

## **Assessment of Workplace and Demographic Characteristics of Agrochemical Markets in Southeastern Anatolia Region of Turkey**

**Türkiye Güneydoğu Anadolu Bölgesinde Bitki Koruma Ürünleri Bayilerinin İş Yeri ve Nüfus Bilimsel Özelliklerinin Değerlendirilmesi**

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### **ÖZET**

Güneydoğu Anadolu bölgesinde 2021-2022 yıllarında yapılan bu çalışma ile bölgede hizmet veren bitki koruma ürünleri bayilerinin iş yeri özellikleri ve nüfus bilimsel özellikleri bakımından değerlendirilmesi ve böylece ülkemiz ve bölgemiz ekonomisinde önemli bir yer tutan tarımsal üretime ve tarımsal çalışmalara katkı sunması amaçlanmıştır. Çalışma bölgemizde tesadüfi olarak seçilen 120 adet bitki koruma ürünleri bayisi ile anket çalışması yapılmıştır. Elde edilen bulgulara göre; Görüşülen bayilerin %72' sinin erkek, %28'inin kadın personelden oluştuğu bunların %53' ünün bayi sahibi ve %47' sinin bayi çalışanı olduğu, Görüşülen bayilerin %57' sinin 28-38 yaş aralığında olduğu %4' nün 18-28 yaş aralığında olduğu ve 58 yaş üstünde bayi sahibi/işletmecisi olmadığı belirlenmiştir. Ayrıca görüşülen bayilerin %53 1-6 yıl, %25' nin 7-16 yıl, %22' sinin ise 17-26 yıl arasında bayi işletmecisi olduğu, bayilerin, %31' nin Bitki Koruma, %27' sinin Tarla Bitkileri ve %14' nün Bahçe Bitkileri bölümünden mezun olduğu %28' nin ise fakülte veya yüksekokulların Tarım makineleri, Tarım Ekonomisi, Organik Tarım vb. bölümlerinde mezunu olduğu tespit edilmiştir. Görüşülen bayilerin %5' inin teknisyen ve %18' inin tekniker olduğu Görüşme yapılan bayilerin; %76' sının Lisans sonrası herhangi bir eğitiminin olmadığı, %18'nin Yüksek Lisans öğrenimine devam ettiği, %6' sının ise yüksek lisans mezunu olduğu tespit edilmiştir.

**Anahtar Kelimeler:** Bitki Koruma Ürünleri Bayileri, Türkiye, Güneydoğu Anadolu Bölgesi, Nüfus Bilimsel Özellikler, İş Yeri Özellikleri

### **ABSTRACT**

This study conducted in Southeastern Anatolia Region in 2021-2022 aimed to evaluate the workplace and population characteristics of agrochemical markets in the region and thus contribute to agricultural production and activities, which hold an important place in our country's and region's economy. A survey was conducted with 120 randomly selected agrochemical markets in our study area. According to the findings, 72% of the interviewed dealers were male, and 28% were female personnel. 53% of them were business owners and 47% were employees. 57% of the interviewed dealers were in the age range of 28-38, 4% were in the age range of 18-28, and there were no business owners/operators above 58 years of age. Furthermore, 53% of the dealers had been in the business for 1-6 years, 25% for 7-16 years, and 22% for 17-26 years. It was determined that 31% of the dealers graduated from the Plant Protection Department, 27% from the Field Crops Department, and 14% from the Horticulture Department, while 28% were graduates of faculties or higher schools in

Agriculture Machinery, Agricultural Economics, Organic Agriculture, etc. Moreover, 5% of the interviewed dealers were technicians, and 18% were technologists. It was found that 76% of the interviewed dealers had no post-graduate education, 18% were pursuing a master's degree, and 6% had a master's degree.

