

## **The Structure of the Olive Plantation Farms in the Eastern Mediterranean Region and the Prospects of Improvement**

**Assist. Prof. Arzu Secer**

Faculty of Agriculture  
Department of Agricultural Economics  
Cukurova University  
Sarıcam/Adana, Turkey

**Prof. Dr. Faruk Emeksiz**

Cukurova University  
Faculty of Agriculture  
Department of Agricultural Economics  
Sarıcam/Adana, Turkey

### **Abstract**

*With the incentives for olive production in Turkey in 2004, olive plantation area has expanded and the production of oil has increased. In Mediterranean Region, between 2000 and 2016, there was an increase of 170.73% in the area of olive plantations. In the same period, the olive presentation land expanded by 185.94% in Eastern Mediterranean Region. The present study, in this respect, aims to explore the structure of the olive production farms as well as the production techniques utilized, the problems faced during production process, and provide suggestions. In the area where the present study is carried out, the land size is 26.57 da, the number of parcels is 2.38 units, and the size of the parcels is 11.16 da. The most common local olive type in the region is Gemlik, the plantation of which is usually done by the official incentives. The most common problems encountered during olive plantation are maintenance procedures, irrigation, harvesting practices, and fertilization. Problems in the region and province specific obstacles were identified in order to be able to provide solutions, plans, and programs to improve the product quality while encouraging the producers to adapt efficient plantation practices.*

**Keyword:** Olive, production, Eastern Mediterranean Region, Turkey.

### **1. Introduction**

The increase in population and overall raise in awareness regarding healthy diet and consumption of local food products have led to a significant rise in the consumption of olive oil and table olive. This increase in demand has directly affected the countries that produced table olive and olive oil leading to important developments in international trade.

Almost all the world's olive production is grown in the Mediterranean coastal countries. Among these countries, there are EU countries such as Spain, Italy, and Greece in addition to Non-EU countries like Turkey, Tunisia, Syria, and Morocco. In Turkey, production of olive has been encouraged by the government since 2004, which has lead both to expand in olive plantation areas and to an increase in production.

In Turkey, the olive plantation area, which was 6 million hectare in 2000-2001, was expanded by 40.92% in 2015-2016 reaching 8.4 million hectare. During this period, the production also increased from 1.2 million tonnes by 44.17% and reached 1.7 million tonnes. The yield per tree, on the other hand, has grown from 14 kg to 22 kg (an incline by 62,96%) (TSI, 2017).

The olive production in Turkey is mostly takes place in Aegean, Marmara, and Mediterranean Regions. The expansion in olive plantation areas between 2000 and 2016 was 27.38% in Aegean Region, 13.52% in Marmara Region, and 170.73% in Mediterranean Region (TSI, 2011). During the same period, there was also an expansion in olive plantation areas in Eastern Mediterranean Region by 185.94%.

As a result, olive production is expected to increase significantly in the near future. The amount and the quality of the yield are very important since they will directly affect the quality and the amount of the final products, namely olive oil and table olive. There are a considerable number of studies in literature focusing on the structure of olive farms and their production techniques (Oktayet al., 1994; Konaket al., 1998; Tunalioglu&Gokce, 2002; Gokce, 2003; Ozkaya, 2003; Dizdarogluet al., 2003; Anac, 2005; Artukogluet al, 2012). However, there are no studies, as far as we are concerned, focusing on the structure of olive farms and their production techniques in Eastern Mediterranean Region. Therefore, the present study aims to investigate the structure of olive farms and their production techniques in Eastern Mediterranean Region; determines the problems faced during production; identifies the producers' expectations; and finally provides suggestions in the light of the findings in order to be able to improve olive production in the region.

## 2. Material and Method

### 2.1. Data Collection

The main instrument of the study was a questionnaire implemented to olive producers in the cities where olive production is high (Hatay, Mersin, Osmaniye and Adana). The questionnaire was prepared in the light of an extensive literature review conducted in the field and with the guidance of field experts (Isıklıet al., 1988; Olgun, 1988; Oktayet al., 1994; Belletti&Marescotti, 1997; Tunalioglu&Gokçe, 2002; Gokçe, 2003; Dizdarogluet al., 2003; Kocet al., 2004; Ozgursoy&Akdemir, 2007; Karray, 2008; Olgunet al., 2008). The producers completed the questionnaire between 1<sup>st</sup> and 15<sup>th</sup> March 2009. The questionnaire consisted of demographic information (e.g., age, educational background, and experience in the field); the structure of their olive production farms (e.g., the size of the production facility, the number of parcels, production patterns, etc.); olive production techniques (e.g., sapling supplies, fertilisation, disinfestation, irrigation, etc.); the problems faced; and their future expectations in terms of olive production.

