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Price behaviour of cumin in Rajasthan

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Abstract
In view of this the present study was undertaken by collecting monthly wholesale prices of cumin in Rajasthan. This study was based on the secondary data on arrival and prices of cumin in selected A.P.M.Cs., of Rajasthan for the period of 11 years i.e., from 2010-11 up to 2020-21. In the analysis the estimates of linear trend in wholesale prices of cumin of the Rajasthan indicates that the regression coefficient β associated with the time element (T) was positive. Yearly prices of cumin in Jalore and Jodhpur mandies exhibited one and half cycle, which was consisting of 5-6 years. However, there were a cycle exhibited in Jaipur mandi with no clear ends. Almost similar type of irregular behaviour in yearly prices of cumin was observed in all selected mandies. The irregular fluctuations did not exhibit any definite periodicity in their recurrence in the selected mandies for cumin. The existence of seasonality in prices of cumin in the Jaipur, Jalore and Jodhpur mandies is quite different and no stable pattern was found. The seasonal price index of cumin in selected mandies were lowest in the month of March, lower during the harvesting period i.e. in all selected mandies. It was observed that cumin arrivals were more evenly distributed among the in Jaipur mandi while in other two mandies the pattern was quite similar. Looking to IPR, In case of cumin, there was much variability in prices was found maximum in Jalore mandi while it was lowest in Jodhpur mandi whereas in case of ASPV, it was inverse to IPR. Maximum variation in prices from all selected mandies was estimated in Jalore mandi.

Keywords: Prices and arrivals, seasonal, trend, cyclical, irregular, IPR, ASPV

Introduction
Agriculture is one of the oldest occupations in the world. When man started to the settling life on the earth, the first occupation was somewhat agriculture. Before invention of the agriculture occupation, man depended on haunting the animals for the food. When man invented the fire, he started to boil the food and slowly became interested in using fruits and vegetables.

India has the second-largest arable land resources in the world. With 20 agro-climatic regions, all the 15 major climates in the world exist in India. The country also has 46 of the 60 soil types in the world. Agriculture plays a vital role in India's economy. 54.6 per cent of the total workforce is engaged in agriculture and allied sector activities (Census 2011). The share of agriculture in GDP increased to 19.9 per cent in 2020-21 from 17.8 per cent in 2019-20. Gross Value Added by agriculture, forestry, and fishing was estimated at. 19.48 lakh crore (US$ 276.37 billion) in FY20. According to the estimate, the share of the agriculture and allied sector in total GVA has improved to 20.2 percent in 2020-21 and 18.8 percent in 2021-22. India can be among the top five exporters of agro-commodities by shifting its focus on cultivation and effectively handholding farmers, according to the World Trade Centre. The total agricultural and allied products exports stood at US$ 41.25 billion in FY2021 (Annual Report, Economic Survey 2020-21) [4].

According to the fourth advance estimates for 2020-21, total food grain production in the country is estimated at a record 308.65 million tonnes, which is 11.15 million tonnes higher than that production of food grain of 297.50 million tonnes achieved during 2019-20. For FY 2021-22, the government has set a target to increase production by 3.9%. Production of horticulture crops in India reached a record 331.05 million metric tonnes (MMT) in 2020-21 (as per 3rd advance estimate), an increase of 10.5 million metric tonnes over FY 2020. The production of fruits, flowers, spices and honey is expected to rise (Agricultural Statistics at a Glance 2020-21) [3].

Agricultural marketing plays a significant role in the movement of commodity from the producer to the consumer and in stabilizing the prices. Agricultural marketing plays an important role not only in stimulating production and consumption, but in accelerating the pace of economic development. The planned increase in agricultural output must be coordinated with changes in the demand and supply for agricultural commodities and

marketing. This can be fruitful only when the producer's share in consumer's rupee increase considerably irrespective of the volume of the marketable surplus produced with the farmers. Therefore, marketing is rightly considered as an essential input in addition to improved seed and fertilizer in modern agriculture (https://indiaagronet.com).

