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Seasonal dynamics and price volatility in pearl millet markets: Evidence from time series analysis

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Abstract

Pearl millet (*Pennisetum glaucum* L.) originated in Central tropical Africa and widely distributed across the arid and subtropical regions of Africa and Asia. In India, pearl millet is the sixth major cereal in terms of area and production. In India, pearl millet primarily grown for grain production for food and stover after harvesting of grain used as dry fodder. The present study was aimed to estimate the seasonal variation and trends of arrival and prices and price volatility by using advanced time series analysis. The time series data on monthly arrivals and prices of pearl millet were collected from the major six number of APMCs markets of Maharashtra. The seasonality of arrivals and prices were analyzed by estimating seasonal arrival and prices indexes and intra year variability. Cyclical movements of time series data on arrival and prices was estimated by residual method. Data used were pertaining to the period of 20 years i.e., 2005-2024. Seasonal indexes analysis of data indicated that all of the selected markets seasonal arrival indices of pearl millet were higher than the price indices. The clear pattern of maximum and minimum arrivals and prices were noticed in most of the market. The seasonal arrival peaks occurred primarily in October to December across all the selected markets due to the kharif harvest. The prices were lowest during the same period because of arrival pressure and highest during April to June when the relatively less arrival in the market. The cyclical indices of pearl millet arrivals in a selected markets of Western Maharashtra showed strong periodic movements, particularly during the period from 2021 to 2023. In the Marathwada region, Jalna and Chhatrapati Sambhajinagar markets also exhibited cyclical behaviour during 2009-2011 and again during 2020-2023. The pearl millet prices in the selected markets of Western Maharashtra remained relatively stable, with cyclical values consistently close to unity. However, markets of Marathwada region exhibited stronger price cycles during 2009-2011 and 2020-2023.

Keywords: Pearl millet, prices and arrivals, trend, seasonal indices, intra year variability, coefficient of variation, cyclicity

Introduction

Pearl millet (*Pennisetum glaucum* L.), commonly referred to as bajra, is an important cereal crop cultivated mainly in the arid and semi-arid regions of Asia and Africa. The crop is widely recognized for its tolerance to drought, high temperature, and poor soil fertility, making it particularly suitable for rainfed farming systems. Because of these adaptive characteristics, pearl millet is increasingly viewed as a climate-resilient crop capable of supporting food and nutritional security in environmentally fragile regions (Satyavathi *et al.*, 2021) [13]. In addition to its resilience, pearl millet possesses considerable nutritional value, being rich in micronutrients, dietary fibre, and essential amino acids when compared with several major cereal crops (Tanwar *et al.*, 2025) [15].

India ranks among the leading producers of pearl millet globally, where the crop is predominantly grown under dryland conditions. In several semi-arid regions, pearl millet cultivation contributes significantly to sustaining rural livelihoods and enhancing farm resilience under changing climatic conditions (Yadav *et al.*, 2021). Recent studies have also highlighted the growing importance of millets in promoting sustainable agriculture, nutritional security, and climate-smart farming practices (Mukherjee *et al.*, 2025) [11]. Despite its production

significance, the marketing of pearl millet often experiences considerable seasonal variation in market arrivals and prices. These fluctuations are largely associated with harvesting cycles, supply availability, and variations in market demand, which may create price instability in agricultural markets. Therefore, understanding seasonal patterns and price behaviour is essential for improving market efficiency and ensuring better price realization for farmers. In this context, the present study examines the seasonal patterns, long-term trends, and price volatility of pearl millet arrivals and prices in selected markets of Maharashtra using advanced time-series analytical techniques.

Materials and Methods

The time series data on monthly arrivals and prices of pearl millet were collected from the major APMCs markets of Maharashtra for the period of 20 years i.e., 2005-2024. Selection of markets were decided on the basis of maximum arrivals of pearl millet in the market. For the data analysis four markets from western Maharashtra, and two markets from Marathwada region were selected.

Seasonal indices of arrivals and prices were estimated by ratio to moving average method (Acharya *et al.* 1995) [20].

$$\text{Seasonal Index (prices)} = \frac{\text{Actual average prices for the month}}{\text{Moving average price for the month}} \times 100$$

$$\text{Seasonal Index (arrivals)} = \frac{\text{Actual average arrivals for the month}}{\text{Moving average arrivals for the month}} \times 100$$

Inter and intra year variability in arrivals and prices were studied by following formula.

$$\text{C.V. (\%)} = (\text{SD} / (\sum X / n)) \times 100$$

Where:

- C.V. = Coefficient of variation
- S.D. = Standard deviation
- X = Area, Production, Productivity
- N = Number of year

Cyclical Movement of Time Series Data on Price

Cyclical movement of time series data on price was estimated by residual method

Where;

