Interregional comparative analysis of farmers' perceptions and expectations of climate change

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Highlights

- *Farmers associate climate change with drought.*
- *According to the farmers, the leading factors causing climate change are human-induced factors that disrupt the ecological balance.*
- *The most important concern regarding the effects of climate change is that production costs will increase.*
- *Farmers are reluctant to implement adaptation or mitigation methods that can be developed against climate change.*

Abstract

This study looked into the relationship and effects of agricultural activities in different regions of Turkey on climate change. This study aims to determine farmer awareness of climate change and its effects, as well as farmer adaptation capabilities in different regions of Turkey against climate change, and to develop extension and policy tools based on the findings. Data were collected through face-to-face surveys with farmers in the provinces where the research was conducted. In this context, a proportional sampling survey of 418 farmers was conducted. The collected information was subjected to factor analysis and the independent t-test. According to the findings, farmers associate climate change with precipitation, and the effect of precipitation and the risks it poses in increasing or decreasing crop yields are of particular concern. Farmers in the Southeastern Anatolia Region are more concerned about heat and drought than farmers in the Mediterranean Region. Furthermore, producers believe that human-caused factors and economic development have a greater impact on climate change than agricultural activities. Farmers in research areas are concerned that climate change will increase migration from rural areas and the decline of forests and animal species. As a result, raising individual awareness and utilising new technology in rural areas is critical. Farmers' awareness of new and environmentally friendly agricultural techniques must be raised to increase their use.

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Introduction

Excessive and unconscious use of Earth's limited resources disrupts the natural balance. As a result, major issues such as hunger, scarcity of water resources, extinction of living species, soil pollution, vegetation deterioration, global warming, and climate change emerge (Özdağ, 2011; Şahin *et al.,* 2015; Kaya, 2021). Climate change and its impact on developing countries agricultural sectors have become a global concern in recent years. The growing global population raises the demand for goods and services. As a result, global climate change is a mechanism that affects humans, animals, and all other living things. Furthermore, humans' increased use of fossil fuels is accumulating in the atmosphere. As a result, while natural resources are being depleted, the warming of the Earth's surface contributes to climate change. These factors are detrimental to agricultural activities (Dellal, 2008; Gürel and Senel, 2010) and put social and economic pressure on the agricultural sector (Akalın, 2014). Therefore, the issue of climate change, which affects the entire world, is a problem that requires immediate action (Polat and Dellal, 2016).

Climate change is a serious threat, particularly to life-sustaining water resources, and has reduced the amount of water available for agricultural use, threatening global food security. Climate change is defined in the United Nations Framework Convention on Climate Change as a change in climate caused by human activities that directly or indirectly degrade the composition of the

atmosphere, in addition to natural climate change observed over a comparable time period (Çakmak and Gökalp, 2011). People's living conditions are becoming increasingly complex as a result of climate change. It can then endanger everyone's health and jeopardize food safety (Kurukulasuriya and Rosenthal, 2003). Furthermore, it strains the world's food supply by lowering agricultural productivity (Bindi and Olesen, 2000; Kumara and Parikh, 2001; McMicmael and Githeko, 2007; Islam *et al.,* 2015).

Agricultural activities are both negatively impacted by and contributors to climate change. Agriculture is responsible for approximately 20% of the world's increasing greenhouse gas emissions (Pathak and Wassmann, 2007). Greenhouse gases such as CO_2, CH_4, and N_2O are released due to agricultural activities (energy consumption, production, livestock, fertilization, pesticides, *etc*.). As a result, agricultural production is one of the causes of climate change (Houghton, 2003). Climate change could significantly impact pollinator-dependent crop production, which will have serious implications for global food security (Rader *et al.,* 2013). Only global solutions can address this global issue.

As a result of environmental, economic, and social pressures, countries' search for solutions has accelerated. Today, in order to eliminate these negativities due to climate change, first of all, it is necessary to determine the situation with climate change scenarios (Kaya, 2021). In this context, mitigation and adaptation policies are carried out in the fight against climate change and its effects on agriculture jointly by international climate circles (Bayraç and Doğan, 2016).

Many studies have been conducted to investigate the effects of climate change on the agricultural sector and producer perceptions, and some of the most recent studies are listed below.

