

RESEARCH PAPER

Market Arrival and Price Behaviour of Major Vegetables in Regulated Sub Market Yard Baijnath, Himachal Pradesh, India

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ABSTRACT

In the field of horticulture, the production of vegetables plays a significant role in the development of agriculture and the country's economy. It not only generates more income and employment opportunities but also contributes to equitable distribution when the marketing aspect is managed effectively. This study aimed to investigate the correlation and seasonal patterns of arrivals and prices of specific vegetables in the regulated sub market yard Baijnath of Kangra district, Himachal Pradesh, from the year 2010-11 to 2022-23. The findings revealed that cauliflower had the highest rate of increase in monthly arrivals, while ladyfinger had the highest increase in monthly prices. Interestingly, the prices of vegetables moved inversely as well as directly to their arrivals, indicating a negative and positive correlation depending upon the off-season production of various vegetables in the state. The study also found that cucumber had the highest average monthly variability in arrivals, while ladyfinger had the highest variability in prices. Furthermore, it was observed that most vegetables had higher arrivals during the peak season and lower arrivals during the lean season.

HIGHLIGHTS

- ① Vegetable prices and arrivals show seasonal and inverse correlations, especially during peak production.
- ② Lady finger had the highest price variability, while cucumber showed the most fluctuation in arrivals.
- ③ Inadequate infrastructure and lack of market intelligence limit farmers' income and decision-making.

Keywords: Arrivals, Prices, Correlation, seasonal pattern, monthly variability

Vegetables play a vital component in day-to-day life of people from economic and nutritional point of view as it generates high income and employment and improves nutrition (Kumar *et al.* 2005). The production of the vegetables in Himachal Pradesh has increased to 1867.41 metric tonnes during 2022-23 from 450 metric tonnes during 1997-98 which is more than 300 % increase over these years. This growth underscores the prominence of vegetable cultivation within the horticulture sector, which is regarded as more profitable due to its potential to generate higher incomes, provide

more employment opportunities, and contribute to better nutrition. The diverse climatic conditions of Himachal Pradesh play a significant role in ensuring a steady supply of vegetables throughout the year. However, this variability in production and supply often leads to price fluctuations, exposing vegetable growers to substantial risks. The perishable nature

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of vegetables further compounds challenges, as they require immediate post-harvest marketing to maintain their freshness and quality. The marketing of vegetable commodities is a complex process and is comprised of various practices carried out by different functionaries involved in marketing process (Devkota and Sharma 2014).

One of the key issues faced by vegetable growers is the poor market infrastructure and the involvement of numerous intermediaries in the marketing chain. These factors reduce the producers' share in the consumer's expenditure, leaving farmers with limited profits. Additionally, the lack of adequate market intelligence further hampers farmers' ability to make informed decisions. Without reliable information on prevailing market prices, the volume of arrivals, or demand trends, farmers often struggle to time their market entries effectively (Rai and Pandey, 2004; Sighet *et al.* 2004). This highlights the urgent need for a robust market intelligence system to provide farmers with real-time data on commodity prices and market arrivals. Such a system could empower farmers to optimize their cropping patterns and sell their produce at times when prices are more favorable, thereby enhancing their income and minimizing risks.

Given this context, the present study was conducted to analyze the behavior of market arrivals and price trends of selected vegetables at the regulated sub-market yard in Baijnath. By examining the dynamics of vegetable marketing in this region, the study aims to provide insights into the challenges faced by farmers and recommend strategies for improving market efficiency and profitability.

METHODOLOGY

The study has culled monthly wholesale prices and arrivals data from regulated sub-market yard Baijnath for the major vegetables viz. tomato, cabbage, cauliflower, green pea, cucumber, brinjal, radish, and lady finger for a period of fourteen years (2010-11 to 2022-23). All the relevant secondary data has been collected from the regulated sub market yard Baijnath, district Kangra, Himachal Pradesh. The analytical tools used in the study are described below.

Seasonal indices

Fielder and Osagie (1985) formula was used to

calculate the seasonal indices of monthly arrivals and wholesale prices of selected vegetables in regulated sub market yard Baijnath.

$$SI_{ij} = \frac{Y_{ij}}{\bar{Y}_i - (6 - j)b} * 100$$

Where,

SI_{ij} = Monthly index for arrivals/prices in j^{th} month in i^{th} year

Y_{ij} = The average monthly arrivals (q) / prices ($\text{₹}/q$) in j^{th} month in i^{th} year.

$\bar{Y}_i$ = Average monthly arrivals (q)/ prices ($\text{₹}/qt$) in i^{th} year

j = The number assigned to month ($j = 1, 2, 3, \dots, 12$, where $j = 1$ for April and $j = 12$ for March)

b = Trend coefficient

Finally, the average seasonal index for a particular month was computed as follows;

$$S_j = \frac{\sum_i^n SI_{ij}}{n}$$

Where,

S_j = Average monthly seasonal index for arrivals/prices for j^{th} month over a period n

n = Number of years

Coefficient of Variation (CV)

CV measured the variability in arrivals and wholesale prices of selected vegetables.

$$C.V. = \frac{S.D.}{\bar{X}} * 100$$

Where,

C.V. = Coefficient of variation

S.D. = Standard Deviation

$\bar{X}$ = Arithmetic mean

Relationship between market arrivals and price

Karl Pearson correlation coefficient was computed to find the degree of relationship between market arrivals and prices, correlation coefficient ' r ' was worked out for different years using the formula.

$$r = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sqrt{\sum (x_i - \bar{x})^2 * \sum (y_i - \bar{y})^2}}$$