- T = Linear trend
- C = Cyclical element
- S = Seasonal variation
- I = Irregular fluctuations

Results and Discussion

Seasonal indices of arrivals and prices of pearl millet in Western Maharashtra

The seasonal indices of monthly arrivals and prices of pearl millet in Pune, Chalisgaon, Malegaon and Sangli markets are presented in Table 1 and Fig. 1. The table showed that, in the Pune, Chalisgaon, Malegaon and Sangli markets, the arrivals indexes of pearl millet were maximum in the months of December (147.43%), May (178.88%), October (170.85%) and January (172.24%), respectively and minimum during the month of April (80.38%), July (41.45%), April (65.16%), and July (54.01%), respectively. The indices of per quintal prices were highest in the month December for the three markets namely Pune (107.02%), Malegaon (104.01%) and Sangli (104.67%), and for the Chalisgaon market it was highest in the month of April (104.04%)

The arrivals indexes in Pune market were more than 100 in the months of January, February, November and December, in the months of April, May and October to December in Chalisgaon market, in the months of May and September to December in Malegaon market, and in the months of January to February and October to December in Sangli market. The per quintal price index of pearl millet of Pune and Sangli market were above the 100 in the months from August to December, for the Chalisgaon market in the month of April, July, November and December and for the Malegaon market in the month of April, May, July, August, November and December.

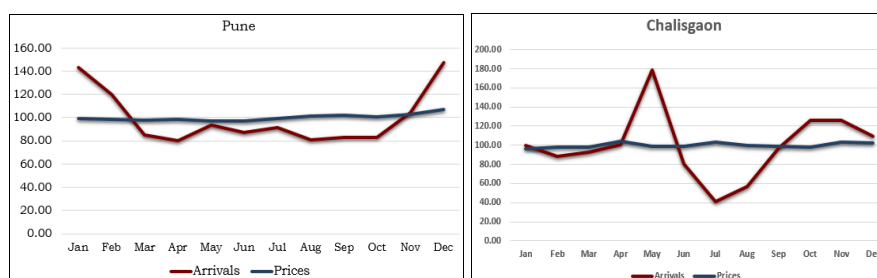
Table 1: Seasonal indices of arrivals and prices of pearl millet in Western Maharashtra (2005 to 2024)

Month	Pune		Chalisgaon		Malegaon		Sangli	
	Arrivals Indices	Prices Indices	Arrivals Indices	Prices Indices	Arrivals Indices	Prices Indices	Arrivals Indices	Prices Indices
Jan	143.16	99.25	99.98	96.14	93.93	98.60	172.24	97.15
Feb	120.12	98.56	88.83	97.71	80.65	96.89	114.69	96.18
Mar	85.42	97.52	92.68	98.28	70.62	97.76	68.94	96.23
Apr	80.38	98.26	101.08	104.04	65.16	102.24	85.94	99.44
May	93.76	96.94	178.88	99.27	116.08	100.63	63.57	97.74
Jun	87.50	96.85	80.46	98.78	93.70	99.13	66.52	99.09
Jul	91.43	99.33	41.45	103.41	79.46	101.35	54.01	100.44
Aug	80.93	101.12	57.23	99.69	86.11	102.48	66.91	103.00
Sep	82.79	101.88	97.54	99.06	120.07	97.16	86.50	103.06
Oct	82.99	100.79	126.34	98.18	170.85	95.91	118.10	100.70
Nov	104.11	102.47	125.79	103.12	122.89	103.86	146.02	102.30
Dec	147.43	107.02	109.73	102.31	100.49	104.01	156.58	104.67
Total	1200	1200	1200	1200	1200	1200	1200	1200

Seasonal Indices of arrivals and prices of pearl millet in Marathwada region:

The seasonal indices of monthly arrivals and prices of pearl millet for the period of last 20 years (2005 to 2024) in the selected markets of Marathwada region are presented in Table 2 and in Figure 2. It was noticed that, the highest indices of arrivals of pearl millet in the Jalna and Chhatrapati Sambhajanagar markets of Marathwada region were 215.43 per cent and 198.35 per cent, respectively in the month of October. The highest price indices of pearl millet

were in the month November as 110.46 per cent and 107.39 per cent in the Jalna and Chhatrapati Sambhajanagar markets, respectively. On the contrary, the lowest arrivals indices were recorded in the months of March, i.e. 35.65 per cent and 45.58 per cent in the month of April in the Jalna and Chhatrapati Sambhajanagar markets, respectively. In case of lowest indices per unit prices of pearl millet were 95.26 per cent (February) and 95.52 per cent (February) in the Jalna and Chhatrapati Sambhajanagar markets, respectively.



