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Research Article

Investigation of Pesticide Awareness Levels of Farmers with Different Farming Systems in Çanakkale Province

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Abstract

This study was conducted to determine the level of awareness of farmers engaged in organic farming, good agricultural practices (GAP) and conventional farming on pesticide use in Çanakkale province in 2024. The sample size in Çanakkale province and its districts was calculated by ‘Simple Random Sampling Based on Proportion Averages’ method. The surveys were conducted with 200 organic farmers, 109 good agricultural practices farmers and 378 conventional farmers. Cronbach's Alpha (α) value, which is the overall reliability level of the study, was calculated as 0.955. Farmers' knowledge levels regarding pesticide use were evaluated using a Likert scale. The Chi-Square test was applied to analyze the relationship between farmers' knowledge levels and factors such as education, farming experience and age. According to the pesticide use awareness level data, it was determined that the higher the education level, the higher the level of knowledge, and in terms of farmer behavior, organic farming and good agricultural practices limit the use of pesticides and reduce the risks on the environment and human health.
Keywords: Pesticide, Awareness Level, Likert Scale

Çanakkale İlinde Farklı Üretim Sistemlerine Sahip Çiftçilerin Pestisit Farkındalık Düzeylerinin Araştırılması

Öz

Bu çalışma, Çanakkale ilinde 2024 yılında organik tarım, iyi tarım uygulamaları (GAP) ve konvansiyonel tarım yapan çiftçilerin pestisit kullanımı konusundaki farkındalık düzeylerinin belirlenmesi amacıyla yapılmıştır. Çanakkale ili ve ilçelerindeki örneklem büyüklüğü “Oran Ortalamalarına Dayalı Basit Tesadüfi Örnekleme” yöntemi ile hesaplanmıştır. Anketler, 200 organik tarım çiftçisi, 109 iyi tarım uygulamaları çiftçisi ve 378 konvansiyonel tarım çiftçisi ile yapılmıştır. Çalışmanın genel güvenilirlik düzeyi olan Cronbach's Alpha (α) değeri 0.955 olarak hesaplanmıştır. Çiftçilerin pestisit kullanımı konusundaki bilgi düzeyleri Likert ölçeği kullanılarak değerlendirilmiştir. Çiftçilerin pestisit kullanımına ilişkin bilgi düzeyleri Likert ölçeği kullanılarak değerlendirilmiştir. Çiftçilerin bilgi düzeyleri ile yaş, eğitim ve çiftçilik deneyimi gibi faktörler arasındaki ilişkiyi analiz etmek için Ki-Kare testi uygulanmıştır. Pestisit kullanımı bilinç düzeyi verilerine göre, eğitim düzeyi yükseldikçe bilgi düzeyinin de yükseldiği, çiftçi davranışları açısından ise organik tarım ve iyi tarım uygulamalarının pestisit kullanımını sınırlandırdığı, çevre ve insan sağlığı üzerindeki riskleri azalttığı tespit edilmiştir.
Anahtar Kelimeler: Pestisit, Farkındalık Düzeyi, Likert Ölçeği

Introduction

The rapidly increasing world population has heightened the demand for food and a strategy of obtaining more food from unit area has been adopted to meet the increasing food demand. The way to increase the yield and quality of agricultural products is through the use of modern agricultural techniques and inputs. However, this approach, which has long aimed to increase productivity, has made the use of chemical pesticides and fertilizers essential in order to get more yield. Controlling harmful organisms, that restrict crop production are critical factors in increasing yield. Chemical control with pesticides is a form of agricultural control used to protect the agricultural product from the damage of, pests and to ensure quality production, and has been the most important component that increases production since the 1940s (Tiryaki and Temur, 2010). However, considering the environmental problems caused by using pesticides, there is a situation that needs attention. In addition, residue problems occur as a result of incorrect applications in the use of pesticides and this is considered an important problem in the world.

In the world, increasing agricultural production and reducing costs by increasing productivity is one of the main agricultural policy objectives. However, intensive input use causes serious economic and environmental problems on natural resources and human health. Between 0.015-6.0 percent of pesticide application reaches the target pest, while the remaining 94.0-99.9 percent reaches non-target organisms and soil (Graham-Bryce, 1977). This situation poses health risks due to environmental pollution, soil accumulation, and residual pesticide contamination. In order to prevent environmental pollution caused by chemicals in agriculture and to consume pesticide-free agricultural products, individuals who are sensitive to these risks should be brought into the society. Therefore, pesticide applicators must be trained.

To determine the contribution of pesticides to potential environmental and human health problems and to minimize these problems, there is a need for studies on the toxicological effects of pesticides, as well as studies on the behavior and risk perceptions of farmers, who are the main applicators of pesticides (Unakıtan et al. 2017).