The data of the study was strengthened by secondary data gathered from previous studies in the field in addition to the statistical information in the reports by Ministry of Food, Agriculture, and Livestock province and district directorships in Hatay, Mersin, Osmaniye and Adana; Turkish Statistical Institute (TSI); and International Olive Oil Council (IOOC).

### 2.2. Method

The Eastern Mediterranean Region, which counts for 19.50% of the total olive production in Turkey (average totals for 2006-2007), was chosen as the research area (TSI, 2011). Eastern Mediterranean Region is comprised of Hatay, Adana, Osmaniye, Mersin and Kahramanmaraş cities. The sampling for these cities was conducted following "Purposive Sampling Method" considering the number of olive trees and the amount of production they have. As a result, Hatay, Mersin, Osmaniye and Adana were included in the research sample as they constituted 95.23% of the olive trees and 97.47% of the total olive production in the region based on 2006-2007 reports. As Kahramanmaraş's share is negligible, it was not included in the research sample.

The cities included in the research sample were also selected based on both the amount of their contribution to olive production in Turkey and the opinions of the experts in City and District Agriculture Directorships as well. Consequently, Antakya (province centre), Altınözü and İskenderun districts in Hatay making up for 56.29% of the total olive production in the province; Mut and Tarsus districts in Mersin forming 50.15% of the total olive production in the province; Ceyhan and Yüreğir districts in Adana contributing 52.13% of the total production; and finally central district in Osmaniye with 45.28% of the total olive production were included in the research sample. The sample, thus, consisted of four cities and eight districts. As for the selection of villages, Farmer Registry System was used as reference and 18 villages with high olive plantation areas in these cities were included in the sample. The olive producers' list were created in these villages constituted the frame list of the study. Applying 'Stratified sampling Method' to this frame list, the number of the participants for the study was determined using the following formula (Cicek&Erkan, 1996).

$$n = \frac{(\sum N_h S_h)^2}{N^2 D^2 + \sum N_h (S_h)^2}$$

In the formula, n: total sample size; N<sub>h</sub>: the number of units in h<sup>th</sup> strata; S<sub>h</sub>: the standard deviation in h<sup>th</sup> strata; N: the total number of farms; D: d/Z (d: the mean deviation; Z: 95% confidence interval in the t-distribution table).

Accordingly, in the selected 18 villages, the farms included in the study sample were determined to be 130 with 95% confidence interval and 5% deviation. The sample volume was distributed proportionally to the strata.

**Table 1. Distribution of Farms by Olive Plantation Area Size Groups**

Group Intervals (da)	Frequency (Nh)	Mean	Standard Deviation (Sh)	nh*sh	Variance (sh <sup>2</sup> )	nh*sh <sup>2</sup>	Sample size (ni)
1-10	641	6.30	2.73	1,747.57	7.43	4,764.43	48
11-30	729	18.66	5.64	4,111.96	31.82	23,193.76	55
31-60	350	52.22	18.18	6,363.00	330.51	115,679.34	27
Total	1720	22.83	26.55	12,222.54	369.76	143,637.54	130

The distribution of the questionnaires into the districts was conducted based on their shares in the olive production whereas the distribution into villages was done based on their shares in the olive plantation area (as no records regarding production were found). Accordingly, out of 130 total questionnaires; 64 questionnaires in Hatay, 43 questionnaires in Mersin, 18 questionnaires in Osmaniye and 7 questionnaires in Adana were implemented.

### 3. Results

#### 3.1. Structure of Farms

##### 3.1.1. The Size of the Plantation Area, the Number and the Size of the Parcels

The average plantation area size in the region is found to be 53.95 da. The highest average farm size is in Adana (235.86 da) and the lowest is in Osmaniye (32.13 da). The average parcel number in the region is 5.00 and the average parcel size is 10.79 da. The smallest parcel number is in Osmaniye (3.13 units) and the highest is in Adana (6.29 units). The average parcel size is the lowest in Hatay (8.68 da) and the highest in Adana (37.50 da) (Table 2).