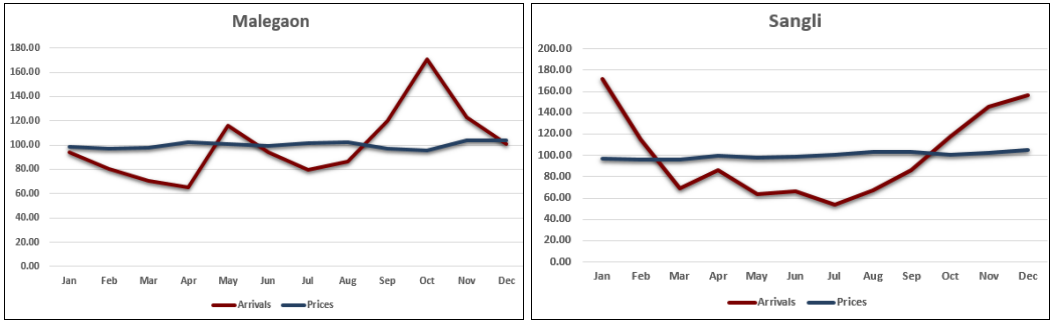


Fig 1: Seasonal Indices of arrivals and prices of pearl millet in Western Maharashtra

The maximum arrival indexes in Jalna market were in the month of May and September to November while it was maximum in the months of August to November in the Chhatrapati Sambhajnagar market. The per quintal price indexes were above the 100 in the month of July, August, November and December and in Jalna and Chhatrapati Sambhajnagar market.

In case of overall results of pearl millet, seasonal arrival peaks occurred primarily in October to December across all the selected markets due to the kharif harvest. The prices were

lowest during the same period because of arrival pressure and highest during April to June when the relatively less arrival in the market. The sharpest seasonal price troughs were seen in the Western Maharashtra which is the major pearl millet belt. These higher swings in the seasonal indices demonstrated the concentrated marketing of pearl millet soon after the harvest which is possibly driven by limited storage capacity and urgent liquidity needs of farmers. Similar strong post-harvest price depressions have been reported in other millet-dominant states (Chaudhary & Sharma, 2022; Kumar & Sonnad, 2023) [2, 21].

Table 2: Seasonal indices of arrivals and prices of Pearl millet in Marathwada region (2005 to 2024)

Month	Jalna		Chhatrapati Sambhajnagar	
	Arrivals Indices	Prices Indices	Arrivals Indices	Prices Indices
January	79.16	98.11	85.29	95.84
February	48.58	95.26	65.64	95.52
March	35.65	95.33	46.00	97.39
April	47.14	99.91	45.58	101.65
May	115.31	96.79	83.70	100.43
June	85.36	96.36	81.80	96.64
July	75.35	100.64	85.75	101.58
August	97.53	102.00	116.36	102.84
September	133.66	97.55	132.57	97.71
October	215.43	100.07	198.35	97.08
November	168.24	110.46	162.33	107.39
December	98.59	107.51	96.64	105.92
Total	1200	1200	1200	1200

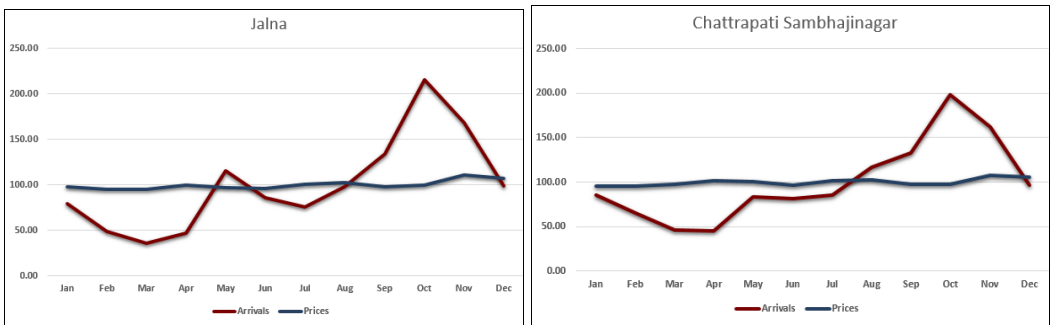


Fig 2: Seasonal Indices of arrivals and prices of sorghum in Marathwada and Vidarbha region

Intra-year variations in arrivals and prices of pearl millet in Maharashtra
Western Maharashtra Region

The intra-year variability in the arrivals and prices of pearl millet in western Maharashtra markets over 20 years are presented in Table 3 and graphically depicted in fig. 3. The overall variation in arrivals of pearl millet and its prices was 82.30 per cent and 42.21 per cent in Pune market, 125.39 per cent and 40.77 per cent in Chalisgaon market, 74.71 per cent and 40.59 per cent in Malegaon market, and 68.20 per cent and 43.75 per cent in Sangli market, respectively. It was observed

that in all the four of the selected markets, the variation in arrivals was greater than the variation in prices. The greatest overall variation in arrivals and prices was observed in Chalisgaon market (125.39%) and Sangli market (43.75%), respectively.

