

ANALYSIS OF SEASONAL FLUCTUATIONS IN CUCUMBER PRICES: THE CASE OF TÜRKİYE

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Abstract

In this study, the development of cucumber production in the world and Türkiye and the changes and seasonal fluctuations in cucumber prices in Türkiye were analyzed. The price data used in this study cover the period 2010-2023 and were obtained from the Antalya Fruit and Vegetable Wholesale Market. Production data covers the period 2000-2022 and was obtained from the Food and Agriculture Organization (FAO). Türkiye ranks 2nd in the world in terms of cucumber production and therefore has significant cucumber production potential. Cucumbers, which are produced both in greenhouses and open fields, are supplied almost every month of the year. In 2023, 57.42% of the total cucumber production in Türkiye came from greenhouses and 42.58% from open fields. In this study, seasonal index values of cucumber prices were calculated and compared in three ways: simple average, moving average, and trend analysis. According to all three methods, cucumber prices increased in December, January, February, and March and decreased in May, June, and July. The reason for this is that field cucumbers are harvested in the summer, which increases their supply and decreases their prices. We also found seasonal fluctuations in cucumber prices throughout the year. This can be explained as follows; since cucumber is a perishable product, its storage period is short, and they should be consumed immediately after harvest. Therefore, the demand for cucumber is high during the harvest season, whereas the demand for cucumber continues throughout the year. In this case, supply is delayed to match demand and causes price fluctuations.

Key words: vegetables, cucumber prices, price analysis, seasonal fluctuations, Türkiye

INTRODUCTION

Cucumber is one of the most important vegetables that are grown both in greenhouses and open fields. The total greenhouse vegetable production in Türkiye is approximately 8 million tons, of which 13.5% is cucumber. Cucumber ranks 2nd after tomato in greenhouse vegetable production. Vegetable production in the field is 23.81 million tons, of which 3.4% is cucumber. In field production, cucumber ranks 5th among vegetables. In total 1,871,712 tons of cucumbers were produced, 1,074,796 tons were grown in greenhouses and 796,916 tons in the field. Of the total cucumber production, 57.42% is greenhouse production and 42.58% is field production [9].

Türkiye ranks 2nd in the world in cucumber production [6] and 6th in cucumber exports [7]. Approximately 7% of the vegetables produced in Türkiye are exported [7]. In this

regard, producers, consumers, and exporters are affected by seasonal fluctuations in the prices of cucumber, which is one of the most important vegetables for the Turkish agricultural economy.

The reason for seasonal fluctuations in fresh fruits and vegetables is that they are produced in certain seasons of the year, are perishable products, and have short storage times. Fresh fruit and vegetables prices are generally high at the beginning of the harvest period and fall rapidly toward the middle of the harvest period as production increases.

The main factors affecting the prices of agricultural products are farmers' production decisions, market conditions, specific characteristics of agriculture (numerous risks and uncertainties, climatic conditions, diseases and pests, regional differences), and fluctuations in product supply [8].

In this study, seasonal fluctuations in cucumber prices—an important product for producers and consumers—were analyzed. As

a result, the reasons for fluctuations in prices were revealed, and a suggestion was developed.

MATERIALS AND METHODS

The primary material of this study was obtained from FAO and statistical data from the Antalya Fruit and Vegetable Wholesale Market. The development of cucumber production in the world, Türkiye and major cucumber-producing countries between 2000 and 2022 was evaluated. These data were analyzed using simple and chained index ratios. Cucumber prices were converted to real prices using the Producer Price Index (PPI) calculated by the Turkish Statistical Institute (TURKSTAT) [10]. Annual and monthly changes in cucumber prices and their causes were analyzed.

Simple ratio, moving ratio, and trend ratio methods were used for seasonal price fluctuations [5].

RESULTS AND DISCUSSIONS

The development of cucumber production in the world

Development of cucumber production

The world cucumber cultivation area changed from 1.9 million hectares in 2000 to 2.1 million hectares in 2022.

