

TOMATO PRODUCTION COST AND PROFITABILITY ANALYSIS: CASE STUDY IN TOKAT CENTRAL DISTRICT, TÜRKİYE

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Abstract

Türkiye is among the leading countries in the world in terms of tomato production amount and cultivation area. Tokat is a province with the production potential of various fruit and vegetable species. This research was conducted to reveal the cost and profitability of tomato production through the example of Tokat province. The basic data set used in this study is based on the results of a survey conducted with 76 tomato producers in seven villages of Tokat Central District. The survey was conducted in November-December 2022. It has been revealed that the producers consist of individuals with an average age of 48.2 years and experienced farmers considering their professional experience. 60.3% of farmers are primary or secondary school graduates. The average tomato production area of producers is 9.8 decares. It was determined that the total production cost for one decare of tomato production area was \$788.5. While 92.9% of the total cost consists of variable costs, 7.1% consists of fixed costs. Among variable costs, the most important costs are product maintenance, tool machine maintenance and seedling expenses. The yield of one decare of tomato production area is 7.2 tons. The net profit from one decare area is 1,204.4 dollars. High costs such as fertilization, spraying, equipment and machinery maintenance, and purchasing seedlings reduce the production profit. Increasing support on these issues will contribute to the sustainability of production.

Key words: tomatoes, production cost, net profit, Tokat, Türkiye

INTRODUCTION

According to the Food and Agriculture Organization (FAO) 2021 data, the total tomato cultivation area in the world is 5,167,388 hectares. 22.2 percent of the cultivated areas are in China, 16.4 percent in India, 16.3 percent in Nigeria, 3.3 percent in Pakistan and 3.2 percent in Türkiye. It is also available. According to the same data, China ranks first and Türkiye ranks fifth in the world with a tomato cultivation area of 165,204 hectares [6]. FAO's 2021 data shows that 189.1 tons of tomatoes were produced in the world. 35.8 percent of tomato production was in China, 11.2 percent in India and 6.9 percent in Türkiye. According to the amount of tomato production, China ranks first, India ranks second, and Türkiye ranks third [6]. Table 1 contains data on the top ten tomato exporting countries in the world. According to data, 8,354 thousand tons of tomatoes were exported to the world in 2022. The countries with the highest tomato exports were Mexico,

the Netherlands and Morocco. According to 2023 data, Türkiye ranks 5th in world tomato exports.

Table 1. World tomato exports (1,000 tons)

Countries	2019	2020	2021	2022	2023
World	8,040	8,306	8,672	8,354	-
1 Mexico	1,618	1,739	1,904	1,956	2,010
2 Netherlands	1,086	1,018	949	909	865
3 Morocco	605	597	630	740	659
4 Spain	767	729	662	610	659
5 Türkiye	535	519	617	520	587
6 Afghanistan	175	283	312	211	325
7 France	236	255	277	32	315
8 Djibouti	-	-	-	-	266
9 Portugal	87	66	107	156	234
10 Canada	177	174	198	191	212

Source: Trade-MAP, Accessed on 09.08.2024 [12].

Table 2 includes data on the top ten countries importing tomatoes in the world. The countries with the largest share in tomato imports in 2023 are Djibouti, USA and

Germany. Türkiye is not among the countries that import tomatoes.

Table 2. World tomato imports (1,000 tons)

Countries	2019	2020	2021	2022	2023
World	9,945	7,892	-	-	-
1 Djibouti			8,484	9,432	13,267
2 ABD	1,825	1,838	1,940	1,982	2,015
3 Germany	720	743	756	655	654
4 France	517	509	516	569	529
5 United Kingdom	406	380	323	389	369
6 Pakistan	233	365	404	323	354
7 Russian Federation	558	467	427	322	268
8 Netherlands	229	227	243	244	219
9 Poland	159	173	173	181	216
10 Canada	212	189	201	198	204

Source: Trade-MAP, Accessed on 9.08.2024. [12].