In a study conducted by Jin et al. (2017) on small-scale farmers in China, it was found that although farmers were aware of a certain level of risk, they used excessive pesticides and that the probability of excessive pesticide use decreased significantly as the farm scale increased.

Teguh et al. (2024) examined the knowledge and awareness levels of paddy farmers in Besut, Terengganu on the use of beneficial plants in pest management. A survey of 56 farmers revealed that 67.9% of farmers had moderate knowledge and 73.4% had moderate awareness. The study highlights the need for continuous awareness programs by local authorities to increase the adoption of biological pest control methods.

Akkouch et al. (2025) evaluated the knowledge, practices and health perceptions of farmers in the Akkar region of Lebanon on pesticide use. In the study conducted with 151 farmers, it was determined that farmers had moderate knowledge but low environmental awareness. While 37.7 percent of farmers did not use protective equipment, 67.5 percent experienced acute symptoms such as skin and respiratory irritation problems. The study recommends the development of training programs, making protective equipment accessible and strengthening the regulatory framework to reduce health and environmental risks from pesticide use.

Meira et al. (2025) examined the pesticide risk perception of agricultural managers and consumers and investigated the role of this perception on environmental attitudes and purchase intentions. In the study conducted with 37 agricultural managers and 202 consumers in Brazil, it was determined that pesticide risk perception partially affected farmers' environmental attitudes and directly affected consumers' purchase intentions. The results show that farmers' environmental attitudes are shaped by personal norms and risk perception, while consumers make purchasing decisions based on trust, knowledge and risk perception. The study emphasizes that education, regulatory measures and transparent risk communication strategies should be developed to reduce pesticide-related risks and increase consumer confidence.

In the study conducted by Akar and Tiryaki (2018), 66.9% of farmers utilize pesticide dealers in pesticide selection. 34.1% of the farmers think that some pesticides may leave residues, 81.5% think that they will harm human health and 79.1% think that spraying harms the environment. In another study conducted by Erdal et al. (2019), 50% of the farmers stated that they buy pesticides according to their own experience. Erdil and Tiryaki (2020), 74.2% of farmers stated that they did not know the warnings and signs on the pesticide label, and 44.0% stated that they took into account the recommendations of pesticide dealers in determining the spraying time. In the study of Kaplan and Ayaz (2023), while determining the pesticide dose, 33% of the farmers do it according to their own experience. 60% think that pesticides leave no residue

In the study conducted by Özerdoğan et al. (2017), 90.9% of farmers changed their clothes after applying pesticides. It was determined that 87.6% of the farmers applied the recommended dose of pesticide. In the study of Akar and Tiryaki (2018), 42.1% of farmers stated that they used protective equipment while applying pesticides, while 31.7% stated that they did not use it because they did not consider it necessary. 55% of farmers dispose of empty pesticide boxes by burning them. In the research of Erdal et al. (2019), It was determined that 97% of the farmers in the research area use pesticides, but about 50% of them do not have information about the content of the pesticide they use. In the study conducted by Erdil and Tiryaki (2020), 60.7% of farmers reported that they did not change their clothes after spraying, 74.2% were unaware of the warnings and symbols on pesticide labels, and 63.0% did not use protective equipment while handling pesticides.

Taşkır and Tiryaki (2024) examined the level of awareness of 270 farmers in Çanakkale on the environmental and health risks of pesticides. According to the results, although the level of awareness increases as the level of education increases, wrong practices are common. While 41.85% of the farmers dump the remaining pesticides on the edge of the agricultural fields, 6.3% of them throw them into the environment. In addition, 45.18% use protective equipment and 46.67% pay attention to labeling information. The study reveals that farmers need more training on pesticide use.

Pesticide consumption of Türkiye is 57.766 tons in 2023 (TSI, 2024). The main problem in our country is the uncontrolled use of pesticides in some regions and the products grown in these regions cause residue problems. In Çanakkale Province, which is our study area with a wide range of production in Türkiye, annual pesticide consumption is 1.491.165 kg (or liter) (TSI, 2024). This situation has led to the necessity of measuring the knowledge and experience of farmers that shape their tendency towards pesticides.

The aim of our study was to determine the level of education and awareness of the farmers who produce with different farming systems on the basis of districts in Çanakkale Province on the use and selection of pesticides and their environmental sensitivities. The study emphasizes the importance of the topic by conducting a comparative analysis through a questionnaire survey. At the same time, it has been observed that no comparative study has been conducted in this region before. This situation reveals the topicality of the issue.

