

AN ANALYSIS OF TOMATO PRODUCTION COST AND LABOR FORCE PRODUCTIVITY IN TURKEY

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Abstract

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The aim of this study is to determine the unit production cost and labor force productivity of tomato in the main production regions. The main material of the study consists of the data compiled by survey studies implemented in provincial directorates of the Ministry of Agriculture and Rural Affairs. As a result of the study, the unit product cost is calculated minimum with 0.10-0.11 YTL/kg in the provinces where industrial tomato production is a widespread activity. The unit cost in table tomato production is minimum in the province of Eskisehir with a value of 0.16 YTL/kg and maximum in the province of Antalya, where production under greenhouse conditions is a widespread activity, with a value of 0.45 YTL/kg. Labor force productivity is maximum in the provinces of Bursa and Antalya and minimum in the province of Balikesir, where tomato is not planted in rotation with other products and where tomato agriculture suffers from various diseases.

Key words: Tomato, cost, productivity, labor, comparative analysis

Introduction

Tomato is one of the most consumed food sources among vegetables. The annual fresh tomato consumption in Turkey per capita is over 80 kg due to reasons such as suitable ecological conditions, tomato's rich vitamin and mineral content, its important place in nourishment habit and its relatively cheap price. This amount is 3 to 4 times greater than that in the EU and many important producer countries (Keskin et al., 2007). In 2007, 125.5 million tons of tomato was produced in the world, with China being the largest producer, followed by the EU, USA and Turkey with

shares of 26%, 13%, 9%, and 8% respectively (Anonymous, 2008). Although tomato production is being carried out in almost all the provinces of Turkey, production under greenhouse conditions is generally carried out in the Mediterranean region. There is also a regional differentiation in the industrial tomato production and such production activities are generally carried out in the Aegean and Marmara regions (Keskin et al., 2005). There are 400 types of table tomato and 60 types of industrial tomato seeds approved by the Ministry of Agriculture and Rural Affairs (MARA). Sabrina, Dalmone, Gigante, and Fantastic 144 are some of the important table tomato

varieties and New Crimson, Delicious Red, Bonanza, and Rio Grande are among the leading industrial varieties (Anonymous, 2006).

Approximately 90% of the tomatoes processed in the industry in Turkey are used in tomato paste production and the rest are used in the production of other tomato products such as canned tomato, dried tomato, and pickle. Dried tomato production has increased in the recent years due to its high prices and significant demand for it as a diversified product. Turkey exports tomato and tomato products and fresh production are mainly consumed domestically. Although fresh tomato export amounts differ according to years, 200-250 thousand tons of tomatoes are exported on average annually, whereas tomato import is insignificant. 55-60% of tomato paste production, which is the most important processed tomato product, is exported. 9% of the enterprises carrying out organic agriculture in Turkey produce tomato and these enterprises are generally in the Aegean and Marmara Regions (Anonymous 2008b; Anonymous, 2008c). Organic tomato production, like processed products production, is carried out for exportation and the EU and USA are important countries Turkey export tomatoes to (Keskin et al., 2007).

Costs of main agricultural products in Turkey are calculated regularly on a yearly basis by various institutions. However, tomato production costs are calculated only for limited areas in some academic studies. This may be attributed to specific reasons pertaining to vegetable production activity and difficulties in calculation of a standard cost. In this study, the professionals working in the region are utilized to perform a comparison among the provinces. First, a survey form related to production and marketing structure has been filled out in cooperation with agricultural directorates in the provinces and tomato production costs data have been acquired on a province basis with the help of the cost forms. Thus, production structure and costs of the important provinces carrying out tomato production have been determined and the labor force demand and productivity per unit area have been calculated.

Material and Method

The data acquired through surveys sent to the Provincial Directorates of MARA (PDMARA) that are important in tomato production constitute the main material of the study. The surveys were conducted in two stages. In the first stage, a survey study for production and marketing data were implemented with PDMARA. According to 2006 data 14 provinces are important in tomato production in terms of production amount and varieties such as table and industrial. In 2007, under the light of these data, information acquired from the tomato cost forms sent to the province of Antalya, where table tomato production is widespread, the provinces of Balikesir, Izmir and Bursa, where industrial tomato production is widespread, the province of Canakkale, which is an important table and industrial tomato producing province, and the province of Eskisehir, which is out of this classification, comprise the second stage of the study. In addition, during the 2007 season, Antalya farmers were interviewed about farming under greenhouse conditions. Finally, the physical cost elements and the ratios of these in the costs from the studies implemented in different dates in various regions of Turkey were studied to perform a comparison.