From the table, in Pune market, estimates of the monthly variability over the period of 20 years (2005-2024) revealed that, variation in arrivals and prices of pearl millet were ranged between 66.15 per cent (May) to 106.90 per cent (February) and 40.01 per cent (May) to 44.62 per cent (January), respectively. In case of Chalisgaon market, variation in arrivals

and prices of were ranged between 103.09 per cent (August) to 157.55 per cent (September) and 38.42 per cent (July) to 43.24 per cent (February), respectively. Similarly, in Malegaon market the variation in arrivals were ranged between 48.38 per cent (September) to 93.07 per cent (November) and variation in prices were ranged between 39.24 per cent (June) to 41.88 per

cent (September), respectively. Moreover, in Sangli market, variation in arrivals were ranged between 50.45 per cent (December) to 90.54 per cent (October) while variation in prices were ranged between 42.64 per cent (September) to 45.34 per cent (February), respectively.

Table 3: Intra-year coefficient of variations in arrivals and prices of Pearl millet in Western Maharashtra (WM) (2005-2024)

Month	Pune		Chalisgaon		Malegaon		Sangli	
	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices	Arrivals	Prices
January	91.25	44.62	140.27	42.22	82.31	40.02	55.99	45.08
February	106.90	43.12	146.69	43.24	78.07	40.44	88.73	45.34
March	82.88	42.61	116.62	40.88	79.81	40.87	62.74	44.98
April	83.13	41.27	119.11	39.61	82.66	41.14	63.51	42.88
May	66.15	40.01	128.70	40.86	67.85	40.33	68.74	42.81
June	72.01	41.24	106.50	39.08	82.90	39.24	59.66	43.46
July	82.32	40.74	106.51	38.42	78.10	39.96	83.38	43.09
August	81.13	42.15	103.09	39.47	68.28	40.58	68.89	43.30
September	83.68	43.09	157.55	39.87	48.38	41.88	67.43	42.64
October	79.98	43.14	128.82	41.81	67.12	39.84	90.54	43.25
November	76.23	42.50	117.54	41.55	93.07	41.64	58.30	43.66
December	81.95	42.01	133.33	42.17	67.95	41.12	50.45	44.52
Mean	82.30	42.21	125.39	40.77	74.71	40.59	68.20	43.75

Marathwada Region

The intra-year variation in the arrivals and prices of pearl millet in the selected markets of Marathwada region over a period of 20 years (2005-2024) are given in Table 4 and graphically illustrated in fig.4.

From the Table, it is observed that, the overall variation in arrivals of pearl millet in Jalna and Chhatrapati Sambhajinagar markets of Marathwada region are 55.50 per cent and 76.09 per cent, respectively, while variation in prices were 42.72 per cent and 41.90 per cent, respectively.

The month wise analysis shows that, the estimates of arrivals were varied between 40.98 per cent (September) to 94.90 per cent (May) in Jalna market, while variation in prices were ranged between 40.22 per cent (October) to 46.08 per cent (April). In case of Chhatrapati Sambhajinagar market, the variation in arrivals ranged between 63.13 per cent (May) to 95.94 per cent (August) and variation in prices were ranged between 40.04 per cent (January) to 43.70 per cent (April)