Prices are mirror of economy of the country. In general, prices for agricultural products are highly unstable compared to non-agricultural products. This price instability is directly linked to the biological nature of agricultural production (which suffers from climate instability or pests), also implying the difference between planned production and production obtained. Stable prices play an important role to determine the farm income. Agriculture supply is uncertain and this uncertainty in supply leads to fluctuations in prices. It is said that next to rains, prices are the greatest enemy of the farmer. As per price theory, prices are a function of demand and supply, but demand and supply are independently related to prices (Rastogi and Athaley, 2019) [10]. Agriculture being a biological industry and monsoon dependent lead to uncertainty in supplies of agricultural commodities and this uncertainty in supply leads to fluctuations in prices. The wide fluctuations affect the farmer's capacity of making sustained efforts for increasing production. This fluctuation in prices of agricultural commodity is greatest obstacle in the way of agricultural development (Benke, 2016) [7].

The seasonal nature of agricultural production itself leads to price fluctuations. Seasonal variations also influence monthly price changes, as some crops can only be harvested once or twice a year and for some of them, the possibility of storage is impractical. Hence price fluctuation in agricultural commodities is a common phenomenon due to their seasonal nature of production, wide ecological imbalances compared to other crops and seasonal demand for agricultural commodities (Thakare, Daundkar, Rathod and Bondar, 2017) [13].

Objectives

This study was devoted to discussion of substantive results, followed by economic interpretations and analytical inferences. This study has been deal with the estimation and interpretation of the price behaviour of selected agricultural commodity.

Research Methodology

The study was purposively confined to the state of Rajasthan. Secondary data in respect of arrivals in different markets and monthly prices of cumin for the period of eleven years from 2010-11 to 2020-21 was collected from Directorate of Economics and Statistics, Government of Rajasthan, Jaipur, Mandi offices of selected mandies and AGMARKNET (https://agmarknet.gov.in) to study the relationship between prices and arrivals.

Selection of the major crops of Rajasthan was done from the different commodity on the basis of rank of Rajasthan in production compared to all over India crop viz. cumin was selected purposively for the detailed study. Jodhpur and Jalore for cumin were selected on the basis of rank in production of the selected agricultural commodity in whole Rajasthan. Jaipur district of Rajasthan having biggest mandies was also selected purposively for the comparative study. For cumin Jodhpur and Bheenmal (Jalore) mandies were selected on the basis of maximum arrivals. Jaipur grain market mandi was also selected purposively for the comparative study of prices and arrivals as it is the biggest APMC of the Rajasthan.

Analysis of data

Price behaviour of selected agricultural commodities

Decomposition of prices was done to study the variations in monthly prices of cumin for the period of eleven years. A time series is a complex mixture of four components namely, Trend (T), Cyclical (C), Irregular (I) and Seasonal (S) variations. These four types of movements are frequently found either separately or in combination in a time series. The relationship among these components is assumed to be additive or multiplicative, but the multiplicative model is the most commonly used method in economic analysis, which was used for the study and it can be presented as under:

$P_t = T_t \times C_t \times S_t \times I_t$ (in monthly price series).

$P_t = T_t \times C_t \times I_t$ (in yearly price series).

Where,

P_t = Time series data on prices of selected agricultural Commodities (₹./qt.).

S_t = seasonal fluctuation at time t.

T_t = Trend value at time t.

C_t = Cyclic fluctuation at time t.

I_t = Irregular fluctuation at time t.

Analysis of trend in prices

Over a long period of time, time series is very likely to show a tendency to increase or decrease over time. The factors responsible for such changes in time series are mainly the growth of population, change in the taste of people, technological advances in the field, etc.

For examining the trend in prices, linear function was estimated by using the Ordinary Least Squares (OLS) method.

Linear function

$$P_t = \alpha + \beta T_t + U_t$$

Where,

P_t = Index number of prices of selected agricultural commodity in t^{th} year.

