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ARAŞTIRMA MAKALESİ **RESEARCH ARTICLE**

Evaluation of Attitudes and Knowledge Levels of Olive Producers in the Application of Agricultural Pharmaceuticals (Mardin Province)

Mardin İli Zeytin Üreticilerinin Tarımsal İlaç Ürünlerinin Uygulamasında Tutum ve Bilgi Seviyelerinin Değerlendilirlenmesi

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Abstract

Olives are one of the essential nutrients in human nutrition and health, thanks to the vitamins they contain. There are many diseases, pests and weed species in olive gardens that cause a loss of productivity and quality of this important nutrient. Producers use different methods in plant protection practices to combat these existing pests. This study was conducted to determine the awareness levels of olive producers about plant protection practices in Derik district of Mardin province, where olive production was intense in 2020. For this purpose, the information collected through a 20-question survey method conducted face to face with a total of 90 producers in 15 villages through simple random sampling was evaluated on a percentage basis. According to the results of the current study, it was determined that the olive farmers had high education levels, and the majority of them had other non-agricultural incomes besides agriculture. Those engaged in olive cultivation consult plant protection dealerships and the provincial/district Directorate of Agriculture and Forestry in choosing plant protection products and adjusting their dosage. They stated that the brand and active ingredients are important features in the selection of chemical pesticides, and while they apply pesticides in advance for precautionary purposes without seeing the pests and diseases, they do not use the same pesticides against the same diseases and pests every year and apply the recommended dosage. Producers pay attention to the waiting time between the last spraying and harvest time due to the fact that chemical pesticides leave residues on the products, and they take protective measures for their own health during chemical pesticide application. In order to solve the plant protection problems faced by farmers in the agricultural field, cultural measures are generally applied along with chemical control. However, it is inevitable that chemicals will create many negative situations for human and environmental health over time. For this reason, it is important to carry out an effective, economical and environmentally friendly struggle using appropriate methods in plant protection practices in order to avoid being exposed to undesirable side effects.

Keywords: Plant protection problems, Survey, Olive, Mardin

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Öz

Zeytin içerdiği vitaminler sayesinde insan beslenmesinde ve sağlığında yer alan temel besin maddelerin birisidir. Zeytin bahçelerinde bu önemli besin maddesinde verim ve kalite kaybına neden olan, birçok hastalık, zararlı ve yabancı ot türü bulunmaktadır. Üreticiler mevcut olan bu zararlılarla mücadelede bitki koruma uygulamalarında farklı yöntemleri kullanmaktadırlar. Bu çalışma 2020 yılında zeytin üretiminin yoğun olarak yapıldığı Mardin ili Derik ilçesi zeytin üreticilerinin bitki koruma uygulamalarında farkındalık düzeylerini belirlemek amacıyla yapılmıştır. Bunun için, basit tesadüfi örneklemeyle 15 köyde, toplam 90 adet üreticiyle yüz yüze yürütülen 20 soruluk anket metoduyla toplanan bilgiler yüzde oran üzerinde değerlendirmeler yapılmıştır. Çalışma sonuçlarına göre zeytincilik yapan çiftçilerin, eğitim düzeylerinin yüksek ve çoğunluğunun tarımla birlikte tarım dışı başka gelirleri olduğu belirlenmiştir. Zeytincilikle uğraşanların bitki koruma ürünlerini seçiminde ve dozunu ayarlamasında bitki koruma bayiliklerine ve Tarım ve Orman il/ilçe Müdürlüğüne danışmaktadırlar. Kimyasal ilaç seçiminde marka ve etken maddelerinin önemli bir özellik olup, zararlı ve hastalıkları görmeden tedbir amaçlı önceden ilaç uygularken her yıl aynı hastalık ve zararlılara karşı aynı zirai ilacı kullanmadıkları ve tavsiye edilen dozu uyguladıklarını ifade etmişlerdir. Üreticilerin kimyasal ilaçların ürünler üzerinde kalıntı bıraktıklarından dolayı son ilaçlama ile hasat zamanı arasındaki bekleme zamanına özen gösterdikleri ve Kimyasal ilaç uygulama esnasında kendi sağlığı açısından koruyucu önlemleri almaktadırlar. Bununla birlikte ilaçlamadan önce herhangi bir kalibrasyon yapmadıkları ve kullandıkları kimyasal ilaçları karıştırarak uyguladıklarını, ilaçlama sonrasında ise ilaçlama aletlerini temizledikleri ve kullanılan kimyasalların boş kaplarını ve ambalajlarını çevreye rastgele atmadıklarını bildirmişlerdir. Çiftçiler, tarımsal alanda karşılaştıkları bitki koruma sorunlarını çözmede genellikle kimyasal mücadele ile birlikte kültürel tedbirleri de uygulamaktadır. Ancak kimyasalların zamanla insan ve çevre sağlığı açısında birçok olumsuz durum yaratması kaçınılmazdır. Bu sebeple arzu edilmeyen yan etkilere maruz kalmamak için bitki koruma uygulamalarında uygun olan yöntemleri kullanarak etkin, ekonomik ve çevreci bir mücadele yapılması önemlidir.