**Keywords:** Agrochemical markets, Turkey, Southeastern Anatolia Region, Population Characteristics, Workplace Characteristics

## 1. INTRODUCTION

Due to the increasing population and decreasing agricultural land, it is believed that current production is not sufficient to meet people's food needs. In addition, many industrial products depend on agricultural production for their raw materials. Therefore, production that will feed people and provide raw materials for the industry should be carried out by the principles of the lowest cost, highest yield, and highest quality.

To use modern agricultural techniques and increase agricultural production, it is necessary to combat harmful organisms, diseases, and weeds that cause economic losses. Agricultural producers prefer chemical control over other methods because they achieve fast and significant results in the fight against these factors. In preventing damage caused by harmful organisms to products in agricultural production areas, chemical control is used more than 95% of the time (Kışlalıoğlu and Berkes, 1985; Turabi, 2007; Tiryaki et al., 2010).

According to a study conducted by Yıldırım (2000), it was stated that there could be a yield loss of 45-65% in products when plant protection products are not used. However, when plant protection products are not used by instructions, negative consequences can arise for human and environmental health (Öztürk, 1990). Recently, the increasing negative effects of the active ingredients of chemical plant protection products on the environment, human, and animal health have raised concerns (Nicolopoulou-Stamati et al., 2016).

With the publication of biologist Rachel Carson's book "Silent Spring" in 1962, the effects of insecticides on human and environmental health began to be recognized (Levine, 2007). Reports by Hallenbeck and Cunningham-Burns (1985) and the National Toxic Network (NTN) (2009) also described the acute and chronic health effects of pesticides. Pesticide exposure can occur through inhalation, skin absorption, and ingestion, and can cause serious health problems in the long term, as well as immediately noticeable health problems in the short term.

The acute health effects of pesticides, depending on the type, can include eye, nose, or throat irritation, difficulty breathing, skin irritation, redness, headache, stomach ache, diarrhea, nausea, vomiting, dizziness, tremors, muscle weakness, and blurred vision. Chronic effects include brain cancer and other types of cancer, birth defects, dementia, obesity, miscarriage and infertility, autoimmune diseases (diabetes), asthma, allergies, and chemical sensitivities (ILO, 1991; WHO, 2008).

As a result of the widespread and uncontrolled use of chemical plant fertilizers and plant protection products, soil pollution has become a global problem today. This situation poses serious threats to sustainable agriculture and food safety. Studies have shown that excessive chemical use damages soil quality, reduces soil biological diversity, reduces soil organic matter content, and therefore reduces plant productivity (Kafaei et al., 2019).

In Turkey, in the year 2021, the amount of plant protection products used was quite high, with 11,070,658 kg-L of insecticides, 19,097,968 kg-L of fungicides, 13,319,891 kg-L of herbicides, 2,342,473 kg of acaricides, 282,948 kg-L of rodenticides and molluscicides, and 6,851,062 kg-L of others, totaling 52,965,000 kg-L (Anonymous, 2022).

The Southeast Anatolia Region is known as one of the first agricultural regions. The region has abundant water sources, fertile lands, and suitable climate conditions. Thanks to these features, it consists of basins where many crops can be grown in different seasons of the year. The economy of the Southeast Anatolia Region is based on agriculture and animal husbandry. The production is quite high in the region due to its wide agricultural lands and fertile soils. With the favorable climatic conditions for agriculture, the agricultural sector plays an important role in the region, which has basins where many crops can be grown in different seasons of the year. As a result of the completion of projects aimed at developing agriculture in the region, an increase in irrigable agricultural land is expected. This situation also brings the potential for an increase in the diversity of the crops cultivated.

In the study area in the year 2021, the quantities of plant protection products used were as follows: Insecticides 824,754 kg-L, Fungicides 1,160,931 kg-L, Herbicides 1,429,747 kg-L, Acaricides 138,165 kg-L, Rodenticides and Molluscicides 8,556 kg-L, and Other products 98,820 kg-L, with a total of 3,660,973 kg-L (Anonymous, 2022).

Plant protection products, which are of great importance for regional and national agriculture, provide efficient production by reducing the impact of harmful organisms. In this respect, agrochemical markets serving in the region also play an important role. Their activities, effectiveness, and advice and recommendations provided to producers contribute to the more efficient implementation of agricultural activities.

