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Evaluation of Wheat Producers' Adoption for Protective Agriculture Techniques

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ABSTRACT

In the study, it was aimed to determine the non-price factors affecting the wheat producers in Kadınhanı and Ilgın districts of Konya in Turkey. The main material of the study is the data obtained from the face-to-face survey conducted with the wheat producers in these districts in 2018. In this context, whether the dependent variables affect irrigation, yield, income, area and producer demographic characteristics were analyzed with the help of the bivariate probit model. In the applied model, it is concluded that as the area of operation increases, the producers' levels of applying protective agriculture techniques increase and as their income increases, their awareness of climate change decreases. Additionally, as the wheat yield increases, it is found that the producers' level of application of protective agriculture techniques and the possibility of being aware of the changes in the climate decrease.

1. Introduction

Environmental problems caused by climate change affect the agricultural sector in many ways. While global climate change causes a decrease in agricultural products and loss of products in the short term, it may cause more permanent damages such as drought in the long term. At the same time, the decrease in groundwater resources and the unexpected decrease of precipitation during the season also affect agricultural production. The problem of combating and adapting to climate change, especially improving the sustainability of ecosystems, has no boundaries and has been emphasized in many international agreements. Effective implementation of the adopted strategies and plans relies on multi-level governance, involvement of various stakeholders and expert support. One of the means of adaptation mentioned is protective agriculture, which is named differently but the ultimate goal is common.

Protective agriculture is an agro-ecological based approach based non tillage or minumum/striped tillage, product rotation, different agricultural systems and water saving methodology. This method include direct sowing, phytosanitary, fertilizing, pre-planting cover crops, weed management and plant residue management (FAO, 2018; Corsi, 2018). Protective agriculture provides economic advantage which reduces production costs (Yalcin et al, 2003).

In Turkey, when compared to the previous year, a decrease of 8.86% in the area sown and 9,127% in harvested area was recorded in 2019. The decrease in the cultivated area and the harvested area affected the production amount 10% negatively. Konya has 9.7% of wheat area in Turkey and its wheat production amount corresponds to 10.2% of the country (MIEM, 2019). Wheat yield was 291 (kg/ decare) in 2018 and decreased by 288 (kg/decare) in 2019 (TUIK, 2020). The average yield of wheat in Turkey is 2.629 kg/ha. In terms of added value, the agricultural industry based on wheat and wheat products is said to be one of the main sectors in the food industry and economy (Kan et.al., 2017; FAOSTAT, 2017).

The main objective of the study is to determine the non-price factors affecting the application level of protective agricultural techniques and climate change perception of wheat producers in Kadinhanı and Ilgın districts of Konya province in Turkey.

2. Material and Methods

The research was carried out based on the data obtained from the face-to-face survey conducted with wheat producers in 2018 in Kadınhanı and Ilgın districts in Turkey. The stratified sampling method, was used to determine the number of producers. Homogeneous layers should be obtained in terms of the width of the cultivated area in order to increase the accuracy of the forecast (Yamane, 2001). Thus, it is expected that the sensitivity of the estimation will increase if homogeneity is provided. In determining the sample volume, 5% standard error has been accepted within the 95% confidence intervals. As a result of the sampling method, 100 producers randomly selected in Konya were interviewed.

In the study, to determine the factors affecting the protective agriculture practices and the perception level of climate change, the analysis was made by choosing the bivariate probit model, which is one of the qualitative reactive regression models. These models are also called reactive qualitative preference models (Güris et al., 2017). In qualitative-response regression models, the dependent variable can take two or more values. In the models with two options, the most beneficial one is selected (Greene, 2016). In this model, the independent variable or variables can be of any type (qualitative, quantitative, etc.) (Tari, 2018). The multivariable probit model was proposed by Ashford and Sowden (1970) in order to model the system of binary results that are related to each other within the framework of regression. The bivariate probit model is a special version of the multivariate probit model where it is more than one variable (Giampiero, 2013; Gencer, 2016; Emmanuel, 1992). In Bivariate probit models, unlike independent variables, correlation is sought between dependent variables. Two variables that are thought to be related are analyzed together (Ozer, 2007; Gencer, 2016).

The least squares method is insufficient in the estimation of the econometric model used because the least squares method acts with the assumption that the dependent variable shows normal distribution. While the least squares method is used in regression estimation, this method is not used in regression models with qualitative variables. None of the qualitative responsive models can be predicted consistently with linear regression models and therefore, in most cases, estimation is done by using maximum likelihood method (Greene, 2016). The most likelihood estimation method function is given below.