Anahtar Kelimeler: Bitki koruma sorunları, Anket, Zeytin, Mardin

1. Introduction

Olive, which is one of the basic foods in people's lives, is consumed in the form of cooking, oil, shampoo, cream, etc. in the cosmetic sector. It is evaluated in different forms.

There is a total of 23.054.310 tons of olive production in the world in 2021, and countries such as Spain, Greece, Italy, Turkey, Morocco, Syria, Tunisia, Algeria, Egypt, and Portugal are important olive producers in this production. Türkiye ranks 3rd in the world with an olive production of 1.738.680 tons (Anonymous, 2021a).

Due to Turkey's favorable climatic and geographical conditions, olives are grown primarily in the Aegean, Marmara, Mediterranean, Southeastern Anatolia and Black Sea regions Mete et al., 2023. The total olive production area is 2.976.000 tons with 163.034.684 olive trees in an area of 9.011.261 decares (Anonymous, 2022). Mardin province, which is an important olive production region of the Southeastern Anatolia Region, has a total of 745.999 olive trees, 466.195 of which are fruit-bearing and 279.804 of which are non-fruitful, in an area of 20.123 decares, yielding 4.620 tons of product (Anonymous, 2022).

There are many harmful factors that directly and indirectly cause quantity and quality losses in olive production areas. The constant demand for increased food production has led to the intensive use of chemical fertilizers, pesticides, agricultural machinery, and other natural resources (Güngörmez et. al., 2022). In previous years, many studies on the detection and damage of pests in the olive fields of our country have been carried out in the Aegean, Marmara, Mediterranean, and Southeastern Anatolia (Bodenheimer, 1941; Nizamlıoğlu and Gökmen, 1964; İyriboz, 1968; Kaya, 1979; Keçecioğlu, 1984; Güçlü et al., 1995; Kaçar and Ulusoy, 2005; Kaplan, 2019). The commercial market value of agricultural products damaged by harmful species decreases as a result of consumers not choosing them and not eating them (Alabouid and Bayhan, 2022). Chemical warfare is an indispensable form of struggle used all over the world due to its easy application against pests in agricultural areas and rapid results. However, uncontrolled and haphazard applications of pesticides used in chemical warfare negatively affect human and environmental health. While pesticides make a great contribution to increasing efficiency and quality in agricultural production, on the other hand, pesticides mix with soil, water and air, threatening the existence of living organisms. Farmers generally prefer the chemical warfare method to solve plant protection problems, and unconscious pesticide applications bring about many negativities in terms of human and environmental health (Kaplan and Saltuk, 2021). They reported that most of the producers in Mardin Province are unaware of the harmful insect species that significantly negatively affect the development and efficiency of agricultural production (Kaplan and Bayhan, 2017). Chemicals employed unintentionally to combat harmful elements can lead to the development of resistance in target pests over time, resulting in residues in food products. Conversely, the natural balance among living organisms is disrupted by the eradication of beneficial non-target species, which contributes to the emergence of previously unimportant pests as major ones. Additionally, phytotoxicity can occur in plants. Given the significant role that plant protection problems and practices play in agricultural production, a survey was conducted among olive producers.

2. Materials and Methods

In the study, data was obtained in the form of questions and answers with 20-question survey forms from enterprises producing conventional olives in Derik district of Mardin province. In Mardin province, determined as the research area of the study in 2020, there are a total of 261 farm holdings olives registered in the Farmer Registration System (FRS). (Anonymous, 2021b). Since it is not possible to conduct a study by interviewing all of the farmers operating in Mardin province, the number of farmers surveyed was calculated using the formula below using the "simple random sampling method" (Çiçek and Erkan, 1996). In the study, the sampling volume was determined within 5% error and 95% confidence limits and the number of farmers to be surveyed was determined as 90 people (Kaplan and Baran, 2021).