Where,

r = Correlation coefficient

x = Average monthly prices in rupees per quintal

y = Total monthly arrivals in quintal

n = Number of observations

RESULTS AND DISCUSSION

Variability in monthly arrivals

The variability in monthly arrivals of selected vegetables is depicted in Table 1. The crop wise analysis in the regulated sub market yard Baijnath showed that the variability in the market arrivals of potato was maximum (44 to 51 %) during the month of November and December and quite low (27 %) during May. The average volume of potato received in the market was lowest (172 qt) during off-season July and maximum during the peak season March. The variability in the arrivals of the tomato was more (57 to 65%) during the months of November to February. The average arrivals were maximum (438 qt) during March and lowest (229 qt) during August. Likewise for cabbage the variability

in the arrivals was maximum during the months of November to January and the average arrival was maximum during the peak season January and lowest in the off-season month July (Kumar *et al.* 2005). The variability in the arrivals of the cauliflower follows the same pattern as cabbage and the maximum average arrivals (370 qt) in the market were seen in the month of February. The maximum variability in the arrivals of green pea were observed in the month of September (108 %) followed by June (87 %). The average arrivals of the green pea was maximum (191 qt) during peak production month of February. For cucumber the variability in arrivals were observed in the month of November to January and the maximum and minimum average arrivals were seen in during May and February respectively. The average arrivals of the radish were maximum during the month of February which is the peak season and lowest in the off-season July. On contrary lady finger which is *Kharif* season crop the arrivals were maximum (142qt) during June and minimum (13 qt) in the month of February. The mean arrivals of the respective vegetables in the market were 252 qt (potato), 405 qt (tomato), 152 qt (cabbage), 225 qt (cauliflower), 106 qt (green pea), 99 qt (cucumber), 114 qt (brinjal), 126 qt (radish) and 76 qt (lady finger).

Table 1: Variability in monthly arrivals of vegetables in SMYB, 2010-11 to 2022-23

Particulars	Potato		Tomato		Cabbage		Cauliflower		Green Pea		Cucumber		Brinjal		Radish		Lady Finger	
	Mean (qt)	CV (%)	Mean (qt)	CV (%)	Mean (qt)	CV (%)	Mean (qt)	CV (%)	Mean (qt)	CV (%)	Mean (qt)	CV (%)	Mean (qt)	CV (%)	Mean (qt)	CV (%)	Mean (qt)	CV (%)
April	267.73	41.92	437.11	54.78	148.32	39.31	228.69	48.56	97.21	77.13	137.68	79.64	136.27	47.58	123.12	44.99	64.38	64.40
May	241.15	27.45	436.82	47.32	112.11	49.21	137.04	43.96	84.32	76.54	224.07	66.09	172.96	70.71	83.00	65.24	132.81	55.40
June	212.00	31.58	418.00	49.00	98.57	38.59	100.15	27.71	52.71	87.06	162.29	56.31	115.31	46.82	66.23	50.60	142.38	58.45
July	172.00	34.12	296.57	56.40	96.21	47.56	91.50	36.69	42.14	76.51	104.50	57.26	109.54	44.36	48.08	53.42	119.62	66.86
August	172.54	47.84	229.14	46.12	100.50	68.02	101.96	44.57	43.43	57.19	90.39	71.11	101.92	44.66	59.15	50.70	136.08	59.66
September	213.69	36.48	271.21	46.79	145.29	46.60	113.08	53.37	30.79	107.90	88.86	57.84	119.08	29.20	77.08	80.32	110.38	46.45
October	227.31	34.17	330.29	45.94	154.93	57.86	179.31	48.17	21.75	71.57	62.07	97.45	105.73	42.81	115.65	51.71	75.58	78.03
November	290.81	44.07	403.96	64.62	169.57	82.46	324.27	73.07	81.32	80.55	50.93	191.76	109.92	79.02	172.04	39.27	31.00	100.96
December	292.62	51.46	425.21	58.11	163.21	89.98	327.85	57.62	174.36	58.12	47.07	210.92	101.92	79.83	187.54	41.42	19.23	164.73
January	292.42	39.64	403.93	58.89	183.39	75.12	359.46	47.15	188.46	36.06	49.75	157.36	111.62	80.94	188.42	25.77	29.92	152.60
February	298.15	42.98	427.21	57.43	160.43	60.98	369.54	30.00	191.29	37.71	31.43	76.93	87.38	65.40	197.15	33.14	13.38	81.77
March	348.81	34.65	437.93	50.23	157.68	40.23	366.04	32.06	174.64	35.27	56.54	59.79	92.23	51.06	190.42	30.78	37.54	96.15
2010-11 to 2022-23	252.44	45.81	405.41	92.57	151.69	63.95	224.91	72.21	106.12	85.25	99.22	102.97	113.66	64.74	125.66		76.03	

Variability in monthly prices

The extent of monthly price variability and average for selected vegetables in the regulated sub market yard Baijnath is brought out in Table 2. The price variability for the potato in the market was more during the month of October to November (50 to 52 %). The average monthly prices were lowest (₹ 823) in January and maximum (₹ 1673) in October. The variability in the monthly prices of tomato is maximum in the month of June which is the off-season and the maximum (₹ 2933) prices were observed during September and minimum (₹ 1538) in April. The pattern of monthly price variability is not uniform for cabbage as it is maximum (66 to 81 %) during February to April and October and November (63 to 67 %). The average prices of cabbage was maximum (₹ 1703) during September and minimum (₹ 816) during April. The average prices of cauliflower was maximum (₹ 3458) during August and minimum (₹ 1152) during February. The variability in the monthly prices of green pea was moderate throughout the year and the average prices was maximum (₹ 8119) during off-season in the month of September and minimum (₹ 2338) during the peak season February. The average price for cucumber was maximum (₹ 2919) during December and for brinjal it is maximum (₹ 2092) during October. Radish has shown the variability in prices during the months December to June. And its average prices is maximum during October and minimum during March. On contrary for lady finger the average prices were Maximum (₹ 5738) in the month of March.