This research aims to analyze the business characteristics and population demographic characteristics of agrochemical markets in the region.

## 2. MATERIAL AND METHOD

The primary material of this research consists of 11-question interview forms prepared to assess the workplace characteristics and population information of plant protection product dealers operating in the Southeast Anatolia Region. The interview forms were filled out as a result of face-to-face interviews conducted with plant protection product dealers selected to represent the Southeast Anatolia region, specifically Diyarbakır, Şanlıurfa, and Mardin provinces. The obtained data encompasses the findings collected during the completion of these forms.

In the selected representative provinces, there are a total of 250 agricultural pesticide dealers, with 60 in Diyarbakır, 50 in Mardin, and 140 in Şanlıurfa (Anonim, 2021). The proportional sample size formula was utilized in determining the agricultural pesticide dealers for the survey study (Miran, 2003; Miran, 2009). This method has been employed in numerous studies (Aşkan and Dağdemir, 2015; Karakaya and Kızıloğlu, 2017; İkkat Tümer, 2017; Pala and Mennan, 2018; Akar and Tiryaki, 2018).

$$n = \frac{N * p * (1 - p)}{((N - 1) * \sigma^2) + p * (1 - p)}$$

To ensure that the sample size is sufficiently large to reduce the potential error, it is appropriate to accept the value of  $p=0.5$ , which maximizes the product of  $p(1-p)$  (Engindeniz and Çukur, 2003). In the formula,  $n$  represents the sample size,  $N$  denotes the population size,  $p$  represents the proportion of the characteristic being studied in the population ( $p=0.5$ ),  $(1-p)=0.5$ ,  $\sigma^2$  signifies the variance (with a value of 1.96 for a 95% confidence interval in the table), and  $r$  represents the margin of error (7.5%).

$$\sigma^2_p = r / \left( \frac{Z\alpha}{2} \right) = \frac{0.075}{1.960} = 0.03826$$

$$n = \frac{250 * 0.5 * (1 - 0,5)}{[(250 - 1) * (0.03826)^2] + (0,5 * 0,5)} = 101,709$$

Utilizing the proportional sampling formula with a 95% confidence level and a 7.5% margin of error, the sample size was determined to be 102. The number of agricultural pesticide dealers to be interviewed in this study was calculated using the proportional distribution method based on the total number of agricultural pesticide dealers in Diyarbakır, Mardin, and Şanlıurfa provinces (Table 1).

**Table 1.** Distribution of the Number of Dealers to be Surveyed in Diyarbakır, Mardin, and Şanlıurfa Provinces

Provinces	Total Agrochemical Dealers *	Number of Agrochemical Dealers to be Interviewed	Number of Agrochemical Dealers Interviewed
Diyarbakır	60	24**	31
Mardin	50	20	26
Şanlıurfa	140	57	63
<b>Total</b>	<b>250</b>	<b>101</b>	<b>120</b>

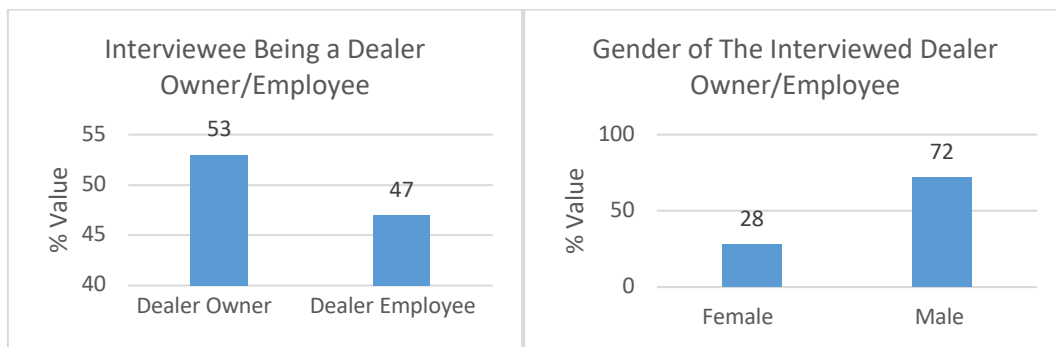
\* Total number of pesticide dealers in provinces