3. Results and Discussion

3.1. Socio-Economic Characteristics of Olive Producers

When the demographic structure of the participants in the survey study in Mardin province is examined, all olive producers are male, 14% of them are literate, 40% are primary school graduates, 13% are secondary school graduates, 10% are high school graduates and 23% are Collage/University. He was determined to be a graduate of

a college/university (*Table 1*). In the past years, the importance given to agricultural production in the region was low and the people operating in this field were uneducated. The increase in human population in the world and the demand for agricultural products have increased. Therefore, in recent years, with the development of technology and the increase in the quality of life, there has been an increase in the number of educated and conscious people involved in agricultural activities, as in every professional field. As a result of the study, the high number of university graduates in agricultural activities in Mardin is a result of this situation. In parallel with this, 63.3% of apple farmers in Antalya have completed primary school and 14.4% have completed college (Kızılay and Akçaöz, 2009; Çelik and Karakaya, 2017) determined that 20% of those engaged in apple production are literate and illiterate producers, 25% are primary school graduates, 10% are secondary school graduates, 15% are high school graduates and 10% are university graduates. It was determined that 5% of peanut producers in Siirt were illiterate, 56% were secondary school graduates, 26% were high school graduates and 13% were college/university graduates (Dilmen et al., 2020). They reported that all vineyard producers in Mardin are male, 20% of them are illiterate, 64% are primary school graduates, 12% are secondary school graduates, 4% are high school graduates (Kaplan and Baran, 2021).

It was reported that 82% of olive producers in Mardin province have social security and 42% have income other than agriculture (*Table 1*). The reason why most of those engaged in farming have high social security is that they work in the public sector as well as engage in trade. In Seyhan and Yüreğir, 53.6% of the farmers have social security, while 70.5% do not have any income other than agriculture (Emeli, 2006); In Manisa, 64% of farmers have social security, while 66% do not have any other income than agriculture (Karataş and Alaoğlu, 2011); In Nevşehir, 73.5% of the farmers have social security, 26.5% do not have social security, 31.2% have income other than agriculture, and 68.8% do not have income other than agriculture (Erdoğan and Gökdoğan, 2017); They reported that 73.9% of the vineyard producers in Mardin (Savur) province have social security and 55.6% have income other than agriculture (Kaplan and Baran, 2021).

Table 1. Demographic information of olive producers surveyed in Mardin province

(%) Characteristic	Rate (%)
Gender	
Male	100
Female	0
Level of Education	
Illiterate	-
lliterate	14
Primary School	40
Secondary School	13
High School	10
College/University	23
Occupational status	
Farmer	73
Tradesman	12
Manuel Worker	-
Civil Servant	5
Pensioner	10
Social Security	
Yes	82
No	18
Non-Agricultural Income	
Yes	42
No	58

3.2. Knowledge, Attitude And Behavior of Producers Regarding Plant Protection Products

In Mardin province, 63.75% of olive producers make their recommendations and choices based on the provincial and District Directorate of Agriculture and Forestry, 34.50% look at pharmaceutical dealers, and 1.75% look at their own experience and neighbors (*Table 2*). Among the studies similar to this study, Tücer et al. (2004) stated that 65% of the viticulturalists in Manisa Saruhanlı district preferred pesticides based on the Agricultural Organization, 16% based on their experience, 11% based on plant protection dealers and 8% based on their neighbors; Kızılay and Akçaöz, (2009), according to the recommendation of apple growers in Antalya, 54% of them choose pesticides from plant protection dealers, and 10% of them from consultant agricultural engineers; according to Kızılaslan and Somak (2013), 54% of the producers choose their pesticides, 3 of them reported that they got information from agricultural pesticide dealerships, 30% based on their own knowledge and experience, and 15.7% from agricultural district directorate officials. According to Erdoğan and Gökdoğan (2017), 88.9% of the farmers in Nevşehir came from plant protection dealerships. 7.9% said they acted according to their own knowledge and experience, 2.1% said they acted according to advice from agricultural organizations, 0.5% looked at their neighbors and 0.5% said they acted according to the advice of the agricultural engineer who advised them; Çelik and Karakaya (2017) determined that 30.4% of apple producers choose pesticides by consulting subject experts of agricultural organizations, 24.4% by looking at their neighbors and acquaintances, and 21.2% choose pesticides based on their own experience. They stated that they decided to choose pesticides according to the Provincial/District Directorates of Forestry, 52.50% according to plant protection dealerships, 2% according to the consultancy Agricultural Engineer, and 12.5% according to their own knowledge and their neighbors (Kaplan and Baran, 2021).

Table 2. Awareness level of producers about who they get their pesticide advice from

From whom do you get pesticide (fungicide, herbicide and insecticide) advice?	Rate (%)
Vendor	34.50
District Directorate of Agriculture and Forestry	63.75
Own-experience and neighbour	1.75
Consultant Agricultural Engineer	

When purchasing pesticides (fungicides, herbicides and insecticides) used against diseases and pests, 25% of olive producers choose according to whether they have been used before, 35.50% according to their recommended effective substance, 18% according to their brand and 21.50% according to their cheapness. It was determined that they did (*Table 3*). According to Boyraz et al. (2005), 78% of apple farmers choose pesticides according to the density of pests and diseases, 11% according to the prices of pesticides, and 6% according to spraying costs; Çelik and Karakaya (2017) stated that when apple producers buy pesticides, 50.9% of them decide based on the mechanism of action of the pesticide, 28.7% based on the prices of the pesticides, and 20.4% based on the brand of the pesticide. Kaplan and Baran (2021) found that in the selection of pesticides used by viticulture farmers in Mardin against diseases and pests, 10% were based on the pesticide they used before, 20.6% on the suggested active ingredient, 28% on the brand of the drug, and 41.4% on the pesticide. They stated that they did it because it was cheap.