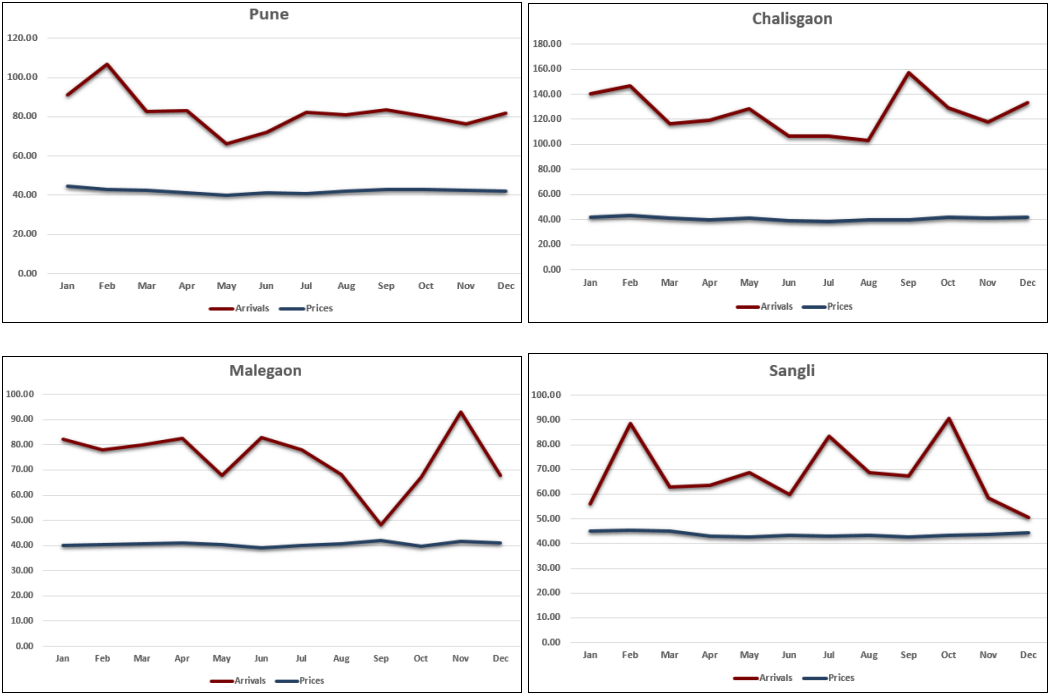


Fig 3: Intra-year coefficient of variations in arrivals and prices of Pearl millet in Western Maharashtra (2005-2024)

Table 4: Intra-year coefficient of variations in arrivals and prices of Pearl millet in Marathwada region (2005-2024)

Month	Jalna Arrivals	Jalna Prices	Chhatrapati Sambhajinagar Arrivals	Chhatrapati Sambhajinagar Prices
January	57.15	43.33	77.22	40.04
February	48.75	44.73	80.94	41.60
March	57.10	45.39	69.12	42.89

April	54.19	46.08	77.60	43.70
May	94.90	41.81	63.13	41.63
June	56.64	41.14	64.36	40.91
July	53.92	41.50	82.51	40.29
August	49.07	42.09	95.94	41.61
September	40.98	42.47	78.15	40.57
October	43.12	40.22	76.07	40.76
November	65.67	41.69	86.92	42.19
December	44.49	42.17	71.86	41.66
Mean	55.50	42.72	76.99	41.49

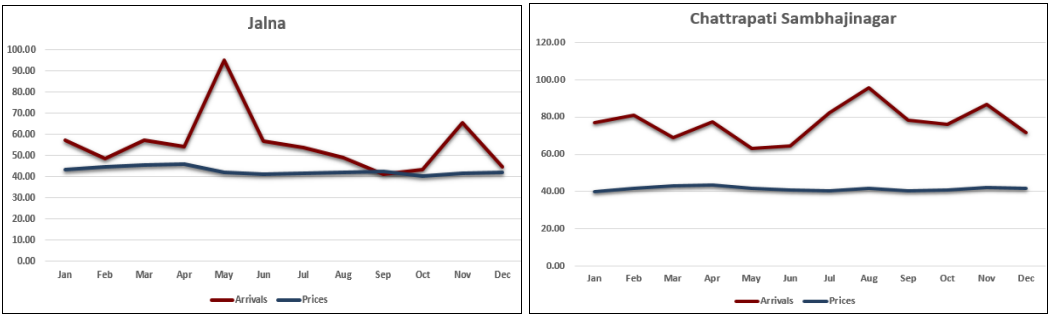


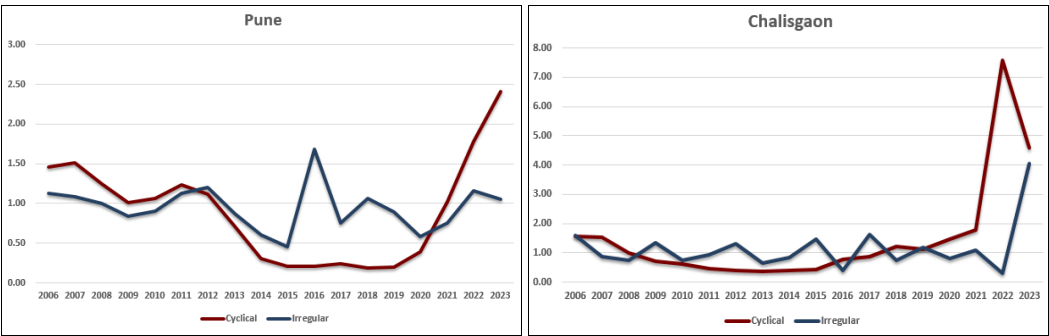
Fig 4: Intra-year coefficient of variations in arrivals and prices of Pearl millet in Marathwada region (2005-2024)

Cyclical and irregular movements of time series data on arrivals of pearl millet Western Maharashtra Region
The cyclical and irregular movements of pearl millet arrivals in selected markets of western Maharashtra are presented in Table 5 and Figure 5. The cyclical arrival indices for Pune, Chalisgaon, Malegaon, and Sangli markets of western Maharashtra showed strong periodic behaviour, especially between 2021 and 2023. These recurring

increases may reflect the rapid revival of millet cultivation and promotional efforts in recent years (Dhaniya *et al.*, 2024; Prabha Rani *et al.*, 2023) [24, 25]. The chalisgaon market, however, showed a higher irregular component than the other markets, especially in 2022, indicating that sudden disruptions such as rainfall variations or less arrivals. Earlier studies also highlight the sensitivity of millet supply to climate variation (Sharma *et al.*, 2022; Nayak *et al.*, 2024) [22, 23].