T_t = Serial number assigned to the t^{th} year.

U_t = Random disturbance term with usual OLS assumptions, α, β and are regression coefficients to be estimated.

Analysis of cyclical component

Cyclical movements are fluctuations which differ from periodic movements. Cyclical movements have longer duration than a year and are periodicity of several years as in business cycles. The cyclical component under multiplicative hypothesis in the yearly price series was worked out by

i) Calculating the trend values by estimating linear trend equations.

ii) Dividing the original observations on prices (or index numbers) by the estimated trend values and multiplying it by 100. This yields an index of cyclical component along with irregular component because.

Symbolically:

$$\frac{P_t}{\widehat{P_t}} \times 100 = \frac{T_t \times C_t \times I_t}{T_t} \times 100 = (C_t \times I_t)\ 100$$

Where,
P_t = Original price or index number of price.
P_t = Estimated trend value and T_t, C_t and I_t are trend, cyclical and irregular components.

iii) The irregular component can be removed by taking the weighted three year moving average of (C x I) 100 series obtained in (b) above with 1:2:1 as weight.

Analysis of irregular component
Here the effects could be completely unpredictable, changing in a random manner. A given observation is affected by episodic and accidental factors. These are also known as causal series and are affected by the unknown causes. These unknown causes act in an unpredictable manner. The irregular component in an annual series of prices does not have a definite pattern. It was estimated as residual component by using the estimates of trend and cyclical components.

i) Under the multiplicative hypothesis, we isolate the C x I component by dividing the original price index numbers by estimated linear trend values. The cyclical component (C) was isolated from C x I by taking three years weighted moving averages of C x I series. The index of irregular component can be computed by the following:

$$I_t = \frac{C_t \times I_t}{C_t} \times 100$$

Analysis of seasonal component
For Seasonal analysis ratio to moving average method is used to substantiate the objectives and it is the most widely used method of measuring seasonal variations. The logical reasoning behind this method follows from the fact that 12 months moving average can be considered to represent the influence of cycle and trend C × T. If the actual value for any month is divided by the 12 month moving average centered to that month, presumably cycle and trend are removed.

Intra-year price variation
The following approaches will be used to precisely measure the intra-year price variation.

Extent of intra year price rise
The intra year price rise-the difference between the lowest and highest price within a year will be measured by calculating the following per cent coefficient:

$$IPR = \frac{HSPI\text{-}LSPI}{LSPI} \times 100$$

Where,
IPR = Intra-year price rise (expressed in per cent terms).
HSPI = Highest seasonal price index.
LSPI = Lowest seasonal price index.

Since this measure is affected by the lowest coefficient, another measure called the coefficient of average seasonal price variation (ASPV) will also be computed.

Average seasonal price variation
The average seasonal price variation (ASPV) will be calculated as

$$ASPV = \frac{HSPI - LSPI}{(HSPI+LSPI)/2} \times 100$$

Where:
HSPI = Highest seasonal price index
LSPI = Lowest seasonal price index
Present worth of cost

Results and Discussion
Price behaviour of cumin in selected mandies of Rajasthan
The linear trend, cyclical, irregular seasonal variations and extent of price variation of cumin prices and arrivals are for the from July 2010-11 to June 2020-21 presented in the following section.

Trend, cyclical and irregular components in yearly prices of cumin
The estimates of linear trend in yearly prices of cumin for the selected mandies of the Rajasthan have been presented in the table 1. The table indicates that the regression coefficient β associated with the time element (T) was positive and highly significant at 1 percent level of significance for all the three selected mandies. The value of regression coefficient for time was estimated to be the highest for Jaipur mandi (5.72) followed by Jalore mandi (2.52) and Jodhpur mandi (1.60). The estimates of the time element alone explained 15.00 percent to 76.00 percent variation in the wholesale prices of cumin in the selected mandies during the study period.