Table 3. Features they pay attention to when purchasing pesticides (Herbicide, Insecticide and Fungicide)

What kind of situations do you pay attention to when purchasing pesticides (Herbicides, Insecticides and Fungicides)?	Rate (%)
Previous use	25
Recommended active substance	35.60
Brand	18
Price	21.40

66% of the growers in Mardin Derik district, which has a great potential for olive production, do not always use the same pesticide against the same diseases and pests, while 34% always use the same pesticide (*Table 4*). Kaplan and Baran (2021) stated that 63.5% of grape growers do not always use the same pesticides in the fight against the same diseases and pests, while 26.5% constantly use the same pesticides.

Table 4. Producers' knowledge levels regarding using the same pesticides against the same diseases and pests

Do you always use the same pesticides for the same diseases and pests?	Rate (%)
Yes	34
No	66

A successful chemical control against pests and diseases in the agricultural field is primarily achieved by spraying at the appropriate time and number. Therefore, while the highest effect is achieved from the pesticides, the pesticide costs are reduced to economical levels. In response to the question of how olive producers decide when to spray pesticides against diseases and pests; 15.8% of the producers detect diseases and pests when they first see them, 40.60% according to the recommendations of experts in the provincial/district directorates of agriculture and forestry, 30.6% by consulting agricultural pesticide dealers, and 9% detect diseases and pests. and 4% reported that they decided the time to spray pesticide based on other farmers around them (*Table 5*). Here, 15.8% of the farmers reported that they sprayed pesticides when they first encountered diseases and pests. In this case, it can be thought that farmers who know the pests and diseases have the essential technical knowledge, although they do not have enough knowledge.

In generally, the application times of the drugs are considered correct considering the development periods of the plants. However, it does not seem possible for manufacturers to determine the exact application time of drugs by taking into account the biology of pests and diseases. Because it requires technical knowledge and experience on this subject, this can be done with training given by subject experts of agricultural organizations.

In similar studies by Yücel et al. (1995), 42.15% of the agricultural producers in Harran district of Şanlıurfa province reported that they decided to spray pesticides based on their experience, 9.80% by looking at their surroundings, 34.31% by applying to agricultural organizations, and 13.72% by consulting agricultural pesticide dealers. Üremiş et al. (1996), in a survey conducted in the Çukurova region, 38.64% of the farmers responded according to their experience and dealers' statements, 35% according to their experience, 19.09% according to dealer statements, 5.45% according to the recommendations of technical organizations, 1.82% stated that the dosage and timing of the drugs used were adjusted according to the drug label. Zeren and Kumbur (1998) started that 40.18% of the farmers determined pesticide doses and application times according to the recommendations of the pharmaceutical seller, 29.92% according to their experience, and 16.23% followed the drug labels. İnan and Boyraz (2002) determined that 44.20% of the agricultural producers in the Konya region determined the spraying time based on their own experience, 24.20% on the advice of agricultural pesticide dealers, 20% by consulting the growers in the vicinity, and 11.60% by applying to the provincial/district directorates of agriculture. In a survey conducted by Kadıoğlu (2003) in Tokat province, 58.74% of farmers decided on the time of spraying based on agricultural engineers, 29.14% decided on their own, 6.20% based on advice from pesticide dealers and 5.81% on the advice of agricultural pesticide dealers. Stated that they benefited from other farmers around them. Boyraz et al. (2005), 35% of apple farmers stated that they sprayed for pests or diseases when they first saw them, and 22% stated that they applied pesticides using predictive and early warning methods. Karaçayır (2010) reported that 43.2% of apple farmers in Karaman province applied pesticides before encountering pests, and 56.8% reported that they decided to spray after they first encountered pests. Karataş and Alaoğlu (2011) stated that 56% of grape growers in Manisa resorted to spraying when they first encountered diseases or pests, and 34% of them resorted to spraying without seeing the diseases and pests. Kaplan and Baran (2021), when 17% of grape growers in Mardin province first encountered diseases or pests, 25% according to the recommendations of the Provincial/District Directorate of Agriculture and Forestry, 36% by consulting agricultural pesticide dealerships, 12% of them reported that they did not decide on the time to spray without encountering diseases or pests, and 10% of them stated that they did not decide on the time of spraying by looking at other producers around them.