\*\* $(60 \times 102) / 250 = 24.48$

The interview forms were completed by the researchers to accurately capture the information relevant to the objectives of the study. The results of the research were evaluated regarding the workplace characteristics and population features of the plant protection product dealers. The data were analyzed using percentage calculations, and the findings were presented in the form of tables and graphs.

### 3. RESULTS AND DISCUSSION

It was determined that 72% of the interviewed dealers were male and 28% were female, of which 53% were dealer owners and 47% were dealer employees (Figure 3.1).



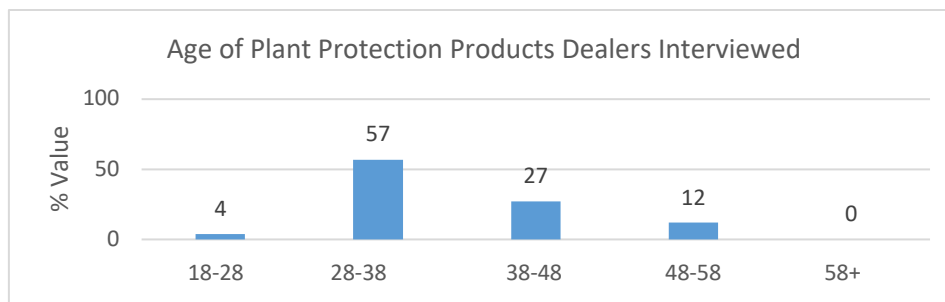
**Figure 3.1.** Dealer Staff and Gender Status

In a study conducted in Manisa province in 2008, it was reported that 91.7% of the pesticide dealers were male and 8.3% were female employees (Karabat and Atış, 2008). In the GAP region, it was found that there were no female employees in pesticide dealerships (Kaplan and Bayhan, 2014). In a study conducted in Şanlıurfa province in 2015, it was reported that 98% of the pesticide dealers were male and 2% were female employees (Kara et al., 2015).

It was also reported that 96.9% of the pesticide dealers in the GAP region were male and 3.1% were female employees, and in the pesticide dealerships in the GAP region, 98.2% were male and 1.8% were female employees (Kara and Şimşek, 2016; Mutlu and Cici, 2017). In a study conducted in Bursa province in 2019, it was reported that 92.9% of the pesticide dealers were male and 7.1% were female employees, of which 53.6% were dealer employees and 46.4% were dealer owners (Erbek, 2019).

Our findings are similar to other studies, but an increase in the number of female employees was observed.

It was found that 57% of the interviewed dealers were between 28-38 years old, 4% were between 18-28 years old, and there were no dealers or operators over 58 years old (Figure 3.2).



**Figure 3.2.** Age of Dealer Operator/Staff

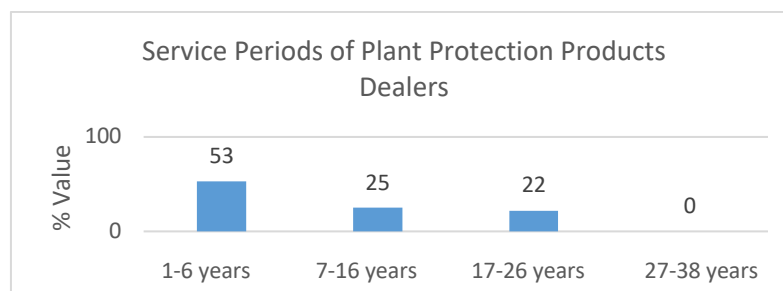
In the study conducted on agrochemical markets serving in the GAP region, it was determined that 44% were between 31-40 years old, 35% were between 20-30 years old, 3% were between 51-60 years old, and 2% were 61 years old and above (Kaplan and Bayhan, 2014).