In the main hypotheses of the study, the absence hypothesis defends that the variables used in the model have no effect, while the alternative hypothesis argues that the variables are effective.

H_0: Independent variables have no effect on the level of protective agriculture practices and climate change.

H_1: Independent variables have no effect on the level of protective agriculture practices and climate change.

For the bivariate probit regression application, the data set consisting of wheat producers in Kadınhanı and Ilgın districts of Konya was used. Y_1 is defined as dependent variable for producers who apply protective agriculture method coded 1 and 0 vice versa. Y_2 is defined for producers who believe that climate change is a fact and threat agriculture as 1 and for 0 who doesn't believe climate change issues (Table 1).

Dependent variables in the model:

Y_1= Protective agriculture techniques

Y_{11} = Applying Y_{12}= Not applying and rejecting

Y_2= Climate change

Y_{21} = Accepting its existence Y_{22}= Denying its existence

Independent variables are chosen as age, enterprise area width, yield, income, experience for quantitative types and education level and irrigation for qualitative types in Table 1.

Table 1. Variables Used in Model

Independent variables		**Type**	**Display form**	**Reference**
$\mathbf{X_1}$	Age	Quantitative	Years	(Bicer & Vaizoglu, 2015)
$\mathbf{X_2}$	Enterprise area width	Quantitative	Decares (ha^{-1})	(Koksal & Cevher, 2015).
$\mathbf{X_3}$	Yield	Quantitative		(Keles 2019)
$\mathbf{X_4}$	Income	Quantitative	TL	(Yayar et al., 2014)
$\mathbf{X_5}$	Experience	Quantitative	Years	(Akyuz & Atis, 2018)
$\mathbf{D_{1i}}$	Education level	Qualitative	D_{11}: Primary and below D_{12}: Secondary and high school D_{13} : High school D_{14} : University and higher	(Yayar et al. 2014)
$\mathbf{D_{2i}}$	Irrigation	Qualitative	D_{21}: Applying irrigation D_{22}: Not applying irrigation	(Yildiz & Topal, 2002)

3. Findings and Discussion

In the study, it was aimed to determine the preferences of producers to apply protective agriculture techniques and the factors affecting their view on climate change. In this context, bivariate probit model was used. Descriptive statistics of the variables used in the model can be seen in Table 2. The scope of protective farming techniques is defined as mainly *"Direct sowing-stubble sowing, stripy processing, using certified seeds etc."*. Used as a dependent variable, producers applying protective agricultural techniques make up 30% of the total producers. As another dependent variable, while those who accept the presence of climate change are 75%, 25% of the producers stated that there is no climate change. There are two reasons why the bivariate probit model is preferred. The first reason is the attempt to look at the application level of producers of protective agriculture techniques and the factors that affect the level of awareness of climate change awareness at the same time. The second reason is that there is a correlation between climate change awareness and protective agriculture techniques.

Table 2. Descriptive statistics of model variables

Variables					
Dependent variables	**Qualitative Variables**		**Frequency**	**Percent (%)**	**Cumulative Percent (%)**
	Protective agriculture techniques	Not applying	70	70	70
		Applying	30	30	100
	Climate change	No	25	25	25
		Yes	75	75	100
Independent variables	**Quantitative Variables**		**Average**	**Standard deviation**	**Standard error**
	Age		46.55	11.52	1.15
	Eneterprise field width		117.79	105.35	10.53
	Yield		343.71	199.67	19.96
	Income		182804.1	354082.1	35408.21
	Experience		26.83	13.24	1.32
	Qualitative Variables		**Frequency**	**Percent (%)**	**Cumulative Percent (%)**
	Education	Primary education and below	36	36	36
		Secondary education	14	14	50
		High school	32	32	82
		University and above	18	18	100
	Irrigation	Non irrigatied	10	90	10
		Irrigated	90	90	100