According to the findings of Molua and Lambi (2007), who used data obtained from farmer surveys in Cameroon, a country whose economy is largely agricultural, net incomes decrease in all farms as precipitation decreases or temperature rises. As a result, when compared to other factors required for efficient production, the climate has been determined to be the most important determinant. Polat and Dellal (2016) interviewed 40 farmers who practiced sustainable agriculture in the Göksu delta in 2014 to learn about their attitudes toward climate change. According to the findings, approximately 82% of farmers are aware of climate change and its consequences. Despite this level of awareness, only 14% of farmers are optimistic about new practices that will adapt to climate change, while the majority appear determined to stick with traditional methods. Çaltı and Somuncu (2018) used in-depth interviews, one of the qualitative research techniques, to determine farmers' levels of awareness and adaptation to the effects of climate change on the agricultural sector in the Ankara province. Locals have considered the views of relevant administrators and scientists in this context. The study's findings revealed that producers are affected by climate change, farmers cooperate insufficiently, adhere to traditional agricultural practices, and the use of organic fertilisers is limited, but chemical pesticides are commonly used.

The goal of this study is to compare the relationship and effects of climate change on agricultural activities in Turkey's Mediterranean and Southeastern Anatolia regions, to assess farmer awareness of climate change and its effects, to identify farmer adaptation capabilities to climate change across different regions, and to contribute to the agricultural extension and policy tools that will be implemented as a result of the findings.

Materials and methods

Materials

The primary source of the study's data is information gathered from farmers in the provinces of Hatay and Adana in the Mediterranean region and Mardin and Batman in Southeastern Anatolia. The number of surveys was calculated using the number of farmers and producers on a province-by-province basis. The population size was calculated using the total number of registered farmers from the Agriculture and Forestry Directorates of four provinces. The proportional sample size was used to determine the number of surveys (Newbold, 1995).

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

In the equation, n is the sample size, N is the population size (TOB, 2021), p is the prediction rate (for a maximum sample size of 0.5), and σp^2 is the rate variance (with a 95% confidence range and a 5% error margin). The calculation yielded a sample size of 380, but the survey was carried out with 418 participants by administering 10% extra surveys overall. The survey numbers were distributed proportionally to the provinces based on the number of farmers in each province. Accordingly, a survey was conducted with 135 people in Adana, 100 in Hatay, 102 in Mardin, and 81 in Batman. In this context, general information about farmers and their enterprises has been determined. In addition, farmers' responses to weather events were assessed in order to determine their perceptions of climate change.

Furthermore, the research looked into the causes of climate change, the effects on agricultural activities, expectations as a result of climate change, measures to be taken (individual and state), and problems in combating climate change. To assess the farmers' general knowledge, open-ended and closed-ended questions were used. On climate change issues, the Likert scale (quinary) was used. Aside from primary data, secondary data included climate change studies and reports from institutions and organisations.

Methods

The raw data from the study were uploaded to the computer and processed for analysis purposes, and the database was created as an Excel file and then uploaded to the SPSS program, where descriptive analyses (mean, standard deviation), factor analysis, and the independent sample t-test were used.

A factor analysis was used to determine farmers' perceptions of the variables that cause climate change as well as their perceptions of the effects of climate change. By reducing the number of variables, factor analysis provides benefits such as ease of visualisation and interpretation of the analysis (Islamoğlu and Alnıaçık, 2016). The KMO (Kaiser-Maier-Olkin) and Barlett tests were used to ensure that the scales used for factor analysis were appropriate. As a result of the analysis of the factors that cause climate change, the KMO value of the producers was determined to be 0.812, the Barlett sphericity value was determined to be 0.000, the KMO value for the perceptions of the effects of climate change was determined to be 0.799, and the scale and data were determined to be suitable for factor analysis. The independent sample t-test was used to determine whether there was a statistically significant difference in the factors obtained between the research regions.

