Original Article

The Relationship Between Chemical Use in Agriculture, Climate Change, And Public Health: Example of Turkey

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Abstract
Aim: This study aimed to investigate the impact of agricultural chemical use on climate change and public health.
Methods: This cross-sectional and correlational study was conducted between July 2023 and October 2023 in a region heavily dependent on hazelnut cultivation. The sample consisted of hazelnut growers and farmers (n=202). A data collection form specifically designed by the researchers, based on observation and existing literature, was used.
Results: The participants, 83.2% were male and 70.8% reported middle-income status. Among those who perceived pesticide use as a threat to human health, significantly higher percentages also believed in a potential link between climate change and health issues and that climate change has a significant impact on health behaviors. In addition, participants who were aware of alternative solutions to chemical use in agriculture and those who believed that chemical use increases the risk of cancer showed increased sensitivity to the effects of climate change on health behaviors (p=0.010; p=0.011).
Conclusion: The results suggest that climate change has a profound effect on health-related behaviors. Those who perceive agricultural chemicals as harmful are more likely to perceive a link between climate change and health concerns.

Keywords: Agricultural workers, climate change, farmers, public health

Introduction

In recent years, farmers have increasingly suffered from the harmful effects of indiscriminate chemical use and the escalating effects of climate change. Global challenges in the agricultural sector are intensifying by the day, making agriculture one of the most challenging industries to work in (Nera et al., 2020). Despite these obstacles, agricultural labor continues to represent a significant portion of the global workforce (Atalay et al., 2017). Hazelnut production in particular is of great importance to Turkey. As of 2022, Turkey is the world's leading producer of hazelnuts, with the majority of cultivation taking place in the country's Black Sea region (Bars, 2023).

Although hazelnuts may appear to be a seasonal crop, their cultivation requires year-round care and sustainable practices that take into account climatic and geographic conditions. Hazelnut cultivation also involves extensive use of chemicals, underscoring the need for human health assessments. Soil analysis should be performed routinely, good agricultural practices should be promoted, and both

chemical and non-chemical methods should be monitored by experts (Nadarajan & Sukumaran, 2021; Yildirim et al., 2022). In this context, both traditional and modern agricultural approaches overlap. It is critical to assess whether farmers are using chemicals in an informed manner, whether they are conducting soil tests, and whether they are familiar with sustainable practices such as organic and good agricultural practices (Potena et al., 2020).

In recent years, shifts in climate patterns have received as much attention as the chemicals used in agricultural practices. The relationship between agriculture and climate change is two-way. Agriculture is a major economic driver, particularly in developing countries, but the potential impacts of climate variability on agricultural productivity can pose significant threats to food security, environmental sustainability, and human well-being (Meral & Millan, 2023). Manifestations of climate change include atypical phenomena such as extreme heat waves, storms, floods, and avalanches. Sustainable soil management, along with the prudent and judicious use of chemicals, offers valuable strategies for mitigating the effects of climate change (Yohannes, 2016). Indeed, the issue of climate change remains on the global agenda, largely driven by human activities, with agricultural practices contributing through the inappropriate use of chemicals and the release of greenhouse gases (Balogh, 2020).

Reckless agricultural practices and excessive use of chemicals not only exacerbate climate change but also pose significant risks to public health. Such irresponsible agricultural practices lead to health complications that often endanger human lives (Komarnytsky et al., 2022). One of the few studies conducted on farmers found that symptoms such as dizziness, coughing, and headaches were common among those exposed to pesticides, with 34% facing increased health risks (Laor et al., 2019). Chemical misuse affects not only the individual farmer but also society at large, leading to prolonged illness, increases in infectious and vector-borne diseases, and potentially irreversible damage to the human body (Deniz et al., 2020). To develop effective public health interventions, we must first understand the complex interactions between climate change and health outcomes, which requires robust evidence (Joacim Rocklöv et al., 2014). However, the current literature is severely lacking in this regard (Aydogdu, 2020; Güngör et al., 2022). Therefore, this study aimed to elucidate the relationship between agricultural chemical use, climate change, and public health.