According to the results, the gross income of the producers from agriculture and non-agriculture is an average of 182804.1 TL. The average operational area width of the producers interviewed in Kadınhanı and Ilgın districts is 117.79 and the average yield of this area is 343.71 TL/da. Standard deviation values of operating width, yield and income variables were calculated as 105.35, 119.67 and 354082 respectively. The average age of producers is 46.55. The age range of the producers participating in the research is between 19 and 71. The education level of the producers in the agricultural establishments sampled is classified in 4 categories. According to this classification, 36% of the producers participating in the survey have primary education, 14% secondary education, 32% high school, 18% university and higher education. According to the research, the average experience of the producers is 26.83 years and the standard deviation is 13.24. Years of experience of producers range from 1 to 60 years. The producers were asked whether they are making irrigation and which irrigation methods they use and 90% of them stated that they are making irrigation. Producers' irrigations systems and water sources are given Table 3. Most of the producers (80%) use water from well and 20% of producers benefits from river. Agricultural irrigation system is preferred as 36.47 % drip irrigation, 35.22 % sprinkler irrigation, 6.91% other system. Producers apply either sprinkler and drip irrigation systems for only 21.8% of them.

Table 3. Water resources and irrigation systems

Wheat irrigation	%	Water resources	%	Agricultural Irrigation Systems	%
Irrigated	72	Well	80	Drip irrigation	36.48
				Sprinkler	35.22
		River	20	Other	6.91
				Both (drip+sprinkler)	21.38
Non-irrigated	28				
Total	100		100		100

Correlation matrix is given in Table 4 in order to determine the presence of multiple linear correlation between variables. According to the correlation matrix of independent variables, there is a strong (0.74> 0.50) and same relationship between age and experience variables. R values of other variables indicate that there is no multiple linear connection. However, age variable and experience variable r value was found to be 0.74 and age and education variable r value was found to be -0.53. The existence of multiple linear connections must be tested for age, experience and education variables.

Table 4. Correlation matrix of variables

Correlation matrix	**Age**	**Area Width**	**Yield**	**Income**	**Experience**	**Education**	**Irrigation**
Age	1.000						
Area Width	-0.1300	1.0000					
Yield	-0.1062	-0.0083	1.0000				
Income	-0.0460	0.2916	0.0421	1.000			
Experience	0.7490	-0.0973	-0.0145	-0.0003	1.0000		
Education	-0.5319	0.2903	0.0075	0.1096	-0.4526	1.0000	
Irrigation	-0.1234	0.0662	0.1660	0.1645	-0.2773	0.0936	1.0000

In order to decide the correlation coefficients obtained from the correlation matrix, variance swelling factor (VIF) values were examined (Table 5). It was found that average VIF 1.62<5, income (1.13 <5), age (2.68<5), area (1.06<5), experience (2.58<5), education (1.52 <5) and VIF value of the irrigation variable (1.18<5). So there is no multiple linear connection problem in the model.

Normality assumption was tested with Shapiro-Wilk W and Kolmogav-Simirnov tests with skewness coefficients showed in Table 5. The Shapiro-Wilk W test absence hypothesis is expressed as “data is suitable for normal distribution” and alternative hypothesis is expresses as “data is not suitable for normal distribution”. Prob>z values are; age (prob>z=0.44), experience (prob>z=0.33), establishment area width (prob>z=0.76) and education (prob>z=0.31). Absence hypothesis was accepted because p values are <0.05. In other words, the data are suitable for normal distribution. Alternative hypothesis was accepted for yield, income and irrigation variables. According to the Kolmogorov-Smirnov test, the ho hypothesis is expressed as “data is suitable for normal distribution” and the h1 hypothesis is expressed as “not suitable”. P value is accepted for the ho hypothesis. In this context, h0 hypothesis is accepted for age (0.677), efficiency (0.118), establishment area width (0.364), income (0.056) and experience (0.129) variables, while alternative hypothesis is accepted for other variables. When looking at the skewness coefficient values in normality test, the data of age (-0.13), yield (0.86), experience (0.03), enterprise area width (-0.20), income (-0.86) and education (0.08) variables are normally distributed. The logarithm of data related to the enterprise width has been taken and retested.

Table 5. Testing Independent Variables

Variables	Multiple linear linkage testing				Normality test					
					Shapiro-Wilk W		Kolmogorov-Simirnov		Skewness and Flatness Coefficient	
	VIF	SQRT VIF	Tolerance	R^2	Z	Prob>Z	Statistics	P	Skewness	Flatness
Age	2.68	1.64	0.372	0.62	0.12	0.44*	0.72	0.677	-0.13	2.29
LogArea	1.18	1.09	0.846	0.15	-0.72	0.76*	0.92	0.364	-0.20	2.75
Yield	1.06	1.03	0.940	0.05	3.08	0.00	1.19	0.118	0.86	4.07
LogIncome	1.13	1.06	0.883	0.11	3.83	0.00	1.33	0.056	-0.86	7.66
Experience	2.58	1.61	0.387	0.61	0.42	0.33*	1.17	0.129	0.03	2.27
Education	1.52	1.23	0.658	0.34	0.48	0.31*	2.41	0.000***	0.08	1.54
Irrigation	1.18	1.09	0.845	0.15	5.57	0.00	5.29	0.000***	-2.66	8.11
Average VIF = 1.62										

