

MORINGA PRICE DYNAMICS IN UZHAVAR SANDHAIS: EVIDENCE ON DAILY PRICE SPREADS, INSTABILITY, AND SPATIAL DISPERSION IN TAMIL NADU

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ABSTRACT

Moringa is a highly perishable horticultural crop in Tamil Nadu, which makes farmers sensitive to short-term price variations. Uzhavar Sandhais provide a direct marketing channel for the farmers; however, price conditions may vary across markets over time. Earlier studies have examined moringa production, marketing channels and price fluctuations, but limited studies have been done on farmers' direct-to-consumer marketing channel (Uzhavar Sandhais). The present study examined the price behaviour of six selected Uzhavar Sandhais in Dindigul, Karur and Theni districts, which are among the major moringa-growing districts of Tamil Nadu, during 2025. Daily minimum, maximum and modal price data were obtained from the Government of India's AGMARKNET portal. Descriptive statistics, monthly mean prices, linear trend analysis, Cuddy–Della Valle Instability Index (CDVI), reported daily Min–Max price spreads and pairwise spatial price dispersion were used for the analysis. The mean modal price ranged from ₹5,617.91 per quintal in Andipatti to ₹8,774.14 per quintal in Dindigul. The coefficient of variation ranged from 47.71 per cent in Andipatti to 68.32 per cent in Karur, while CDVI ranged from 47.51 to 66.14 per cent. Prices showed positive trends in Karur, Dindigul and Theni and negative trends in Palani and Kulithalai. Monthly prices were relatively high during January–February, declined during March–April and July–August, and increased towards November–December. Theni recorded the highest mean reported relative daily price spread (43.57%), while Karur recorded the lowest (11.69%). The simple average spatial dispersion was 0.1614 among within-district pairs and 0.2428 among between-district pairs. The findings show considerable variation in moringa prices across the selected markets and months, highlighting the need for timely price information and marketing support for fresh moringa.

KEYWORDS: Moringa, Uzhavar Sandhai, price behaviour, price instability, Min–Max spread, spatial price dispersion, Tamil Nadu

1. INTRODUCTION

Moringa (*Moringa oleifera* Lam.) is an important commercial horticultural crop in Tamil Nadu and is cultivated mainly for its tender pods and leaves. The crop has gained economic importance because of its demand as a vegetable and the growing market for moringa-based products.

Marketing is an important issue in moringa because of its perishable nature. Rajendran (2017) reported considerable fluctuations in moringa prices in Tamil Nadu and noted that, being a perishable crop, moringa has to be sold within a short period after harvest. Hence, farmers have less opportunity to wait for better prices when the market price is low. Price variation and uncertainty due to perishability and seasonal production have been reported in other vegetable crops similar to moringa (Kumar et al., 2005; Chaudhary et al., 2019).

In this context, direct marketing provides an alternative to the usual marketing channels involving intermediaries. In Tamil Nadu, Uzhavar Sandhai was introduced in 1999 to bring farmers and consumers together directly and to reduce the role of intermediaries in the marketing of fruits and vegetables. It was also intended to provide better prices to farmers and fresh produce to consumers at reasonable prices. Jayaprakash et al. (2016) also described Uzhavar Sandhai as a direct farmer–consumer market developed to reduce the role of middlemen and commission agents.

Earlier studies have reported several benefits to farmers from Uzhavar Sandhai. Kallummall and Srinivasan (2007) reported that farmers were able to receive a fair price with immediate cash payment and could bring small quantities of produce to the market, which was difficult through wholesale channels. Gayathri et al. (2021), in a study of vegetable sellers in Uzhavar Sandhai in Coimbatore, found that better prices were an important reason for using the

market and that direct sales to consumers were widely practised among the respondents. These studies show that Uzhavar Sandhai can be an important direct marketing outlet for farmers, particularly for fresh and perishable produce. However, the availability of a direct marketing outlet does not by itself indicate that price conditions are uniform across markets or stable over time. The prices in Uzhavar Sandhai may also be influenced by market conditions, while similar studies on vegetable markets have shown that prices can vary considerably across months and markets. Gayathri et al. (2021) also reported constraints related to transportation, availability of buyers and the need for grading-based price fixation within Uzhavar Sandhai. Studies of vegetable price behaviour have further shown that changes in market conditions and supply can be associated with substantial price variation.