Results and discussion

General characteristics of the farmers

Plant production employs 71.5% (n:299) of farmers, animal production employs 2.4% (n:10), and plant and animal production employs 26.1% (n:109). The average land area is 20.9 ha, with 19.4 ha in the Mediterranean Region provinces and 23.1 ha in the Southeastern Anatolian Region provinces. On average, business owners produce in four different parcels. The average age of the farmers in the surveyed enterprises is 46.8 (standard deviation: 11.76), and 93.5% are male (n: 391). The average number of households in the Mediterranean Region was found to be 4.3 people (SD: 1.6), 6.3 people (SD: 2.1) in the Southeastern Anatolia Region, and 5.2 people (SD: 2.07) in general. Social security is held by 76.6% (n: 320) of business owners, while non-agricultural income is held by 41.6%. While the rate of those with a high school diploma or higher in the surveyed enterprises was 56.5% (n: 133) in the Mediterranean provinces, it was 48.6% (n: 79) in the Southeastern Anatolia provinces. According to the province-based evaluation, farmers (65.0%) with a high school or higher education level in the province of Hatay outnumber those in the other provinces.

According to the data, 50.7% (n: 212) of business owners live in the village, 21.3% (n: 89) in the district centre, 10.0% (n: 42) in the city centre, and 18.0% (n: 75) live in both the village and the district or city. The rate of village residents was 47.6% (n: 112) in the Mediterranean Region and 54.6% (n: 100) in the provinces of Southeastern Anatolia. The rate of being a member of any cooperative/union in enterprises was determined to be 30.8% (n: 129), with the Mediterranean region having a rate of 20.4% (n: 48) and Southeastern Anatolia having a rate of 44.2% (n: 81). Farmers in both regions are overwhelmingly members of the Agricultural Credit Cooperative (73.5%).

Agricultural insurance is provided to cover the negative effects of climate change and the economic losses that may result from other risks (illness, accident, *etc*.) that may occur during the agricultural production process (Yazg and Olhan, 2018). The state also pays a portion of farmers' agricultural insurance premiums in Turkey (between 50% and 67%). The proportion of producers who obtained agricultural insurance for their products/animals in the last production period in the examined enterprises was 34.0% (n: 142), with this rate being 25.5% (n: 60) in the Mediterranean Region and 44.8% in the Southeastern Anatolian Region (n: 82).

Most enterprise owners stated that they did not receive training in this field, with only 18.4% (n: 77) stating that they did. While the record-keeping rate for agricultural activities carried out in enterprises was determined to be 58.9% (n: 246), this rate was 73.2% (n: 172) in the Mediterranean Region and 40.6% (n: 74) in the Southeastern Anatolia Region. At most (52.0%), business owners keep records on a seasonal basis.

Climate change perceptions of farmers

Farmers' perceptions of climate change are essential in understanding the adaptation strategies they can develop against adverse conditions caused by climate change because agricultural activities are heavily reliant on climatic conditions. As a result, farmers were asked to explain what climate change means to them. According to the findings, 98.1% of farmers were aware of climate change and associated it with precipitation the most (36.8%). In addition, the following responses were given: famine (15.5%), deterioration of natural balance (13.4%), loss of yield or product (12.0%), decrease/change of seasons (9.6%), change in harvest dates (5.3%), economic crisis (3.3%), and global warming (2.2%). Numerous studies have found that farmers associate climate change with precipitation and given the importance of precipitation and the risks it poses in increasing or decreasing crop yield, precipitation appears to be a particular concern for farmers (Tate *et al.,* 2010; Suresh *et al.,* 2021; Wheeler and Lobley, 2021).

According to studies conducted by Wiles (2012) in the United Kingdom and Houser *et al*. (2019) in the United States, farmer predictions regarding climate change are largely consistent with scientific studies. From this perspective, farmers' observations of changes in meteorological events (temperature, precipitation, humidity, *etc*.) in their regions are also important evidence for us to understand how the climate changes compared to the long-term average. According to Table 1, the average perception of farmers in the Mediterranean and Southeastern Anatolia Regions about the change in temperature and drought events compared to previous years is greater than 4.0 and quite strong. However, for both factors, the averages are higher, and the standard deviations are lower in the Southeastern Anatolia Region. As a result, it is possible to conclude that farmers in the Southeastern Anatolia Region are more concerned about temperature and drought than farmers in the Mediterranean Region.