Methods

Study design: This cross-sectional and correlational study was conducted between July 2023 and October 2023.

Participants: The sample consisted of individuals involved in hazelnut farming in one province in the Black Sea region. The population size was determined by referring to the number of farmers/agricultural workers registered with the local Directorate of Agriculture. For known populations, the sample size was calculated using the freely available Epi Info software, resulting in a target of 200 participants. Following the literature, an additional 10% was added as a buffer to account for potential data loss. Consequently, 20 participants were designated as reserves to mitigate losses due to dropouts or eligibility issues, resulting in a final sample size of 202 participants (n=202).

Data Collections: The data collection instrument was a questionnaire developed by the researchers based on an extensive review of the literature. This form included demographic questions, inquiries about agricultural chemical use, alternative methods where applicable, perceptions of climate change, and structured health-related questions (Topuz & Bozoglu, 2018; Kumar & Kumar, 2019; Aydogdu, 2020).

Once the pool of questions for the questionnaire was created, feedback was sought from an agricultural engineer specializing in this area and two public health experts to refine the tool before implementation. Their input was

incorporated after reviewing the evaluation forms that were emailed to the experts. This process ensured the content validity of the questionnaire through expert consensus. The relevance of each statement was rated on a 4-point scale (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, and 4 = very relevant). All items received high scores (3 or 4) from the experts and only minor revisions were made. The Content Validity Index (CGI) of the questionnaire was calculated to be 0.98, above the acceptable threshold of 0.80, confirming its content validity (Polit & Beck 2006). Once finalized, the questionnaire was piloted with agricultural workers to ensure its clarity and comprehensibility.

Data Analysis: Data were processed and analyzed using SPSS 22.00 statistical software. A significance threshold of $p<0.05$ was used for all statistical tests. Various methods were used in the analysis, including skewness and kurtosis coefficients, percentage and frequency distributions, chi-square analysis, Pearson's chi-square test, Fisher-Freeman-Halton test, Fisher's exact test, and binary logistic regression analysis.

Ethical approval for the study was obtained from Giresun University Social Sciences, Science and Engineering Sciences Research Ethics Committee dated May 3, 2023 and numbered 05/23. The participants gave written informed consent and recorded by researchers.

Results

It was found that 83.2% of the participants were male, 61.4% had undergraduate or graduate degrees, 38.1% were employed as civil servants, 70.8% reported middle-income status, 65.8% resided in rural areas, and the mean age was 47.91±11.08.

Among the participants, 60.9% had done soil analysis, 85.6% were familiar with organic and good agricultural practices, and 89.1% considered the use of chemicals in agriculture to be harmful. In addition, 75.7% were aware of alternatives to chemical use in agriculture, while 97.5% believed that chemical use posed a risk to human health and 96.0% believed that it contributed to the increase in cancer. In addition, 98% perceived chemical use in agriculture as a threat to environmental health, and 97% thought it threatened water and food safety. In terms of disease risks, 85.6% believed that agricultural chemicals contribute to infectious diseases and 65.3% believed that they contribute to vector-borne diseases. In addition, 76.7% believed that chemical use had a negative impact on climate change, while 93.6% reported an increase in diseases and pests. Finally, 95% saw a potential link between climate change and health problems, and 92.1% believed that climate change affects health behaviors (Table 1).

Among participants who believed that the use of chemicals in agriculture is harmful, the rate of those who were familiar with organic and sustainable farming practices, those who perceived chemical use as having a negative impact on climate change, and those who observed an increase in diseases and pests, as well as those who recognized a potential link between climate change and health issues and its influence on health behaviors was significantly higher ($p<0.05$). Similarly, among participants who were aware of alternative solutions to chemicals in agricultural practices, the rate of those who had conducted soil analyses, those who were familiar with organic and sustainable agriculture, those who linked chemical use to adverse climate effects, increased disease and pest outbreaks, and health problems, and those who believed a link between climate change and health behaviors was significantly higher ($p<0.05$). In addition, participants who viewed agricultural chemical use as a risk to human health were significantly more likely to believe in a link between climate change and health problems and to believe that climate change affects health behaviors ($p<0.05$). In addition, among participants who believed that agricultural chemical use contributes to rising cancer, the rate of those who were knowledgeable about organic and sustainable agriculture, and those who linked chemical use to climate change, health problems, and behaviors was statistically significantly higher ($p<0.05$).