**Table 2. The Average Plantation Area Size, Parcel Size and Parcel Number**

Provinces	Plantation Area Size (da)	Number of Parcel	Size of Parcel (da)
Hatay	41.92	4.83	8.68
Mersin	49.93	5.61	8.90
Osmaniye	32.13	3.13	10.26
Adana	235.86	6.29	37.50
Average	53.95	5.00	10.79

The average olive plantation area is found to be 26.57 da. The size is 25.70 da in Hatay, 27.81 da in Mersin, 15.75 da in Osmaniye, and 51.57 da in Adana. The average parcel number in olive plantation areas is 2.38 units. The highest number is in Mersin with 2.55 units, and the smallest number is in Adana with 1.57 units. The average parcel size in the plantation areas is determined to be 11.16 da with the highest in Adana (32.85 da) and the lowest in Osmaniye (8.16 da) (Table 3). The size of the olive plantation area, the number of parcels and the size of the parcels are found to be similar for Hatay, Osmaniye and Mersin while Adana displays differences in these compared to the other three cities. In Hatay and Mersin, olive production has a long history and a traditional agricultural practice. Since the majority of the olive plantation areas are divided based on inheritance laws, the size of the parcels are small and the number is high. On the other hand, Adana's experience in olive production is relatively recent allowing the plantation areas to be structured using the newest techniques in bigger closed yards.

The share of olive plantation area in the total plantation area is 49,25 on average. This rate is 61.31% in Hatay, 55.69% in Mersin, 49.1% in Osmaniye, and 21.87% in Adana.

**Table 3. The Average Olive Plantation Area, the Number and the Size of Parcels**

Cities	Olive Plantation Area (da)	Number of Parcel	Size of Parcel (da)
Hatay	25.70	2.47	10.40
Mersin	27.81	2.55	10.90
Osmaniye	15.75	1.93	8.16
Adana	51.57	1.57	32.85
Average	26.57	2.38	11.16

### 3.1.2. Ownership Status of the Olive Plantation Areas

Plantation land is determined by adding rental or jointly used land to the privately owned land while deducting rental, jointly used lands outside the farm. Among the investigated lands, there is no part rented or jointly used other than olive plantation purposes. Therefore, the size of the plantation lands has been calculated by adding rental or jointly used land to the privately owned land.

In the farms, 48.14 da of the land is privately owned, 3.30 da of it is rented, and 2.51 da of it is cultivated jointly. Of the total land in the region, 89.23% is privately owned, 6.12% of it is rented, and 4.65% is jointly cultivated. In Hatay, the rate of land ownership is relatively lower compared to the other provinces (Table 4).

**Table 4. Ownership Status of Total Land in the Farms**

Provinces	Private Property		Rental		Joint		Total	
	da	%	da	%	da	%	da	%
Hatay	35.39	84.42	3.19	7.61	3.34	7.97	41.92	100.00
Mersin	45.90	91.93	2.05	4.11	1.98	3.97	49.93	100.00
Osmaniye	29.00	90.26	2.33	7.25	0.80	2.49	32.13	100.00
Adana	219.71	93.15	14.29	6.06	1.86	0.79	235.86	100.00
Average	48.14	89.23	3.30	6.12	2.51	4.65	53.95	100.00

Property ownership in olive gardens displays similar pattern. Of the total land, 91.63% is privately owned, 5.16% is rented, and 3.21% is jointly cultivated. While there is no rented land found in Osmaniye, the rate of the jointly cultivated olive gardens is considerably higher than the other provinces (Table 5).