Factors causing climate change according to farmers

Among the adaptation, efforts are raising public awareness about climate change and ensuring that society is not negatively impacted by it (Laukkonen *et al*., 2009). In this regard, it is critical to understand societal perceptions and attitudes toward the causes of climate change. Although people's beliefs about the causes of

Table 1. Opinions of farmers on the change of weather events.

Variable	Mediterranean	Southeast	Mean
Drought	4.12±0.72	4.43±0.62	4.26±0.69
Heat	4.06±0.79	4.51±0.52	4.25±0.72
Moisture	3.94±0.75	2.81±1.07	3.44±1.06
Storm	3.01±1.13	2.40±0.99	2.74±1.11
Flood	3.01±1.23	2.25±0.88	2.68±1.15
Hail	2.83±1.04	2.28±0.84	2.59±0.99
Frost events	2.79±1.10	2.24±0.83	2.55±1.02
Hoarfrost	2.82±1.04	2.32±0.84	2.74±1.11
Precipitation	2.42±1.22	1.34±0.54	1.94±1.12

1: Decreased a lot; 2: Decreased partially; 3: Unchanged; 4: Increased; 5: Increased a lot.

climate change are subjective, they can be influenced by their demographics, education levels, experiences, and the cultural and geographical environment in which they live. The study used 11 variables to examine farmers' perceptions of the factors that cause climate change. After reducing the number of variables, factor analysis was used to identify the variables that have a relationship with one another, and three factors with eigenvalues greater than one emerged as a result of the analysis. The first factor is made up of four items and explains 23.66% of the total variance, the second factor is made up of four items and explains 18.44% of the total variance, and the third factor is made up of three items and explains 17.29% of the total variance. The three factors identified as a result of the analysis account for 59.4% of the total variance (Table 2).

Factor 1 has been identified as being directly anthropogenic, factor 2 as being related to agricultural activities, and factor 3 as being related to economic development. According to the farmers in the research area, the primary causes of climate change are human-induced factors that disrupt the ecological balance. Farmers believe that forest fires or activities such as tree cutting and stubble burning are primarily to blame for climate change. While farmers agree that fossil fuel use, industrialisation, and urbanisation all harm the climate, it has been determined that agricultural irrigation, dams, and livestock activities have a low perception. As a result, producers believe that human-induced factors and economic development have a high impact on climate change, while agricultural activities have a lower impact. It was determined that the obtained results are comparable to the findings of Akyüz and Atış (2018)'s study with farmers in the 'Küçük Menderes' Basin. The t-test was used to determine whether farmers in the research regions have different perceptions of the factors causing climate change. The analysis found a significant difference between the averages of human-induced factors and agricultural activity factors among farmers in the Mediterranean and Southeastern Anatolia regions. In both factors, it was determined that farmers in the Mediterranean Region had higher averages and a higher perception level than farmers in the Southeastern Anatolia Region. It was determined that there was no significant difference between the research regions in terms of economic development (Table 3).

Views of farmers on the impact of climate change

Agriculture is the most vulnerable sector to climate change's negative effects. Because farming relies heavily on forecasting weather and seasons based on previous years' experience, changes in seasons and unusual weather patterns result in crop or livestock

Table 2. Factor analysis results regarding the variables causing climate change.

Items	Factor			Mean	Standard deviation
	Human	Agriculture	Economy		
Burning of stubble	0.798	0.175	0.035	4.17	0.95
Forest fires/cutting trees	0.748	0.170	0.035	4.22	0.97
Increasing number of vehicles	0.664	0.154	0.094	4.08	0.98
Other human interventions	0.586	0.065	0.225	4.15	0.97
Increasing agricultural irrigation	0.076	0.714	0.154	3.76	1.14
Livestock activities	0.013	0.677	0.023	2.81	1.36
Construction of dams	0.236	0.580	0.339	3.60	1.10
Use of chemicals and fertilisers	0.287	0.519	0.134	4.01	0.95
Increasing urbanisation	0.224	0.066	0.876	3.98	0.97
Increasing industrialisation	0.211	0.161	0.859	3.93	0.99
Use of fossil fuels	0.420	0.002	0.727	3.97	0.94
Variance explanation %	23.635	18.435	17.293		
Cronbach's alpha			0.862		
KMO			0.761		
X-Square			1470.5		
P			0.000		

1: Strongly disagree; 2: Disagree; 3: Undecided; 4: Agree; 5: Strongly agree..