Seasonal Behaviour of Vegetables

The seasonal nature of the vegetables causes the seasonal changes in the prices of selected vegetables. The non-availability of the cold storages, play vital role in the seasonal behavior of prices and arrivals of the vegetables. The seasonal indices of monthly wholesale prices and arrivals of selected vegetables are given in Figs. 1 to 9. The seasonal indices of arrivals and prices showed the magnitude of changes in arrivals and prices from one month to the next and may be useful in determining the best time to sell the produce. The indices of the arrival of potatoes were higher during November to March and were at peak level during March (135.5 per cent) (Fig. 1). Lowest arrivals of the potato in the

market were found during the month of August (67.7 per cent). The price indices were maximum during October (136.3 per cent) and lowest during the month of January (69.8 per cent) (Chaudhary and Singh 2021).

Fig. 2 depicts the seasonal behaviour of tomato in regulated sub market yard Baijnath. The indices of arrivals of tomato in the market were higher during the month of May (121 %) and lowest in the month of August (81.6 %). The price indices of tomato were at peak during the month of October (125.6 %) followed by 123.9 % in the month of August and lowest in the month of May (63.4 %). This showed that the production of tomato was at peak during this period of the year in the state.

Fig. 3 presented the arrivals and price indices for the cabbage in the market. The arrivals of cabbage were highest in the month of January (122 %) followed by March (117.7 %) and lowest in the month of August (69.3 %) as cabbage is a winter season crop and production during the rainy season is comparatively less. Further the price indices of cabbage revealed that the prices of the crop were highest in the month of October (141.2 %) followed by August (133.2 %) and lowest in the month of April (71.2 %).

The seasonal indices of arrivals and prices of cauliflower are shown in Fig. 4. The arrival indices of cauliflower showed that the arrivals were maximum in the month of February (167.6 %) followed by March (161.3 %) and January (161.0 %) as it is the main growing season of crop in the state. Lowest arrival indices were found in the month of July (42.6 %). The prices of the cauliflower were maximum in the month of August (160.9 %) followed by September (149.4 %) and lowest in March (52.5 %).

Seasonal indices of arrivals and prices of green pea are presented in the Fig. 5. The arrivals indices showed the maximum trends in January (202.8 %) followed by February as these are the peak marketing months of the crop in Himachal Pradesh and lowest in the month of October ((22.7 %) which is sowing season of the crop (Ankita *et al.* 2020). The price indices of green pea is maximum in the month of September (182.3 %) followed by October (176.7 %) as the supply of green pea is lowest during this period of year in the market and on lower side in the months of January to March.

The indices of the arrival of cucumber were higher

Table 2: Variability in monthly prices of vegetables in SMYB, 2010-11 to 2022-23

	Potato		Tomato		Cabbage		Cauliflower		Green Pea		Cucumber		Brinjal		Cucumber		Brinjal		Radish		Lady Finger	
	Mean (₹)	CV (%)	Mean (₹)	CV (%)	Mean (₹)	CV (%)	Mean (₹)	CV (%)	Mean (₹)	CV (%)	Mean (₹)	CV (%)	Mean (₹)	CV (%)	Mean (₹)	CV (%)	Mean (₹)	CV (%)	Mean (₹)	CV (%)	Mean (₹)	CV (%)
April	1000.00	41.79	1538.46	42.64	816.07	66.98	1692.31	40.74	3138.46	36.65	1469.23	38.03	1488.46	37.39	1007.69	37.39	1007.69	49.65	4038.46	34.71		
May	1019.23	45.92	2592.31	26.66	983.93	43.69	2215.38	46.14	3584.62	38.34	1080.77	40.19	1350.00	33.63	1119.23	33.63	1119.23	53.31	2696.15	23.89		
June	1096.15	43.67	2355.77	118.45	1258.93	39.66	2780.77	47.29	4301.92	36.74	1628.85	51.08	1305.77	35.76	1482.69	35.76	1482.69	59.02	1873.08	36.35		
July	1230.77	44.12	2830.77	25.28	1596.43	43.06	2880.77	34.73	5034.62	36.80	1634.62	40.02	1875.00	37.98	1398.08	37.98	1398.08	44.43	2057.69	34.72		
August	1311.54	42.51	2534.62	43.34	1389.29	62.51	3457.69	28.04	5238.46	41.96	1811.54	44.48	1965.38	28.39	1450.00	28.39	1450.00	39.69	1946.15	21.65		
September	1550.00	46.47	2932.69	33.99	1703.57	44.87	3369.23	36.75	8119.23	38.97	1842.31	52.54	1773.08	27.38	1419.23	27.38	1419.23	36.63	1911.54	18.75		
October	1673.08	51.89	2888.46	34.80	1471.43	63.16	3023.08	42.46	7846.15	31.56	2411.54	34.63	2092.31	49.52	1619.23	49.52	1619.23	52.04	2373.08	20.74		
November	1636.54	50.88	2188.46	71.13	1185.71	67.18	2030.77	38.76	5211.54	33.58	2546.15	24.29	1680.77	32.74	980.77	32.74	980.77	47.64	2930.77	30.24		
December	1142.31	50.37	1969.23	44.08	1067.86	49.23	1546.15	30.80	2857.69	29.41	2919.23	36.52	1423.08	31.29	738.46	31.29	738.46	59.51	4826.92	38.88		
January	823.08	42.06	1823.08	32.95	1071.43	51.47	1469.23	44.66	2765.38	32.02	2469.23	33.53	1888.46	19.13	873.08	19.13	873.08	48.26	5000.00	29.74		
February	826.92	33.00	1823.08	30.90	957.14	66.19	1151.92	50.78	2338.46	32.47	2669.23	20.93	1946.15	29.16	800.00	29.16	800.00	49.21	5676.92	24.75		
March	923.08	33.30	1866.67	25.01	838.46	80.98	1226.92	52.69	2515.38	38.37	1923.08	30.47	1930.77	29.81	757.69	29.81	757.69	49.98	5738.46	26.30		
2010-11 to 2022-23	1186.06	53.36	2274.36	55.63	1284.13	57.76	2237.02	54.92	4412.66	58.06	2033.81	45.32	1726.60	37.19	1137.18	37.19	1137.18	57.23	3422.44	53.72		