**Table 5. Ownership Status of Olive Gardens in the Farms**

Provinces	Private Property		Rental		Joint		Total	
	da	%	da	%	da	%	da	%
Hatay	23.89	92.98	1.48	5.78	0.33	1.25	25.70	100.00
Mersin	25.38	91.26	1.00	3.60	1.43	5.14	27.81	100.00
Osmaniye	14.49	92.00	0.00	0.00	1.26	8.00	15.75	100.00
Adana	47.81	92.71	2.41	4.67	1.35	2.62	51.57	100.00
Average	24.35	91.63	1.37	5.16	0.85	3.21	26.57	100.00

### 3.1.3. Irrigation in Plantation Areas

33.77% (18.22 da) of the plantation area is irrigated and 66.23% (35.73 da) of them is used dry. The ratio of the irrigated areas compared to the total plantation area varies in these cities. The ratio of irrigated land is just over 20% of the total plantation area in Hatay, Osmaniye, and Adana while it is around 80% in Mersin (Table 6). The reason for Mersin to have such a high irrigated land could be attributed to its having high rates of garden plants production.

**Table 6. Irrigation in Olive Plantation Areas**

Cities	Wet		Dry		Total	
	da	%	da	%	da	%
Hatay	9.32	22.23	32.60	77.77	41.92	100.00
Mersin	39.97	80.05	9.96	19.95	49.93	100.00
Osmaniye	6.13	19.08	26.00	80.92	32.13	100.00
Adana	51.57	21.87	184.29	78.13	235.86	100.00
Average	18.22	33.77	35.73	66.23	53.95	100.00

The irrigation in olive plantation lands differs in these regions as well. Of all the farms included in the study, almost half of the area is irrigated (47.50%). The high percentage results from Adana and Mersin having almost all of the olive plantation lands irrigated (100% and 95.83%, respectively). The irrigation rates are lower in Hatay (27.20%) and Osmaniye (18.67%).

### 3.1.4. Area Utilization Status

The utilization status of the analysed areas is displayed in Table 7. Accordingly, the highest rates belong to olive (26.57 da; 49.25%) followed by wheat (14.97 da; 27.75%), apricot (2.92 da; 5.41%), and barley (2.72 da; 5.04%). Also, sunflower, vetch, lemon, vineyard, and other products are produced in these regions.

**Table 7. Area Utilization Status in the Region (da)**

Cities	Olive	Wheat	Apricot	Barley	Other*	Total
Hatay	61.31	26.77	0	0.91	11.01	100.00
Mersin	55.7	5.83	17.70	9.31	11.46	100.00
Osmaniye	49.02	37.54	0	0	13.44	100.00
Adana	21.86	55.12	0	7.88	15.14	100.00
Average	49.25	27.75	5.41	5.04	12.55	100.00

Other\*: It includes the plants produced in the areas smaller than 500 m<sup>2</sup> per farm. (Sunflower, vetch, vineyard, lemon, pomegranate, plum, pepper, oat, cucumber, peas, walnut, tomato, apple, fig, tobacco, onion, pear, eggplant, and chickpea).

### 3.1.5. Demographic Characteristics of the Participants

The mean age of the participants is 53.72 years, which is 56.53 for Hatay, 49.91 for Mersin, 51.53 for Osmaniye, and 56.57 years for Adana. This indicates that the oldest farmers are from Adana and the youngest ones are from Mersin. The experience with olive production among all the participants is 28.66 years. The time of experience differs among these cities. While in Hatay and Mersin, as traditional olive producers, the experience by years are 37.27 and 23.16, respectively; for Adana and Osmaniye, the experience are 17.53 and 8.43 years, respectively.

Among the participants, 65.38% of them are graduates of elementary school, 11.54% of them are literate, 7.69% of them are graduates of secondary school, 7.69% are graduates of high school and 3.85% are illiterate. Only 3.85% of the participants have a university degree. The highest graduation status is elementary school for all the cities.

## 3.2. Olive Production Techniques

### 3.2.1. Present Varieties

The selection of varieties differs among the cities and done based on the evaluation type. Of all the olive trees which the farms have, 47.18% of them are Gemlik, 25.83% of them are Halhali and 18.97 of them are Ayvalik. Hatay province has idiosyncratic varieties, namely Halhali, Karamani, and Saurani. In Mersin, on the other hand, Ayvalik and Sarı Ulakare the common types and considered specific to the region. Also, Gemlik is among the varieties found in Mersin. Gemlik is the most common variety in the region since it is the variety distributed under the agricultural support programs. Therefore, the number of Gemlik trees has significantly increased in recent years.