Results and Discussion

Production Methods

In Turkey, tomato cultivation lands have reached to 183 703 hectares with an increase of 145%, production has reached to 10 millions tones with an increase of 449% and the productivity increase has doubled (Table 1) over the last thirty five years. More than 3/4 of the tomatoes processed by the industry are produced in the provinces of Bursa, Manisa, Izmir, Balikesir and Konya, whereas more than 1/2 of the table tomatoes are produced in the provinces of Antalya, Mersin, Canakkale, Mugla and Tokat.

The total production of these provinces constitutes 63% of table tomato production, 85.7% of industrial tomato production, and 69.8% of the total produc-

Table 1
Development of tomato production in Turkey

Year	Area sown, ha	% (1970=100)	Production, tons	% (1970=100)	Yield, tons/ha	% (1970=100)
1970	75 000	100	1 810 000	100	24.1	100
1980	108 000	144	3 550 000	196	32.9	137
1990	158 880	212	6 000 000	331	37.8	157
2000	208 410	278	8 890 000	491	42.7	177
2005	201 116	268	10 050 000	555	50.0	207
2006	193 909	259	9 854 877	544	50.8	211
2007	183 703	245	9 945 043	549	54.1	224

Source: Anonymous 2008, Anonymous 2008a.

Table 2
Tomato production in some important provinces (2006)

Fresh Tomato				
Provinces	Producers* %	Production, tons	Fresh tomato production, %	Processed tomato production, %
Antalya	6.7	1 666 826	99.9	0.1
Canakkale	4.3	482 100	53.8	46.2
Mersin	3.2	771 223	99.9	0.1
Mugla	4.1	451 922	100	0.0
Tokat	3.0	525 676	91.9	8.1
%	21.4	39.6	52.5	9.1
Processed Tomato				
	Producers* %	Production, tons	Fresh tomato production, %	Processed tomato production, %
Bursa	4	907024	22	78
Manisa	2	694281	19	81
Izmir	3	734670	29	71
Balikesir	5	399994	17	83
Konya	1	241655	47	53
%	14	30	11	77
Total	282690	9854877	6912745	2942132

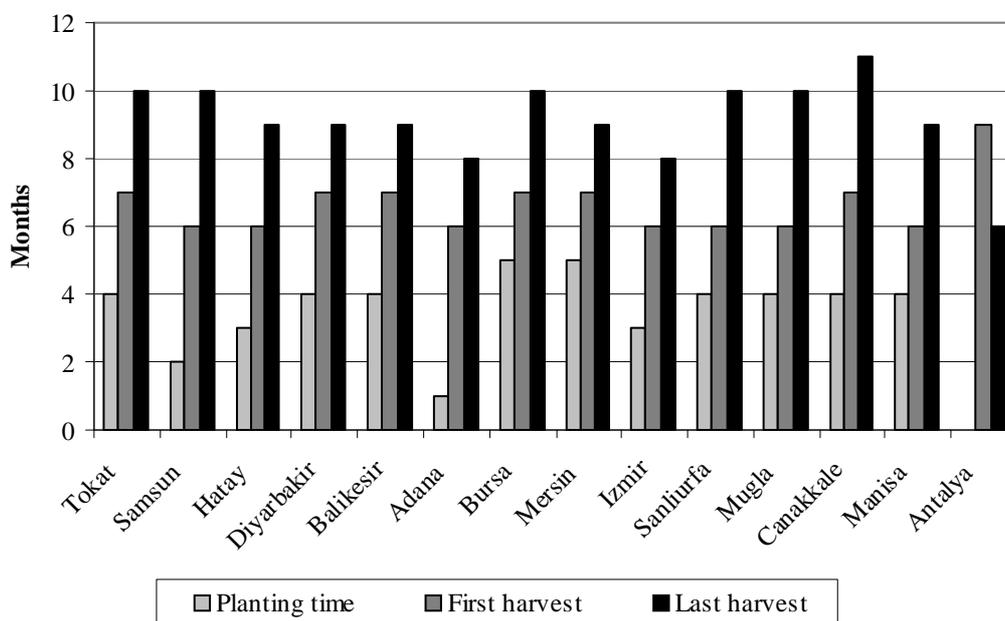
Source: TUIK

* 2001 Agricultural Census

tion. 35.5% of approximately 283 thousand tomato producers carry out their production activities in these provinces (Table 2).