Table 5: Cyclical and irregular movements of time series data on arrivals of pearl millet in western Maharashtra

Year	Pune		Chalisgaon		Malegaon		Sangli	
	Cyclical	Irregular	Cyclical	Irregular	Cyclical	Irregular	Cyclical	Irregular
2006	1.46	1.13	1.57	1.60	1.26	1.06	0.74	0.57
2007	1.51	1.08	1.53	0.87	1.16	1.11	0.96	1.69
2008	1.24	1.00	1.01	0.73	1.02	0.85	1.16	0.72
2009	1.01	0.84	0.71	1.34	0.86	1.06	1.03	1.00
2010	1.06	0.90	0.61	0.73	0.79	1.03	1.31	0.93
2011	1.23	1.13	0.46	0.92	0.79	0.82	1.46	1.15
2012	1.12	1.20	0.39	1.32	0.81	1.12	1.53	0.98
2013	0.71	0.87	0.37	0.66	0.87	1.01	1.34	1.06
2014	0.30	0.60	0.41	0.85	0.83	0.99	1.19	0.93
2015	0.21	0.45	0.43	1.47	0.70	1.11	1.12	0.93
2016	0.21	1.68	0.78	0.40	0.65	0.77	1.05	1.17
2017	0.24	0.75	0.86	1.62	0.66	1.03	0.97	0.91
2018	0.19	1.06	1.20	0.74	1.13	0.70	0.79	1.00
2019	0.20	0.89	1.13	1.17	1.39	1.38	0.63	1.12
2020	0.39	0.58	1.48	0.79	1.66	0.88	0.49	0.77
2021	1.02	0.75	1.79	1.09	1.43	1.11	0.79	0.50
2022	1.78	1.16	7.59	0.30	1.23	1.02	1.09	1.47
2023	2.41	1.05	4.58	4.05	1.06	0.80	1.18	1.08



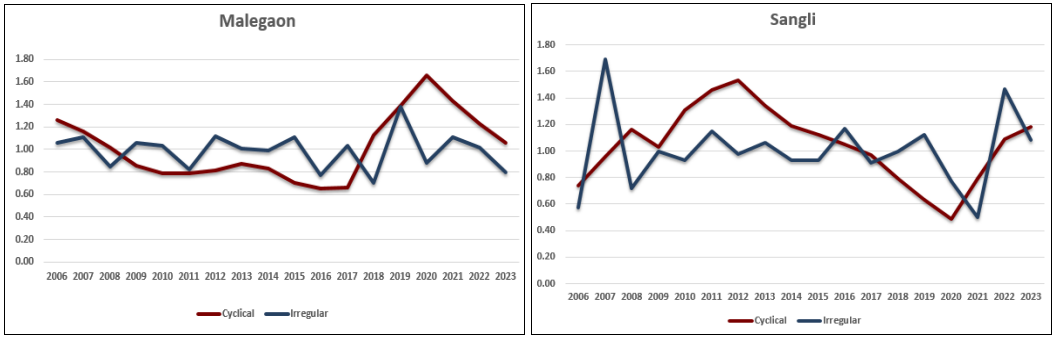


Fig 5: Cyclical and irregular movements of time series data on arrivals of pearl millet in selected markets of Maharashtra

Marathwada Region

The cyclical and irregular movements of pearl millet arrivals in selected markets of Marathwada region of Maharashtra are presented in Table 6 and Figure 6. In Jalna and Chhatrapati Sambhajnagar markets, the cyclical element was strong during 2009-2011 and again in 2020-2023, indicating that production and market arrivals followed a repeating pattern. Sharma and Singh

(2014) ^[14] observed a similar behaviour in Rajasthan, showing a consistent pattern in pearl millet markets. The irregular component remained generally low, except for 2017 in Chhatrapati Sambhajnagar market possibly due to when short-term disturbances. (Madhu *et al.*, 2024) ^[26].