In deciding on the dosage for the use of chemical pesticides against pests in olive fields, 61% of the farmers rely on plant protection dealers, 31.75% on the Provincial/District Directorates of Agriculture, 2% on their own knowledge and 5.5% on their neighbors' experiences. They did (*Table 6*). Özkan et al. (2003) found that 41.71% of citrus farmers act according to the drug's package insert, and 27.81% act according to their own knowledge and experience when deciding on the drug dosage; Kalıpçı et al. (2011), in Konya province, 8.3% of farmers consult

Table 5. Knowledge levels of olive producers about determining the time for monitoring pests and diseases in olive orchards pests

How do you decide when to spray against pests and diseases in olive orchards?	Rate (%)
Vendor	40.60
District Directorate of Agriculture and Forestry	30.60
First sighting of pests and disease	15.80
Before sighting of any disease and pests	9
Looking at other producers	4

the drug's package insert, 26.6% their own information, 11.6% their neighbor's advice, 33.3% consult their plant protection dealers, 10% in adjusting the drug dose. 8% of them did so by asking the recommendations of the Provincial/District Directorates of Agriculture, 3.3% of them did so by asking the Chambers of Agriculture, and 5.8% of them did so according to the recommendation of the consulting agricultural engineer; Gedikli (2012) asked the plant protection dealers and Agricultural Engineers of 33.33% of the farmers to choose the pesticide dose; Gözener et al. (2017), in choosing the drug dose of farmers, 90.28% rely on the recommendations of pharmaceutical-fertilizer dealers, 59.72% on the usage labels of the drugs, 40.28% on their own knowledge and experience, 1% on 39% of the Food, Agriculture and Livestock Provincial/District Directorates do it according to the recommendations of the subject experts and 1.39% according to the severity of the diseases; Kaplan and Baran (2021), While producers in Mardin province decide on the dosage of pesticides in chemical warfare against pests in their vineyards, 68% consult the plant protection dealer, 20.8% consult the Provincial/District Directorates of Agriculture, 7.2% consult their own experiences and 5% consult their surroundings. Reported that they made dose adjustments.

Table 6. Knowledge level regarding the dosageof pesticides

How do you adjust the dosage of pesticides (insecticides, fungicides and herbicides)?	Rate (%)
Vendor's advice	61
District Directorate of Agriculture and Forestry	31.75
Own experiences	2
Neighbour's advice	5.5

In terms of knowledge about the suggested dose of the pesticide, it was reported that 91.6% of the olive producers used the recommended dose, 4.2% used a dose above the suggested dose, and 4.2% used a dose below the recommended dose (*Table 7*). Using the appropriate dose recommended by olive producers in chemical control is likely to increase the success rate in combating pests. Similar to the results of this study, Tücer et al. (2004) found that 72% of viticulture farmers used the recommended dose, 26% applied a dose above the recommended dose, and 2% applied a dose they deemed appropriate; According to Kalıpçı et al. (2011), 33.3% of the producers make their drug dose selection according to the recommendations of plant protection dealers. Peker (2012) stated that 88% of farmers in Konya province employed the suggested dose, 8% increased the drug dose to get better results, and 4% applied a dose below the recommended dose; Erdoğan and Gökdoğan (2017) reported that 50.7% of farmers used the recommended dose and 50.3% used more than the recommended dose; Akar and Tiryaki (2018) stated that 71.4% of the producers follow the recommendations of plant protection dealerships in selecting drug doses; Kaplan and Baran (2021) reported that 87.8% of Mardin vineyard producers applied the recommended dose, and 12.2% applied a dose above the recommended dose. Contrary to these studies, Boz et al. (1998) stated that 64.47% of farmers in Aydın province used a dose higher than the recommended dose.

Table 7. Information levels regarding the recommended dosage of the pesticide

Usage of pesticide (fungicide, herbicide and insecticide) according to the recommended dosage?	Rate (%)
Recommended dosage	91.6
Exceeding recommended dosage	4.2
Below the recommended dose	4.2