The cucumber cultivation area, which was 1 million 978 thousand hectares in the average of 2000-2004, increased by 9.94% in 2022 and reached 2 million 174 thousand hectares. When the change in production areas compared with the previous period is analyzed, the highest increase was realized in the average of 2010-2014 with 8.55%.

As of the same date, global cucumber production has varied between 41 million tons and 95 million tons.

Cucumber production, which was 41 million 319 thousand tons compared to the average of 2000-2004, increased by 129.24% and reached 94 million 718 thousand tons in 2022. When the change in production compared with the previous period is analyzed, the highest increase was realized in the average of 2010-2014 with 30.45%.

Although there is not much change in the world's cucumber production areas, the amount of production is increasing every year. Although the world cucumber yield was 20 930 kg per hectare in 2000-2004, it increased by 108.13% to 43 562 kg per hectare in 2022 (Table 1).

Table 1. The development of cucumber production in the world

Years	1,000 Hectare	A Index*	B Index**	1,000 Tons	A Index*	B Index**	kg/ha	A Index*	B Index**
2000-2004	1,978	100.00	-	41,319	100.00	-	20,930	100.00	-
2005-2009	1,930	97.61	97.61	53,775	130.15	130.15	27,835	132.99	132.99
2010-2014	2,096	105.95	108.55	70,150	169.78	130.45	33,446	159.80	120.16
2015-2019	2,153	108.85	102.73	82,932	200.71	118.22	38,534	184.11	115.21
2020	2,153	108.88	100.03	90,745	219.62	109.42	42,140	201.34	109.36
2021	2,161	109.27	100.37	92,613	224.14	102.06	42,851	204.74	101.69
2022	2,174	109.94	100.60	94,718	229.24	102.27	43,562	208.13	101.66

*(Average of 2000-2004=100), **(Previous year=100)

Source: [2].

In terms of world cucumber production, China ranks first with a share of 81.57%.

China is followed by Türkiye with a share of 2.05% and Russia with a share of 1.73%. It was determined that China's share of global cucumber production increased, and Türkiye's share decreased in the years analyzed (Table 2).

The cucumber cultivation area in Türkiye decreased by 22.42% from 45 476 hectares in 2000-2004 to 35 278 hectares in 2023.

It tended to decrease as of the years analyzed. In 2022, it increased by 36.26% compared with the previous year, and in 2020, it decreased by 29.28% compared with the previous period.

Cucumber production varied between 1.72 million tons and 1.93 million tons in the years under review.

Table 2. Development of cucumber production in the world's leading producers

Years	China	Türkiye	Russian Fed.	Mexico	Uzbekistan	Other countries	World
	1,000 Tons						
2000-2004	26,000	1,749	972	470	166	11,962	41,319
2005-2009	37,480	1,727	1,060	552	262	12,694	53,775
2010-2014	51,585	1,753	1,588	653	542	14,029	70,150
2015-2019	65,262	1,854	1,628	985	861	12,342	82,932
2020	72,928	1,886	1,687	1,160	813	12,271	90,745
2021	74,815	1,890	1,603	1,039	890	12,376	92,613
2022	77,258	1,939	1,636	1,078	904	11,903	94,718
	%						
2000-2004	62.93	4.23	2.35	1.14	0.40	28.95	100.00
2005-2009	69.70	3.21	1.97	1.03	0.49	23.61	100.00
2010-2014	73.54	2.50	2.26	0.93	0.77	20.00	100.00
2015-2019	78.69	2.24	1.96	1.19	1.04	14.88	100.00
2020	80.37	2.08	1.86	1.28	0.90	13.52	100.00
2021	80.78	2.04	1.73	1.12	0.96	13.36	100.00
2022	81.57	2.05	1.73	1.14	0.95	12.57	100.00

Source: [2].