Table 3. Perceptions of farmers regarding the factors causing climate change by region.

Factor	Region	N	Mean	Standard deviation	t	P
Human origin	Mediterranean	235	4.25	0.64	8.853	0.000
	Southeast	183	3.61	0.79		
Agricultural activities	Mediterranean	235	4.25	0.66	3.072	0.002
	Southeast	183	4.03	0.75		
Economic development	Mediterranean	235	3.38	0.93	0.216	0.833
	Southeast	183	3.40	0.78		

losses (Chinh *et al.,* 2022). Farmers' perceptions of the effects of climate change were assessed using an 18-item scale in this study. The factor analysis yielded six factors with eigenvalues greater than one, with the first factor consisting of four items, the second factor consisting of four items, the third factor consisting of three items, the fourth factor consisting of three items, the fifth factor consisting of two items, and the sixth factor consisting of two items. The percentage of total variance explained by all factors was determined to be 68.1%. (Table 4). Factor 1 is production cost, factor 2 is product quality, factor 3 is crop diversity, factor 4 is production quantity, factor 6 is health concerns, and factor 5 is technological development expectations related to agricultural activities.

According to climate change studies, crop diseases and pests will become more prevalent due to adverse climatic conditions (Gutierrez, 2000; Nasir *et al*., 2018), increasing production costs (Ndamani and Watanebe, 2017; Gupta *et al*., 2021). Farmers in the research region are most concerned about the effects of climate change on water resources, which will decrease as production costs and input use rise. The mean of this factor was 4.35, with a standard deviation of 0.57, and it was determined that farmers had the highest anxiety levels. Farmers believe less precipitation and higher temperatures will increase the use and cost of production resources. It has been determined that the decrease in the presence of pasture, which is important in terms of livestock activities, the change in plant production periods, and the concern that product quality and production patterns will decrease are all critical determinants of farmers' perceptions of climate-related risk in the research regions. According to climate change reports, deforestation and urbanisation are the primary sources of carbon emissions globally (IPCC, 2007). The fear that climate change will increase migration from rural areas while decreasing forests and animal species has been identified as one of the factors of concern for producers in research areas.

Studies on the existence, potential future effects, and magnitude of climate change's human health consequences are essential to policy discussions. Climate change, according to studies, has an impact on vector-borne and other infectious diseases (Haines *et al.,* 2006). However, heat waves have been reported to be fatal to the elderly and children (Benmarhnia *et al*., 2015), and floods caused by extreme weather events cause deaths or permanent psychological diseases (Lealfilho *et al*., 2018). However, it was discovered that farmers in the research region had lower perceptions of the effects of climate change on human health and deaths (mean: 3.73, SD: 0.78) than other factors. Another source of concern for farmers is that climate change will hurt plant and animal species as well as healthy food production. This factor has a mean of 4.27 and a standard deviation of 0.59, both of which cause concern. Although it is intended to mitigate the effects of climate change, new production technologies and the expectation of increased mechanisation, which are among the factors that indirectly cause climate change, have been identified as important factors. The average of this factor is 3.90, with a standard deviation of 0.75, and it has been discovered that farmers have high expectations of reducing the effects of climate change. The results of the t-test analysis performed to measure the differences between the factors related to the effects of climate change on farmers among the regions examined

Table 4. Results of factor analysis regarding the effects of climate change.