Considering the opinions of olive producers in Mardin regarding the pesticide residue problem; 34.20% reported that pesticides left residue on the products, 45.80% reported that they left little residue on the product,

and 20% reported that they did not leave any residue on the product (*Table 8*). Özkan et al. (2003), 70.4% of producers in Antalya stated that they left pesticide residues on their products, 10.4% stated that pesticide residues were removed by washing, and 19.2% reported that they had no idea about this issue. Karaçayır (2010), 34.3% of those who produce apples say that pesticides may leave residues on the product, 23.8% say that all agricultural chemicals leave residues, 18.1% say that they will not leave residues when the recommended dose of agricultural chemicals are applied, 13.4% think that residues can be removed by washing, and 10.4% stated that pesticides do not leave residue; Kalıpçı et al. (2011) repoted 70.4% of farmers in Antalya province reported that they left pesticide residues on their products, 10.4% were unaware that cleaning removes pesticide residues. 19.2% did not know. Erdoğan et al. (2017), in Adıyaman, 38.7% of almond growers reported that their products left pesticide residues, 32.3% reported that they left little residue, and 29% reported that there were no residues in their products. Peker (2012) stated that 80% of tomato producers in Konya say that pesticides do not leave residues on the products, 20% say pesticides leave residues, and 40% say pesticide residues will disappear with washing. Akar and Tiryaki, (2018) 23.3% of the producers in Antalya say that pesticide residues on the products will disappear by washing, 24.9% say that pesticides do not leave residues, 34.1% say that some pesticides may leave residues, and 17.7% do not have information about pesticide residues. They stated. Regarding the pesticide residue of peanut producers in Siirt, 33% of the producers reported that it was destroyed by rain washing, 39% did not have information about the residue, 16% reported that pesticides left residue and 12% reported that their pesticides did not leave residue (Dilmen et al., 2020).

Table 8. The knowledge levels of the growers about the pesticides leaving residue on the products

Do you know that pesticides leave residues on products?	Rate (%)
Leaves a residue	34.20
Leaves little residue	45.80
Leaves no residue	20

79% of the producers who use pesticides in their olive groves stated that they attach importance to the waiting time in pesticides, 8.50% do not care, and 12.50% sometimes care (*Table 9*). It is an important result that the majority of producers comply with the waiting period. Boyraz et al. (2005), while 71% of apple farmers paid attention to the time to wait between the last spraying and harvest time, 29% reported that they did not pay attention to this. Karaçayır (2010) determined that 43.2% of the farmers pay attention to the waiting times between the last spraying and harvest, 32.8% know the waiting time but do not pay attention, and 24% do not know the waiting time. Erdoğan and Gökdoğan (2017) reported that 80% of potato growers pay attention to the waiting time between the last pesticide application time and the harvest time, and 20% do not pay attention to the waiting time. Gözener et al. (2017), 91.67% of the growers reported that they did not know the time from the last spraying to the harvest, 6.94% of them knew and did not pay attention to this period, and 1.39% of them knew and paid attention to the time. Akar and Tiryaki (2018) determined that 87.3% of the farmers in Antalya comply with the waiting periods between the last spraying and harvest, 12.7% of them do not comply with the time period between the last spraying and harvest. Kaplan and Baran (2021) stated that 88.6% of the wine famersusing pesticides in Mardin paid attention to the pesticide waiting times, while 11.4% stated that they did not.

Table 9. The knowledge levels of the famers about the time they should wait between the last spraying and the harvest time

Do you pay attention to the waiting time of pesticides?	Rate (%)
Yes	79
No	8.50
Sometimes	12.50

During spraying in Mardin, 58.34% of olive growers stated that they used protective clothing and masks, 12.50% of them sometimes used them, and 29.16% of them never used them. It has been reported that more than half of the olive growers comply with the protective measures and act carefully when spraying (*Table 10*). However, Özkan et al. (2003) found that 68.8% of farmers took protective measures at the time of pesticide application, while 31.2% did not; Tücer et al. (2004), 57.82% of gowers used protective clothing and equipment when spraying, 42.18% did not; According to the study conducted by Akbaba (2010), 61% of the producers used masks during

spraying; Bayhan et al. (2015) found that 76% of manufacturers take protective measures during spraying and 24% do not take any protective measures; Erdoğan and Gökdoğan (2017) stated that 84.7% of the breeders did not wear protective clothing and masks at the time of drug application, while 15.3% took protective measures. According to Akar and Tiryaki (2018), 42.1% of the farmers in Antalya use protective clothing and equipment while using pesticides, while 31.7% do not use them because they do not consider it important; Kaplan and Baran (2021) stated that 48% of vineyard growers use protective equipment during spraying in Mardin, 16% use it occasionally and 36% do not use any protective equipment.