Table 3. World tomato yield (tons/hectare)

Countries	2017	2018	2019	2020	2021
1 Holland	508.4	508.4	505.6	486.6	475.6
2 Belgium	496.1	470.3	473.9	502.4	448.6
3 Swedish	361.3	455.8	422.5	381	436.5
4 Finland	364.7	393.2	449.4	412.5	417.6
5 Denmark	379.3	392	392	392	379.6
6 Ireland	315	392	373	371	377
7 United kingdom	367	363.6	354	345.7	350.3
8 Norway	320.4	336.9	314.2	356	341.5
9 Iceland	3335	303.3	295.8	290.8	308.5
10 Austria	303.1	290.8	291.7	293.4	298.8
32 Türkiye	68.3	69.8	71.2	72.6	79.2

Source: FAO , Accessed on 9.08.2024 [7].

Table 4. Tomato producer prices (\$/tons)

Countries	2017	2018	2019	2020	2021
1 Iceland	5,105.3	5,652.8	5,457.3	5,307.9	5,258.3
2 Norway	2,531.5	3,550.0	3,644.3	3,446.3	4,351.6
3 Luxembourg	2,699.9	3,542.9	3,806.2	3,883.5	4,139.6
4 Saint Lucia	3,277.8	2,977.8	3,075.9	3,268.5	3,355.6
5 Barbados	2,980.0	2,755.0	2,590.4	2,891.9	2,941.5
6 Guayana	2,072.8	1,569.4	1,474.9	1,556.4	2,718.5
7 Brunei Sultanate	1,835.8	2,261.1	2,232.5	2,556.7	2,538.0
8 Denmark	2,025.5	2,018.6	1,996.3	2,151.9	2,509.1
9 Antigua and Barbuda	-	-	2,129.0	2,499.9	2,444.4
10 Japan	2,489.6	2,562.9	2,336.9	2,655.1	2,341.6
5 Türkiye	299	312.3	274.8	232	215

Source: FAO, Accessed on 9.08.2024[7].

Table 3 shows the ranking of world countries in tomato yield. Holland, Belgium, Sweden and Finland are the countries with the highest yield per unit area in tomato production. According to 2021 data, Holland obtained 475.6 tons of tomatoes from one hectare of land. Türkiye has an average tomato yield of 79.2 tons in one hectare area. Data on how much dollars producers sell a ton of tomatoes are given in Table 4. According to 2021 data, the countries where tomatoes are sold at the highest price by producers are Iceland, Norway, Luxembourg and Saint Lucia. It was recorded that Icelandic tomato producers sold one ton of tomatoes for an average of 5,258.3 USD. It can be stated that producers in Türkiye earn an average of 215 USD from 1 ton of tomatoes. Table 5 reflects the tomato cultivation area and production amounts of Türkiye and Tokat by years. According to TÜİK data, 13.3 million tons of tomatoes were produced in an area of 1,663,234 decares in Türkiye in the 2023 production season. Antalya, Bursa, Manisa, Konya and Izmir are among the provinces with the highest tomato production in Türkiye.

Table 5. Tomato production area and quantity (2015-2023)

Türkiye	Production area (decare)	Production quantity (tons)	Years	Production area (decare)	Production quantity (tons)	Tokat
	1,871,637	12,615,000	2015	72,730	525,918	
1,806,873	12,600,000	2016	62,658	481,843		
1,774,741	12,750,000	2017	59,969	456,378		
1,694,837	12,150,000	2018	51,220	374,573		
1,734,214	12,841,990	2019	51,660	385,702		
1,744,372	13,204,015	2020	50,408	370,503		
1,652,035	13,095,258	2021	38,118	279,085		
1,587,191	13,000,000	2022	29,971	224,984		
1,663,234	13,300,000	2023	18,741	121,917		

Source: TÜİK, 2024 [13].