The findings of the study are expected to contribute to the development of policies that support the principles of sustainability in agricultural production. In addition, it is thought to be an important source for the planning and implementation of awareness-raising activities to reduce the environmental impacts of pesticide use. In this respect, it is envisaged that our research will be a guide for both farmers and decision makers who determine agricultural policies.

Materials and Methods

The main focus of the study is to evaluate the responses of farmers who practice conventional agriculture, organic agriculture and good agricultural practices in the city center and districts of Çanakkale to the survey questions.

Questionnaire included; a) personal information, b) production information, c) economic levels of farmers, d) education levels, e) pesticide usage and application methods, f) effects of pesticides on the environment, g) pesticide selection criteria, h) pesticide purchasing criteria, i) principles of application of pesticides. The questionnaires were conducted as face-to-face interviews.

Determination of sample size

In determining the number of farmers to be survived, statistical methods should be used to represent the study area. One of the most important parameters to be considered for the accuracy of the results is the correct determination of the sample size. While determining the sample size of the number of farmers to be surveyed according to the settlement units, the 'Simple Random Sampling Based on Ratio Averages' method was used to best represent the farmers population in the center and districts of Çanakkale (Collins, 1986; Miran, 2003; Kılıç et al., 2018). The following equation was used to calculate the sample size (Eq. 1):

$$n=\frac{(Z\alpha/2)^{2} \times p \times (1-p)}{d^{2}} \qquad (1)$$

where;

n= Sample size (Number of farmers to be surveyed)

$Z\alpha/2$= The tabulated value corresponding to the desired confidence level (90%)

p= Estimated proportion of the population that presents the characteristic (p = 0.5)

d= Tolerated margin of error (0.05)

Table 1. Total number of farmers surveyed based on different farming system and according to Simple Random Sampling Method based on Proportion Averages

Conventional Farming		Organic Farming		GAP* Farming		Total	
Number of farmers registered in Farmer Registration System	Number of Surveys Conducted	Number of farmers registered in Farmer Registration System	Number of Surveys Conducted	Number of farmers registered in Farmer Registration System	Number of Surveys Conducted	Number of farmers registered in Farmer Registration System	Number of Surveys Conducted
20.034	378	416	200	151	109	20.601	687

*Good Agricultural Practices (GAP)

The number of farmers to be surveyed was calculated as 378, 200 and 109 for Conventional Farming, Organic Farming, and GAP Farming, respectively with a tolerated error of 0.05 and a 95% confidence level. The total number of farmers across all three farming systems was 687 (Table 1).

Statistical Analyses

The main material of the study is the survey questions we prepared to investigate the sensitivity of farmers who apply different farming systems about pesticide use and the damages that pesticides cause to the environment. 'Cronbach Alpha' method was used in the homogeneity of survey items for the success of the study (Cronbach, 1951; Kılıç, 2016). Cronbach Alpha coefficient (a), which is the measure of internal consistency, explains the homogeneity of the items in the scale and its general value varies between '0' and '1'. This coefficient, which is frequently used in study models using Likert scale, allows us to understand whether the survey questions are consistent with each other and whether they make appropriate measurements for the purpose (Uzunsakal and Yıldız, 2018). In previous survey studies, a Likert scale was used to assess the responses of participants regarding their awareness of pesticide use (Likert, 1932; Akar and Tiryaki, 2018; Erdil and Tiryaki, 2020).

Cronbach's Alpha coefficient was calculated to assess the internal consistency and reliability of the questionnaire. Each question was assigned a numerical value based on its content, and the total scores were subjected to Cronbach's Alpha analysis. This method quantifies the homogeneity of survey items by measuring the proportion of total variance attributable to shared constructs. A high Cronbach's Alpha value indicates strong internal consistency, confirming that the questionnaire items effectively measure the intended awareness levels. The formula for calculating Cronbach's Alpha Coefficient is in Eq.2,

$$a = \frac{K}{K-1} * \left(\frac{1-\sum_{i=1}^{K} \sigma_{Y_i}^2}{\sigma_x^2} \right) \quad (2)$$

Y_i: : Observed values of question i
X=$Y_1 + Y_2 + \cdots + Y_K$: Sum of observed values
$\sigma_{Yi}^2 =$ Variance of question i
$K=$ Number of question
$1 - \sum_{i=1}^{K} \sigma_{Y_i}^2 =$ Sum of variance of questions
$\sigma_x^2 =$ Variance of total score

Likert Scale and Chi-Square (x ^{2}) independence test were applied in the analysis of the data obtained from the answers given by the farmers to the questionnaires while calculating the awareness levels. The awareness levels of the farmers were evaluated at different awareness levels in line with their answers to the scale. The highest score of the farmers who participated in the survey was determined as 96. Accordingly, the score intervals determining the pesticide use awareness levels are in the range of maximum 4 points from each question (0-20 points: Very low, 21-40 points: low: 41-60 points: medium, 61-80 points: high, 81-96 points: very high).

