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TOMATO MARKET DYNAMICS IN ROMANIA: INSIGHTS FROM 2018 TO 2023

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Abstract

Tomatoes (Solanum Lycopersicum L.) belong to the Solanaceae family and are widely cultivated worldwide due to economic and nutritional importance. The aim of the paper was to assess the trend on the tomato market in Romania during 2018-2023. Thus, some specific indicators were analyzed such as: cultivated area, average production, total production, average selling price, average annual consumption per inhabitant, average monthly consumption of tomatoes per person, quantities of tomatoes bought by a household. It studied the evolution of foreign trade as well. The results have shown that during the period studied, the average production per hectare, decreased by 23% and the area cultivated with tomatoes having also the same trend, decreased by approximately 16%. Also, during this period, an increasing consumption trend was observed, but the highest growth rate was registered for the price, from 3.09 lei/kg in 2018 to 4.86 lei/kg in 2022.

Key words**:** *consumption, price, import, export, tomatoes*

INTRODUCTION

Tomatoes (*Solanum Lycopersicum*) are one of the most important vegetables worldwide and they are native to South America. They were brought to Europe by Spanish Explorers in the mid-1500s, and today are the second most consumed and cultivated species after potatoes [15].

Tomatoes can be cultivated in different geographic areas, in open fields or greenhouses, and the fruits can be harvested manually or mechanical [14]. They can be consumed fresh or processed in various forms [18] such as salads, sauces, concentrated pasta, juices, etc., offering numerous benefits for human health.

Tomatoes are a good source of phytochemicals and nutrients, such as lycopene, potassium, iron, folate and vitamin C [4]. Tomato consumption regulates the digestive and the cardiovascular function, having an impact on the transport speed of the product due to its perishable nature [7]. From a biochemical point of view, tomatoes are mainly composed of water (80%), sugar and proteins, to which are added vitamins (A, B, C, E, K), minerals (bromine, calcium, cobalt, copper, iron, phosphorus, iodine, sodium, potassium, magnesium, sulfur, zinc, nickel), malic, citric, and pectic acids [16]. The potential benefits of tomatoes for health include the anti-cancer properties of lycopene in relation to its anti-angiogenic properties, reducing insulin-like growth factor (IGF) in the blood, and can help reduce high blood pressure, the risk of cardiovascular disease, and the risk of atherosclerosis [5].

The main tomato producing countries worldwide are China, India, Turkey, the United States of America and Egypt. Currently, China is the largest tomato-producing country in the world, with an area of 1,137,416 ha, and production reached 68,241,811 tons in 2022 [8].

In Europe, the first tomato-producing countries are: the Russian Federation, Italy, Ukraine and Spain, and Romania is in fifth place.

Tomatoes in Romania can be cultivated both in protected areas and in open field, aiming to ensure a continuous flow of production

throughout the year. In present, the species is widely studied by researchers around the world to improve the culture technology [9] and the production. The management of the crop influences the yield, acceptability and price depending on the cultivar [20].

Regarding production, on average, the indoor high-tech greenhouse systems have higher production compared to the open-field system [12]. To increase productivity, it is recommended to increase the genetic diversity in breeding this species to obtain germplasm with a wider range of tolerance to different stress factors and marketable traits. Increasing economic efficiency can also be made by improving the technology or applying methods that increase the precocity, the commercial quality of the fruits, the realization of the earliest possible harvests which can be valued at high prices. Therefore, the authorities from Romania must take into consideration the existing potential for tomato cultivation and the components of a better management of the total demand [13].

In Romania, despite the agro-ecological conditions favorable the production of most vegetable species, current production is insufficient and usually the price is uncompetitive compared to imported vegetables. On the other hand, vegetable export of national fresh and processed vegetables is low in terms of value and quantity.

In this context, the aim of the research was to study the Romanian tomato market to identify the main trends that can be the base of future decisions regarding measures to increase production and marketing sector.

MATERIALS AND METHODS

The paper presents the main trend on tomato market in Romania during 2018-2023. The data were retrieved from specialized websites such as National Institute of Statistics and the International Trade Center. For this study, research was conducted on the topic by analyzing the data statistically.

In the study, it was done an analysis aimed at determining the degree of concentration of imports and exports, and for this the Gini coefficient was determined, using the following formula [17]:

$$GS = \sqrt{\frac{n\sum_{i=1}^{n} g_i^2 - 1}{n-1}} \quad \text{.....(1)}$$

where:

Gi – the share of product "i" in total sales;

n – represents the number of cases.