Table 10. Producers' knowledge levels regarding protective measures to be taken during pesticide application

How do you take care of your health while spraying? (Using protective clothing, mask, glasses and gloves during application)	Rate (%)
I always use	58.34
I sometimes use	12.50
I never use	29.16

When asked what do you do with empty pesticide containers after spraying, olive producers reported that 7.5% of the participants washed and reused them, 51.60% threw them away, 27.5% burned them and 13.4% randomly threw them into the environment (*Table 11*). Similar studies on the subject have found that farmers exhibit different attitudes and behaviors. Özkan et al. (2003), 7.45% of farmers burned empty pesticide packages, 21.81% threw them away, 14.36% buried them in the ground, and 7.45% randomly threw them around; Tücer et al. (2004), 60.54% of the producers randomly throw their empty pesticide packages into the environment, 4.98% reuse them for various purposes, 19% bury them in the ground and 15.48% destroy them by burning; Erturk et al. (2012), 35.6% of growers buried empty pesticide containers under the ground, 34.6% threw them into the garden/field, and 29.8% left them in the trash; Akbaba (2010) stated that 61.1% of farmers in the Çukurova region collect empty pesticide containers in one area and then destroy them by burning them; Karataş and Alaoğlu (2011) found that 65.3% of viticulturalists destroy empty agricultural chemical containers by burning them, 24% hrow them around haphazardly, and 10.7% put them under the ground; Çelik and Karakaya (2017) reported that 50% of apple producers in Bingöl collected the empty pesticide packages and containers in a suitable area and destroyed them by burning them, 30% put them in garbage bins and 20% collected them in a corner of the garden. Akar and Tiryaki (2018) reported that in Antalya province, 8.5% of the producers randomly threw the empty medicine containers into their surroundings, 55% burned them, 10% put them under the ground, 26.2% put them in bags and put them in the trash, and 0.3% put them in the trash. He stated that he used it again for different purposes. Kaplan and Baran (2021) found that in Mardin, 2% of the vineyard producers demolished and reused the pesticide containers emptied after spraying, 15.6% buried them in the ground, 20% threw them into garbage bins, and 24.3% buried them somewhere. They stated that they collected and burned them and 38.1% of them threw them around haphazardly.

Table 11. Producers' knowledge levels regarding the evaluation of empty pesticide containers

What do they do with empty pesticide (fungicide, herbicide and insecticide) containers?	Rate (%)
Wash it for further use	7.5
Bury in the ground	-
Put in trash	51.60
Burn	27.50
Randomly throw around	13.40

It was determined that 83% of the olive producers cleaned the spraying equipment after spraying, 12% sometimes cleaned it and 5% did not clean it (*Table 12*). Tücer et al. (2004) While 85.42% of grape producers in Manisa clean their sprayers after spraying, 14.58% do not; Ertürk et al. (2012), 69.2% of agricultural producers in Iğdır stated that they washed the sprayer after spraying, 27.9% said they washed it occasionally, and 2.9% did not wash it; Erdoğan et al. (2017), after spraying in almond orchards, 90.3% of the growers cleaned the sprayer, 6.5% never cleaned it and 3.2% cleaned it occasionally; Kaplan and Baran (2021), 78.3% of grape producers reported

that they cleaned the sprayer after spraying, 14% reported that they cleaned it occasionally, and 7.7% did not clean it.

Table 12. Producers' knowledge levels about cleaning the sprayer after spraying

Do you wash the sprayer after spraying?	Rate (%)
Yes	83
Sometimes	12
No	5

It was started that 17.5% of those engaged in olive production applied pesticides by mixing them, 38.5% occasionally applied them as a mixture, and 44% never used them as a mixture (*Table 13*). As a matter of fact, similar to the study by Boyraz et al. (2005) found that 83% of apple growers did not apply pesticides in mixtures, and 17% did not apply them in mixtures; Peker (2012) stated that 56% of farmers apply pesticides in mixtures, 24% apply pesticides without mixing, and 20% occasionally use pesticides in mixtures; Erdoğan and Gökdoğan (2017) reported that 56.1% of farmers use pesticides in mixtures, and 43.9% use pesticides without mixing; Erdoğan et al. (2017), 78.5% of almond growers use pesticides in mixtures, 19.4% occasionally use them in mixtures, and 2.1% never use them in mixtures; Kaplan and Baran (2021) stated that 56.5% of vineyard producers use pesticides by mixing them, 16.5% use them by mixing occasionally, and 28% use pesticides without mixing them at all.

Table 13. Knowledge levels of producers about the mixing and use of pesticides

Do you mix pesticides?	Rate (%)
I mix pesticides	17.5
I sometimes mix pesticides	38.5
I never mix pesticides	44

To the question of how farmers producing olives in Mardin store pesticides; It was determined that 72.4% of the farmers kept it in cool warehouses and shelters, 14.6% in a suitable place in their homes and 13% in medicine warehouses (*Table 14*). Peker (2012) reported in a study that 64% of farmers keep pesticides in cool warehouses, 22% in a suitable place in their homes, and 10% in medicine warehouses. Çelik and Karakaya (2017) reported that 50% of apple producers keep the pesticides they use in barns, or in a shelter, 35% in a special cupboard and 15% reported that they store it somewhere in the house. Akar and Tiryaki (2018), 1.3% of farmers in Antalya store pesticides in a suitable area of their homes, 22% in a private They reported that they kept it in a cabinet, 4% on shelves in a special room, 5% in barns and animal shelters, 57.7% in their warehouses, 8.2% bought as much as they would use, and 1.8% reported that they kept it in other places.