Cucumber production increased by 7.04% from 1 million 750 thousand tons in 2000-2004 to 1 million 872 thousand tons in 2023. In the same period, cucumber yield per hectare increased by 38.01% from 38,444 kg to 53,056 kg (Table 3).

It is possible to say that there is a decreasing trend in the cucumber cultivation area, an

increasing trend in production, and a fluctuating trend in yield in Türkiye. Therefore, increases in yield were effective for increasing production.

In a study, it was determined that Türkiye's comparative advantage in cucumber trade was moderate to high until 2015, but Turkey lost its comparative advantage after this date [1].

Table 3. Development of cucumber production in the Türkiye

Years	Hectare	A Index*	B Index**	Tons	A Index*	B Index**	kg/ha	A Index*	B Index**
2000-2004	45,476	100.00	-	1,748,624	100.00	-	38,444	100.00	-
2005-2009	42,347	93.12	93.12	1,726,572	98.74	98.74	40,859	106.28	106.28
2010-2014	38,593	84.87	91.14	1,753,066	100.25	101.53	45,434	118.18	111.20
2015-2019	36,830	80.99	95.43	1,853,930	106.02	105.75	50,415	131.14	110.96
2020	26,048	57.28	70.72	1,886,239	107.87	101.74	72,414	188.36	143.63
2021	25,930	57.02	99.55	1,890,160	108.09	100.21	72,895	189.61	100.66
2022	35,333	77.70	136.26	1,938,545	110.86	102.56	54,865	142.71	75.27
2023	35,278	77.58	99.84	1,871,712	107.04	96.55	53,056	138.01	96.70

*(Average of 2000-2004=100), **(Previous year=100)

Source: [9].

Cucumber production in Türkiye takes place in two ways: in greenhouses and open fields. Between 2000 and 2023, the share of production in greenhouses changed between 52.71% and 61.90%.

The percentage of production in the open field changed between 38.10% and 47.29% (Fig. 1).

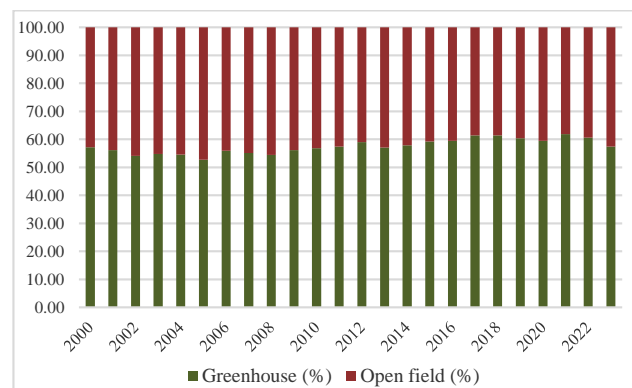


Fig. 1. Shares of cucumber produced in greenhouse and open field in Türkiye

Price analysis

When the monthly real prices of cucumber in Türkiye between 2010 and 2023 were analyzed; it was determined that the highest average prices were in February (841.91 TRY/ton), January (693.89 TRY/ton), and March (553.77 TRY/ton). The lowest average prices were recorded in June (156.86 TRY/ton), May (177.35 TRY/ton), and July (268.95 TRY/ton).

In January, February, and March, the standard deviation values were high, and the fluctuations in cucumber prices were higher in these months than in the other months.

In June and May, the standard deviation values were low and cucumber prices were stable compared with those in other months. The months with high coefficients of variation were October and May.

Real cucumber prices in these months were more variable than average cucumber prices. In February, when the coefficient of variation was low, cucumber prices were less variable than average cucumber prices.

The months with the highest seasonal index values were February, January, March, and December. Cucumber prices during these months were above year averages. The months with the lowest values were June, May, and July. In these months, cucumber prices were well below the yearly average (Table 4).

Seasonal fluctuations in cucumber prices in Türkiye were observed throughout the year. It was determined that cucumber prices increase in the last month of the year and the first month of the year and decrease in the summer months.