Table 1: Estimates of linear trend equations for yearly prices of cumin in selected mandies of Rajasthan during 2010-11 to 2020-21

Mandies	Intercept (α)	Slope Coefficient (β)	Coefficient of determination (R^2)
Jaipur	115.10	5.72**	0.76
Jalore	109.54	2.52**	0.25
Jodhpur	105.82	1.60**	0.15

Note: **denotes significant at 1 percent level of significance

Here, an attempt has been made to examine the cyclical and irregular behaviour of yearly prices of cumin in the selected mandies of the state as shown in table 2 to 4 and figures 1 to 3. Yearly prices of cumin in Jalore and Jodhpur mandies exhibited one and half cycle, which was consisting of 5-6 years. However, there was a cycle exhibited in Jaipur mandi with no clear ends. Almost similar type of irregular behaviour in yearly prices of cumin was observed in all selected mandies.

Table 2: Components of time series in yearly prices of cumin in Jaipur mandi during 2010-11 to 2020-21

Year	Components of time series		
	Trend	Cyclical	Irregular
2010-11	86.52	-	-
2011-12	92.23	111.85	108.32
2012-13	97.95	98.60	96.03
2013-14	103.66	86.95	96.47
2014-15	109.38	87.41	97.63
2015-16	115.10	94.28	100.85
2016-17	120.81	99.40	102.21
2017-18	126.53	100.83	98.51
2018-19	132.25	102.14	100.89
2019-20	137.96	103.31	99.82
2020-21	143.68	-	-

Table 3: Component of time series in yearly prices of cumin in Jalore mandi during 2010-11 to 2020-21

Year	Components of time series		
	Trend	Cyclical	Irregular
2010-11	96.92	-	-
2011-12	99.45	99.77	97.30
2012-13	101.97	92.01	104.17
2013-14	104.50	86.42	91.72
2014-15	107.02	91.64	99.64
2015-16	109.54	104.81	99.86
2016-17	112.07	114.24	103.84
2017-18	114.59	115.24	99.83
2018-19	117.11	107.82	104.10
2019-20	119.64	95.17	96.40
2020-21	122.16	-	-

Table 4: Components of time series in yearly prices of cumin in Jodhpur mandi during 2010-11 to 2020-21

Year	Components of time series		
	Trend	Cyclical	Irregular
2010-11	97.81	-	-
2011-12	99.41	100.78	100.53
2012-13	101.01	96.03	103.75
2013-14	102.62	89.18	93.68
2014-15	104.22	92.22	97.59
2015-16	105.82	104.35	100.96
2016-17	107.43	112.66	103.60
2017-18	109.03	113.52	98.55
2018-19	110.63	108.57	104.66
2019-20	112.23	96.45	98.66
2020-21	113.84	-	-