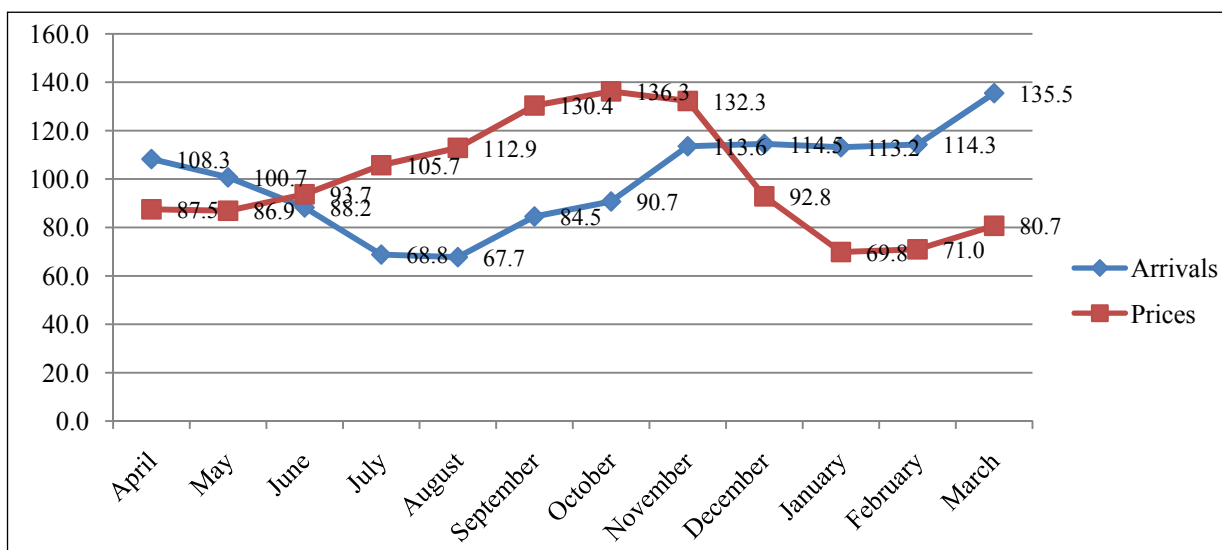


Fig. 1: The seasonal indices of arrivals and prices of Potato

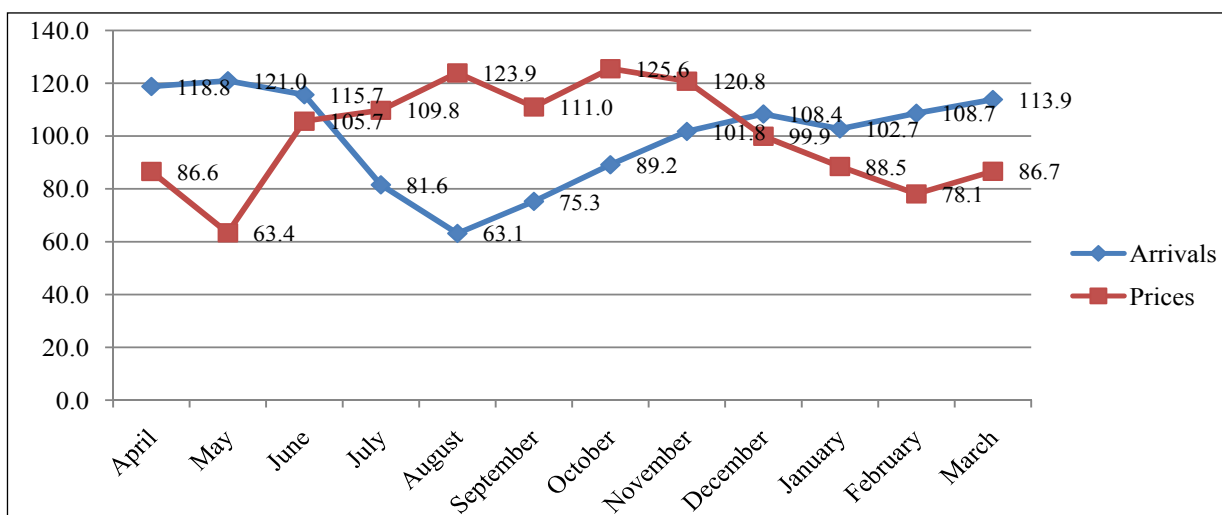


Fig. 2: The seasonal indices of arrivals and prices of Tomato

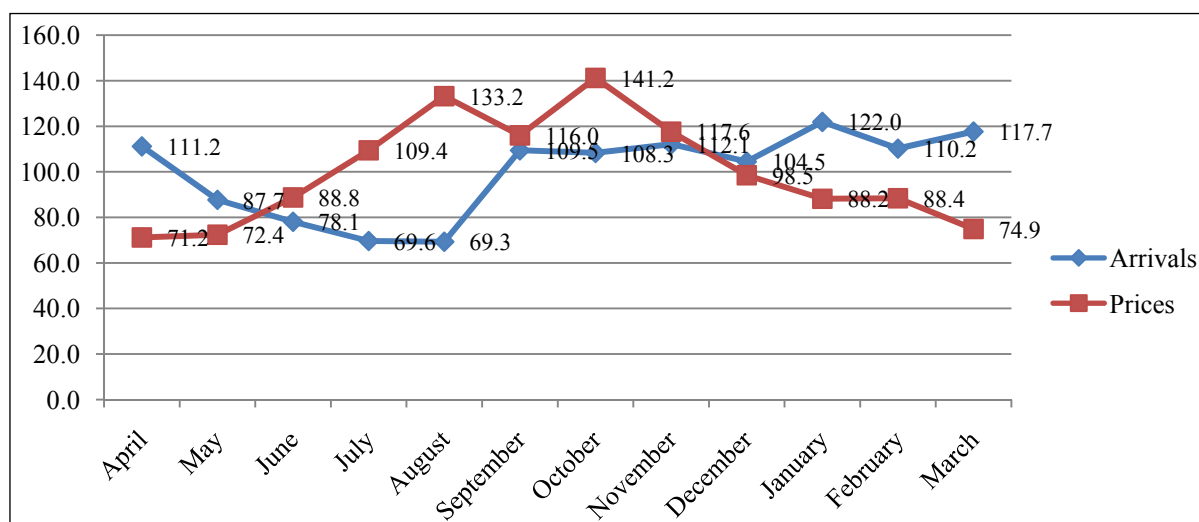


Fig. 3: The seasonal indices of arrivals and prices of Cabbage

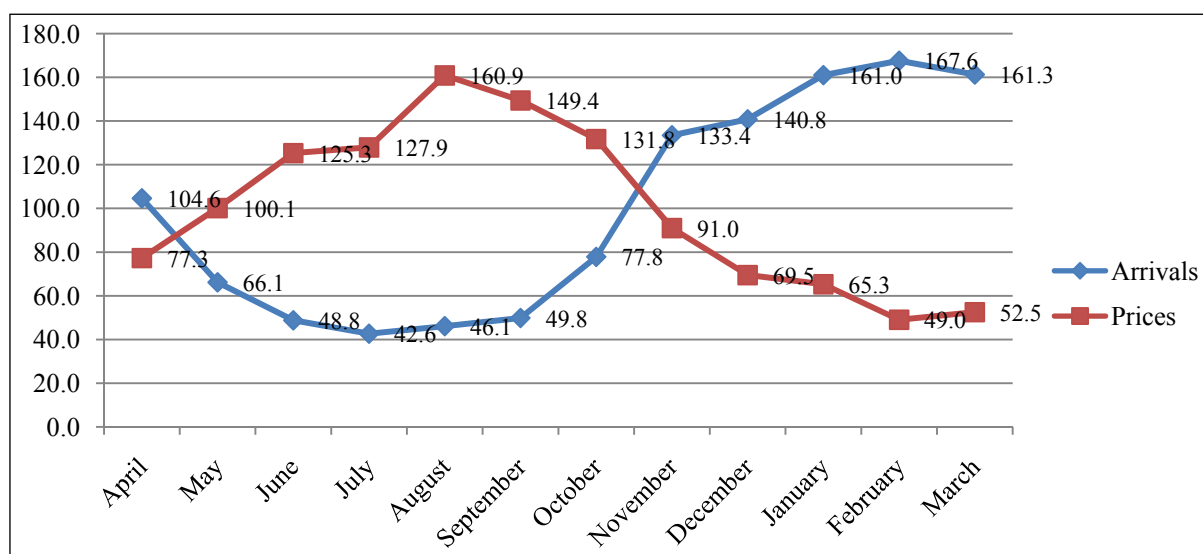


Fig. 4: The seasonal indices of arrivals and prices of Cauliflower

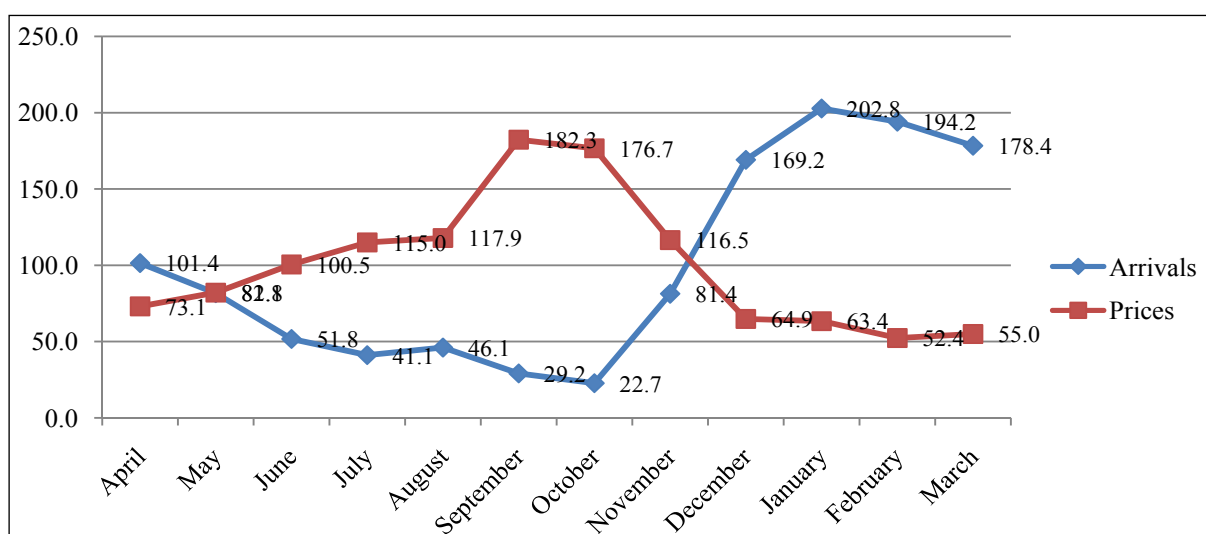


Fig. 5: The seasonal indices of arrivals and prices of Green Pea

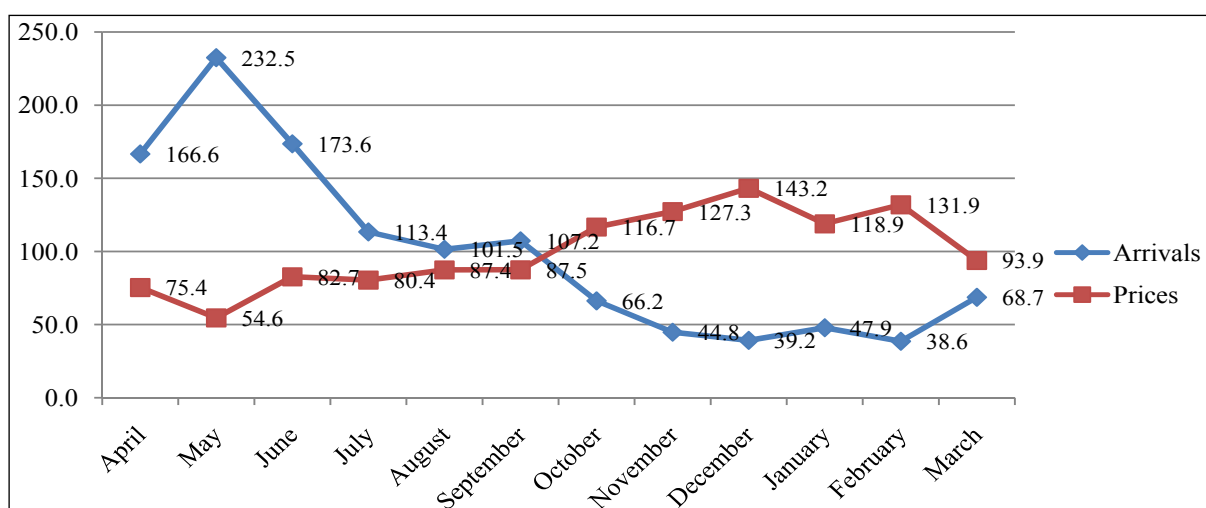


Fig. 6: The seasonal indices of arrivals and prices of Cucumber

during April to June and were at peak level in the month of May (232.5 %) (Fig. 6). Lowest arrivals of the cucumber in the market were found during the month of February (38.6 %). The price indices were maximum during December (143.2 %) and lowest during the month of May (54.6 %) (Chaudhary and Singh, 2021).

Further the indices of arrivals of brinjal (Fig. 7) were higher during April and May and lowest during February (73.2 %). The price indices of brinjal were maximum in the month of October (116.5 %) and on lower side in the month of June (75.6 %).

The arrival and prices indices of radish are presented in Fig. 8. The indices of arrivals of radish were

higher during November to March and were at peak in the month of February (155.5 %) and were lowest in the month of July (38.4 %). On contrary the indices of prices were higher during August to October and were at peak in October (138.4 %) and lowest during December (59.1 %)

The arrival and prices indices of Lady Finger are presented in Fig. 9. The indices of arrivals of Lady Finger were higher during April to October and were at peak in the month of June (190.7 %) and were lowest in the month of February (19.9 %). On contrary the indices of prices were higher during November to March and were at peak in March (162.8 %) and lowest during June (53.4 %).