Table 14. Knowledge levels of farmers regarding the preservation of pesticides

Where do you preserve pesticides?	Rate (%)
Cool warehouse, warehouse, barn etc. in shelters	72.40
In a convenient place in their home	14.60
In drug stores	13

It was reported that 66.2% of the producers applied chemical control, 14.84% applied cultural control, 11% applied biotechnical control methods and 2.62% did not apply any method (*Table 15*). It was reported that in Tokat, which is similar to this conflict, 43.58% of the farmers chose cultural measures, 33.33% mechanical warfare and 23.07% physical warfare instead of chemical warfare (Kadıoğlu, 2003). 83.3% of farmers use chemical warfare to combat pests, diseases and weeds (Akar and Tiryaki, 2018); It was reported that 71% of vineyard growers applied chemical control, 12.9% cultural control, 8% mechanical control, 5% physical control and 3.1% biotechnical control methods (Kaplan and Baran, 2021).

While 78% of olive producers answered "I agree" to the statements regarding the pesticides they use may be harmful to human and environmental health and other living organisms, 19% of the producers stated that they did not know that they were harmful and 3% did not agree that they were harmful (Chart 16). Akbaba (2010), in a survey conducted in Adana, reported that more than 70% of farmers "fully agreed" with the statement that the

pesticides they use could harm human and environmental health and other living organisms. Jallow et al. (2017) stated in their research that 71% of 250 producers stated that the pesticides used were harmful to health and 65% were harmful to the environment. Akar and Tiryaki (2018) found that 87.5% of growers agreed with the statement regarding the harmful effects of pesticides in agriculture. While 70% of the producers stated that they completely agreed with the claims about the harmful effects of pesticides on the environment and other living organisms, they reported that there were no producers who strongly disagreed with the claims about the harmful effects of pesticides on the environment and other living organisms.

Table 15. Awareness levels of producers regarding methods of combating diseases, pests and weeds

What control methods do you use against pests, diseases and weeds?	Rate (%)
Chemical control	66.20
Cultural control	14.84
Mechanic control	-
Physical control	-
Biotechnical control	11
Biologic control	-
None	7.96

Table 16. Producers' opinions about the negative effects of pesticide use on human and environmental health

Are pesticides hazardous to human and environmental health?	Rate (%)
I agree	78
I don't agree	3
I don't know	19

4. Conclusions

Unconscious and untimely chemical control against harmful organisms in agricultural production areas has negative effects on human and environmental health. Therefore, in order to prevent these negative situations from occurring, a survey was conducted with olive producers in Mardin province in order to raise awareness in the application of plant protection products in olive gardens. When faced with problems related to plant protection and applications, which have an important place in these areas, the knowledge levels of the relevant producers were determined, as were who they consulted and what they did to solve the problems, and what they paid attention to in the selection and application of plant protection products. As a result of the study, it was determined that 66.2% of the producers resorted to chemical control against existing diseases, pests and weeds in the olive fields, and 63.75% of the producers consulted the Provincial and District Directorate of Agriculture and Forestry in pesticide selection and dosage application. They stated that the majority of producers pay attention to the required waiting period between the last spraying time and the harvest time, since pesticides leave residues on the products. However, they knew that they definitely agreed with the idea that pesticides would be harmful to human and environmental health and other non-target living organisms. They stated that they took the necessary protective measures for their own and environmental health during the spraying and that they took care in cleaning the spraying equipment, storing pesticides and destroying empty boxes.

As a result, it is extremely important that plant protection activities are designed to reduce the possible negative effects on the agroecosystem and biological balance in terms of sustainable agricultural production. The fight against the main diseases and pests in olive groves should be carried out within the framework of integrated pest management; In cases where chemical control is inevitable, it will be beneficial to use selective pesticides that are relatively safe for human and environmental health. Thus, if practices that reduce the use of chemical pesticides are preferred, pesticide residues and pests will be prevented from gaining resistance to pesticides, the natural balance between human and environmental health as well as living things will be preserved, and there will be a certain level of reduction in the production costs of the producers.

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Ethical Statement

There is no need to obtain permission from the ethics committee for this study.

Conflicts of Interest

There is no conflict of interest between the article authors.

Authorship Contribution Statement

Concept: Kaplan, M.; Design: Kaplan, M.; Data Collection or Processing: Kaplan, M.; Statistical Analyses: Kaplan, M.; Literature Search: Kaplan, M.; Writing, Review and Editing: Kaplan, M.

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