Chi-square test (x^2) for independence

Chi-Square (x^2) independence test was used to understand whether the calculated consciousness levels were related to other factors (Düzgüneş et al., 1983; Hovardaoğlu, 1994). As a result of the Chi-Square t Chi-Square (x^2) independence test was used to understand whether the calculated consciousness levels were related to other factors (Düzgüneş, et al., 1983; Hovardaoğlu, 1994). As a result of the Khi-Square tests, it was understood whether the research variables significantly affected the level of consciousness, it was understood whether the research variables significantly affected the level of consciousness.

$$x^2 = \sum \frac{(Oi - Ei)^2}{Ei} \quad (Z) \qquad (3)$$

x^2: Chi-Square test
Oi: observed value of i.
Ei: expected value of i.

If the critical x^2 value (determined based on the degrees of freedom (df) and a significance level of 0.05 (α)) is lower than the calculated x^2 value, a significant relationship exists between the two variables. The factors analyzed concerning pesticide use awareness include education level, farming experience, age, the type of farming.

The significance of the relationship between the variables subjected to the Chi-Square test was assessed using the Coefficient of Contingency (CC), i.e. the coefficient of dependency (Düzgüneş, 1983). The coefficient of contingency formula is shown below (Eq.4).

$$\mathrm{CC} = \sqrt{\frac{x^2}{N + x^2}} \qquad (4)$$

CC: Coefficient of Contingency
x^2: Chi-Kare
N: Total number of farmers surveyed

As a result of the Chi-Square tests applied, it was understood whether the variables subject to the research significantly affect the level of consciousness. At the decision stage, H_0 hypothesis was established (H_0= There is no relationship). If the calculated critical x^2 value is greater than the calculated table value [from the Chi-Square distribution table value corresponding to the 0.05 level of significance (α) and the determined degree of freedom (DF)], there is a significant association between the two variables. In addition, P values of the variables subjected to evaluation were calculated.

ANOVA (Analysis of Variance) method was used to determine the difference between three different farmer groups. Post-hoc statistics were used to determine which group caused the difference between the groups (Köklü et al., 2006).

Results and Discussion

Cronbach Alpha Reliability Test

The closer the calculated Cronbach's Alpha coefficient is to 1, the higher the internal consistency of the scale items. A coefficient greater than 0.7 is considered to indicate good reliability. In terms of reliability classification, the following thresholds are commonly used: >0.9 - Excellent, >0.8 - Good, >0.7 - Acceptable, >0.6 - Questionable, >0.5 - Poor, and values below 0.5 are deemed unacceptable (Gliem and Gliem, 2003; George and Mallery, 2003).

In this study, the overall reliability of the scale, represented by Cronbach's Alpha (α), was calculated as 0.955, indicating an excellent level of reliability ($0.9 \leq \alpha$). Since this reliability level exceeds the acceptable threshold, no modifications were made to the questionnaire, and the analysis was conducted based on the participants' responses.

Assessment of Awareness of Pesticide Use

The significance of the relationship between farmers' pesticide use awareness level and age was examined. The Chi-Square (x^2) test and p-value were calculated (Table 2).

Table 2. Awareness levels of pesticide use according to the education level of farmers

Education	Very Low		Low		Medium Level		High		Very High		Total, Σ		
	Observed (%)	Expected	Observed (%)	Expected	Observed (%)	Expected	Observed (%)	Expected	Observed (%)	Expected	Observed (%)	Expected	Survey basis
Uneducated	2 (100)	0.2	0	0.5	0	0.5	0	0.5	0	0.3	2 (100)	2.0	0.3
Primary School	61 (43.9)	12.7	66 (47.5)	32.2	12 (8.6)	34.6	0	36.8	0	22.7	139 (100)	139.0	20.2
Middle School	0	18.9	93 (45.1)	47.7	98 (47.6)	51.3	15 (7.3)	67.3	0	33.6	206 (100)	206.0	30.0
High School	0	23.3	0	58.8	61 (24.0)	63.2	161 (63.4)	67.3	32 (12.6)	41.4	254 (100)	254.0	37.0
University	0	7.9	0	19.9	0	21.4	6 (7.0)	22.8	80 (93.0)	14.0	86 (100)	86.0	12.5
Total. Σ	63 (9.2)	63.0	159 (23.1)	159.0	171 (24.9)	171.0	182 (26.5)	182.0	112 (16.3)	112.0	687 (100)	687.0	100.0