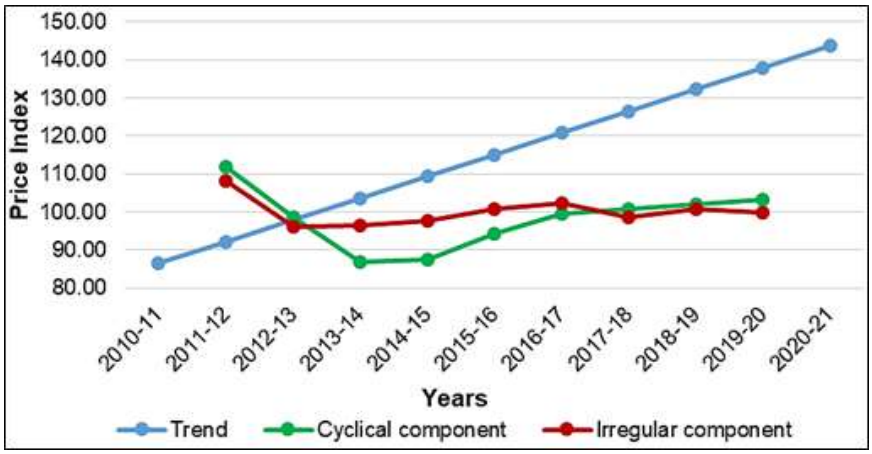

Fig 1: Components of time series in prices of cumin in Jaipur mandi

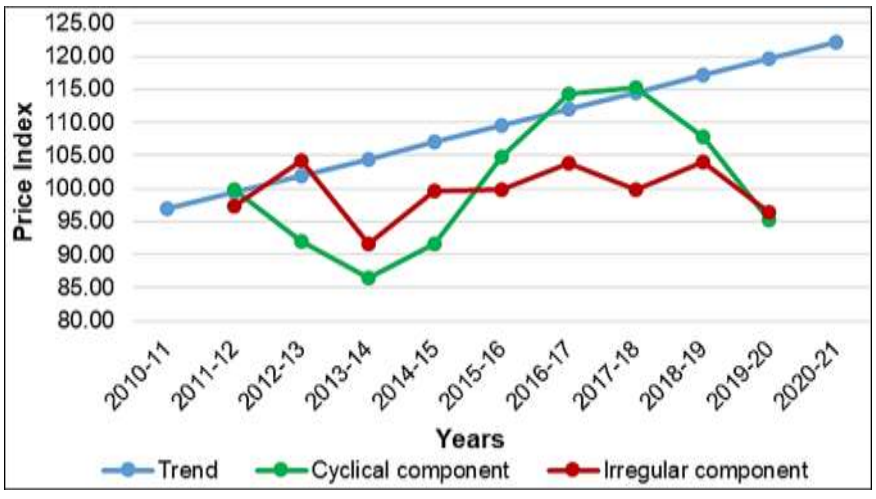

Fig 2: Components of time series in prices of cumin in Jalore mandi

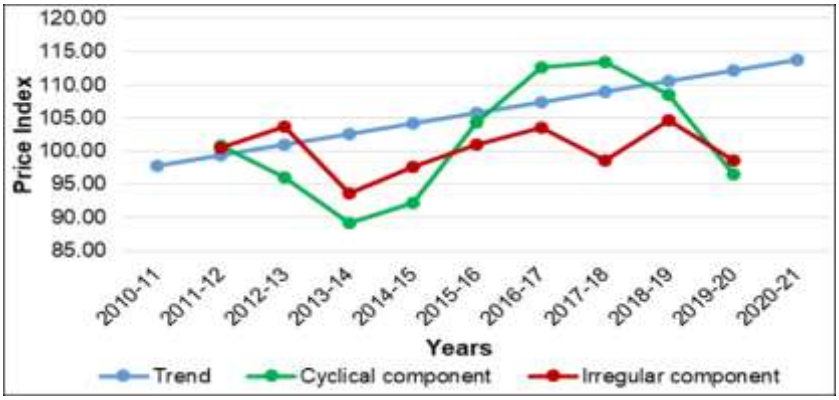

Fig 3: Components of time series in prices of cumin in Jodhpur mandi

Seasonal indices in monthly prices and arrivals of cumin in selected mandies of Rajasthan

For seasonal analysis of prices, index numbers of monthly prices of cumin for the selected markets of Rajasthan were calculated from the raw data for the period from July -2010 to June-2021.

The estimated results of seasonal indices of monthly prices and arrivals of cumin in the selected mandies of Rajasthan are presented in table 5 and 6, and figures 4, 5 and 6. The existence of seasonality in prices of cumin in the Jaipur, Jalore and Jodhpur mandies is quite different and no stable pattern was found. The table shows that cumin price indices in Jaipur mandi the price fluctuations varied from 93.22 for month of March to 104.25 for month of August, which was highest seasonal price index of cumin in Jaipur mandi. Cumin price indices in Jalore mandi continued to increase from 88.54 in the month of March (lowest seasonal price index) to the month of July (106.88), which was highest seasonal price index. In Jodhpur mandi the price fluctuations varied from 94.75 (March) to 102.90 (February).