Of the tomato production in Turkey, 20% is carried out under greenhouse conditions and such pro-

duction is particularly widespread in the provinces of Antalya and Mersin in the Mediterranean region. Production under greenhouse conditions is carried out during the periods when production in open fields is not possible and the products of such farming are used

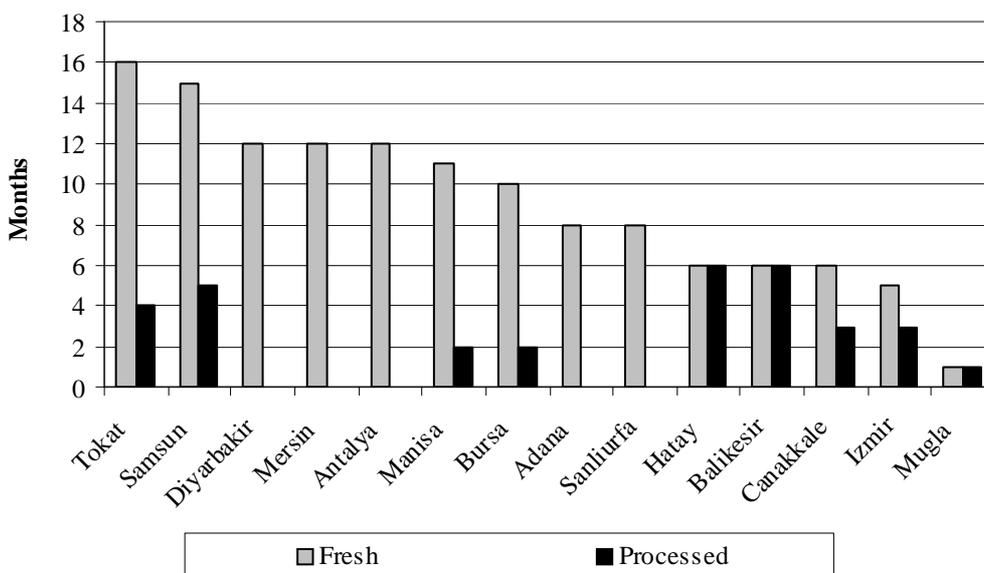


Source: Data of survey studies implemented with agricultural directorates of provinces

Fig. 1. Production period of fresh tomato production

in table consumption. Production under greenhouse conditions is carried out in plastic greenhouses, glass greenhouses, and in low and high tunnels and the production in plastic greenhouses is continuously increasing. Important factors in this increase are that plastic

greenhouses are cheaper, more modern, and functional. As there is a transformation from family enterprises to commercial enterprises, newly constructed greenhouses consist of plastic greenhouses in general. Production under plastic greenhouses has been in-



Source: Data of survey studies implemented with agricultural directorates of provinces

Fig. 2. The number of harvests in tomato production

creasing due to the fact that soilless production is carried out in these greenhouses and that soilless production is increasing (Keskin et al., 2007).

There are two types of tomato production under greenhouse conditions namely single and double planting. In double planting, the same greenhouse consecutively produces two crops within the same year within the periods starting from August/September and January. In the province of Antalya, the amount of the glass and plastic greenhouse fields vary between 0.1-0.6 hectares and productivity per hectare varies between 140 to 200 tons. The production period continues until the months of June/July and coal and wood is used for heating (Keskin et al., 2007).

Planting and harvesting time varies depending on the climate and production system. Open planting in table tomato is generally carried out between March and May and the first harvesting period begins with June and could continue until the end of October. Production under greenhouse conditions is carried out in

the October-June period (Figure 1). The numbers of harvests vary in table and paste tomato production. There may be 6 to 16 harvests for table tomato whereas the number of harvests for paste tomato varies in general between 2 and 4 and the maximum number is 5 to 6 (Figure 2).