The degree of inequality in a frequency distribution is measured by the Gini coefficient.

A value close to 1 of the Gini-Struck coefficient suggests a high degree of concentration, while a value close to 0, it indicates a weak degree of concentration of the analyzed market.

For the detailed analysis of data on imports, processing methods were used that included: descriptive statistics on the mean, standard deviation, and coefficient of variation.

The mean represents the total sum of values of a series divided by the number of values in that sample [19].

Standard deviation and variance are measures of variability. The average of squared deviations from the mean is known as the variance, in other words the variance reflects the degree of dispersion in the data set, while the standard deviation represents the average level of variability in the dataset (is the square root of the variance) [2, 3].

In order to identify if there is a link between the import and consumption of tomatoes in Romania, a linear regression model was determined. The linear regression determines the influence of an independent variable on the interaction with a dependent variable [1, 11] and determines the line the best fits the data, by looking at the regression coefficient that minimizes the total error [2]. For a better understanding of the results, in the study it was included a graph (plot) that simply represents the observations on the x and y axes, including the regression line.

RESULTS AND DISCUSSIONS

In Romania, one of the key factors that influences the production obtained, is represented by the area cultivated with

tomatoes. At national level, the area cultivated with tomatoes in 2018 was over 40,741 hectares, decreasing in 2023 to 33,862 hectares, a drop of over 16% (Table 1). The average area for the period was 36,323 hectares cultivated.

Regarding the average tomato production/ha, the analysis showed that from 2018 to 2023, tomato production registered a decreasing trend, with values between 14,003 kg/ha in 2023 and 21,858 kg/ha in 2021, with an average of 17,967 kg/ha. The percentage difference in the period analyzed was -23%.

Total production had the same trend, the values ranging between 474,182 tons in 2023 and 753,377 tons in 2021, the average of the period being 652,499 tons. The percentage difference in 2023 compared to 2018 was -36%. It can be observed that production has decreased drastically, while the consumption of tomatoes has increased, because we are in a consumer society, so the production has gone against the natural trend. Improving tomato yield was due to applying modern technologies, by using competitive biological material (varieties and hybrids), high-performance agricultural machines and equipment, but also the effective use of plant protection methods.

According to FAO [8], productivity in the last 40 years has registered major changes, from 1,873,000 t/ha in 1982 it reached 298,920 t/ha in 2022.

Table 1. Evolution of main technical indicators for tomato crops in Romania

Indicator	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2023/ 2018 (%)**	**Average**
Area (ha)	40,741	40,845	34,115	34,747	33,631	33,862	83.12	36,323.5
Average production (kg/ha)	18,235	16,879	21,858	21,681	15,148	14,003	76.79	17,967.33
Total production (t)	742,899	689,401	745,682	753,377	509,455	474,182	63.83	652,499.33

Source: [21].

Table 2 contains indicators regarding the consumption and the quantity of tomatoes purchased. The average price of tomatoes in the analyzed period had a strictly upward trend, increasing from 3.09 lei/kg in 2018 and reaching 4.86 kg in 2022, equal to an increase of 57%. The selling price of tomatoes can be influenced by demand and supply, and by the period of early and extra-early sales, which ensure the recovery of expenses from peak season periods, which are less economically favorable. Also, during the harvest season for producers it is recommended to forecast the recovery price [7]. Regarding average annual consumption in the period 2018-2022, it decreased by 11.86% from 41.3 kg to 36.4 kg. The volatility of capitalization price affects the consumption trend of tomatoes.

In addition, the trend of average monthly consumption per person, it can be observed that during the analyzed period it was stable, with fluctuation between 1.124 kg/month in 2018 and 1.191 kg/month in 2021. In 2022, it was registered a slight decrease reaching 1.138 kg/month. The drop can be due to the high price in that period.

Table 2. Evolution of main indicators for tomato market in Romania

Indicator	**2018**	**2019**	**2020**	**2021**	**2022**	**2022/2018 (%)**
Average price (lei/kg)	3.09	3.69	4.16	4.17	4.86	157.28
Average annual consumption per inhabitant (kg)	41.3	41.4	41.8	45.1	36.4	88.14
Average monthly tomato consumption per person (kg)	1.124	1.133	1.148	1.191	1.138	101.25
The quantity of tomatoes bought by a household (kg)	0.861	0.867	0.939	0.980	0.943	109.52

Source: [21].