In the case of moringa, Venkatesan et al. (2018) identified Aundipatti in Theni, Aravakkurichi in Karur and Oddanchatram in Dindigul among the important moringa trading centres in Tamil Nadu and reported the presence of different marketing channels for fresh moringa pods. Their findings also showed differences in producer share across marketing channels and the weaknesses in the organisation of the moringa supply and value chain. Previous studies have examined the economic importance, marketing channels and price fluctuations of moringa in Tamil Nadu. However, market-level evidence on the daily behaviour of moringa within Uzhavar Sandhais across different locations in Tamil Nadu remains limited.

Therefore, the present study examines the price behaviour of moringa across selected Uzhavar Sandhais in Tamil Nadu during 2025. The analysis focuses on differences in price levels, linear price movement and instability, monthly price patterns, reported daily price ranges and spatial price dispersion across selected markets.

Objectives of the Study

- To examine the level and variation in moringa prices across selected Uzhavar Sandhais.
- To examine the temporal movement, instability and monthly variation in moringa prices across the selected markets.
- To examine the reported daily Min-Max range and spatial price differences in moringa across the selected markets.

2.1 Data source and study period

The study utilised daily secondary market price data for moringa, including minimum, maximum and modal prices (₹/quintal), obtained from the Government of India's AGMARKNET portal. The observation period covered 1 January 2025 to 31 December 2025.

2.2 Study area and market Selection

Six Uzhavar Sandhais were selected from three important moringa-growing districts of Tamil Nadu, namely Dindigul (Dindigul and Palani), Karur (Karur and Kulithalai) and Theni (Theni and Andipatti). The selection of these districts was based on their importance in moringa cultivation. The Agriculture Policy Note 2023–24 of the Government of Tamil Nadu reports a total area of 21,501 ha under moringa in the state and identifies Dindigul (5,623 ha), Karur (3,080 ha) and Theni (2,936 ha) among the major moringa-growing districts. Therefore, these three districts were selected for examining moringa price behaviour in direct-marketing markets.

Within these districts, two Uzhavar Sandhais were selected from each district to examine the variation in moringa price behaviour across market locations. The analysis was based on reported market-day observations. Dates without reported prices were retained as unobserved rather than being assigned zero values or imputed.

2.3 Analytical Methods

The price behaviour of moringa across the selected Uzhavar Sandhais was examined using descriptive statistics, monthly price analysis, linear trend and price instability analysis, daily Min–Max price spread and spatial price dispersion.

2.3.1 Descriptive Statistics

The level and variation in moringa modal prices were examined using mean, median, minimum, maximum, standard deviation and coefficient of variation (CV). The coefficient of variation was calculated as:

$$CV = \frac{SD}{\bar{P}} \times 100$$

where, SD is the standard deviation and $\bar{P}$ is the mean modal price.

2.3.2 Monthly Price Pattern

The monthly price pattern of moringa was examined by calculating the mean modal price for each month using the reported daily observations during 2025. The monthly mean was calculated as:

$$\bar{P}_m = \frac{\sum_{t=1}^{N_m} P_{mt}}{N_m}$$

where, $\bar{P}_m$ is the mean modal price in month m , P_{mt} is the reported modal price on the t^{th} observation in that month, and N_m is the number of reported observations in the month. The analysis was used to compare the month-wise movement in moringa prices during the study year.

2.3.3 Linear Trend and Price Instability Analysis

To examine the direction and magnitude of change in moringa modal prices during 2025, a linear trend was used for each selected Uzhavar Sandhai as:

$$P_t = a + bt + e_t$$

where, P_t is the modal price of moringa (₹/quintal) at the t^{th} observation, a is the intercept, b is the trend coefficient, t is the chronological time index, and e_t is the error term. The coefficient b indicates the average change in modal price for a one-unit increase in the time index. The time index t represented the calendar-day sequence from 1 to 365; observations with missing prices were omitted from estimation. The coefficient of determination (R^2) and the significance of the estimated trend coefficient were obtained from the fitted regression, following the approach used in agricultural market-price analysis by Kaur and Guleria (2022).