53.2% of Türkiye's tomato production amount was realized in the five provinces mentioned. Antalya has a production share of 19.6%, Bursa 11.5%, Manisa 8.2%, Konya 7.2%, and Izmir 6.7%. According to 2023 data, 1.1% of tomato cultivation areas are in Tokat. In 2023, 121,917 tons of tomatoes were produced in Tokat and approximately 1% (0.92%) of Türkiye's total tomato production amount is produced in Tokat. While Tokat province ranks 23rd in Turkey in terms of tomato

cultivation area, it ranks 18th in terms of production amount. When Turkey's tomato production data between 2015-2023 is examined, it is seen that there has been no significant change in production amount. This situation is not the same for Tokat province. It is observed that there has been a 76.8% decrease in tomato production in Tokat in the last 9 years [12]. This situation reveals that producers in Tokat province have started to withdraw from tomato production.

When global and national scale data are examined, it is seen that tomatoes are an agricultural product of strategic importance for both world countries and Türkiye. Tokat is a province that has a say in tomato production, and it is understood from previous years' data that it has a production potential above its current production capacity. This research was conducted to determine the cost and profitability of tomato production with data obtained from tomato producers in Tokat province.

Literature review

In their research with tomato producers in Hatay province, Çiftçi and Tapkı (2023) stated that the most important marketing problems of the producers were low product prices, lack of organization, lack of product storage facilities and high transportation costs [3]. Yüzbaşıoğlu and Tosun (2024) [15] also found problems regarding tomato production and marketing in Tokat province.

Durmuş and Semerci (2023) revealed that there are differences in yield, pesticide use and diesel fuel usage in tomato farms of different sizes [5].

In the study of Kaptanoğlu and Tosun (2024), it was determined that the main problems encountered in tomato production are diseases and product losses, and the main problem in the marketing phase is low and unstable prices. According to the research findings, approximately 49% of producers tend to quit production. Those who considered giving up production mentioned reasons such as production not being profitable, product disease, marketing problems and high input costs.

Bayramoğlu et al. (2021) stated that there is a statistically significant relationship between

tomato production costs and seedling, fertilizer, medicine, material and seasonal maintenance costs [1].

In their research, Karadaş and Güler (2021) mentioned that the most important problem in tomato production is high input prices [8].

Kazak et al. (2018) in their research in Izmir province, they revealed marketing problems such as price uncertainty of producers, buyers not paying in advance, lack of producer union and product losses [9].

In this context, the paper aimed to analyze the cost and profitability of tomato production through the example of Tokat province.

MATERIALS AND METHODS

The basic data set used in this study was obtained from face-to-face survey interviews conducted with farmers producing tomatoes in villages affiliated to the Central District of Tokat province in 2022. According to the statistics of the Ministry of Agriculture and Forestry for 2021, there are a total of 1,697 tomato producers in 113 villages affiliated to the Central District. Based on the purposeful sampling method, it was decided to take into account the villages with the highest tomato production among 113 villages. While determining the number of villages to be researched, 11 villages corresponding to 10% of the total number of villages (113 villages) were included in the scope of the research.

11 villages with the highest number of producers were identified and it was deemed appropriate to conduct the research in these villages. The number of surveys to be conducted in 11 villages was calculated using the proportional sampling method below. The number of enterprises that will represent the main population, taking into account the number of tomato producers:

$$n = \frac{Nt^2pq}{d^2(N-1) + t^2pq} \dots \dots \dots (1)$$

where:

n: Number of businesses to represent the population

N: Total number of businesses in the population

S: Standard deviation of the population

t: Ruler value at 90% confidence limits

d: Acceptable margin of error [2].

The most appropriate sample size to represent the main population was determined as 76. After determining the number of businesses to be surveyed, survey forms were created and interviews were held with 76 tomato producers. The data obtained were transferred to digital media and interpreted with descriptive statistics and statistical tables.

The alternative cost principle was used to determine the cost in table tomato production. Variable and fixed costs that constitute the production cost were calculated separately by considering the production processes.