Level of awareness of pesticide use

H_0 hypothesis (H_0): There is no relationship between the two variables.
X^2 *critical* =34.27 with df=16 and α =0.05
X^2 *calculated*= 1065.987

calculated $x^2 > x^2$ *critical*
H_0: reject
p < 0.001 CC=0.780*

*p <0.001

When analyzing the level of pesticide use awareness of farmers according to their educational status, 0.2% of illiterate farmers have a very low level of awareness, 47.5% of primary school graduates have a low level of awareness, 45.1% of secondary school graduates, 47.6% have a medium level of awareness and 7.3% have a high level of awareness. Among high school graduates, there were no individuals with very low and low level of awareness, while 24% had medium, 63.4% had high and 12.6% had very high level of awareness. Among university graduates, 7% have high level of awareness and 93% have very high level of awareness. The findings indicate that organic and GAP farmers have higher pesticide awareness levels compared to conventional farmers.

The results of the Chi-Square test show that there is a statistically significant relationship between education level and pesticide use awareness (p<0.05). The Coefficient of Contingency (CC=0.780) shows that the relationship is at a strong level.

When we look at the pesticide use awareness levels of farmers according to their experience, 62.2% of farmers with 1-10 years of experience have very low, 35.7% have low and 2% have medium awareness level (Table 3). Among farmers with 11-20 years of experience, 1.3% have very low, 64% have low and 34.7% have medium level of awareness. Among farmers with 21-30 years of experience, 17.3% have low, 51.2% have medium and 31.5% have high level of awareness. Among farmers with 31-40 years of experience, 20.7% have medium, 65.2% have high and 14% have very high level of awareness. With these data, it is observed that the awareness of farmers increases as their experience increases. In general, when the situation of the farmers in our study area is analyzed, it is determined that the farmers who produce with organic agriculture and good agricultural practices are mostly olive farmers and their level of awareness in pesticide use has increased due to their long years of olive production.

Table 3. Awareness levels of pesticide use according to farmers' experience

Experience (years)	Level of awareness of pesticide use												
	Very Low		Low		Medium Level		High		Very High		Total, Σ		
	Observed (%)	Expected	Observed (%)	Expected	Observed (%)	Expected	Observed (%)	Expected	Observed (%)	Expected	Observed (%)	Expected	Survey basis
1-10	61 (62.2)	9.0	35 (35.7)	22.7	2 (2.0)	24.4	0	26.0	0	16.0	98 (100)	98.0	14.3
11-20	2 (1.3)	13.8	96 (64.0)	34.7	52 (34.7)	37.3	0	39.7	0	24.5	150 (100)	150.0	21.8
21-30	0	14.9	28 (17.3)	37.5	83 (51.2)	40.3	51 (31.5)	42.9	0	26.4	162 (100)	162.0	23.6
31-40	0	15.0	0	38.0	34 (20.7)	40.8	107 (65.2)	43.4	23 (14.0)	26.7	164 (100)	164.0	23.9
41>	0	10.4	0	26.2	0	28.1	24 (21.2)	29.9	89 (78.8)	18.4	113 (100)	113.0	16.4
Total. Σ	63 (9.2)	63.0	159 (23.1)	159.0	171 (24.9)	171.0	182 (26.5)	182.0	112 (16.3)	112.00	687 (100)	687.0	100.0

H_0 hypothesis (H_0): There is no relationship between the two variables.

X^2 *critical* =34.27 with df=16 and α =0.05

X^2 *calculated*= 1132,597

calculated $x^2 > x^2$ *critical*

H_0:reject

p < 0.001 CC=0.789*

*p <0.001

The results of the Chi-Square test show that there is a statistically significant relationship between length of experience and pesticide use awareness (p<0.05). The Coefficient of Contingency (CC=0.789) shows that the relationship is at a strong level.

Table 4. Awareness levels of pesticide use according to different farming systems

Producers	Level of awareness of pesticide use												
	Very Low		Low		Medium Level		High		Very High		Total, Σ		
	Observed (%)	Expected	Observed (%)	Expected	Observed (%)	Expected	Observed (%)	Expected	Observed (%)	Expected	Observed (%)	Expected	Survey basis
Organic Farmers	2 (1.0)	18.3	22 (11.0)	46.3	58 (29.0)	49.8	74 (37.0)	53.0	44 (22.0)	32.6	200 (100)	200.0	29.1
GAP Farmers	2 (1.8)	10.0	15 (13.8)	25.2	24 (22.0)	27.1	31 (28.4)	28.9	37 (33.9)	17.8	109 (100)	109.0	15.9
Conventional Farmers	59 (15.6)	34.7	122 (32.3)	87.5	89 (23.5)	94.1	77 (20.4)	100.1	31 (8.2)	61.6	378 (100)	378.0	55.0
Total. Σ	63 (9.2)	63.0	159 (23.1)	159.0	171 (24.9)	171.0	182 (26.5)	182.0	112 (16.3)	112.0	687 (100)	687.0	100.0

H_0 hypothesis (H_0): There is no relationship between the two variables.