Price instability was measured using the Cuddy–Della Valle Instability Index (CDVI):

$$CDVI = CV\sqrt{1 - R^2}$$

where, CV is the coefficient of variation and R^2 is the coefficient of determination obtained from the fitted time-trend regression. The index was applied to the daily modal-price series to measure price instability after accounting for the fitted time trend, following Cuddy and Della Valle (1978).

2.3.4 Daily Min–Max Price Spread and Relative Price Spread

The reported daily price range was examined using the difference between the reported maximum and minimum prices:

$$Spread_t = Max_t - Min_t$$

To compare the price range relative to the prevailing modal price, the relative price spread was calculated as:

$$Relative\ Spread_t = \frac{Max_t - Min_t}{Modal_t} \times 100$$

These measures were used to show the extent of reported price variation within individual market days.

2.3.5 Spatial Price Dispersion

Spatial price differences between markets were examined using modal prices reported on common dates. For each pair of markets, the absolute log-price difference was calculated as:

$$D_{ij,t} = |\ln(P_{i,t}) - \ln(P_{j,t})|$$

where, $P_{i,t}$ and $P_{j,t}$ are the modal prices reported in markets i and j on the same date t .

The mean spatial price dispersion for each market pair was calculated as:

$$\bar{D}_{ij} = \frac{1}{T_{ij}} \sum_{t=1}^{T_{ij}} D_{ij,t}$$

where T_{ij} represents the number of common reporting dates for the two markets. Only actual common-date observations were used, and missing observations were neither interpolated nor forward-filled. A lower value indicates relatively closer reported price levels, while a higher value indicates greater price separation. The use of absolute log-price differences as a measure of price dispersion is consistent with the approach used in agricultural-market research (Andrabi et al., 2023).

3. RESULTS AND DISCUSSION

3.1 Descriptive characteristics of Moringa prices

Table 3.1 shows substantial differences in moringa modal prices across the selected Uzhavar Sandhais during 2025. The mean modal price ranged from ₹5,617.91 per quintal in Andipatti to ₹8,774.14 per quintal in Dindigul. The median prices ranged from ₹5,500 in Andipatti to ₹8,000 in Dindigul, while the observed maximum prices reached ₹29,750 in Karur and ₹27,500 in both Dindigul and Palani.

Table 3.1 Descriptive statistics

District	Market	N	Mean (₹/qtl)	Median (₹/qtl)	Minimum (₹/qtl)	Maximum (₹/qtl)	SD (₹/qtl)	CV (%)
Dindigul	Dindigul	321	8,774.14	8,000	2,000	27,500	5,087.63	57.98
Dindigul	Palani	348	7,904.74	7,000	1,000	27,500	5,348.07	67.66
Karur	Karur	323	8,196.59	7,000	1,500	29,750	5,599.58	68.32
Karur	Kulithalai	337	7,841.99	7,000	1,500	19,500	4,863.93	62.02

Theni	Theni	323	6,462.23	6,000	1,200	17,500	3,402.67	52.65
Theni	Andipatti	282	5,617.91	5,500	1,400	14,000	2,680.30	47.71

Note. N represents the number of reported daily modal-price observations. SD = Standard deviation; CV = coefficient of variation.

Relative price variation also differed considerably across the markets. Karur recorded the highest coefficient of variation at 68.32 per cent, followed by Palani (67.66%), Kulithalai (62.02%), Dindigul (57.98%), Theni (52.65%) and Andipatti (47.71%). Thus, a market with a higher average price did not necessarily have lower relative variation. Dindigul recorded the highest mean price but still exhibited considerable price variation.

This variation is particularly relevant for fresh moringa because of its perishability. Rajendran (2017) reported substantial fluctuations in moringa prices in Tamil Nadu and noted that fresh produce has to be marketed within a short period after harvest, limiting the scope for postponing sales when prices are unfavourable. Thus, price conditions differed across the markets even though all of the selected markets provided a direct marketing channel for farmers. The descriptive statistics show differences in price levels and relative variation, but they do not show the direction of the price movement during the year. Hence, the linear trend and price instability were examined.