Participants who believed that agricultural chemical use poses a threat to environmental health were statistically more likely than others to have conducted soil tests, to be familiar with organic and sustainable farming practices, to perceive chemical use as harmful to climate change, and to recognize a potential link between climate change and health issues and its influence on health behaviors ($p<0.05$). Similarly, those who viewed agricultural chemical use as a threat to water and food safety were significantly more likely to have done soil testing, to be knowledgeable about organic and sustainable agriculture, and to believe that chemical use exacerbates climate change and correlates with health problems ($p<0.05$). Participants who believed that agricultural chemicals cause infectious diseases were also more likely to be aware of organic and good farming practices, perceive a negative impact on climate change, observe an increase in diseases and pests, and associate climate change with health issues and behaviors ($p<0.05$). In addition, those who believed that agricultural chemicals contribute to vector-borne diseases were significantly more likely to have conducted soil tests, to view chemical use as harmful to the climate, to observe increased disease and pest incidence, and to perceive a link between climate change and health problems, including its effect on health behaviors ($p<0.05$).

The regression model developed in the study was statistically significant (-2 log L = 72.797, $\chi 2$ (7) = 39.043, $p < 0.001$). The Hosmer-Lemeshow test further confirmed that the model fit the data well ($\chi 2 = 4.322$, $p=0.504$ [$p>0.05$]). The independent variables related to agricultural chemical use explained 41.3% of the variance in the dependent variable, "the impact of climate change on health behaviors" ($R^2=0.413$ [Nagelkerke]). The model showed high classification accuracy, correctly predicting outcomes for 95.0% of participants. Among the independent variables, two emerged as significant predictors of the perceived impact of climate change on health behaviors: "Knowing that there are alternatives to chemicals in agricultural practices" and "Believing that the use of chemicals in agriculture contributes to an increase in cancer" ($p<0.05$). Specifically, participants who were aware of non-chemical alternatives in agriculture were more likely to believe that climate change influences their health behaviors (OR = 6.04, 95% CI = 1.54-23.69). In addition, those who believed that the use of chemicals in agriculture has led to an increase in cancer were more likely to believe that climate change affects their health behaviors (OR = 77.81, 95% CI = 2.67-260.59) (Table 3).

Table 1. Distribution of Some Descriptive Characteristics of the Participants (N=202)

Descriptive Characteristics	N	%
Gender		
Female	34	16.8
Male	168	83.2
Educational Status		
Primary School	10	5.0
Secondary School	16	7.9
High School	52	25.7
Undergraduate/Graduate	124	61.4

Profession		
Farmer/agricultural worker	53	26.2
Officer	77	38.1
Retired	31	15.4
Self-Employment	41	20.3
Income Level		
Low	16	7.9
Moderate	143	70.8
High	43	21.3
Place of Residence		
Rural	133	65.8
Urban	69	34.2
Conducted Soil Analysis		
Yes	123	60.9
No	79	39.1
Awareness of Good Agricultural Practices and Organic Farming	173	85.6
Aware	29	14.4
Not aware		
Views on Chemical Use in Agriculture		
Safe method	22	10.9
Unsafe method	180	89.1
Awareness of Alternatives to Chemical Applications		
Aware	153	75.7
Not aware	49	24.3
Beliefs about the Risk of Chemical Use in Agriculture to Human Health	197	97.5
Poses a risk	5	2.5
Does not pose a risk		
Belief that Chemical Use in Agriculture Increases Cancer Risk	194	96.0
Yes	8	4.0
No		
Belief that Chemical Use in Agriculture Poses a Risk to Environmental Health	198	98.0