Daily wages of male and female workers in the study area were used to calculate the family labor wage. Working capital interest, which is a variable cost, reflects the opportunity cost of the capital invested in the production activities. The revolving fund interest rate was calculated assuming that variable costs are spread homogeneously throughout the production period. The credits extended for crop production have been calculated by considering the interest rate of TC Ziraat Bank [14]. The interest rate a bare land value has been determined as 3% of the current trade value of the bare land in the study area [10].

RESULTS AND DISCUSSIONS

General socio-economic characteristics of the farmers

Some information was obtained regarding the socio-economic characteristics and agricultural production activities of the producers participating in the research, and this information is shown in Table 6.

The age of the participants in the study was determined as 48.2 years, and the average experience of working with tomatoes was 25.2 years. Değer et al. (2020) determined that greenhouse tomato producers in Fethiye, Muğla, are on average 47 years old and have approximately 18 years of tomato production experience [4]. While Karadaş and Güler

(2021) found that tomato producers in Iğdır province were on average 52 years old [8], Kazak et al. (2018) stated that the producers in İzmir Torbalı are on average 45 years old and have 13 years of tomato production experience [9]. In the research conducted by Öruk and Engindeniz in 2019, the average age of tomato producers was determined as 45 and their production experience was 21 years [11]. 35.3% of the producers are primary school graduates, 25% are secondary school graduates, 22.4% are high school graduates, and 15.8% are university graduates. Çiftçi and Tapkı (2023) determined that 50% of tomato producers in Hatay province were primary school graduates [3]. In the study conducted by Karadaş and Güler in 2021, it was determined that 44% of tomato producers in Iğdır province were primary school graduates [8].

Table 6. Some socio-economic characteristics of the farmers

	Mean	Freq.	(%)
Age (year)	48.2		
Farming experience (year)	25.2		
Educational status of the farmers	Illiterate	1	1.3
	Primary school	27	35.3
	Secondary school	19	25.0
	High school	17	22.4
	Associate degree	4	5.3
	University	8	10.5
Total	76	100	
Branch of production	Only crop production	32	42.1
	Livestock and crop production	44	57.9
	Total	76	100

Source: Survey results.

According to the information obtained regarding production activities, plant and animal production activities are carried out together in 57.9% of the enterprises. It was understood that 42.1% of the enterprises within the scope of the research produced only vegetables. The average production area allocated by the producers to tomatoes was determined as 9.8 decare.

Tomato production cost and profitability

Cost calculations for tomato production were made based on the findings from the research and are presented in Table 7. It has been determined that for one decare of tomato

production area, there are 158.8 seedling costs and \$33.1 land plowing costs. The ratio of seedling expense in the production cost is 21.7% and the ratio in the total cost is 20.1%. The release cost corresponds to a share of 4.5% in the production cost and 4.2% in the total cost. Maintenance costs were determined as \$215.8 in total. The share of maintenance costs in production is 29.5% and the share of total costs is 27.4%. The most important maintenance costs are fertilization, spraying and irrigation, respectively. Fertilization costs constituted 42.4% of variable costs, followed by pesticide costs with 39.9%. Machinery-equipment maintenance cost was calculated as \$199.1. This amount corresponds to a share of 27.2% in the production cost and 25.3% in the total cost. Harvesting cost was determined as \$49 and transportation cost was determined as \$35.4. The variable cost per acre is \$732.6 and accounts for 92.9% of the total cost. Fixed costs per decare were determined as \$55.9 and their share in the total cost was 7.1%. The total production cost per decare was calculated as \$788.5. Based on the information, it was determined that the most important cost items in tomato production are maintenance operations (fertilizer, medicine and irrigation), seedling purchase and maintenance costs of machinery and equipment. In the research conducted by Bayramoğlu et al. (2021) in Antalya province, the production cost of one kilogram of tomatoes was calculated as 2.4 dollars, gross profit as 0.35 dollars and net profit as -0.24 dollars [1]. In their research in Iğdır province, Karadaş and Güler (2021) revealed that 8.1% of the tomato production cost consists of fixed costs and 91.9% consists of variable costs. In the study, it was calculated that 45.2% of variable costs consisted of harvest and transportation, 27.2% consisted of soil preparation, and 23% consisted of maintenance costs [8]. In another research, Ukav (2018) determined that 84.6% of the tomato production cost consists of variable costs [14].