X^2 *critical*= 21.95 with df=8 and α =0.05

X^2 *calculated*= 124.391

calculated $x^2 > x^2$ *critical*

H_0:reject

p < 0.001 CC=0.392*

*p <0.001

When we look at the level of awareness of pesticide use according to different farmers, 1 of the organic farmers has a very low level of awareness, while 11% have a low level of awareness, 29% have a medium level, 37% have a high level and 22% have a very high level of awareness (Table 4). Among the farmers practicing Good Agricultural Practices (GAP), 1.8% have very low, 13.8% have low, 22% have medium, 28.4% have high and 33.9% have very high level of awareness. Among the conventional farmers, 15.6% have very low, 32.3% have low, 23.5% have medium, 20.4% have high and 8.2% have very high awareness. With these data, it was determined that the awareness levels of farmers practicing organic farming and good agriculture were higher than those of farmers practicing conventional agriculture.

The Chi-Square test shows that there is a statistically significant relationship between different farming systems and pesticide use awareness (p<0.05). The Coefficient of Contingency (CC=0.392) shows that the relationship is at a moderate level.

Table 5: Comparison of Awareness Score with Different Producer Groups

Categories	n	$\bar{x}$	ss	F	p	Post Hoc (Tukey)
Organic Farmers[a]	200	62.025	17.202	59.779	0.000	a > c, b > c
GAP Farmers[b]	109	64.395	19.017			
Conventional Farmers[c]	378	45.722	22.451			

According to the ANOVA results in Table 5; the awareness levels of different producer groups differ statistically significantly (p<0.05). According to the post-hoc test performed to understand which groups this difference arises from; it is seen that the scores of the scale used to determine the awareness levels of the producers engaged in conventional agriculture are lower than the organic agriculture producers and GAP farmers. The average level of consciousness of organic farmers (62.025) and GAP farmers (64.395) is at the level, while the level of consciousness of conventional farmers (45.722) is at the medium level.

Proportional Data

In our research, the data obtained from the questionnaires were also calculated proportionally (%) (Table 6).

Table 6: Findings on Farmers' Knowledge, Use and Supply of Pesticides

Question	Answer					
	Organic Farming (%)		GAP Farming (%)		Conventional Farming (%)	
	Yes	No.	Yes	No.	Yes	No.
Do you read the labels of the pesticides you take?	62	12	58	16	30	48.5
Do you pay attention to the expiry date when buying pesticides?	80	6	69.5	10.5	60.5	30
Do the pesticides you use leave residues on the product?	8	65	17	58.5	46.5	32
Have you heard of the MRL concept before?	80	10	62	18	25	55
Are pesticides harmful to human health?	93	0	95	0	75.5	19
Do you use protective equipment when spraying?	45	36	85	15.5	23	56
Do you take care not to harm the environment during spraying?	85	3	82.5	1	42.5	35.5
Do you care about the health of consumers?	91	4	89	4.5	78	11
Do you know the special signs and warnings on pesticide labels?	51	36	40.5	36	29.5	47
Do you know the number of the National Poison Centre?	23	65	38.5	51.5	16	79

When the parameters with the highest % value are considered, 62% of organic farmers answered yes, 58% of good agricultural practices farmers answered yes and 30% of conventional farmers answered yes to the question "Do you read the labels of the pesticides you use?". To the question "Do you pay attention to the expiry date when purchasing pesticides?" 80% of organic farmers answered yes, 69.5% of good agricultural practices farmers answered yes and 60.5% of conventional farmers answered yes. To the question "Do the pesticides you use leave residues on the product?", 8% of organic farmers answered yes, 17% of good agricultural practices farmers answered yes and 46.5% of conventional farmers answered yes. To the question "Have you heard of the MRL concept before?" 80% of organic farmers answered yes, 62% of good agricultural practices farmers answered yes and 25% of conventional farmers answered yes.