The table shows that cumin arrival indices in Jaipur mandi was lowest (54.71) for month of August, which continued to increase up to the month of March (250.81) which was highest. Cumin arrival indices in Jalore mandi was lowest (14.46) for month of December, which continued to increase up to the month of April (320.25) which was highest. In Jodhpur mandi arrivals fluctuations varied from 24.72 (February) to 357.78 (April) during the study period. The arrivals were more evenly distributed among the months in Jaipur mandi while in other two mandies the pattern was quite similar. Rao *et al*. (2014) did their study on rice in selected market of Andhra Pradesh and found pronounced seasonality in arrivals and there were negligible variations in seasonal prices of rice.

Table 5: Seasonal indices of monthly prices of cumin in the selected mandies of Rajasthan during 2010-11 to 2020-21

Months	Jaipur	Jalore	Jodhpur
January	101.89	92.72	102.76
February	100.18	90.39	102.90
March	93.22	88.54	94.75
April	98.85	100.61	96.37
May	100.27	99.23	98.10
June	97.10	102.06	96.62
July	96.42	102.50	100.80
August	104.25	106.88	102.45
September	102.75	106.49	99.96
October	100.56	104.09	101.20
November	102.71	103.45	101.66
December	101.84	103.04	102.43
Total	1200	1200	1200

Table 6: Seasonal indices of monthly arrivals of cumin in the selected mandies of Rajasthan during 2010-11 to 2020-21

Months	Jaipur	Jalore	Jodhpur
January	116.23	46.08	27.42
February	109.13	79.10	24.72
March	250.81	252.75	106.06
April	120.09	320.25	357.78
May	121.52	141.16	212.92
June	97.24	80.36	141.78
July	62.24	108.20	105.08
August	54.71	79.24	46.53
September	63.49	36.81	39.57
October	60.57	23.92	72.71
November	59.25	17.66	33.20
December	84.73	14.46	32.24
Total	1200	1200	1200

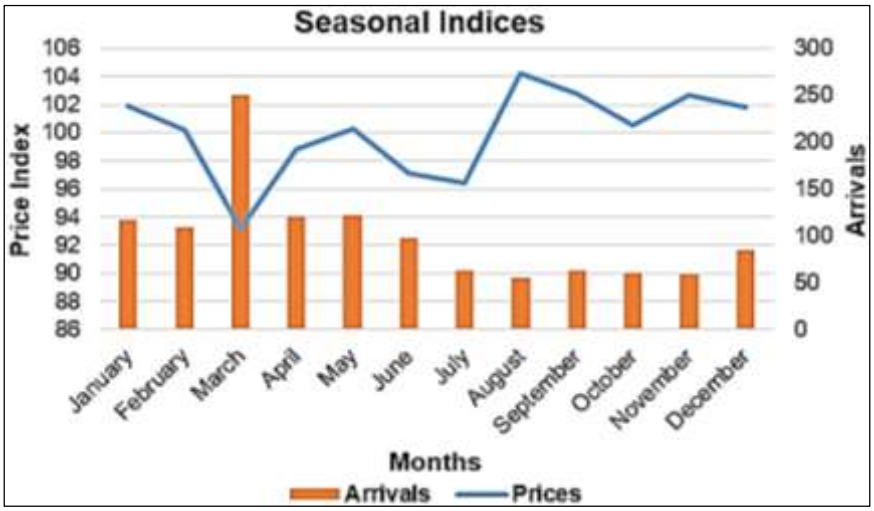

Fig 4: Seasonal indices of monthly prices and arrivals of cumin in Jaipur mandi in Rajasthan during 2010-11 to 2020-21