Table 6: Cyclical and irregular movements of time series data on arrivals of pearl millet in Marathwada region

Year	Jalna		Chhatrapati Sambhajnagar	
	Cyclical	Irregular	Cyclical	Irregular
2006	1.16	1.22	0.94	0.86
2007	1.13	0.86	1.00	1.06
2008	0.98	1.02	1.15	0.97
2009	0.96	1.01	1.31	0.98
2010	0.92	0.97	1.33	1.15
2011	0.88	1.02	1.21	0.97
2012	0.95	0.89	0.97	0.97
2013	0.93	1.20	0.71	1.10
2014	1.02	0.82	0.57	0.72
2015	1.00	1.10	0.47	1.07
2016	0.95	1.12	0.66	0.77
2017	0.74	0.92	0.61	1.56
2018	0.65	0.73	0.89	0.43
2019	0.86	0.92	1.24	1.07
2020	1.16	1.13	1.64	1.23
2021	1.17	1.18	1.43	1.09
2022	1.03	0.80	1.07	0.68
2023	1.05	0.85	1.29	0.72

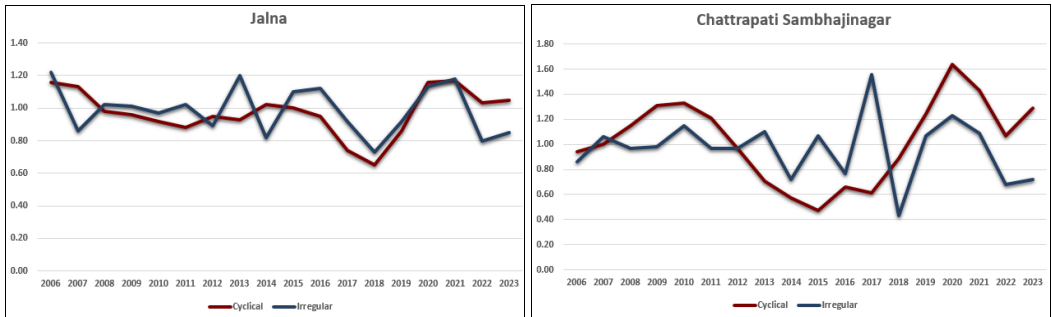


Fig 6: Cyclical and irregular movements of time series data on arrivals of pearl millet in selected markets of Maharashtra

Cyclical and irregular movements of time series data on prices of pearl millet

Western Maharashtra Region: The cyclical and irregular movements of time series data on prices of pearl millet in selected markets of western Maharashtra are presented in Table 7 and Figure 7. The Pearl millet price series across the Pune, Chalisgaon, Malegaon, and Sangli markets remained highly stable with cyclical values consistently close to 1. This indicates smooth, repeating price behaviour with little

unexpected volatility. Similar steady price patterns have been reported in studies on wheat and other cereals (Meera & Sharma, 2016) ^[28]. The irregular values observed to be low that indicates limited influence of random market shocks in the selected pearl millet markets. These low irregular values correspond with efficient functioning of price discovery, possibly supported by procurement and supply chain improvements (Patil *et al.*, 2023) ^[27].

Table 7: Cyclical and irregular movements of time series data on prices of pearl millet in western Maharashtra

Year	Pune		Chalisgaon		Malegaon		Sangli	
	Cyclical	Irregular	Cyclical	Irregular	Cyclical	Irregular	Cyclical	Irregular
2006	1.05	1.01	1.03	1.04	1.09	0.95	1.09	0.95
2007	1.02	1.04	1.00	0.98	1.03	1.02	1.03	1.02
2008	0.98	0.95	0.97	0.97	1.00	0.99	1.00	0.99
2009	0.95	1.01	0.97	1.03	0.97	0.98	0.97	0.98
2010	0.98	0.97	1.00	0.96	0.98	0.98	0.98	0.98
2011	1.00	1.02	1.03	1.03	0.99	1.03	0.99	1.03
2012	1.05	0.97	1.08	0.98	1.03	0.97	1.03	0.97
2013	1.08	1.02	1.10	1.03	1.02	1.03	1.02	1.03
2014	1.06	1.05	1.06	1.03	1.01	1.00	1.01	1.00
2015	1.05	0.93	1.04	0.92	1.00	0.97	1.00	0.97
2016	1.00	1.07	0.95	1.12	0.96	1.06	0.96	1.06
2017	0.97	0.98	0.91	0.91	0.93	0.96	0.93	0.96
2018	0.91	0.99	0.93	0.90	0.94	0.94	0.94	0.94
2019	0.90	0.98	0.94	1.20	0.97	1.08	0.97	1.08
2020	0.91	1.00	0.91	0.94	0.99	0.99	0.99	0.99
2021	0.97	0.97	0.88	0.85	0.99	0.97	0.99	0.97
2022	1.03	1.04	0.97	1.05	1.02	1.01	1.02	1.01
2023	1.07	1.01	1.10	1.04	1.05	1.03	1.05	1.03