The average amount of tomatoes bought by a household increased, although the price was higher. Thus, the quantities gradually increased from 0.861 kg in 2018 to 0.943 kg in 2022.

Romania, in order to cover its need for fresh vegetable, is still dependent on imports (mainly from Turkey and Netherlands), although for increasing investments in the sector, at the national level financial aid was granted through direct payments, but also through opportunities to access European funds [6].

The analysis of tomato export has shown that in 2023, Romania exported 3,747 t worth 5,494 thousand USD (Table 3). Concerning the export, the first three countries that imported tomatoes from Romania were Poland, Hungary and Republic of Moldova with 1,580 t, 500 t and respectively 652 t.

Table 3. Total export and the main countries where Romania exported tomatoes, 2023

Indicator / Country	Value exported (thous. USD)	Quantity exported (tons)
Total (world)	5,494	3,747
Poland	2,669	1,580
Hungary	840	500
Republic of Moldova	598	652
Gini coef.	0.48	

Source: [22].

From a value point of view, the ranking is slightly changed, so that tomatoes worth 2,669 thousand USD were exported to Poland, followed by Hungary with 840 thousand USD and the Republic of Moldova with 598 thousand USD. On the other hand, analyzing tomato imports, it is found that in 2023 the total quantity imported was 92,990 t and the first three importing countries were Turkey with 66,838 tons, Germany with 10,806 tons and Netherlands with 3,369 tons (Table 4). Regarding the value, Romania imported tomatoes with a total value of 167,812 thousand USD, the ranking of the three main countries remaining the same as in the case of quantity. The Gini coefficient for import value is 0.48, suggesting a moderate distribution of imports for 2023.

Table 4. The total import and the main countries from which Romania imported tomatoes, 2023

Indicator / Country	Value imported (thous. USD)	Quantity imported (tons)
Total (world)	167,812	92,990
Turkey	99,539	66,838
Germany	30,007	10,806
Netherlands	12,550	3,369
Gini coef.	0.56	

Source: [22].

In 2023, regarding the exporting countries, the value of the Gini coefficient is 0.56, indicating a higher degree of export inequality, due to a greater concentration of exports in some countries.

If we consider the value of imports in total, it varied between 106,801 thousand dollars in 2019 and 135,780 thousand dollars in 2022 and in the analyzed period it increased by 24.67% in 2021 compared to 2018 (Table 5).

Table 6 presents descriptive statistics for the period 2018-2022 for indicators of the value of Romanian tomato imports. Following the analysis of tomato import value in the period 2018-2022, it was recorded an average of 119,753 thousand dollars (Table 6).

Table 5. Tomato imports value in Romania (US Dollar thous.)

Indicator	**2018**	**2019**	**2020**	**2021**	**2022**	**2022/2018 (%)**
Total (world)	108,910	106,801	112,710	134,564	135,780	124.67
Turkey	48,116	40,376	55,498	62,962	69,225	143.87
Germany	13,952	16,152	17,076	22,056	21,445	153.71
Netherlands	12,426	14,185	14,379	18,570	16,954	136.44

Source: [22].

Regarding Turkey, the lowest recorded value was 40,376 thousand dollars in 2019 and the highest values was 69,225 thousand dollars in 2022. The average of the period represented approximately half of the total in the world, 55,235,40 thousand dollars. For Germany, the values ranged from 13,952 thousand dollars in 2018 to 22,056 thousand dollars in 2021, the

average being around 18,136 thousand dollars. In Netherlands, the minimum imports value was 12,426 thousand dollars in 2018, increasing until 2021 to a maximum of 18,570 thousand dollars. Thus, the imports values emphasize that the trend is increasing gradually in the period analyzed, a fact due to the larger quantity imported, but also being influenced by the price.

Table 6. Descriptive statistical indicators regarding the value of tomato imports in Romania, 2018-2022

	N	Min.	Max.	Mean	Std. Deviation	Variance
Total (world)	5	106801	135780	119753,00	14240,429	202789813,000
Turkey	5	40376	69225	55235,40	11477,868	131741459,800
Germany	5	13952	22056	18136,20	3495,769	12220398,200
Netherlands	5	12426	18570	15302,80	2438,233	5944979,700
Valid N (listwise)	5					

Source: Own calculation based on data from [22].

Regarding the total imported quantity in Romania, it is noted that the highest value was recorded in the 2021 of 92,561 tons (Figure 1). The ranking regarding the countries in 2022 was the following: Turkey was the country that imported the largest number of tomatoes to Romania of 52,914 tons (more than half of the total quantity), followed by Germany with 9,223 tons and the Netherlands with 7,858 tons. Turkey runs first in terms of the amount of tomatoes imported in Romania, as the country is a leader in tomato production in Europe, even if the area cultivated decreased gradually until 2022 [10].