3.2 Linear Trend and Price Instability Analysis

The results in Table 3.2 show that the direction of moringa modal-price movement differed across the selected Uzhavar Sandhais during 2025. Karur, Theni and Dindigul recorded positive trend coefficients of 22.708, 9.030 and 6.051, respectively, whereas Palani and Kulithalai recorded negative coefficients of -11.208 and -7.461, respectively. Andipatti recorded a positive coefficient of 2.972, but the estimated trend was not statistically significant.

Table 3.2 Linear trend and Cuddy–Della Valle Instability Index

Market	N	Trend coefficient (b)	R ²	P-value	CDVI (%)
Karur	323	22.708	0.1434	<0.001	63.23
Dindigul	321	6.051	0.0122	0.048	57.63
Palani	348	-11.208	0.0444	<0.001	66.14
Kulithalai	337	-7.461	0.0223	0.006	61.33
Theni	323	9.03	0.0614	<0.001	51.01
Andipatti	282	2.972	0.0082	0.13	47.51

Note. b is the estimated time-trend coefficient; R² is the coefficient of determination; CDVI is the Cuddy–Della Valle Instability Index.

The R² values were relatively low, ranging from 0.0082 in Andipatti to 0.1434 in Karur. Thus, the linear trend explained only a limited proportion of the observed variation in modal prices. CDVI ranged from 47.51 per cent in Andipatti to 66.14 per cent in Palani. Palani recorded the highest instability, followed by Karur (63.23%), Kulithalai (61.33%), Dindigul (57.63%), Theni (51.01%) and Andipatti (47.51%).

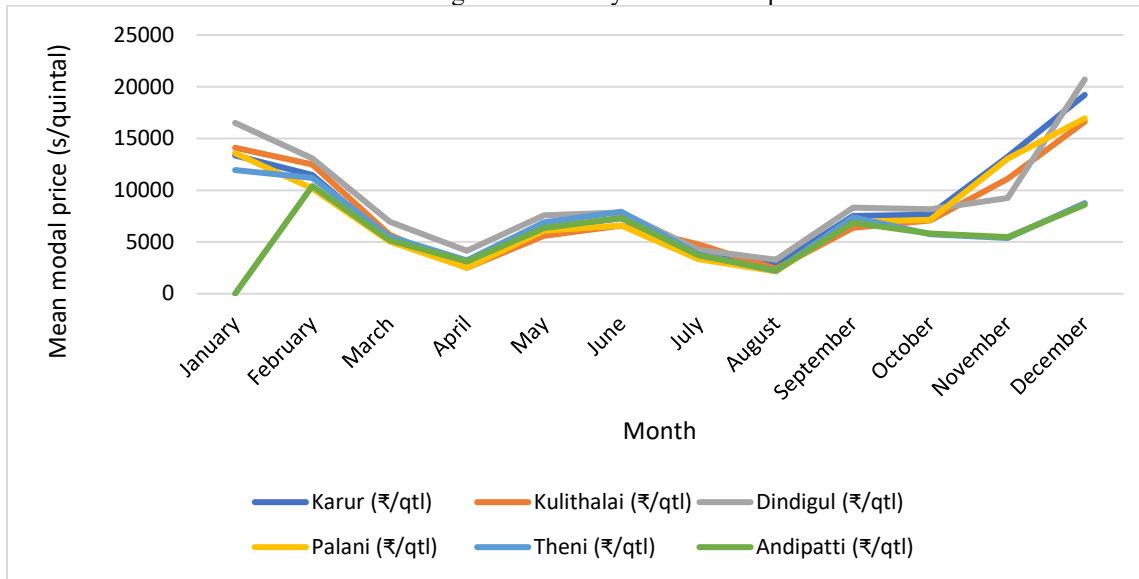
The trend direction was not necessarily related to the level of price instability. Palani recorded a statistically significant negative trend along with the highest CDVI, whereas Andipatti recorded a statistically insignificant positive trend and the lowest CDVI. This indicates that the trend and the degree of instability were not necessarily associated.