**Table 8. The Distribution of Olive Trees by Varieties**

Varieties	Hatay	Mersin	Osmaniye	Adana	Total
	Rate (%)				
Gemlik	35.68	37.44	23.30	100.00	47.18
Halhali	50.29	9.24	-	-	25.83
Ayvalık	-	47.94	76.70	-	18.97
Karamani	8.68	-	-	-	3.99
Saurani	5.35	-	-	-	2.46
Sarıulak	-	5.38	-	-	1.57
Total	100.00	100.00	100.00	100.00	100.00

### 3.2.2. Sampling Supply

Of the olive saplings in the farms analysed, 44.60% were obtained from Province Agricultural Directorships, 40.08% of them were inherited, and 15.32% were purchased from private suppliers. Considering each variety, 93.69% of all the Gemlik saplings were obtained from Province Agricultural Directorships (Table 9). On the other hand, the other local varieties such as Saurani, Karamani, Halhali, and Sarı Ulak were mostly inherited.

**Table 9. The Distribution of Supplies of Olive Saplings by Variety**

Varieties	Province Agricultural Directorship		Heritage		Private Suppliers		Total	
	Number of Trees	Rate (%)	Number of Trees	Rate (%)	Number of Trees	Rate (%)	Number of Trees	Rate (%)
Gemlik	36,093	93.69	444	1.15	1,985	5.15	38,522	100.00
Halhali	-	-	20,240	95.97	850	4.03	21,090	100.00
Ayvalık	320	2.07	5,885	38.00	9,281	59.93	15,486	100.00
Karamani	-	-	3,160	96.93	100	3.07	3,260	100.00
Saurani	-	-	1,960	97.51	50	2.49	2,010	100.00
Sarıulak	-	-	1,040	81.25	240	18.75	1,280	100.00
Total	36,413	44.60	32,729	40.08	12,506	15.32	81,648	100.00

### 3.2.3. Fertilization

Fertilization in olive plantation lands, as one of the culturally accepted forms of measurement in agriculture, plays an important role in increasing the quality and productivity. With the help of effective fertilizations, farmers can increase the quality and the amount of their products assuring regular yield annually. Among the researched farms, 73.08% of them reported that they have regular annual fertilization. Considering each province, 81.25% of the lands in Hatay and Osmaniye; 67.44% of the lands in Mersin and 14.29% of the lands in Adana are reported to be fertilized regularly every year. The low rate for Adana is due to the young age of the olive trees in the province.

The producers applying chemical fertilization to their lands in these provinces are displayed in Table 10 and Table 11. The findings are presented in two categories: fertilization for the trees younger than 10 years (Table 10) and fertilization for the trees older than 10 years (Table 11).

The amount of fertilizers is around 1.04 kg per tree and 22.38 kg per da for the trees younger than 10 years. The amount varies in the provinces: 1.92 kg per tree in Osmaniye, 1.40 kg per tree in Adana, 0.97 kg in Mersin, and 0.78 kg per tree in Hatay (Table 10).

**Table 10. Amount of Chemical Fertilizer Use for Trees Younger than 10 Years (kg/tree)**

Fertilizer Types	Hatay	Mersin	Osmaniye	Adana	Average
	Per Tree				
20-20-0	0.48	0.33	0.36	0.20	0.38
15-15-15	0.15	0.34	0.71	0.40	0.32
18-46	0.06	0.25	0.64	0.00	0.20
33-21	0.09	0.00	0.21	0.40	0.09
Nitrate-26	0.00	0.05	0.00	0.40	0.06
Total	0.78	0.97	1.92	1.40	1.05

As for the trees older than 10 years, the amount of chemical fertilizer used is about 2.93 kg/tree. Hatay has relatively higher use of chemical fertilizer compared to the other cities (3.26 kg/tree). The rate for Osmaniye is 2.56 kg/tree whereas it is 2.55 kg/tree in Mersin. The most frequently applied fertilizer types are found to be 15-15-15 and 20-20-20 (Table 11).