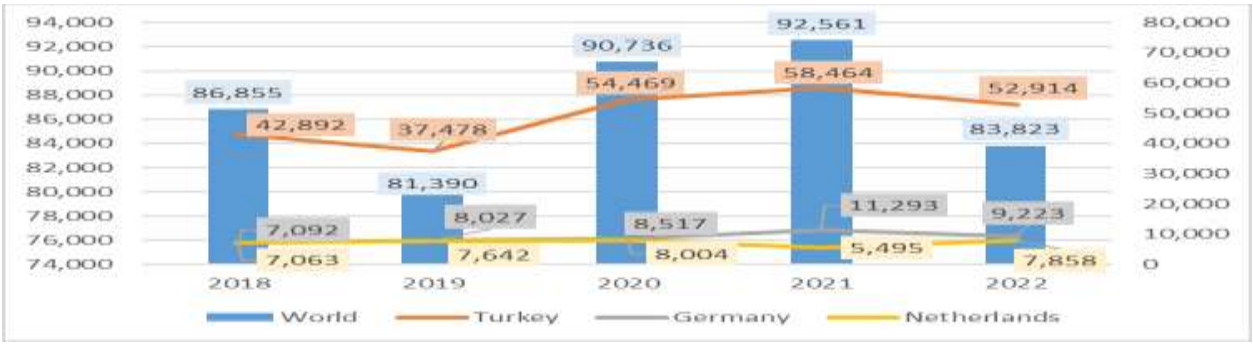

Fig. 1. The quantity of imported tomatoes in Romania
Source: [22].

Regarding the value of tomato exports in the world in 2022, this was 3,129 thousand dollars, Poland being the country with the highest export value of 959 thousand dollars, followed by Hungary with 609 thousand dollars and Spain with 120 thousand dollars (table 7). In the period 2018-2022, there were changes in terms of value, so that in the world the increase was 383.62%, and in terms of countries, the most spectacular increase was recorded in Hungary by 950%.

Table 7. Tomato export value (US Dollar thousand) in Romania

Indicator	**2018**	**2019**	**2020**	**2021**	**2022**	**2022/2018 (%)**
Total (world)	647	1,689	1,596	1,248	3,129	483.62
Poland	213	403	446	563	959	450.23
Hungary	58	34	24	33	609	1,050.00
Spain	90	150	87	81	120	133.33

Source: [22].

Analyzing the exported quantity of tomatoes in 2022, it can be noticed that in world were exported a total of 3,142 tons, of which Moldova exported 901 tons, followed by

Poland with 680 tons and Spain with 90 tons (Figure 2). In the period 2018-2022, the number of exports fluctuated, thus, at world level the increase represented 435%, and regarding the countries, Moldova registered an increase of 439%, followed by Polonia with 277% and Spain with 15%.