The considerable instability observed across the markets is consistent with earlier evidence on moringa price fluctuation in Tamil Nadu. Rajendran (2017) documented considerable price fluctuation and linked the marketing difficulty partly to the perishable nature of moringa. While the trend results identify the direction and instability of the daily price series, they do not show how the price level changed over the individual months of 2025. The monthly pattern was therefore examined separately.

3.3 Monthly Price Pattern

The monthly mean modal prices shown in Figure 1 indicate considerable variation in moringa prices during 2025. Prices were relatively high during January and February and declined sharply during March and April. Prices improved during May and June, followed by another decline during July and August. From September onwards, prices increased in most of the markets and reached the highest level during December.

Figure 1. Monthly mean modal prices



Note. January price for Andipatti was not plotted because no modal-price observation was reported; missing values were not treated as zero.

During January, the monthly mean price ranged from ₹11,944.44 per quintal in Theni to ₹16,517.24 in Dindigul. All selected markets recorded the lowest prices in August. The monthly mean price during August was ₹2,740.74 in Karur, ₹2,407.41 in Kulithalai, ₹3,285.19 in Dindigul, ₹2,155.56 in Palani, ₹2,200.00 in Theni and ₹2,248.15 in Andipatti.

Prices recovered in September and October, followed by a further increase in November and December in most markets. December recorded the highest monthly mean price in all the selected markets. Dindigul recorded the highest value of ₹20,705.88 per quintal, followed by Karur (₹19,216.67), Palani (₹16,935.48), Kulithalai (₹16,633.33), Theni (₹8,739.13) and Andipatti (₹8,583.33).

The markets followed a similar pattern, although the price level differed between districts. Dindigul generally recorded higher monthly prices, while Theni and Andipatti recorded comparatively lower prices. Since the analysis covers only the year 2025, this pattern should be considered as month-to-month variation during the study period and cannot be interpreted as long-run seasonality.

3.4 Daily Reported Min–Max Price Spreads

Table 3.3 shows considerable differences in price spread across selected Uzhavar Sandhais. The mean absolute spread ranged from ₹704.64 per quintal in Karur to ₹2,721.25 per quintal in Theni. The mean relative spread ranged from 11.69 per cent in Karur to 43.57 per cent in Theni relative to the daily modal price.

Table 3.3 Daily Min-Max spread

District	Market	N	Mean Spread (₹/qtl)	Median (₹/qtl)	Minimum (₹/qtl)	Maximum (₹/qtl)	SD (₹/qtl)	Mean Relative Spread (%)	SD Relative Spread (%)
Dindigul	Dindigul	321	1,527.41	1,000	0	10,000	1,341.99	17.72	8.49
Dindigul	Palani	348	2,092.82	1,500	0	15,000	2,354.24	23.6	12.31
Karur	Karur	323	704.64	500	300	2,000	401.56	11.69	6.51
Karur	Kulithalai	337	1,126.71	1,000	0	5,000	864.89	15.29	5.92
Theni	Theni	320	2,721.25	2,500	0	8,000	1,712.32	43.57	18.65
Theni	Andipatti	282	907.45	1,000	0	3,000	492.85	17.6	7.05

Note. N for Theni is 320 because the minimum price was missing on three modal-price reporting dates.

Theni recorded the widest reported daily price range in both absolute and relative terms. Palani followed with a mean relative spread of 23.60 per cent, while Dindigul, Andipatti and Kulithalai recorded 17.72, 17.60 and 15.29 per cent, respectively. Karur recorded the narrowest mean relative spread at 11.69 per cent.

These results indicate that the price level reported for a market day has a considerable range between the minimum and maximum price level. Such differences within the direct farmer-consumer market show that reported prices can differ within the same day. Gayathri et al. (2021) reported grading-related price fixation issues and constraints related to transportation and buyer availability in Uzhavar Sandhai.

However, the present data do not identify the factors generating the observed Min–Max differences. The daily spread demonstrates variation within individual markets, but the modal price itself may also differ across market locations. The spatial dimension of price behaviour was therefore examined using common-date observations.