**Table 11. Amount of Chemical Fertilizer Use for Trees Older than 10 Years (kg/tree)**

Fertilizer Types	Hatay	Mersin	Osmaniye	Average
15-15-15	1.19	1.15	1.11	1.17
20-20-20	1.07	0.98	0.89	1.02
33-21	0.65	0.00	0.39	0.38
18-46	0.35	0.33	0.17	0.33
Nitrate-26	0.00	0.09	0.00	0.03
Total	3.26	2.55	2.56	2.93

Producers also use farm manure. In fact, 68.46% of the producers reported to be using farm manure regularly. The rate of farm manure used is 25.85 kg per tree and 562.71 kg per da. When considering the provinces in terms of farm manure use, Mersin is found to have the highest usage rate with 28.48 kg/tree, followed by Hatay (25.93 kg/tree) and Osmaniye (24.00 kg/tree). The lowest rate is in Adana owing to the young age of the olive trees in this region (9.33 kg/tree).

### 3.2.4. Disinfestation

Of the farms included, 36.92% of them stated that they conduct disinfestation practices regularly every year. Regarding each province separately, it is observed that the majority of the producers in Osmaniye and Adana conduct disinfestation regularly (87.50% and 71.43%, respectively). In Hatay and Mersin, on the other hand, the rate of disinfestation is lower (18.75% for Hatay and 39.53% for Mersin).

In the province, 48 farmers stated that they conduct practices for pest control. Generally, 56.25% of the farmers perceive olive budworm as a threat, commonly in Hatay and Osmaniye. Another harmful pest is olive woolly aphid, which is more common in Mersin plantation lands. Other harmful pests are swallow beetle and olive fruit fly (Table 12).

**Table 12. The Distribution of Pests Tried**

Harmful pests	Hatay		Mersin		Osmaniye		Adana		Total	
	Unit	Rate (%)	Unit	Rate (%)	Unit	Rate (%)	Unit	Rate (%)	Unit	Rate (%)
Olive budworm	10	83.34	6	33.33	10	71.42	1	25.00	27	56.25
Olive Woolly Aphid	1	8.33	7	38.89	2	14.29	3	75.00	13	27.08
Swallow Beetle	0	0.00	5	27.78	0	0.00	0	0.00	5	10.42
Olive Fruit Fly	1	8.33	0	0.00	2	14.29	0	0.00	3	6.25
Total	12	100.00	18	100.00	14	100.00	4	100.00	48	100.00

### 3.2.5. Irrigation

Similar to many other cultivated plants, olive also increases in quality and productivity with water. Olive needs approximately 650-700 mm rainfall annually. In the areas where rainfall is irregular or insufficient, effective irrigation should be conducted. Among the farmers interviewed, 49.23% of them reported that they conduct regular irrigation. The most commonly used irrigation method is drip irrigation (53.13%), followed by fallow irrigation(37.50%) and basin (surface) irrigation(9.37%) (Table 13). While fallow irrigation is mostly preferred in Adana, Hatay and Osmaniye, drip irrigation method is more common in Mersin.

**Table 13. Irrigation Methods in the Farms**

Irrigation Methods	Hatay		Mersin		Osmaniye		Adana		Total	
	Unit	Rate (%)	Unit	Rate (%)	Unit	Rate (%)	Unit	Rate (%)	Unit	Rate (%)
Drip	3	17.65	29	78.38	1	33.33	1	14.29	34	53.13
Furrow	12	70.59	4	10.81	2	66.67	6	85.71	24	37.50
Surface/Basin	2	11.76	4	10.81	0	0.00	0	0.00	6	9.37
Total	17	100.00	37	100.00	3	100.00	7	100.00	64	100.00

### 3.2.6. Other Cultivation Practices

**Pruning:** Pruning is one of the periodical practices done to increase the productivity of the yield. It is described as cutting some of the branches and offshoots of the trees at various ages and for different reasons. Pruning is done by a local trimmer in the region. However, producers have concerns regarding the expertise of these trimmers. Pruning in the region is conducted mostly in February-March(54.03%) and in November-December (45.97%).

**Soil Cultivation:** In the research area, 96.15% of the total lands go through soil cultivation every year on a regular basis. This practice is conducted either once a year (25.60%), twice a year (46.40%), or three times a year (28.00%). The first soil cultivation is done in March, then in April, and finally in May. In 60.80% of the lands, cultivation is done by sweeps or disc harrows and in 39.20%, it is done by hoes covering only tree crests reflections.