In Şanlıurfa, it was determined that 55.4% of the agrochemical markets were between 30-45 years old (Kara et al., 2015). In another study conducted on agrochemical markets in the GAP region, it was found that 23.1% were between 40-49 years old, 14% were 50 years old and above, and 4.3% were 19 years old or younger (Mutlu and Cici, 2017).

According to the study conducted in Bursa province in 2019, the average age of agrochemical markets was 40.5, 36.9% were between 31-43 years old, and 2.3% were 70 years old or above (Erbek, 2019).

When the data obtained from our study is examined, it is seen that the age range in our study area is lower than in other studies.

According to the study, it was determined that 53% of the interviewed dealers had been in business for 1-6 years, 25% for 7-16 years, and 22% for 17-26 years (Figure 3.3).



**Figure 3.3.** Service Periods of Dealers

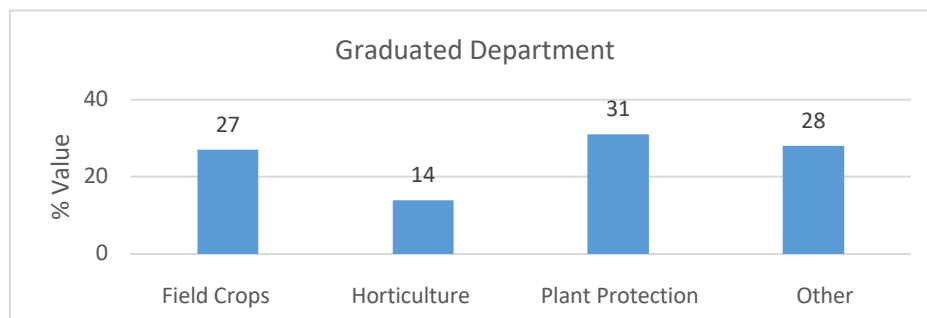
In Konya province, it was reported that 57.58% of the agrochemical markets had been selling pesticides for less than 10 years, while 24.24% had been in the business for more than 20 years (Özbek and Fidan 2013).

In a study conducted in Şanlıurfa province, it was found that 39.80% of the dealers had been in business for 1-3 years, while 54.17% had been in business for more than 8 years. In a study conducted in Çanakkale, it was determined that 62% of the dealers had been in business for 6 years or more, while 27% had been in business for 3-6 years (Öcal Kara et al. 2014, Türkmen et al. 2015).

In a study conducted in Bursa on agrochemical markets, it was determined that 59.5% had been in business for 1-6 years, 32.1% for 7-16 years, 7.1% for 17-26 years, and 1.3% for 27-38 years (Erbek, 2019).

According to our findings, it is observed that similar to other studies, the number of businesses that continue dealership activities has increased in recent years.

It has been determined that 31% of the dealers interviewed are graduates of Plant Protection, 27% of Field Crops, and 14% of Horticulture, while 28% are graduates of Agricultural Machinery, Agricultural Economics, Organic Agriculture, and similar departments at faculties or universities. In addition, it has been found that 5% of the dealers are technicians and 18% are technologists (Figure 3.4).



**Figure 3.4.** Dealer Operator/Personnel Department

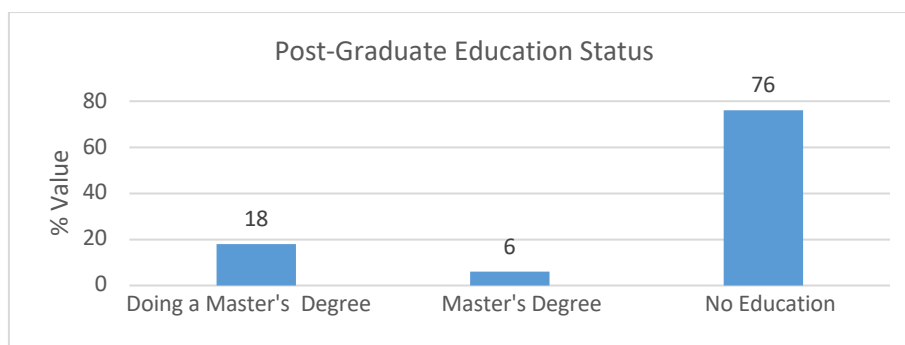
In parallel with our findings, it has been reported that 32.4% of the agrochemical markets within the borders of Adana province are graduates of Plant Protection, 29.4% are graduates of Horticulture, and 23.3% are graduates of Field Crops (Artık and Bostan Budak 2012).