(*<0.05, **<0.01, ***<0.001)

Within the scope of the econometric model application of the study, it is aimed to determine the factors that affect the awareness level of climate change awareness of wheat producers and the application of protective agriculture techniques. The results obtained from the bivariate probit model are given in Table 6. A positive correlation was determined between Y1 and Y2 variables and r = 0.2268 was calculated. The model established was statistically significant as a whole (Prob > chi2 = 0.0112). Rho (ρ) measures the correlation of error terms in two models (Gençer, 2016). The value of ρ between the two models was 0.625 (0.176). The meaning of this figure indicates that there is a moderate relationship between both models. For Rho(ρ)=0 hypothesis testing, it was found that estimated correlation coefficient/ estimated standard error value is 0.626/0.176=2.64. Since the calculated value is greater than the critical value of 1.96, ρ has become significant (Greene, 1996). Significant ρ value indicates that both dependent variables are related and if these dependent variables are analyzed individually, the parameters will be deviated and this model should be analyzed simultaneously, using a bivariate probit model (Demir, 2009). The magnitude of the estimated ρ value indicates that the independent variables that are important for the two dependent variables are neglected. The fact that ρ value is 0.625 (not close to 1) indicates that it is not a very important variable neglected (Özarıcı, 2002). The estimated models are age (0.29 and 0.12> 0.05), yield (0.34 and 0.24> 0.05), experience (0.30 and 0.118> 0.05) and irrigation (0.63 and 0.189> 0.05) and their coefficients are insignificant. Within the scope of the survey, the producers are asked whether there has been any climate change in the last 10 years. In the model defined as Y2, the p value (0.089 <0.10) of the income variable was significant. 1% increase in income reduces acceptance of climate change by -0.25 units. As income increases, awareness of climate change decreases. In the models, the basic category of the education variable is the producers who are at primary school level and the results are evaluated in this framework. In the predicted models, producers with high school education level (0.51

and 0.45> 0.05) and producers with university or higher education level (0.54 and 0.88> 0.05), their coefficients are insignificant. In other words, the level of education has no effect on the implementation of protective agricultural techniques. The secondary education category in the Y2 model is statistically significant since the p value is 0.08 <0.10. As the education level of the producers changes from primary school to secondary school, the level of climate change awareness is negatively affected (Table 6).

Table 6. Bivariate Probit Regression Model Prediction Results

Variables		Y1 (Protective agriculture techniques)				Y2 (Climate change)			
		Coefficient	**St. Error**	**Z**	**P**	**Coefficient**	**St. Error**	**Z**	**P**
Age		0.01956	0.01878	1.04	0.298	-0.03446	0.02252	-1.53	0.126
Enterprise area size		1.3759	0.44880	3.07	0.002 **	-0.15686	0.43764	-0.36	0.720
Yield		-0.00070	0.00075	-0.94	0.349	0.00115	0.00079	1.46	0.144
Income		-0.25797	0.26875	-0.96	0.337	-0.54147	0.31856	-1.70	0.089
Experience		-0.01656	0.01616	-1.02	0.305	0.02795	0.01790	1.56	0.118
Education	Secondary school	-0.59656	0.49346	-1.21	0.227	-0.81578	0.47534	-1.72	0.086
	High school	-0.25857	0.39526	-0.65	0.513	-0.31391	0.41875	-0.75	0.453
	University and master degree	0.27873	0.46206	0.60	0.546	0.07202	0.51362	0.14	0.888
Irrigation	No irrigation	0.25853	0.53599	0.48	0.630	0.65700	0.49996	1.31	0.189
_Cons		-2.31772	1.57699	-1.47	0.142	3.81041	1.82370	2.09	0.037
		Coefficient		**St. Error**		**Z**		**P**	
Athrho		0.73418		0.28933		2.54		0.011	
Rho		0.62562		.176092					
Likelihood = -99.173454		chi2(1) = 6.43868	Prob > chi2 = 0.1076			Wald test of rho = 0 : Wald chi2(18) = 25.67		Prob > chi2= 0.0112	

(*<0.05, **<0.01, ***<0.001)

The marginal effects showing the changes in the dependent variable by increasing 1 unit are shown in Table 7. The probability of producers to apply protective agricultural techniques and to be aware of climate change is calculated for the age variable. These probability values were found to be 0.16, 0.22, 0.27 and 0.28 for the producers' age range, respectively. As the age of the producers' increases, they are more likely to be aware of climate change and benefit from protective agriculture techniques (Table 7).