Items	Factor						Mean	Standard deviation
	Cost	Quality	Diversity	Quantity	Technology	Health		
Production costs will increase	0.826	0.090	0.170	0.030	0.055	0.019	4.42	0.68
Water resources will decrease	0.601	0.146	0.365	0.343	0.092	0.198	4.40	0.63
Drug use will increase	0.841	0.186	0.084	0.143	0.033	0.060	4.40	0.70
Fertiliser use will increase	0.735	0.326	0.097	0.044	0.076	0.060	4.29	0.84
Products will mature earlier	0.448	0.627	0.003	0.031	0.000	0.138	4.18	0.84
Product quality will decrease	0.126	0.837	0.104	0.153	0.049	0.008	4.17	0.77
Pasture areas will decrease	0.115	0.807	0.204	0.024	0.204	0.053	4.13	0.82
The product pattern will decrease	0.276	0.779	0.171	0.024	0.201	0.101	4.06	0.86
Drought/famine will occur	0.059	0.065	0.180	0.709	0.088	0.188	4.29	0.62
Migration from villages to cities will increase	0.006	0.085	0.072	0.773	0.026	0.140	3.88	0.91
Forests (photosynthesis) will decrease	0.262	0.205	0.369	0.634	0.159	0.148	4.34	0.74
Animal species will decrease	0.081	0.247	0.623	0.398	0.114	0.078	4.20	0.68
The amount of GMO products will increase	0.133	0.119	0.764	0.116	0.051	0.069	4.20	0.68
Plant species will disappear	0.072	0.102	0.792	0.0126	0.166	0.112	4.14	0.72
Human diseases will increase	0.165	0.195	0.215	0.157	0.181	0.748	3.72	0.84
Population will decrease	0.059	0.011	0.129	0.308	0.365	0.704	3.49	1.06
New production techniques will emerge	0.043	0.072	0.138	0.028	0.763	0.133	3.98	0.78
Mechanisation will increase	0.096	0.046	0.085	0.071	0.828	0.100	3.79	0.96
Variance explanation %	15.242	15.009	11.701	10.399	8.905	6.887		
Cronbach's alpha	0.812							
KMO	0.799							
X-Square	2042.6							
P	0.000							

1: Strongly disagree; 2: Disagree; 3: Undecided; 4: Agree; 5: Strongly agree.

revealed a significant difference at the level of 0.01 between the regions in terms of all factors except the factor related to the amount of production. In terms of increased production costs, decreased product quality, decreased product diversity, and human health factors, producers in the Mediterranean Region have higher perception/concern levels than producers in the Southeastern Anatolia Region. Regarding the factor of production technology development, it was determined that farmers in the Southeastern Anatolia Region had higher perception levels than farmers in the Mediterranean Region (Table 5). This situation is thought to be the result of climate differences between regions and problems with agricultural irrigation activities.

Measures taken by farmers to mitigate the impact of climate change

Adapting to the current farming system is one method of avoiding climate change risks, preserving livelihoods, and ensuring local food security. However, the most common strategies are thought to be reducing the effects of climate change (mitigation) or coping with the effects of climate change (adaptation) (Laukkonen *et al.,* 2009). Mitigation seeks to avoid the uncontrollable, whereas adaptation seeks to manage the uncontrollable. As a result, while climate change is expected to have a negative impact on agricultural activities, it is also expected to have an impact on adaptation, such as product diversification, land management, increased use of technology, and irrigation management. The adaptation/reduction dependent variable in our study was formed by the average of the answers given to the 14 variables used in the research to determine the measures taken by farmers against climate change and the factors influencing their behaviour towards reducing the factors that cause climate change. The mean of the said variables was determined by using a five-point Likert scale of 3.47, and the standard deviation was determined to be 0.55, which was found to be relatively low (Table 6).

As shown in Table 6, there is a significant difference between the Mediterranean and Southeastern Anatolia Regions in terms of attitudes toward mitigating the effects of climate change and/or adaptation in all variables except avoiding harming the natural environment, supporting environmental campaigns, and saving water. It is intended that farmers' attitudes in both regions are sim-

Table 5. Perceptions of farmers regarding the effects of climate change by region.

Factor	Region	N	Mean	Standard deviation	t	P
Production cost	Mediterranean	235	4.42	0.59	2.641	0.009
	Southeast	183	4.27	0.54		
Product quality	Mediterranean	235	4.29	0.67	4.909	0.000
	Southeast	183	3.97	0.66		
Product variety	Mediterranean	235	4.35	0.58	2.969	0.003
	Southeast	183	4.17	0.60		
Production amount	Mediterranean	235	4.25	0.69	0.508	0.612
	Southeast	183	4.21	0.61		
Production technology	Mediterranean	235	3.81	0.82	2.766	0.006
	Southeast	183	4.01	0.63		
Human health	Mediterranean	235	3.93	0.69	6.434	0.000
	Southeast	183	3.47	0.77		

Table 6. Mitigation and adaptation methods of farmers against the effects of climate change by region.