### 3.2.7. Harvest

The harvest method to choose for olives depends on the ground structure of the plantation floor, the size and the shape of the olive trees, and the land being sloppy or flat. The most common methods are: Traditional methods; the trees are left untouched, picking is done by hand, by shaking the trees, or by scraping the trees. Mechanic Harvesting Methods; Here, simple tools, olive harvesting machines that can be carried on shoulder or on the back, and tractors are used to harvest the olive (Saracoglu, 2008).

In the region, 43.09% of the producers harvest olives by hand. This is followed by pole whipping (26.83%) and scraping by hand (21.14%). In addition, some producers use comb scraping or machines for harvest. In Hatay, the most preferred method is pole whipping (48.44%) while in Mersin, picking by hand is the most commonly used method (53.49%) and comb scraping is widely used in Osmaniye (56.25%). There is no harvest in Adana yet due to the young age of the trees, thus it is not included in the findings in this regard (Table 14).

**Table 14. Harvesting Methods in the Farms**

Harvesting methods	Hatay		Mersin		Osmaniye		Total	
	Unit	Rate (%)	Unit	Rate (%)	Unit	Rate (%)	Unit	Rate (%)
Hand picking	23	35.94	23	53.49	7	43.75	53	43.09
Pole whipping	31	48.44	2	4.65	0	0.00	33	26.83
Hand scraping	8	12.50	18	41.86	0	0.00	26	21.14
Comb scraping	1	1.56	0	0.00	9	56.25	10	8.13
Machine harvest	1	1.56	0	0.00	0	0.00	1	0.81
Total	64	100.00	43	100.00	16	100	123	100.00

The main factor in determining the harvesting method is for the olive processing types (table olive or olive oil). In Hatay, for instance, the producers state that since most of the product is for olive oil production, the damages occuringsince the harvest method affects the quality, and thus pole whipping is a convenient method for them. However, in Mersin, olives are mostly harvested for table and therefore, hand picking or scraping, instead of whipping, is the preferred method.

### 3.3. The Producers' Opinions on Future Olive Plantation

The objective of increasing olive oil production in Turkey has led to an increase in olive production. An increase in the production of an agricultural product requires expansion in production areas and/or an increase in amount of the yield. The governmental supportprograms with the aim of supporting olive and olive oil sectors have led to expansion in the olive plantation areas. If this is to continue, some important precautions should be taken to attain the desired results in the future.

When the participant producers were asked the changes they considered in olive plantation areas, 61.54% of them stated expansion whereas 28.46%of them considered possible restrictions in the areas. The rest 10.00%did not state any changes for the future. For the participants who supported expansion, the main reasons were the high profit of olive products (32.50%), the appropriateness of olive trees to the local soil (27.50%), the convenience of sales for olives(18.75%), low maintenance cost (15.00%), and the satisfaction with the products and the sales (6.25%).

For the participants who postulated restrictions, the factors for them werelack of financial sources (81.08%), the possible drop in the olive prices due to the expected increase in the yield (10.81%), and having no one to take care of the farm in the new generation (8.11%).

### 3.4. Producers' Problems Faced in Olive Production

In order that the olive production sector in the region could improve, the problems, the difficulties, and the needs should be determined first. Then, it could be possible to plan and initiate solutions and sources. In this respect, the study also aims to identify these problems.

The participant producers were asked "What are the problems or difficulties you face during olive production process?". According to the responsirrigation (33.85%), harvest (33.85%), and fertilization (13.85%) are among the most commonly stated obstacles (Table 15). Furthermore, the producers added that they experienced difficulties during disinfestation and sapling supplies.

**Table 15. Producers' Problems in Olive Production**

Problems	Hatay		Mersin		Osmaniye		Adana		Total	
	Unit	Rate (%)	Unit	Rate (%)	Unit	Rate (%)	Unit	Rate (%)	Unit	Rate (%)
Irrigation	15	23.44	27	62.79	2	12.50	0	0.00	44	33.85
Harvest	17	26.56	11	25.58	14	87.50	2	28.57	44	33.85
Fertilization	10	15.63	4	9.30	0	0.00	4	57.14	18	13.85
Sapling Supply	12	18.75	0	0.00	0	0.00	1	14.29	13	10.00
Disinfestation	10	15.63	1	2.33	0	0.00	0	0.00	11	8.46
Total	64	100.00	43	100.00	16	100.00	7	100.00	130	100.00

The most common problems for producers regarding irrigation are the inadequacy of irrigation water and the high cost of irrigation. The producers also stated that they are aware of the significance of drip irrigation system but the slopes of the land are problematic and that even if the land is suitable, they cannot afford the costs of drip irrigation system facility.