Yes	4	2.0
No		
Belief that Chemical Use in Agriculture Threatens Water and Food Security		
Yes	196	97.0
No	6	3.0
Belief that Chemical Use in Agriculture Causes Infectious Diseases		
Yes	173	85.6
No	29	14.4
Belief that Chemical Use in Agriculture Causes Vector-borne Diseases		
Yes	132	65.3
No	70	34.7
Impact of Chemical Use in Agriculture on Climate Change		
Negative impact	155	76.7
Positive impact	9	4.5
Undecided	38	18.8
Perception of Disease and Pest Increase due to Chemical Use		
Increased	189	93.6
Did not increase	13	6.4
Belief in a Link Between Climate Change and Health Issues		
Connection exists	192	95.0
No connection	10	5.0
Belief that Climate Change Affects Health Behaviors		
Affects	186	92.1
Does not affect	16	7.9
Total	202	100
	Mean	**SD**
Age (year)	47.91	11.08

Table 2. Comparison of Participants' Views of the Use of Chemicals in Agriculture, Climate Change, and Public Health

Opinions on the Use of Chemicals in Hazelnut Agriculture	Conducted Soil Analysis				Awareness of Good Agricultural Practices and Organic Farming				Impact of Chemical Use in Agriculture on Climate Change						Perception of Disease and Pest Increase due to Chemical Use				Belief in a Link Between Climate Change and Health Issues				Belief that Climate Change Affects Health Behaviors			
	Yes		No		Yes		No		In a negative way		In a positive way		Undecided		Yes		No		Yes		No		Yes		No	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Views on Chemical Use in Agriculture																										
Safe method	10	45.5	12	54.5	10	45.5	12	54.5	7	31.8	1	4.5	14	63.6	18	81.8	4	18.2	17	77.3	5	22.7	14	63.6	8	36.4
Unsafe method	113	62.8	67	37.2	163	90.6	17	9.4	148	82.2	8	4.4	24	13.3	171	95.0	9	5.0	175	97.2	5	2.8	172	95.6	8	4.4
Test statistic *p-value*	*χ2=2.470a p=0.164*				***p=0.000b***				***χ2=26.006c p=0.000***						***p=0.039b***				***p=0.002b***				***p=0.000b***			
Awareness of Alternatives to Chemical Applications																										
Aware	103	67.3	50	32.7	142	92.8	11	7.2	129	84.3	4	2.6	20	13.1	150	98.0	3	2.0	152	99.3	1	0.7	148	96.7	5	3.3
Not aware	20	40.8	29	59.2	31	63.3	18	36.7	26	53.1	5	10.2	18	36.7	39	79.6	10	20.4	40	81.6	9	18.4	38	77.6	11	22.4
Test statistic *p-value*	***χ2=10.948a p=0.001***				***χ2=26.349a p=0.000***				***χ2=20.569a p=0.000***						***p=0.000b***				***p=0.000b***				***p=0.000b***			
Belief about the Risk of Chemical Use in Agriculture to Human Health																										
Poses a risk	122	61.9	75	38.1	170	86.3	27	13.7	153	77.7	9	4.6	35	17.8	185	93.9	12	6.1	189	95.9	8	4.1	184	93.4	13	6.6
Does not pose a risk	1	20.0	4	80.0	3	60.0	2	40.0	2	40.0	0	0	3	60.0	4	80.0	1	20.0	3	60.0	2	40.0	2	40.0	3	60.0
Test statistic *p-value*	*p=0.078b*				*p=0.151b*				*χ2=4.755c p=0.092*						*p=0.285b*				***p=0.020b***				***p=0.004b***			
Belief that Chemical Use in Agriculture Increases Cancer Risk																										
Yes	120	61.9	74	38.1	169	87.1	25	12.9	153	78.9	9	4.6	32	16.5	182	93.8	12	6.2	187	96.4	7	3.6	184	94.8	10	5.2
	3	37.5	5	62.5	4	50.0	4	50.0	2	25.0	0	0	6	75.0	7	37.5	1	12.5	5	62.5	3	37.5	2	25.0	6	75.0