Measure	Mediterranean	Southeast	Mean	t
Avoiding damaging agricultural lands	4.10±0.73	3.63±0.96	3.89±0.87	5.468**
Avoiding harming the natural environment	3.85±0.91	3.81±0.77	3.83±0.86	0.461
Alerting the environment about climate change	4.14±0.63	3.41±0.86	3.82±0.83	9.617**
Adjusting the sowing/planting time	3.97±0.95	3.55±0.94	3.79±0.97	4.522**
Developing financial instruments	4.03±1.15	3.39±1.02	3.75±1.14	5.949**
Using recycled products	3.92±0.94	2.90±0.93	3.48±1.06	11.015**
Product diversification	3.81±1.21	3.05±1.12	3.48±1.14	6.592**
Supporting environmental campaigns	3.54±1.11	3.36±0.98	3.46±1.10	1.653
Using alternative energy	3.86±0.89	2.88±0.93	3.43±1.03	10.934**
Reducing the number of cultivated land or animals	3.50±1.15	2.86±1.22	3.22±1.22	5.471**
Water saving	3.14±1.21	3.30±1.07	3.21±1.15	1.323
Reducing vehicle use	3.62±1.04	2.50±0.87	3.13±1.11	11.874**
Reducing the use of pesticides and fertilisers	3.20±1.21	2.67±1.02	2.97±1.16	4.782**
Agricultural insurance	2.34±1.42	2.92±1.25	2.53±1.42	0.962*
Mean	3.72±0.50	3.15±0.46	3.47±0.55	11.848**

1: Strongly disagree; 2: Disagree; 3: Undecided; 4: Agree; 5: Strongly agree. **P<0.01; *P<0.05.

ilar in terms of these three variables. Except for agricultural insurance, there was a significant difference at the level of 0.01 between regions in all other variables, and farmers' attitudes in the Mediterranean Region were higher. In terms of agricultural insurance, it has been determined that there is a significant difference at the level of 0.05 between the two regions, with farmers in the Southeastern Anatolia Region having more positive attitudes. Adaptation of farmers' behaviours appears to be the variable with the highest average of attitudes toward mitigation or that are not directly related to agricultural activities, such as avoiding damaging agricultural lands, avoiding harming the natural environment, warning the environment about climate change, adjusting planting time, and improving financial instruments in both regions. Saving water, reducing vehicle use, reducing pesticide and fertiliser use, and purchasing agricultural insurance were found to have the lowest averages of attitude toward adaptation or reduction. As a result, it has been concluded that farmers in the research regions are unwilling or unable to implement adaptation or mitigation methods that can be developed to combat climate change.

Conclusions

According to the findings of this study, which was conducted in two regions important to Turkey's agricultural production, most producers who participated in the research perceive climate change as drought and famine. Farmers' perception of climate change as drought and famine is influenced by the fact that precipitation is an important factor in crop yield and quality. Human-induced factors (forest fires, stubble burning, *etc*.) are the most critical factors causing climate change, according to farmers in the research regions. On the other hand, it was discovered that perceptions of the effects of agricultural irrigation and animal breeding on climate change were low in both regions. The most essential concerns of farmers in the research regions about the effects of climate change are an increase in production costs and input use, as well as a decrease in water resources. As a result, the pressure of climate change on irrigation and costs outweighs environmental concerns for farmers in both regions. It has been determined that farmers in the Mediterranean Region are more concerned about the harmful effects of climate change on agricultural activities and human health. In contrast, farmers in the Southeastern Anatolia Region are more optimistic about new production techniques and mechanisation due to climate change.

Farmers in both regions are not sufficiently aware of the effects of climate change and adaptation, and the number of farmers using important adaptation and mitigation methods such as alternative energy use, water conservation, reducing chemical inputs, and purchasing agricultural insurance is very low. Farmers must be made more aware of the effects of agricultural activities on climate change, water conservation, the use of renewable energy, sustainable agriculture, and climate change adaptation. Deterrent measures are thought to be increased in preventing water waste and excessive use of inputs in agricultural activities, which causes stubble burning and forest fires.

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