As regards to harvesting, the most important issue that farmers face is the cost of harvesting labour. It is a very common practice to make the same payment for harvest fees especially in Hatay and Mersin provinces. In this practice, about ¼ of the product can be given as labour cost. Some producers who do not want to endure this high price prefer harvesting with sticks instead of collecting by hand. The producers also reported other problems they encountered during the harvest. They stated that the harvesting machine has not become widespread, and that there is lack of workers at the desired time and quantity.

During fertilization, the most important problems faced by the farmers are the high fertilizer prices and insufficient knowledge of fertilization. The most important problems encountered in the supply of saplings, on the other hand, are that the saplings are not compatible with their names, that there is a problem in supplying seedlings free from diseases, and that it is difficult to obtain quality saplings because of the high prices of saplings.

#### **4. Conclusion**

Turkey has an important place in the world olive production. Olive planting areas in Turkey are concentrated in the Aegean, Marmara and Mediterranean regions. Olive cultivation in the Mediterranean Region is mainly carried out in Eastern Mediterranean Region (Hatay, Mersin, Osmaniye, Adana and Kahramanmaraş). In recent years, support for the expansion of olive planting areas has reached its goal for this region and has made a rapid increase in planting areas. Therefore, it is very important to present the characteristics of the olive-producing enterprises and the problems in olive production techniques in these provinces and to propose alternative solutions for these problems. Therefore, in this study, the structure and the production techniques of the olive-producing enterprises in the Eastern Mediterranean Region have been determined, problems have been identified and suggestions for developing olive farming in the region have been presented.

Focusing on the Eastern Mediterranean Region, face-to-face interviews were held with 130 olive producers in Hatay, Mersin, Osmaniye and Adana. According to the findings, the average olive field width in the region is 26.57 da, the number of parcels is 2.38 and the parcel width is 11.16 da. The average age of the operators is 53.72 years and the experience period in olive cultivation is 28.66 years.

The most common olive type in the region is gemlik type and plantings of it have usually been made thanks to supports. However, there is a more different situation in Hatay and Mersin. Local olive types of halhali and saurani is frequent in Hatay while ayvalık type is frequent in Mersin. While producers have some obstacles in maintenance processes, they are trying to fulfil them. The most common problems in olive farming are irrigation, harvesting and fertilizing.

Suggestions proposed to contribute to the development of olive production in the region are presented below.

1. The low levels of technical knowledge among the olive producers leads to the reduction of the amount and quality of products. The problems faced during olive production in the region differ from province to province and even from district to district. Therefore, there is a need to focus on issues related to maintenance and quality assurance while considering regional differences to be able to provide specific solutions, plans and programs to improve the situation in each province.
2. There are a large number of olive varieties (Saurani, Halhali, Sariulak, etc.) that have already been adapted to the region. However, the preference of Gemlik type in newly established gardens may lead to the loss of diversity or the negative impact of the industry in case of an emerging disease and pest outbreak. In the Eastern Mediterranean Region, olive genetic resources should be protected and maintained, genetic characteristics of existing crops should be determined and local types should not be neglected in the production of saplings.
3. Harvest of the olive is one of the most important factors affecting product quality and yield. In the region, especially in Hatay, the harvest is made by flapping sticks. The transport and storage of the harvested olives by the sacks negatively affects the quality of the olive and thus, the quality of the final product. During harvesting, the use of modern harvesting techniques, such as simple hand tools, like combs, to prevent damage to trees should be widespread and transport by cases should be encouraged. At this point, the olive processing facilities that serve by appointment, and their assistance to the producers in harvesting the machine or in casing will be effective in increasing the quality of the final product.
4. Some manufacturers do not use chemical input under current conditions. Considering this situation, it can be said that if the necessary certification procedures are performed, the organic olive production potential of the region can be found. If the producers are provided with technical support for certifying these products organically, the products obtained can be evaluated organically on the market.

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