**Fig 7:** Cyclical and irregular movements of time series data on prices of pearl millet in selected markets of Maharashtra

B. Marathwada: The cyclical and irregular movements of time series data on prices of pearl millet in selected markets of Marathwada region are presented in Table 8 and Figure 8. The Jalna and Chhatrapati Sambhajnagar markets of marathwada region showed strong cyclical fluctuations particularly during 2009-2011 and 2020-2023. These fluctuations likely coincide with

the attention on millet production and promotion during recent years under government initiatives (Mohanani *et al.*, 2025; Mehta *et al.*, 2024)^[8, 10]. The short-term irregular fluctuations in the pearl millet prices particularly observed in the year 2017. These fluctuations may be occurred due to short-lived disturbances probably as result of uneven arrivals in the markets.

Table 8: Cyclical and irregular movements of time series data on prices of pearl millet in Marathwada region

Year	Jalna		Chhatrapati Sambhajnagar	
	Cyclical	Irregular	Cyclical	Irregular
2006	1.03	1.06	0.94	0.86
2007	0.99	0.94	1.00	1.06
2008	0.98	0.96	1.15	0.97
2009	1.01	1.06	1.31	0.98
2010	1.04	0.97	1.33	1.15
2011	1.04	0.99	1.21	0.97
2012	1.09	1.00	0.97	0.97
2013	1.09	1.06	0.71	1.10
2014	1.04	0.98	0.57	0.72
2015	1.01	0.94	0.47	1.07
2016	0.93	1.13	0.66	0.77
2017	0.88	0.90	0.61	1.56
2018	0.91	0.88	0.89	0.43
2019	0.90	1.26	1.24	1.07
2020	0.89	0.86	1.64	1.23
2021	0.88	0.88	1.43	1.09

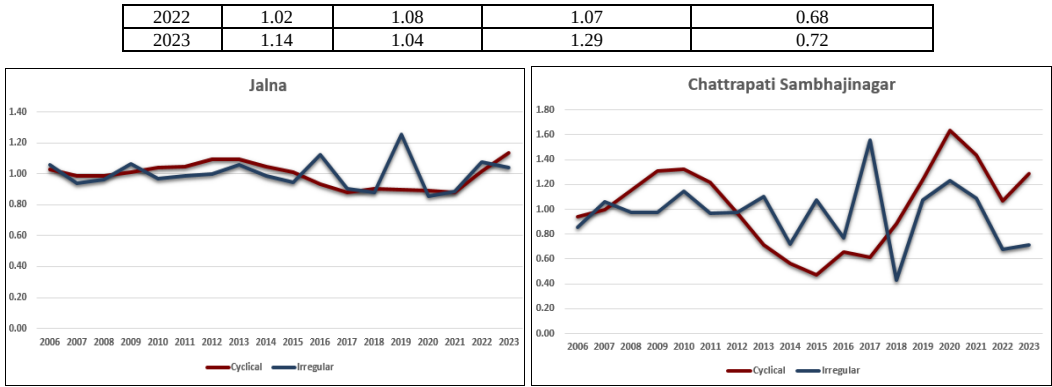


Fig 8: Cyclical and irregular movements of time series data on prices of pearl millet in selected markets of Maharashtra

The overall findings of cyclicity and irregularity analysis clearly confirmed the major role of cyclical behaviour in the both arrival and prices of major millets under study. The prices were less affected by irregular disturbances than arrivals which indicating well-functioning of all the markets under study. The dominance of cyclical patterns indicates a predictable market structure driven by production trends, seasonal factors, and policy interventions. The rise in cyclical values from 2020 onwards coincide with the recent national revival of millets which likely affected both supply and demand. To maintain stability and improve the income of millet growers, continued investment in procurement systems, logistical infrastructure, and millet-based value chains is essential.

Conclusion and Recommendations

The study revealed a distinct seasonal pattern in pearl millet arrivals and prices across the selected markets of Maharashtra. Market arrivals were highly concentrated during October-December following the kharif harvest, which resulted in relatively lower prices due to excess supply. In contrast, prices increased during April-June when market arrivals declined. Time series decomposition indicated that cyclical movements significantly influenced both arrivals and prices, while irregular fluctuations were comparatively higher in arrivals than in prices, suggesting relatively efficient price adjustments in the markets. The rise in cyclical trends after 2020 may reflect increased policy attention and consumer demand for millets in India. Stable and remunerative prices encourage farmers to maintain millet cultivation, while predictable arrivals facilitate participation of traders, processors, and other market actors. However, heavy post-harvest arrivals often create short-term price pressure. Strengthening procurement mechanisms, expanding scientific storage and warehousing infrastructure, and maintaining strategic buffer stocks can help reduce seasonal price volatility and prevent distress sales.

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