To the question whether pesticides are harmful to human health, 93% of organic farmers answered yes, 95% of good agricultural practices farmers answered yes and 75.5% of conventional farmers answered yes. To the question "Do you use protective equipment while spraying?", 45% of organic farmers answered yes, 85% of good agricultural practices farmers answered yes and 23% of conventional farmers answered yes. To the question "Do you pay attention not to harm the environment at the time of spraying?", 85% of organic agriculture farmers answered yes, 82.5% of good agricultural practices farmers answered yes and 42.5% of conventional agriculture farmers answered yes. To the question "Do you care about the health of consumers?" 91% of organic farmers answered yes, 89% of good agricultural practices farmers answered yes and 78% of conventional farmers answered yes. When asked if they were aware of the special signs and warnings on the labels of pesticides, 51% of organic farmers answered yes, 40.5% of good agricultural practices farmers answered yes and 29.5% of conventional farmers answered yes. When asked if they know the number of the National Poison Centre 23% of organic farmers answered yes, 36.5% of good agricultural practices farmers answered yes and 16% of conventional farmers answered yes.

Based on the findings, it is observed that most of the farmers in Çanakkale lack knowledge on pesticide use. In particular, it was found that the majority of farmers engaged in conventional farming relied on their own experience in determining pesticide dosage, but farmers practicing good agriculture and organic farming take label instructions and the recommendations of agricultural engineers into consideration more. These results are in line with the study conducted by Wilson and Tisdell (2000) which showed that education level has a significant effect on pesticide use awareness.

Similarly, in a study conducted by Özercan and Taşcı (2022) Although Türkiye is below the world average in terms of pesticide use, when analyzed on a regional basis, it is determined that pesticide use is much higher than the world average, especially in the Mediterranean Region.

In the study of Madaki et al. (2024) assessed the level of knowledge on pesticide use and personal protective equipment usage habits of smallholder farmers in Ogun State, Nigeria. A survey of 156 farmers revealed that one-third of farmers left pesticide residues in the field, 65 percent randomly disposed of empty pesticide containers and 79 percent did not use basic personal protective equipment such as respiratory masks. The study emphasizes that farmers' knowledge on pesticide management is low and existing methods of information provision are inadequate. It is recommended that government agencies, distributors and farmers should increase education and awareness activities for effective pesticide use.

Conclusion

In conclusion, the study revealed the level of awareness on pesticide use among different farming systems in Çanakkale Province. Organic farming and good agricultural practices reduce the risks on environment and human health by limiting the use of pesticides. However, it was determined that the level of awareness of farmers engaged in conventional agriculture on pesticide use should be increased. Accordingly, it is recommended to strengthen more widespread training programs, advisory services and inspection mechanisms in order to increase the awareness of farmers on pesticide use. Additionally, promoting environmentally friendly agricultural practices, such as biological control methods and integrated pest management, is considered an essential strategy to mitigate the negative effects of pesticides.

Ethics Committee Approval

It was prepared within the framework of the Ethics Committee Decision of Çanakkale Onsekiz Mart University, Graduate Education Institute Ethics Committee dated 08.09.2023 and numbered 11/18.

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This study is part of the first author's master's thesis.

Authors' Contributions

Authors declare the contribution of the authors is equal.

Conflicts of Interest Statement

The authors have declared no conflict of interest.

References

Akar, T., Tiryaki, O., 2018. Farmers' awareness and knowledge level of pesticide use in Antalya Province, Turkey. Journal of Agricultural Research. 12(3): 45-60.

Akkouch, N. H., Halwani, J., Shaarani, I., 2025. Exploring pesticide knowledge, practices, and health perceptions among farmers in akkar, lebanon. International Journal of Environmental Research and Public Health. 22(2): 260.

Arslan, H., Yildiz, R., Demir, S., 2018. The effects of pesticide use on human health and the environment. Environmental Science Journal. 15(4): 78-92.

Collins M., 1986. Sampling. In: Consumer market research handbook. Worcester, R.M., Downham, J., (Eds.), London: McGraw-Hill, 840 pp.

Cronbach L.J., 1951. Coefficient alpha and the internal structure of tests. Psychometrika. 16: 297-334.

Düzgüneş, O., Kesici, T., Kavuncu, O., Gürbüz, F. 1983. Araştırma ve Deneme Metodları. Ankara Üniversitesi Ziraat Fakültesi Yayınları.

Erdal, G., Erdal, H., Ayyıldız, B., Ayyıldız, M., Çiçek, A. 2019. Pesticide use in fruit-vegetable production and awareness level of produces in tokat province. Turkish Journal of Agriculture - Food Science and Technology. 7(10):1515-1521.

Erdil, M., Tiryaki, O. 2020. Manisa İli'nde çiftçilerin tarım ilaçları kullanımı konusundaki bilinç düzeyi ve duyarlılıklarının araştırılması. Çanakkale Onsekiz Mart Üniversitesi Fen Bilimleri Enstitüsü Dergisi. 6(1): 81-92.