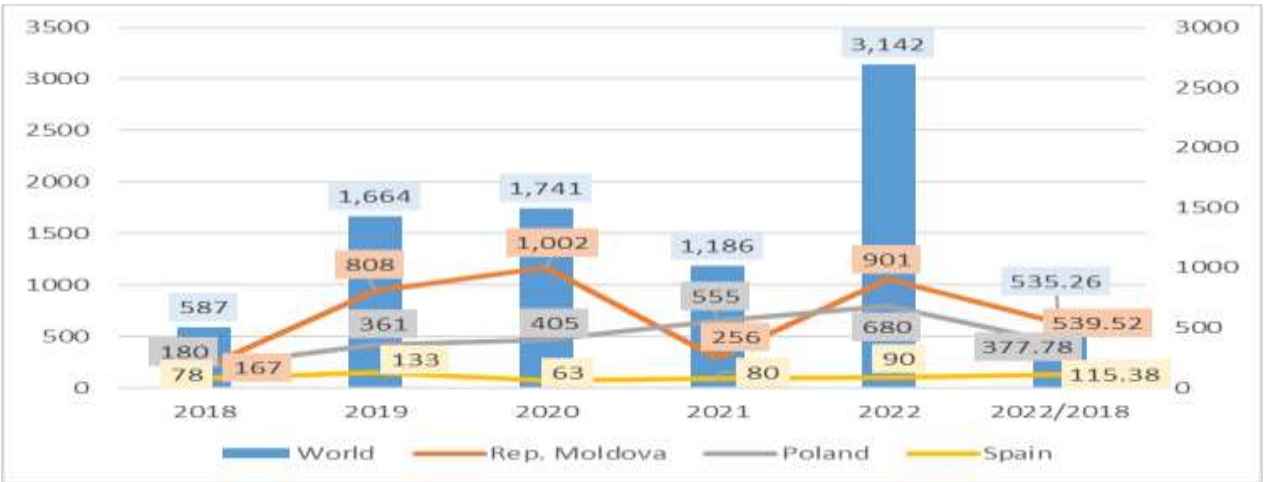

Fig. 2. The quantity of tomatoes exported by Romania
Source: [22].

Analyzing the relationship between the "import" and "consumption" variables, the linear regression between the two variables is presented and resulted in the coefficient of determination of 0.843, so that the dependent variable import is explained in proportion to 84% of the independent variable (Figure 3). It can be said that consumption was based on the import of tomatoes and not necessarily based on the domestic product.

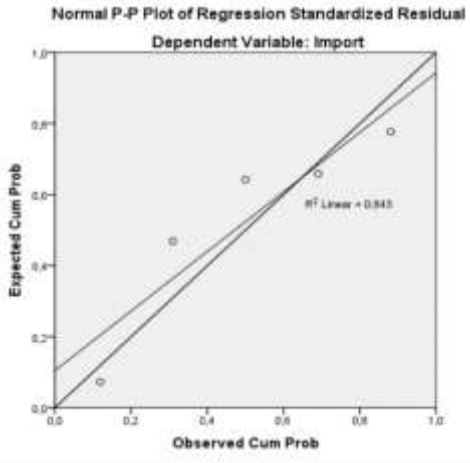

Fig. 3. The relationship between the tomatoes "import" and "consumption"
Source: own processing based on data available on [22].

The evolution of the national trade balance with tomato is presented in Figure 4. Both at the total level and in terms of trade with specific countries, the trade balance is negative (Fig 4). It can be noted that imports are 3 times more meat than exports.

Fig. 4. Romania's trade balance with tomatoes
Source: own processing based on data available on [22].

Thus, Romania is a net importing country regarding the tomato sector, in the period 2018-2023 the total value of the trade deficit gradually increasing from -108,263 thousand dollars to -162,318 thousand dollars. Therefore, the trade balance deficit in the period 2018-2023, increased by 50%.

CONCLUSIONS

Following the research conducted, it was found that the tomato market in Romania is

dynamic, both regarding the demand and supply having an upward trend, nevertheless, only domestic production cannot satisfy the national demand, so that imports have increased significantly in recent years.

The total production of tomatoes registers significant fluctuations influenced directly by the cultivated area, but also by other factors that play a key role in achieving higher productions. The analysis of tomato production per ha showed that from 2018 to 2023, there was a downward trend, the percentage difference in the analyzed period was -23%.

The annual consumption of tomatoes per inhabitant is decreasing, from 41.3 kg to 36.4 kg in the period 2018-2022, being influenced by the increase in the selling price. Also, the average amount of tomatoes bought by a household increased gradually, although the price was higher, from 0.861 kg in 2018 to 0.943 kg in 2022.

As a result, that tomato production has decreased, and Romania is unable to meet its needs of tomatoes during off-season periods, imports have increased.

The analysis of tomato export has shown that in 2023, Romania exported 3,747 t. In terms of exports, Poland, Hungary and the Republic of Moldova Regarding the export, the primary nations receiving tomatoes were Poland, Hungary and the Republic of Moldova. However, examining tomato imports in 2023 reveals that the overall amount imported totaled 92,990 t, with Turkey, Germany and the Netherlands being the first three importing countries.

It can be stated that, in the studied period (2018-2023), the situation between exports and imports is unfavorable, the balance being negative. Consequently, investing in modern agricultural holdings is required to stimulate productivity growth.

Tomato market in Romania can also be influenced by the seasonality of the production at national level. The demand on the market is increasing and producers must satisfy these needs. Since the supply cannot cover the demand, to balance the trade balance, it was resorted to imports, which increased during the analyzed period. However, trying to reach an equilibrium this way does not represent a viable solution for Romania's economy, the balance of external payments may suffer from imbalances, tomato imports both quantitatively and especially in terms of value being quite large.

Identifying the main trends on the tomato market in Romania can represent the basis of future decisions regarding the development strategy of this production and marketing sector.

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