In contrast to our findings, it has been determined that "7% of the agrochemical markets serving in the GAP region are graduates of Plant Protection, 10% of them are graduates of Horticulture, and 10% of them are graduates of Field Crops" (Kaplan and Bayhan 2014).

In a study conducted in Şanlıurfa, it was found that 31.9% of the agrochemical markets were Agricultural Engineers, Technicians, and Technologists, while 68.1% were graduates of other faculties (Kara et al. 2015).

In a study conducted in Bursa province in 2019, it was determined that 28.0% of the agrochemical markets were graduates of Plant Protection, 16.0% were graduates of Field Crops, and 14.9% were graduates of Horticulture. Additionally, it was found that 9.5% of the dealers were Agricultural Technicians and 7.8% were Agricultural Technologists (Erbek, 2019).

It was determined that 76% of the interviewed dealers had no further education after graduation, 18% continued their Master's education, and 6% had a Master's degree (Figure 3.5).



**Figure 3.5.** Post-Graduate Education Status of Dealer Operator/Staff

In a study conducted in Isparta province, it was reported that only 2.38% of the agrochemical markets were Master's graduates (Gül et al., 2010). In a study conducted on agrochemical markets in Bursa province, it was found that 85.1% of them did not receive any education after graduation, 10.1% had a Master's degree, and 4.8% continued their Master's education (Erbek, 2019). It was observed that the dealers in our study area had a higher level of education after graduation.

#### 4. CONCLUSION

This study evaluated the workplace characteristics and population demographics of Plant protection product dealers operating in the region. It was determined that female employment is higher in plant protection product retailers compared to other industries in our working area, but it is much lower compared to male employment. Increasing female employment in agriculture-related institutions and organizations is important for the regional and national economy. Various incentives and support are needed to employ women in the agriculture sector.

According to the "Regulation on Wholesale and Retail Sales and Storage of Plant Protection Products" published in the Official Gazette on February 13, 2019, and in effect, agricultural engineers, pharmacists, chemists/chemical engineers, technicians, or agricultural technicians who have graduated by taking plant health-related courses and who have succeeded in the exam organized by the Ministry of Agriculture and Forestry on the dates determined by the Ministry can obtain permission to sell plant protection products. To solve agricultural problems caused by organisms more effectively and to guide producers with an expert opinion in the field of plant protection, there is a need to increase the employment rate of graduates from the Plant Protection Department as dealer operators or in the employment of plant protection product retailers. Providing various support to these graduates in financing and other areas during the establishment of dealerships, making the employment of Plant Protection Department graduates mandatory in plant protection product retailers, or making changes to the relevant regulation can be considered as methods to increase employment.

With this regulation, it is regulated that the sales places of retailers should not be less than 20 square meters, the retailer floor should be covered with material that will prevent the absorption of chemical substances, the taps of the sink should be automatic and heat-sensitive, the product shelves should be in closed compartments with glass and equipped with a ventilation system. In our study, these issues were examined and it was determined that the retailers meet the specified norms. This situation is important in terms of ensuring unity in the physical conditions of retailers and their work and operations and in terms of the health status of personnel responsible for sales.

Considering the effects of plant protection product retailers on the agricultural economy, human and environmental health, they must be competent in their jobs and preventive measures must be taken with effective monitoring mechanisms to prevent possible material and moral losses.

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