test has been conducted. It has been found from the Duncan test that the average price of potatoes in the year 2017 is significantly low (₹ 905.24/ quintal) where as it is significantly highest in the year 2014 ((₹ 1664.90/ quintal). The average price of potatoes in the year 2016 is ₹ 1367.16/ quintal, which is significantly low as compared to 2014 but greater than 2017 and 2015. There is no significant difference in average prices of potatoes between 2017 and 2015.

Table 1.5: Whole Sale Price of Potato in Different Markets (Price in ₹ / Quintal)

Centre	26-04-2018	26-04-2017	Percentage Variation
Bhopal	1000	370	170 %
Agra	1140	500	128 %
Delhi	900	437	106 %
Ahmadabad	NR	550	NA %
Mumbai	1500	850	76 %
Jaipur	1225	500	145 %
Bhubaneswar	NR	750	NA %
Kolkata	1120	690	62 %
Hyderabad	1753	850	106 %
Bengaluru	1810	1250	45 %
Chennai	2200	1400	57 %
Average	1405	741	90 %

Source: AGMARKNET [9]

The whole sale price of potato in different markets of the country in 2017 and 2018 is presented in table 1.5. It is evident from the table that during the year 2018, wholesale price of potato was highest in Chennai i.e. ₹ 2200/quintal followed by Bengaluru ₹ 1810/quintal, Hyderabad ₹ 1753/ quintal, Mumbai ₹ 1500/ quintal and Jaipur ₹ 1225/ quintal, where as wholesale price of potato was lowest in Delhi i.e. ₹ 900/ quintal. The whole sale price in other markets was near about ₹ 1000/ quintal with average price of ₹ 1405/ quintal. The table further displays that during the year 2017, wholesale price of potato was highest in Chennai i.e. ₹ 1400/ quintal followed by Bengaluru ₹ 1250/ quintal, Hyderabad and Mumbai ₹ 850/ quintal, Bhubaneswar ₹ 750/ quintal and Kolkata ₹ 690/ quintal, where as wholesale price of potato was lowest in Bhopal i.e. ₹ 370/ quintal. The whole sale price in other markets was near less than ₹ 500/ quintal with average price of ₹ 741/ quintal.

Furthermore, it is obvious from the table that the highest increase in the wholesale price of potato in the year 2018 as compared to 2017 was witnessed in Bhopal (170 percent) followed by Agra (128 percent), Jaipur (145 percent) and Delhi and Hyderabad (106 percent). The increase in other markets was less than 100 percent with average percentage increase of 90 percent.

IV. CONCLUSION

Potato is most widely grown vegetable crop in the country with a share of 21.03 percent in area and 26.60 percent share in production. Potato is grown throughout the year in almost all states of the country with Uttar Pradesh as the major producer. Wide variations are witnessed in the price of potatoes in different seasons as well as in different

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markets in the country. It is found from the study that during the year 2018, wholesale price of potato was highest in Chennai i.e. ₹ 2200/ quintal, where as wholesale price of potato was lowest in Delhi i.e. ₹ 900/ quintal. The highest increase in the wholesale price of potato in the year 2018 as compared to 2017 was witnessed in Bhopal (170 percent) followed by Agra (128 percent), Jaipur (145 percent) and Delhi and Hyderabad (106 percent). It is found from the study that the average wholesale price of potato is highest in the month of September with average of ₹ 1544.35/quintal over the study period of four years. Furthermore, It has been found from the study that the average price of potatoes in the year 2017 is significantly low (₹ 905.24/ quintal) where as it is significantly highest in the year 2014 (₹ 1664.90/ quintal), which means that there have been a decline in price of potatoes over the years.

V. RECOMMENDATIONS

- Wide variations are witnessed in the price of potatoes in different seasons as well as in different markets in the country. In this regard the central government as well as state governments should enforce provisions of the Essential Commodities Act, 1955.
- Hoarding of agricultural products is very common in India, Vegetables are kept in stock to resell at higher prices in off seasons. In this regard the government should enforce strictly the Prevention of Black Marketing and Maintenance Supply of Essential Commodities Act, 1980.
- A separate Price Stabilisation Fund (PSF) should be created to moderate price volatility of essential commodities like onion, tomato potatoes.
- India is the third largest consumer of potatoes in the world, which increases demand for potatoes [10], In this regard the government should focus on high yielding varieties to increase the yield of potatoes in the country to match the supply-demand of potatoes.

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