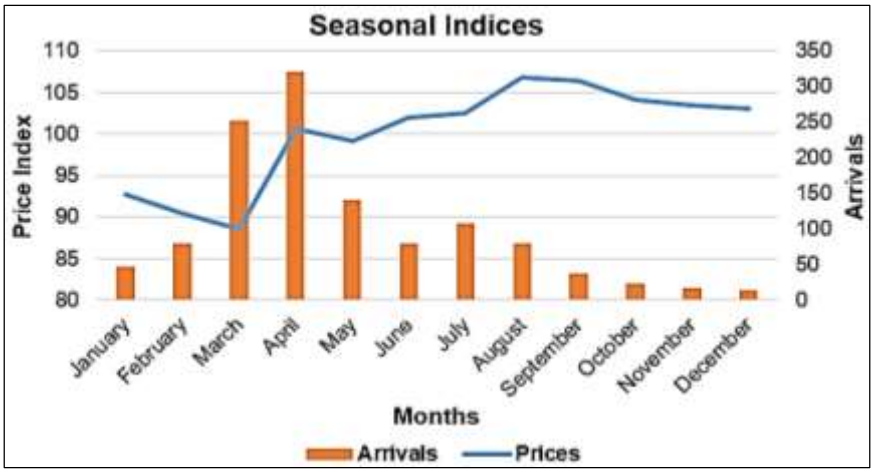

Fig 5: Seasonal indices of monthly prices and arrivals of cumin in Jalore mandi in Rajasthan during 2010-11 to 2020-21

Fig 6: Seasonal indices of monthly prices and arrivals of cumin in Jodhpur mandi in Rajasthan during 2010-11 to 2020-21

Extent of seasonal price variation in selected mandies of cumin in Rajasthan

The results of intra year price rise (table 7) revealed that the extent of intra year price rise (IPR) varied from as low as 8.59 per cent in Jodhpur market to as high as 20.71 per cent in Jalore mandi. The extent of average seasonal price variation (ASPV) varied from as low as 2.06 per cent in Jodhpur market to as high as 4.69 per cent in Jalore mandi. The coefficient of variation for all the selected markets including the state ranged from 2.53 per cent to 5.80 per cent. Maximum variation in prices from all selected mandies was estimated in Jalore mandi.

Table 7: Intra year price rise in cumin in selected mandies of Rajasthan during 2010-11 to 2020-21

Mandies	Lowest Seasonal Price Index		Highest Seasonal Price Index		Magnitude of Variation (%)		
	Months	Seasonal Index	Months	Seasonal Index	IPR	ASPV	C.V.
Jaipur	March	93.22	Aug	104.25	11.831	2.792	2.84
Jalore	March	88.54	Aug	106.88	20.716	4.692	5.80
Jodhpur	March	94.75	Feb	102.90	8.596	2.06	2.53

IPR = Intra Year Price Rise ASPV = Average Seasonal Price Variation C. V. = Coefficient of Variation

Summary and Conclusions

The estimates of linear trend in wholesale prices of cumin of the Rajasthan indicates that the regression coefficient β associated with the time element (T) was positive and shows increasing trend during the study period. Yearly prices of cumin in Jalore and Jodhpur mandies exhibited one and half cycle, which was consisting of 5-6 years. However, there were a cycle exhibited in Jaipur mandi with no clear ends. The irregular fluctuations did not exhibit any definite periodicity in their recurrence in most of the crops. The seasonal price indices of all the selected mandies of cumin recorded higher prices in the month from September to November. During these months the arrivals were lower as it is lean period which raised up the prices. The peak periods of cumin arrivals are during February to April at that time prices are declined. The arrivals of cumin start hitting the market from February and continued for next two months. Looking to IPR and ASPV, there was much variability in prices was found maximum in Jalore mandi. Maximum variation in prices from all selected mandies was estimated in Jalore mandi.

Policy Implications

Keeping in view the above results, a following policy measures are suggested below:

Although warehouse receipt financing can help farmers in selling the crop at proper time but small and marginal farmers do sell the produce just after harvesting and don't take advantage of price variations. Farmers Producer Organisations can help them in aggregating, storing and selling the produce at right place and at right time.

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