Cost Factors in Tomato Production

Product costs vary in considerably based on soil and climate conditions, technology used and between the regions, provinces, and even farms. Therefore, it is not possible to mention of a single or standard cost. However, an evaluation could be made depending on significant cost items and their rational distribution. In vegetable agriculture, cost calculation is more complicated than crop production due to factors such as production under greenhouse conditions and second crop production.

The ratio of the variable and fixed costs in total costs varies considerably for open or under green-

Table 3

Tomato cost and labor force productivity in some important producer provinces (2006)

	Canakkale	Antalya (under greenhouse conditions)	Eskisehir	Balikesir	Bursa	Izmir
Labor force demand, h/ha	1190	2420	1534	1160	700	1425
Tractor power demand, h/ha	12.00	30	34	30	-	-
Labor costs, YTL/ha	2425	4356	3727	2910	1750	2982
<i>Share of labor costs, %</i>	37.77	5.65	39.07	48.83	33.98	40.74
<i>Labor cost, YTL/kg</i>	0.04	0.03	0.06	0.05	0.04	0.07
Input costs, YTL/ha	1895	35980	3549	1750	1380	2300
<i>Share of input costs, %</i>	29.52	46.69	37.20	29.36	26.80	31.42
Total cost, YTL/ha	6420	77062	9540	5960	5150	7320
Yield, kg/ha	60000	170000	58310	55000	50000	40500
Unit cost, YTL/kg	0.11	0.45	0.16	0.11	0.10	0.18
Unit selling price, YTL/kg	0.15	0.65	0.26	0.15	0.30	0.37
<i>Labor force productivity, YTL/h¹</i>	7.56	45.66	9.88	7.11	21.43	10.52
<i>Labor force productivity, YTL/h²</i>	2.17	13.82	3.66	1.97	14.07	5.38
<i>Labor force productivity, kg/wd³</i>	50.42	70.25	38.01	47.41	71.43	28.42

¹GPV/labor force demand ² Net income/labor force demand ³ Yield/labor force demand per hectare

Source: Provincial directorates of Agriculture Surveys

house conditions production. The productivity and the input utilization for upgrading the quality are higher in production under greenhouse conditions and the ratio of the fixed costs in total costs is increasing due to factors such as facility costs, depreciation ratio, and capital interest. In under greenhouse conditions and open production, the use of manure is close to each other with values of 40 and 30 tons per hectare. However, the use of chemical fertilizers varies considerably and this amount can reach to 5 tons in single production in the province of Antalya. The use of pesticides in tomato agriculture varies according to production type (open or under greenhouse conditions), the disease and pest problems in the region, and the knowledge levels of the producers concerning disease and pest management.

In this study, the rate of the labor force and input costs in variable costs in tomato production is calculated as 52% to 78%. Labor costs vary between 34% and 49% in open production whereas in production under greenhouse conditions, labor force costs can decrease down to 6% because of high input costs (Table 3). In the province of Konya, the share of the labor force and variable costs in total cost in tomato production under greenhouse conditions are 6% and 54% respectively (Oguz and Arisoy, 2002). According to a study implemented in the sub-province of Silifke of Mersin province, the share of the family labor force in production under greenhouse conditions varies between 26% and 31% whereas the share of variable costs varies between 49% and 58% (Rad and Yarsi, 2005). In another study implemented by Tumsavas (2003) in the Ayas district of Ankara province, labor force demand per hectare was calculated as 1622 hours, the share of labor force costs was calculated as 40%, and the variable costs were calculated as the 92% of the total production cost. Similar results were obtained in another study conducted by TEAE (2001) in the provinces of Tokat, Antalya, and Icel. According to this study, changing costs in greenhouse production were calculated as 70-79% whereas this value was 89% in open production system. Labor force cost in greenhouse and open production was calculated as 18-21% and 26% respectively whereas labor force

demand was calculated as 2137 hours in open production and 3248-6071 hours in under greenhouse production.