Eryılmaz, G. A., Kılıç, O., Boz, İ. 2019. Türkiye'de organik tarım ve iyi tarım uygulamalarının ekonomik, sosyal ve çevresel sürdürülebilirlik açısından değerlendirilmesi. Yüzüncü Yıl University Journal of Agricultural Sciences. 29(2): 352-361.

George, D. 2003. SPSS for Windows step by step: A simple guide and reference. 11.0 update. Allyn & Bacon.

Gliem J.A., Gliem R.R., 2003. Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education, The Ohio State University, Columbus, OH, October 8-10, 2003.

Graham-Bryce, I.J., 1977. Crop protection:a consideration of the effectiveness and disadvantages of current methods and scope for improvement. Phil, Trans . R. Soc. Lond. 13(281):163-179.

Hovardaoğlu, S., 1994. Davranış Bilimleri İçin İstatistik. (s. 365), Hatiboğlu Yayınları: Ankara.

Jin, J., Wang, W., He, R., Gong, H., 2017. Pesticide use and risk perceptions among small-scale farmers in Anqiu County, China. International journal of environmental research and public health. 14(1):29.

Kaplan, M., Ayaz, T. 2023. Mardin ili kiraz üreticilerinin bitki koruma uygulamalarında bilinç düzeylerinin belirlenmesi. International Journal of Innovative Engineering Applications. 7(1): 150-157.

Kilic, S. 2016. Cronbach's alpha reliability coefficient. Psychiatry and Behavioral Sciences. 6(1): 47.

Köklü, N., Büyüköztürk, Ş., Coklu, Ö. 2006. Sosyal Bilimler İçin İstatistik. PegemA Yayınları, Ankara

Likert R., 1932. A technique for the measurement of attitudes. Archives of Psychology. 22 (140): 1-55.

Madaki, M. Y., Lehberger, M., Bavorova, M., Igbasan, B. T., Kächele, H., 2024. Effectiveness of pesticide stakeholders' information on pesticide handling knowledge and behaviour of smallholder farmers in Ogun State, Nigeria. Environment, Development and Sustainability. 26(7): 17185-17204.

Meira, A. P. G., Zanin, L. M., Favaro, B. F., Stedefeldt, E., da Cunha, D. T., 2025. Pesticide risk perception as an attitudinal mediator: Exploratory research with farm managers and consumers. Food Research International. 200: 115449.

Miran B., 2003. Temel İstatistik. Ege Üniversitesi Basımevi, Bornova, Türkiye, 297 s. ISBN 975-9308800.

Özercan, B., Taşcı, R., 2022. Türkiye'de pestisit kullanımının iller, bölgeler ve pestisit grupları açısından incelenmesi. Ziraat Mühendisliği. (375): 75-88.

Özerdoğan, Ö., Oymak, S., Yüksel, B., Bakar, C., 2019. Plant protection products and personal protective use information, attitude, behavior of Turkish farmers. Atatürk Üniversitesi Ziraat Fakültesi Dergisi. 50(1): 18-31.

Taşkır, U., Tiryaki, O., 2024. Investigation of consciousness levels of Çanakkale farmers on environmental and toxicological risks of pesticides. Plant Protection Bulletin. 64(1): 23-33.

Teguh, F., Mohamed, S., Hamdan, M. H., Suhaimi, N. A. M., 2024. Exploring farmers' knowledge and awareness in employing beneficial plants for paddy pest management in Besut, Terengganu. Journal of Agrobiotechnology. 15(2): 10-18.

Tiryaki, O., Temur, C., 2010. The fate of pesticide in the environment. Journal of Biological and Environmental Sciences. 4(10): 29-38.

TSI, 2023. Turkish Statistical Institute. https://cip.tuik.gov.tr/ (accessed date: 15.08.2024) (in Turkish).
Unakıtan, G., Aydın, B., Azabağaoğlu, Ö., Hurma, H., Demirkol, C., Yılmaz, F., 2017. Bitkisel üretimde çiftçilerin girdi kullanım bilinç düzeylerinin analizi: Trakya Bölgesi örneği. Journal of Agricultural Faculty of Gaziosmanpaşa University (JAFAG). 34(1): 104-117.
Uzunsakal, E., Yıldız, D., 2018. Alan araştırmalarında güvenilirlik testlerinin karşılaştırılması ve tarımsal veriler üzerine bir uygulama. Uygulamalı Sosyal Bilimler Dergisi. 2(1): 14-28.
Wilson, C., Tisdell, C., 2001. Why farmers continue to use pesticides despite environmental, health and sustainability costs. Ecological economics. 39(3): 449-462.