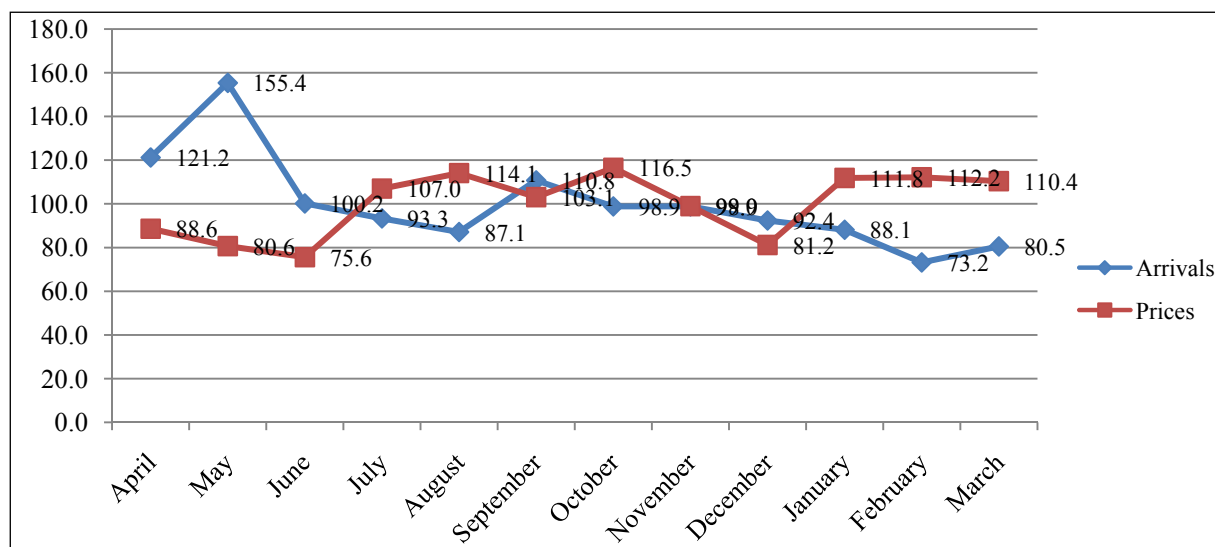


Fig. 7: The seasonal indices of arrivals and prices of Brinjal

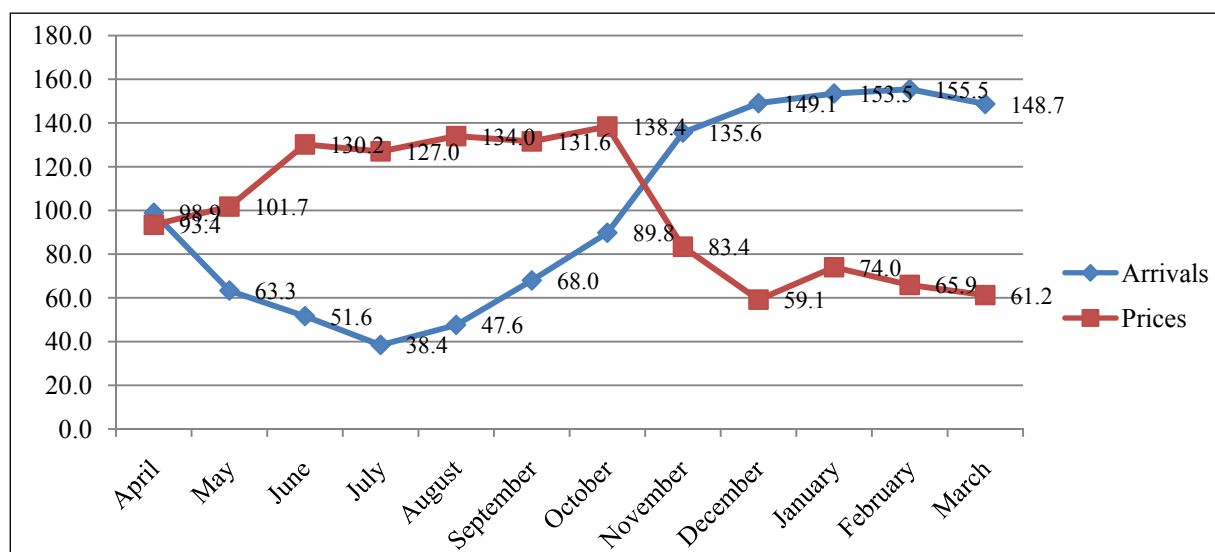


Fig. 8: The seasonal indices of arrivals and prices of Radish

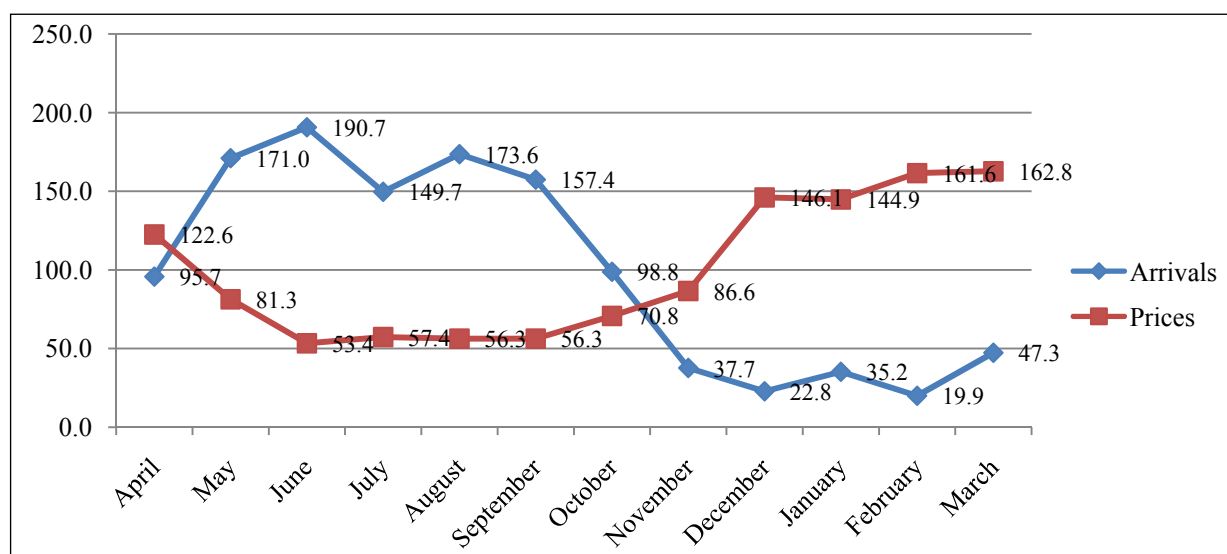


Fig. 9: The seasonal indices of arrivals and prices of Lady Finger

The phenomenon of inverse relationship between the arrivals and prices is a well-known. However, the factors like cold storage facility, value addition through food processing and off-season cultivation of vegetables along with growing polyhouse cultivation etc. not only weaken this relationship but turns it positive (Kumar *et al.* 2005). The relationship between arrivals and prices is studies for different months over different years due to the seasonality in vegetable production. The negative relationship would be seen during peak production period and it will be positive during other months.