Production amounts in production under greenhouse conditions vary considerably based on whether single or double production is carried out and on the use of various systems, such as soilless agriculture, in farms. Besides, the type of the greenhouse (glass or plastic) is an important factor affecting the share of the facility costs in total costs. The value of 170 tons production per hectare given in Table 1 shows the average of the province of Antalya and some farms have a few times more production value than that. In 2006, the highest total costs in production under greenhouse conditions were observed in the province of Antalya due to facility costs and the lowest costs were observed in the province of Bursa, where industrial tomato production is widespread. Minimum costs per unit product were observed in the provinces of Canakkale, Bursa, and Balikesir where, again, industrial tomato production is widespread (Table 3).

Labor Force Productivity

The productivity per decar in the study region varies according to tomato varieties and methods used in farms. According to the data acquired by the surveys implemented in the provinces, 60-65% of the industry and table tomato varieties in the province of Bursa consist of F1 varieties, 80% of the table tomato in the Antalya province consist of Joker F1, Merve and Dorit are the table tomato varieties in the Province of Balikesir, and the 65% of the paste tomato in this province consist of Alta and 2710 varieties. However, wide variety of tomatoes is utilized in the provinces of Canakkale and Izmir and no single variety is the prevailing one. The highest productivity per unit area in the provinces surveyed is in agriculture under greenhouse conditions and the lowest is in open production in Izmir province.

In industry tomato production, 80% of the firms carry out production activities through contracted farmers. However, not paying attention to rotational production causes reductions in productivity and, on the other hand, the developments in irrigation tech-

nologies augment production (Keskin et al., 2005).

Various factors such as the production method (under greenhouse conditions or open), the differences between contracted production system and the non-contracted production, and the differences between the market price and demand of the table and industry tomato impact the labor force productivity in the provinces. A study implemented by Tatlidil and Akturk (2004) showed that the number of seedlings and the amount of the fertilizer used, labor force payments, and the amount of production differ in farms carrying out contracted and non-contracted tomato production and net profits and labor force productivity is higher in contracted production.

As Table 3 depicts, labor force demand is 2420 hour/hectare in production under greenhouse conditions and varies between 700 to 1534 hour/ha in open production. The province of Bursa has the highest labor force productivity with value of YTL 14 per hour. The province of Bursa is followed by Antalya province with a value of YTL 13.8 and Izmir province comes third with a value of YTL 5.4. High facility costs in Antalya and low labor force demand in Bursa are important factors in this result. Besides, the difference between the table and industry tomato prices is another important element. Apart from the physical labor force demand, workmanship fee differences among the provinces are significant points of attention. The province of Antalya has the lowest labor cost with a value of YTL 14.4 per day and the provinces of Balikesir and Bursa have the highest with a value of YTL 20. Harvesting and hoeing are the activities which demand most labor force with rates of 48-51% and 17-24% respectively. According to the study implemented by TEAE (2001) on the other hand, harvesting comprises 47-68% of the labor force demand.

The average size of tomato production area sown in Turkey is smaller than lands, on which crop farming is conducted, with a value of 0.72 ha (Anonymous, 2008a). Family farms have the biggest share in agriculture under greenhouse conditions as is the case with open production and the average greenhouse size is about 500 m² (Rad and Yarsi, 2004). Farms with size

below 0.1 ha comprise 57% of total greenhouses and farms with size between 0.1 and 0.3 ha comprise 41% of them (Sayin, 2005). Capital insufficiencies in Turkish agriculture farms cause low input and technology use and widespread labor intensive production.

Conclusion

It is difficult to estimate of a standard cost in vegetable production due to production under greenhouse conditions and open production. Natural conditions of the regions, land structure, education levels of farmers, and organization structures impact the level of the technique and mechanization used, both of which can cause huge cost differences. Moreover, labor force productivity is important in competition since vegetable agriculture generally necessitates labor intensive production rather than mechanization. The reason is that the most important element in costs is expenditures made for labor force. Therefore, increasing the labor force productivity is important in the sustainability and competitiveness of production.

This study has found that unit production cost and labor force productivity is highest in Antalya province where tomato production under greenhouse conditions is carried out. Facility expenditures increase the costs, and on the other hand, out-of-the-season production increases production and improves labor force productivity. High labor force cost decreases labor force productivity in Balikesir province where industry tomato production is widespread.

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