The reason for this is that prices for field cucumbers fall in the summer months when they enter the market.

In this case, February had a coefficient of variation below 20% and a seasonal index value above 100.

If farmers can put their products on the market this month, they will be able to sell at higher prices and earn more profit. Therefore, it would be beneficial for them to consider this point in their production strategies.

Table 4. Seasonal fluctuations in cucumber real prices

Months	Arithmetic Mean (TRY, ton)	Standard deviation	Coefficient of variation	Seasonal index
January	693.89	166.64	24.02	171
February	841.91	166.40	19.76	207
March	553.77	134.23	24.24	136
April	322.29	80.45	24.96	79
May	177.35	67.99	38.34	44
June	156.86	40.06	25.54	39
July	268.95	80.64	29.98	66
August	352.56	106.85	30.31	87
September	332.88	108.97	32.74	82
October	290.73	125.75	43.25	72
November	348.31	96.62	27.74	86
December	535.75	151.24	28.23	132

Source: Own calculation.

Real cucumber prices per ton in Türkiye varied between 107.33 TRY and 1 140.39 TRY between 2010 and 2014. The average price during this period was 448.34 TRY. In the period 2015-2019, cucumber prices varied between 107.27 TRY and 1 057.16 TRY. In the period 2020-2023, cucumber prices varied between 83.24 TRY and 968.02 TRY. In all years analyzed, real cucumber prices per ton varied between 83.24 TRY and 1 140.39 TRY. Cucumber price volatility was calculated as 51.63%, 54.81%, and 53.79% for these periods and 53.10% for the average of 2010-2023 (Table 5).

Volatility in cucumber prices was very high in all analyzed periods. The reason for this is that cucumber is a perishable product, its storage period is short, and it should be consumed immediately after harvest. Cucumber harvest is performed in certain months, and the product is abundant in these months. Consumer demand for cucumbers continues throughout the year. In this case, cucumber prices fluctuate in months when there is no cucumber harvest.

Table 5. Volatility of annual cucumber price

Years	Average (TRY, ton)	Minimum (TRY, ton)	Maximum (TRY, ton)	Volatile (%)
2010-2014	448.34	107.33	1,140.39	51.63
2015-2019	378.77	107.27	1,057.16	54.81
2020-2023	388.06	83.24	968.02	53.79
2010-2023	406.27	83.24	1,140.39	53.10

Source: Own calculation.

Based on average cucumber prices in Türkiye in 2010, the change in cucumber prices in

other years was analyzed. Cucumber prices per ton decreased by 1.58% from 430.1 TRY in 2010 to 423.3 TRY in 2023. The highest increase relative to the base year was in 2013. The average cucumber price increased by 12.86% to 485.4 TRY. The largest decrease occurred in 2018 when average cucumber prices fell by 19.88% to 377.4 TRY (Table 6). In a study examining the developments in cucumber prices in Türkiye using data from 1999-2013, it was determined that the real price index of cucumber increased by 27% in 2013 compared with 1999 [11].

Table 6. Changes in the annual real price of cucumbers

Years	Average (TRY, ton)	Index (2010=100)
2010	430.1	100.00
2011	442.4	102.86
2012	470.6	109.42
2013	485.4	112.86
2014	413.2	96.07
2015	368.3	85.63
2016	362.7	84.33
2017	377.4	87.75
2018	344.6	80.12
2019	440.8	102.49
2020	388.3	90.28
2021	365.4	84.96
2022	375.2	87.24
2023	423.3	98.42

Source: Own calculation.

Seasonal index values for cucumber prices in Türkiye were calculated and compared in three ways: simple average, moving average, and trend analysis. According to all three methods, cucumber prices increased in December, January, February, and March and decreased in May, June, and July. Starting from August, prices started to increase (Table 7). December and March were found to be the most profitable production periods for farmers.