Calculation results regarding tomato production profitability are given in table 8. The average yield of tomato production in the study region was determined as 7.2

tons/decare and the average sales price as 0.3 dollars/kg. Accordingly, net profit was calculated as 1,992.9 dollars per decare. The total production cost was determined as \$788.5, and the variable cost amount was determined as \$732.6.

Table 7. Production costs of tomato in the study area

COST ITEMS		Cost per unit area (\$/da)	Share in the production cost (%)	Share in total cost (%)
Variable Costs				
Material cost (seedling)		158.8	21.7	20.1
Release		33.1	4.5	4.2
Maintenance cost	Fertilization cost	91.6	12.5 (42.4)*	11.6
	Pesticide cost	86.2	11.8 (39.9)*	10.9
	Irrigation cost	38.0	5.2 (17.6)*	4.8
Total maintenance cost		215.8	29.5	27.4
Equipment machine maintenance cost		199.1	27.2	25.3
Harvest cost		49.0	6.7	6.2
Transport		35.4	4.8	4.5
The interest of revolving funds (%6)		41.5	5.7	5.3
Variable Cost Total (A)		732.6	100	92.9
Fixed costs				
General Administrative costs (A*3%)		22.0	39.4	2.8
Bare land value interest (5%)		33.9	60.6	4.3
Fixed Costs Total (B)		55.9	100	7.1
Total of Production Costs (A + B)		788.5	-	100

1 \$ equals to 18.7 TL in December, 2022 (TC. Merkez Bankası, 30.12.2022)[14].

* It indicates the proportion of maintenance costs.

Table 8. Profitability of tomato production

Items	Value
Yield (tons/da)	7.2
Sale price (\$/kg)	0.3
Income (\$/da) (A)	1,992.9
Production cost (\$/da) (B)	788.5
Variable cost total (\$/da) (C)	732.6
Gross profit (\$/da) (A-C)	1,260.3
Net profit (\$/da) (A-B)	1,204.4

1 \$ equals to 18.7 TL in December, 2022 (TC. Merkez Bankası, 30.12.2022) [14].

The tomato producer made a profit of \$1,204.4 with \$788.5 production cost. In addition, the gross profit earned for the variable cost of \$732.6 was calculated as \$1,260.3. The revenue and \$1,204.4 profit values obtained per unit area reveal that tomato production is a profitable agricultural production activity for the producers. The results in Table 8 reveal that increasing

tomato yield will positively affect producers' earnings. Therefore, both income and profitability in tomato production will increase with increasing yield per unit area.

CONCLUSIONS

Tomato is an agricultural product that has an important place in human nutrition and the food industry. Türkiye is among the countries that produce and export large amounts of tomatoes. According to data obtained from TÜİK, Tokat is one of the provinces with high tomato production potential. However, data showing tomato production amounts over the years reveal that tomato production in Tokat has decreased significantly. Based on these data, it can be said that farmers give up tomato production for different reasons. Among the reasons for manufacturers to give up production are the possibility of high production costs and low profitability. This research was conducted to reveal the cost and profitability of tomato production in Türkiye through the example of Tokat province.

The average age of tomato producers is 48.2 years and their farming experience is 25.2 years on average. 61.6% of the producers consist of individuals with secondary school education or below. The average tomato production area was determined as 9.8 decare. The total cost of tomato production per unit area is \$788.5. Variable costs constitute 92.9% of the tomato production cost of producers, while fixed costs constitute 7.1%. Fertilization costs constitute the majority of variable costs of producers.

According to the information received from the producers, it was determined that 7.2 tons of tomato yield was obtained from 1 decare area. It was determined that a net profit of \$1,204.4 was obtained from one decare of tomato production area. Calculations made as a result of the research reveal that tomato production is profitable.

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