The probability of applying protective agriculture techniques by the establishments having an area width 50 da and the producers' awareness of climate change awareness is calculated as 0.03. Therefore, this value is nor statistically meaningful. The probability of the producers, whose production area is between 50 and 250 da, to apply protective agriculture techniques and to be aware of climate change, is 0.18 and the probability of producers with 250 da is 0.45. The marginal coefficient results given for the establishments whose production area is more than 50 da are statistically significant (Table 7).

Enterprises over 250 da production area are more likely to apply protective agricultural techniques and to accept climate change, compared to establishments with maximum 250 da production area. For the yield variable, the probability of producers to apply protective agriculture techniques and to be aware of climate change is 0.30 for producers having 430 da production area and below, 0.26 and 0.19 for producers having 430-830 da production area. All the results of the yield variable were statistically significant. In line with these results, it is concluded that as wheat yields increase, the probability of applying protective agriculture techniques and being aware of the change in climate change is decreasing (Table 7). Probability was 0.52 for producers with income levels below 20000 TL, and 0.15 for producers between 20000 TL-110000 TL. The income variable is meaningful since all p values are smaller than 0.05. As the income of wheat producers increases, they are less likely to apply protective agricultural techniques and to be aware of climate change (Table 7).

Average experience of the producers participating in the research is 26 years. The least experienced wheat producer is making production for 1 year, and the most experienced is making production for 60 years. The possibility of producers to be aware of climate change and apply protective agriculture techniques is related to the producers' experience. The probability values were calculated as 0.28 under 30 years, 0.25 over 30 years and 0.20 over 46 years. Producers with less experience level are more likely to be aware of climate change and apply protective agriculture techniques (Table 7).

The probability of producers to apply protective agriculture techniques and to be aware of climate change is 0.31 for primary school education level and below, 0.31 for secondary school education level, 0.22 for high school education level and 0.39 for university and higher education level. P values are statistically significant for 4 levels in the training variable (Table 7). Most of the producers (90%) are producing wheat in the districts of Kadınhanı and Ilgın and making irrigation.

Table 7. Calculation of marginal coefficients

Variables		Possibility	Delta – Method St. Error	z	P>|z|
Age	19-33	0 1619488	0.1057843	1.53	0.126
	34-48	0.2239547	0.0646547	3.46	0.001**
	49-63	0.2752465	0.0465268	5.92	0.000***
	64 and above	0.2880881	0.1071744	2.69	0.007 **
Enterprise Area (da)	Below 50 da	0.0373974	0.0345546	1.08	0.27
	50 da - 250 da	0.1851556	0.0462475	4.00	0.000***
	250 da and above	0.4525772	0.0820718	5.51	0.000***
Yield	430 and below	0.3060234	0.0801475	3.82	0.000***
	430-830	0.2613153	0.0456233	5.73	0.000***
	830 and above	0.1980223	0.0980371	2.02	0.043*
Income (TL)	Below 20000	0.5247861	0.2433591	2.16	0.031*
	20000 – 110000	0.3353813	0.0701045	4.78	0.000***
	1100000 and above	0.1585842	0.0769234	2.06	0.039*
Experience	1-15 year	0.2867425	0.1248594	2.30	0.022*
	16-30 year	0.2850186	0.066063	4.31	0.000***
	31-45 year	0.2526154	0.0443584	5.69	0.000***
	46 and above	0.2032644	0.0807891	2.52	0.012*
Education	Primary School	0.3109794	0.0830753	3.74	0.000***
	Secondary School	0.1363369	0.0743021	1.83	0.067
	Highschool	0.2284645	0.0674974	3.38	0.000***
	University and master	0.396636	0.111003	3.57	0.000 ***
Irrigation	Non irrigated	0.184495	0.1078605	1.71	0.087
	Making irrigation	0.2803349	0.0445764	6.29	0.000***

(*<0.05, **<0.01, ***<0.001)

The probability of being aware of the change in the climate in the last 10 years and the possibility of applying protective agricultural techniques is 0.28 . Producers who are not making irrigation constitute 10% of the total producers.