Further looking at the Table 3 would reveal that negative relationship between prices and arrivals is not universally true. The month wise correlation coefficients for potato were negative non-significant during the months from September to February as January and February is the main growing season in Himachal Pradesh and October in other states. The correlation coefficient for potato from 2010-23 is negative. For tomato, the correlation coefficient is positive and statistically non-significant in the month of April, June, September and February and it was negative for the remaining months since tomato. The correlation coefficient for cabbage is negative (-0.55) and statistically significant in the month of July. Likewise, for cauliflower also the correlation coefficient is negative and statistically significant in the months of July (-0.58) and August (-0.57) also during 2010-23 the coefficient is -0.46 and statistically significant. As cabbage and cauliflower

are grown during rainy season in few districts of Himachal Pradesh. For Green peas the correlation coefficient is negative and statistically significant in the months of May (-0.51), June (-0.50) and July (-0.63) and during 2010-23 (-0.52). For cucumber the correlation coefficient is negative in all the months expect for May, but statistically significant only during September as cucumber is rainy season crop. For lady finger the correlation coefficient is negative and statistically significant in the months of November (-0.49), December (-0.66) and January (-0.53).

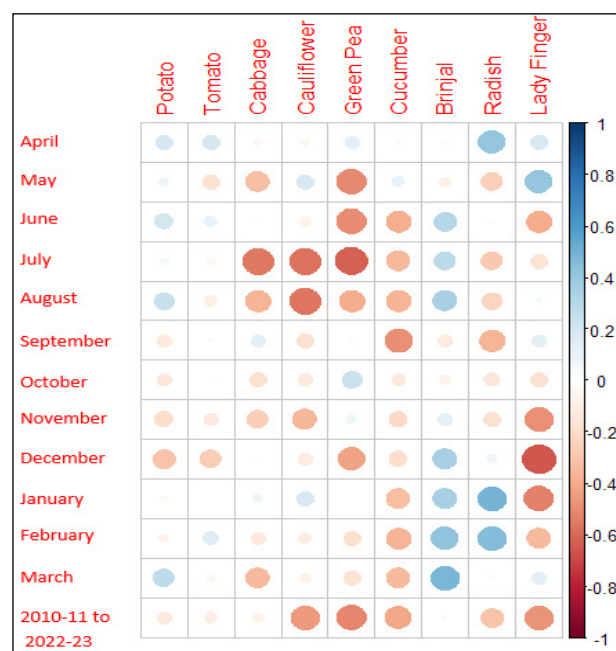


Fig. 10: Correlation coefficients (r) between arrivals and prices

Table 3: Correlation coefficients (r) between arrivals and prices of selected vegetables in Regulated Sub Market Yard Baijnath

Particulars	Potato	Tomato	Cabbage	Cauliflower	Green Pea	Cucumber	Brinjal	Radish	Lady Finger
April	0.19	0.19	-0.05	-0.06	0.13	-0.03	-0.03	0.41	0.18
May	0.07	-0.18	-0.33	0.18	-0.51***	0.10	-0.09	-0.26	0.41
June	0.20	0.10	0.01	-0.08	-0.50***	-0.39	0.30	0.02	-0.40
July	0.05	-0.05	-0.55***	-0.58**	-0.63**	-0.35	0.28	-0.29	-0.17
August	0.24	-0.10	-0.37	-0.57**	-0.40	-0.37	0.35	-0.24	0.04
September	-0.13	0.02	0.12	-0.18	-0.02	-0.49***	-0.12	-0.37	0.12
October	-0.14	-0.02	-0.19	-0.13	0.23	-0.14	-0.08	-0.15	-0.18
November	-0.20	-0.13	-0.27	-0.36	0.07	-0.22	0.13	-0.18	-0.49***
December	-0.31	-0.27	-0.02	-0.12	-0.43	-0.20	0.35	0.07	-0.66**
January	-0.03	-0.01	0.07	0.18	0.00	-0.33	0.35	0.49***	-0.53***
February	-0.07	0.16	-0.14	-0.11	-0.19	-0.37	0.42	0.45	-0.35
March	0.27	-0.06	-0.35	-0.08	-0.17	-0.35	0.48***	0.02	0.13
2010-11 to 2022-23	-0.13	-0.10	-0.08	-0.46*	-0.52*	-0.42*	0.02	-0.31*	-0.48*

Note: *, **, *** significance at 1%, 5% and 10 % level of significance respectively.

CONCLUSION

Growers of vegetables are promoting their produce from farm to market using the conventional methods. The Market Regulation Act does exist, but marketing methods used do not meet the requirements outlined in the Market Regulation Act. The government-established regulated markets were intended to control trade practices, boost marketing effectiveness by lowering marketing costs, get rid of middlemen, and safeguard producer-seller interests. However, the system was unable to prevent trading abuses, which resulted in extremely constrained, ineffective, and trader-dominated marketplaces. There was a lack of openness in procedures including open auction, grading, market costs, and documenting sale earnings. Commission agents play a significant part in setting the market price for products. To increase quality for exports in this situation, organic farming ought to be encouraged. Malpractices such as arbitrary auctions, commission double billing, and arbitrary moisture deductions, among others, ought to be examined. Strict enforcement of the requirement to report sale revenues on specified forms is necessary to ensure that producers receive an open and equitable transaction. Market Committees and the Marketing Board should use large display boards to provide producers with the most recent and accurate local,

state, and national market information in order to foster marketing intelligence among farmers. Additionally, this will improve the co-integration of the region's various marketplaces. To completely transform vegetable production and marketing in the Baijnath district, the creative provisions envisioned in the APMC Act 2005, such as contract farming, the establishment of a market extension cell, the promotion of farmers' and private Mandies, and the establishment of a Standard Grading Bureau in the principal market (Baijnath), may be put into practice.

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