In a study analyzing seasonal fluctuations in cucumber prices in Türkiye using data from 1997 to 2006, it was found that the highest price index occurred in February and the lowest price index occurred in June [4].

In a study analyzing seasonal fluctuations in cucumber prices in Nepal using data from 2013-2022, it was determined that the highest price index occurred from October to March and the lowest price index occurred from April to September [3].

Table 7. Seasonal fluctuations in cucumber real prices using simple average, moving average, and trend ratio methods

Months	Seasonal index with a simple average	Seasonal index with a moving average	Seasonal index with rate on trend
January	171	171	170
February	207	171	206
March	136	141	136
April	79	86	79
May	44	54	43
June	39	49	39
July	66	64	67
August	87	78	87
September	82	80	82
October	72	80	72
November	86	96	86
December	132	129	133

Source: Own calculation.

From January 2010 to December 2023, when monthly cucumber prices were analyzed, the lowest month was May 2022 (83.24 TRY/ton), and the highest month was January 2012 (1,140.39 TRY/ton). It was determined that cucumber prices followed a very fluctuating course throughout the period analyzed. In general, prices peaked in January and February and declined in May and June (Fig. 2).

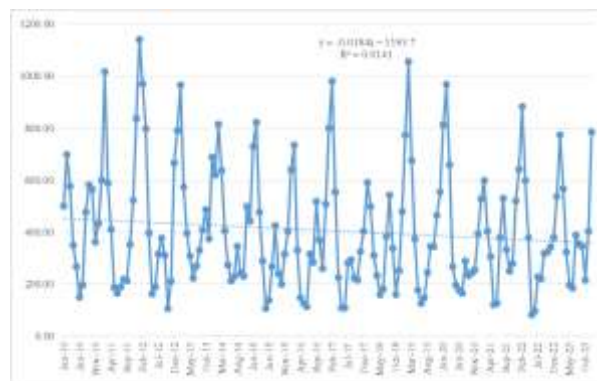


Fig 2. Cucumber real prices

Source: Own calculation.

From January 2010 to December 2023, monthly cucumber price volatility was calculated as 51.63% in the period 2010-2014, 54.81% in the period 2015-2019, 53.79% in the period 2020-2023 and 53.10% as the average of the period 2010-2023. It was determined that monthly fluctuations and volatility in cucumber prices were high during the analyzed period (Fig. 3).

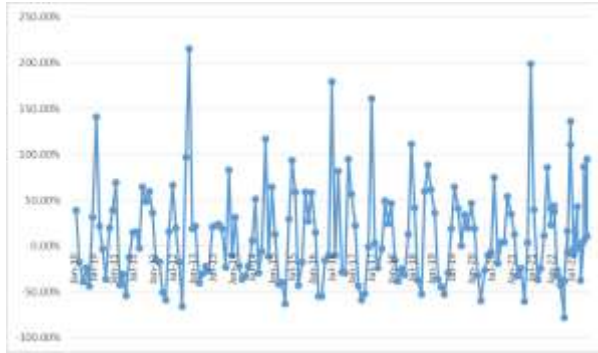


Fig 3. Volatility of cucumber real prices
Source: Own calculation.

CONCLUSIONS

Although cucumber production areas have decreased in Türkiye between the periods examined (2000-2023), production amounts have increased. This shows that cucumber yield has improved. In fact, yield increased by 38.01% due to improvements in agricultural practices during this period. During the period under review (2010-2023), cucumber prices increased in December, January, February, and March and decreased in May, June, and July. Starting in August, prices began to rise again. The seasonal index has its lowest value in June and highest value in February. It was also determined that cucumber prices were highly volatile during all analyzed periods. In general, since cucumber is a perishable and freshly consumed vegetable, its prices decrease during harvest periods. Based on the findings of this study, if farmers can shift their production planning for cucumber production between December and March, their profitability indicators may improve and their incomes may increase.

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