No																								
Test statistic *p-value*	*p=0.267b*				***p=0.016b***				***χ2=12.299c*** ***p=0.002***					*p=0.418b*			***p=0.004b***				***p=0.000b***			
Belief that Chemical Use in Agriculture Poses a Risk to Environmental Health																								
Yes	1230	62.1	75	37.9	1721	86.9	26	13.1	1541	77.8	90	4.5	353	17.7	1863	93.9	121	6.1	1911	96.5	73	3.5	1842	92.9	142	7.1
No	0	0	4	100	25.0		3	75.0	25.0		0	0		75.0		75.0		25.0		25.0		75.0		50.0		50.0
Test statistic *p-value*	***p=0.016b***				***p=0.010b***				***χ2=6.521c*** ***p=0.040***					*p=0.235b*			***p=0.004b***				***p=0.032b***			
Belief that Chemical Use in Agriculture Threatens Water and Food Security																								
Yes	1230	62.8	73	37.2	1712	87.2	25	12.8	1532	78.1	81	4.1	353	17.9	1845	93.9	121	6.1	1902	96.9	64	3.1	1824	92.9	142	7.1
No	0	0	6	100	2	33.3	4	66.7	2	33.3	1	16.7		50.0	5	83.3	1	16.7	2	33.3	4	66.7	4	66.7	2	33.3
Test statistic *p-value*	***p=0.003b***				***p=0.004b***				***χ2=6.989c*** ***p=0.041***					*p=0.333b*			***p=0.000b***				*p=0.073b*			
Belief that Chemical Use in Agriculture Causes Infectious Diseases																								
Yes	10914	63.0	64	37.0	15320	88.4	20	11.6	14213	82.1	72	4.0	2414	13.9	16524	95.4	85	4.6	17022	98.3	37	1.7	16323	94.2	106	5.8
No		48.3	15	51.7		69.0	9	31.0		44.8	2	6.9		48.3		82.8	5	17.2		75.9	7	24.1		79.3	6	20.7
Test statistic *p-value*	*χ2=2.263a* *p=0.152*				***p=0.018b***				***χ2=20.571a*** ***p=0.000***					***p=0.024b***			***p=0.000b***				***p=0.015b***			
Belief that Chemical Use in Agriculture Causes Vector-borne Diseases																								
Yes	8835	66.7 50.0	44 35	33.3 50.0	11756	88.6 80.0	15 14	11.4 20.0	11144	84.1 62.9	63	4.5 4.3	1523	11.4 32.9	12960	97.7 85.7	310	2.3 14.3	13161	99.2 87.1	19	0.8 12.9	12660	95.5 85.7	610	4.5 14.3
Test statistic *p-value*	***χ2=5.336a*** ***p=0.024***				*χ2=2.775a* *p=0.139*				***χ2=13.928a*** ***p=0.001***					***p=0.002b***			***p=0.000b***				***χ2=5.950a*** ***p=0.025***			

a= Pearson chi-square test; b=Fisher's Exact test; c= Fisher-Freeman-Halton test; n=number;%=percentage

Table 3. Analysis Results of the Binary Logistic Regression Model

Variables	Status of Impact of Climate Change on Health Behaviors				
	β	Standard Error	95% CI	OR*	*p*
Views on Chemical Use in Agriculture					
Safe method	1.312	0.807	0.76	3.715	0.104
Unsafe method (Reference)			-18.054		
Awareness of Alternatives to Chemical Applications					
Aware	**1.799**	**0.697**	**1.542**	**6.045**	**0.010**
Not aware (Reference)			**-23.695**		
Belief about the Risk of Chemical Use in Agriculture to Human Health					
Poses a risk	0.644	1.967	0.040	1.904	0.743
Does not pose a risk (Reference)			-90.046		
Belief that Chemical Use in Agriculture Increases Cancer Risk					
Yes	**4.354**	**1.719**	**2.679**	**77.815**	**0.011**
No (Reference)			**-260.591**		
Belief that Chemical Use in Agriculture Poses a Risk to Environmental Health					
Yes	-1.993	2.323	0.001	0.136	0.391
No (Reference)			-12.947		
Belief that Chemical Use in Agriculture Causes Infectious Diseases					
Yes	-1.088	1.155	0.035	0.337	0.346
No (Reference)			-3.242		
Belief that Chemical Use in Agriculture Causes Vector-borne Diseases					
Yes	0.432	0.718	0.377	1.540	0.547
No (Reference)			-6.287		
Model Values					
$\chi 2$	39.043				
p	0.000				
R^2	0.413 [Nagelkerke]				