The probability value of the producers who are not making irrigation is calculated as 0.18. Producers who are making irrigation are more likely to apply protective agricultural techniques and to be aware of climate change (Table 7).

4. Result

In the study, it has been tried to identify factors that affect the level of implementation of protective agricultural techniques of wheat producers and awareness of climate change. In this context, the bivariate probit model was used. The model includes seven independent variables. These are yield, income, establishment area width, age, agricultural experience, education and age variables. In the normality assumption test for variables, the coefficient of weakness, Komogorov-Simirnov and Shapiro-Wilk tests were used. Logarithms were taken since the establishment area width and the yield variables not conforming to the normal assumption. The existence of multiple linearity concept belonging to Ragnar Frisch was tested for independent variables. Correlation matrix followed by VIF values are examined. It is concluded that there is no multiple linear connection between the variables. Protective farming techniques are described as "direct cultivation, strip-toe processing, using certified seeds". In Celik (2009), it was stated that many factors have an impact on the performance of sowing machines directly to the stubble, and it is of great benefit in conducting research at regional level on these factors. The study is product-based and a regional-level research in Kadınhanı and Ilgın districts. A positive relationship between climate change awareness and the implementation of protective agricultural techniques has been detected. In the study of Yayar et al. (2014), a direct relationship was observed between the increase in the level of education and the awareness of the effects of global warming. According to this statement, as the level of education increases, awareness of the effects of global warming has increased. According to the bivariate model results, there was no significant impact on climate change awareness for all levels of the education variable. However, according to marginal coefficients, probability of education level and applying climate change with protective agricultural manegement. In that case, university level coefficient the highest one among all education levels. Although the highest probability is seen at university and above, no linear effect of the education variable was found. Not only the level of education, but also the agricultural training of the producers is very important. In Ipekcioglu (2016), the result of certified seed use rate is high for those participating in agricultural training was obtained and the importance of agricultural education was emphasized. Akyüz and Atış (2018) stated that only irrigation methods and changes in product pattern can only suppress the negative effects of climate change in Küçük Menderes Basin to a certain extent. In the survey, producers were asked whether they make irrigation or not and which irrigation methods they use. 90% of the producers stated that they make irrigation. Producers who make irrigation are more likely to apply protective agricultural techniques and be aware of climate change. Yayar et al. (2014) found that young individuals are more aware of the effects of global warming than individuals aged 45 and over. The probability of wheat producers to apply protective agriculture techniques and to be aware of climate change increases with age more than. Average agricultural experience of producers was found 26.83 years. The years of experience of the producers are between 1 and 60 years and the average experience of the producers is 26 years. Producers with less experience are more aware of climate change and are more likely to apply protective agricultural techniques. 1% increase in income reduces acceptance of climate change by 0.25 units. In other words, as income increases, awareness of climate change decreases. At the same time, as the income of wheat producers increases, they are less likely to apply protective agricultural techniques. As a result of the model, it is concluded that as the establishment area increases, producers' level of application of protective agriculture techniques increases and their awareness of climate change decreases as income increases. Providing efficiency by increasing the efficiency of other inputs in agricultural production and resulting in increased income, water is a limited natural resource and is affected by climate change (Bayramoğlu, 2020). Irrigation in wheat is done to protect crops from water stress, especially in dry agricultural areas where rainfall is inadequate. However, in order to provide maximum benefit from irrigation, cultivation techniques such as soil cultivation and seed bed preparation, variety selection, planting, fertilization, irrigation, disease-pest control and harvesting should be kept at an optimum level according to the regional conditions. In the study conducted by Aykanat and Barut (2018), by using direct sowing method, 326.66 kg/da yield was obtained from the irrigated wheat compared to those not irrigated.

The average yield in Kadınhanı and Ilgın districts was 343.71 kg/da. In the study conducted by Polat (2020), it was stated that the widespread adoption of protective soil cultivation systems can lead to net increases in the accumulation of organic matter in agricultural lands. In this study, it is concluded that as the area of operation increases, the producers' levels of applying protective agriculture techniques increase and as their income increases, their awareness of climate change decreases. Additionally, as the wheat yield increases, it is found that the producers' level of application of protective agriculture techniques and the possibility of being aware of the changes in the climate decrease.

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