3.5 Spatial Price Dispersion Across Selected Markets

The pairwise results in Tables 3.4.1 and 3.4.2 show that the price differences varied across the fifteen market pairs. The average absolute log-price dispersion among the three within-district pairs was 0.1614, compared with 0.2428 among the twelve between-district pairs. Thus, the average price difference was lower for markets within the same district than for markets in different districts.

Table 3.4.1 Within-district market pairs

Market pair	N	Mean absolute log-price dispersion
Theni – Andipatti	281	0.0707
Karur – Kulithalai	315	0.1223
Dindigul – Palani	321	0.2912
Average of Within-district pairs=0.1614		

Table 3.4.2 Between-district market pairs

Market	Dindigul	Palani	Karur	Kulithalai	Theni	Andipatti
Dindigul	-	-	0.189	0.235	0.307	0.295
Palani	0.291	-	0.152	0.184	0.265	0.217
Karur	0.189	0.152	-	-	0.276	0.232
Kulithalai	0.235	0.184	0.122	-	0.307	0.254
Theni	0.307	0.265	0.276	0.307	-	-
Andipatti	0.295	0.217	0.232	0.254	0.071	-
Average of between-district pairs=0.2428						

Note. The reported averages are simple arithmetic means of the pair-level mean dispersions.

However, the pattern was not uniform. Theni–Andipatti recorded the lowest pairwise dispersion at 0.0707, followed by Karur–Kulithalai at 0.1223. In contrast, Kulithalai–Theni recorded the highest dispersion at 0.3074, while Dindigul–Theni (0.3067) and Dindigul–Andipatti (0.2952) also recorded relatively high price separation. Dindigul–Palani, despite being a within-district pair, recorded relatively high dispersion of 0.2912.

Venkatesan et al. (2018) identified Aundipatti in Theni, Aravakkurichi in Karur and Oddanchatram in Dindigul among important moringa trading centres in Tamil Nadu and documented multiple fresh-moringa marketing channels. However, the present price data cannot establish whether differences in transport, market arrivals, information flow, quality or trader behaviour generated the observed spatial price differences. The spatial results therefore show differences in reported price separation across markets. Because the analysis uses simultaneous price differences rather than dynamic price-transmission tests, the results should not be interpreted as evidence of market integration, price causality, or law-of-one-price behaviour.

4. CONCLUSION

The study shows that moringa prices varied considerably across the selected Uzhavar Sandhais during 2025. The mean modal price ranged from ₹5,617.91 per quintal in Andipatti to ₹8,774.14 in Dindigul. The trend analysis showed positive price movement in Karur, Dindigul and Theni and negative movement in Palani and Kulithalai, while CDVI indicated considerable instability across the markets.

Prices also varied considerably across months, with lower prices during July and August and a sharp increase towards November and December. The daily Min–Max analysis showed wider reported price ranges in some markets, particularly Theni. Spatial price differences were generally lower among markets within the same district than between districts, although exceptions were observed.

The results show that price conditions were not similar across the selected markets even though all of them provided direct marketing facilities. This variation is important for moringa farmers because the crop is perishable in nature, and farmers have limited scope to delay sales when prices are low. Uzhavar Sandhai provides an important direct marketing channel by bringing farmers and consumers together and reducing the role of intermediaries.

However, the price variation observed in the present study indicates potential areas for policy and market-support interventions, including timely price information, improved coordination and suitable post-harvest facilities. Given the perishability of fresh moringa, alternative marketing and value-addition opportunities may also be considered alongside improving direct marketing channels.

5. LIMITATIONS

The study is limited to six selected Uzhavar Sandhais for the observation year 2025. Hence, the findings reflect price behaviour during the study period and cannot be generalised to all Uzhavar Sandhais or used to establish long-run price trends. The analysis is based on reported AGMARKNET price observations, and the number of observations varied across markets. Further, the study examines price behaviour using secondary data and therefore does not establish the factors responsible for the observed price differences. Further research incorporating market arrivals, traded quantity, transportation, quality, and other market-level factors may help explain the observed price variation.

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