-2 Log L	72.797
Hosmer-Lemeshow Test ($\chi 2$)	4.322 [p=0.504]

β=Beta coefficient; OR= Odds Ratios

Discussion

In this study, hazelnut workers who viewed the use of chemicals in agriculture as harmful and acknowledged the existence of alternatives to chemical methods showed a high awareness of organic and sustainable agricultural practices. These participants were also more likely to believe that chemical use has a negative impact on climate change, to observe an increase in diseases and pests, and to link climate change to health problems, including its influence on health behaviors. This suggests that participants have a high level of awareness of the intersections between agriculture, climate, and human health. In reviewing the literature, it has been noted that agriculture in underdeveloped countries is often practiced with less awareness that climate change directly affects soil quality and agricultural production, which in turn has adverse effects on human health (Fahad & Wang, 2020). Climate change is widely considered to be one of the most significant threats to human health. A study of climate change concerns in Australia found similar results to ours: rural populations involved in agriculture experienced an increase in pest outbreaks, faced challenges related to drought, and suffered from social and health problems exacerbated by climate change (Austin et al., 2020).

Among participants who believe that the use of chemicals in agriculture poses a threat to human health, a higher proportion also perceive a link between climate change and health problems and believe that climate change affects health behaviors. The expansion of industrialized agriculture has largely led to an increase in the use of chemicals, which, when used appropriately, for example, to protect crops from pests or to control vector-borne diseases, may not pose an inherent threat to public health. However, combined with climate change, most chemicals represent a significant risk factor in the environment, agriculture, and food security (Nicolopoulou-Stamati et al., 2016). In a study conducted in Hanoi, participants acknowledged that climate change was affecting their health, reporting symptoms such as headaches, fatigue, and heart palpitations during extreme temperature fluctuations, and expressing concern about the potential emergence of new diseases (Toan et al., 2014). These findings suggest a critical link between climate and human health, which is consistent with the beliefs of the participants in this study and the broader literature.

Furthermore, among those who associate chemical use in agriculture with increased cancer risk, there is a higher percentage of participants who are knowledgeable about organic and sustainable agricultural practices, believe that chemicals negatively affect climate change, and perceive a link between climate change and health outcomes. While studies on this topic are limited, research on agricultural workers in Canada and the United States found that individuals with high exposure to pesticides were more likely to develop at least one type of cancer (Weichenthal et al., 2010). It is well known that climate change inevitably poses health risks. In fact, the World Health Organization has highlighted this issue in its health argument for climate action, noting that climate-related diseases and deaths are on the rise, while temperature increases and changes in precipitation patterns are inevitable. The most severe impacts of the impending climate crisis are likely to be felt in underdeveloped countries, where it is critical to protect the health of vulnerable populations through climate-sensitive approaches (World Health Organization, 2021).

In this study, participants who perceived the use of agricultural chemicals as a threat to environmental health, water, and food

safety also showed higher rates of soil testing, awareness of organic and sustainable farming practices, and belief that these chemicals negatively impact climate change. They are also more likely to suspect a link between climate change and public health issues. While chemicals have useful applications in everyday life, the long-term effects of their widespread use in agriculture on ecosystems, the atmosphere, and oceans are not well understood. What is clear is the alarming increase in chemical emissions from the agricultural, mining, and energy sectors worldwide. This escalating pollution threatens not only human and animal life, but also the safety of our food, water, and environment (Naidu et al., 2021). To mitigate these risks, it is essential to conduct thorough risk assessments and establish robust, country-specific regulatory frameworks to manage the safe use of chemicals, ensuring both public health and environmental protection (Gizaw, 2019).

A growing number of people believe that the use of chemicals in agriculture contributes to infectious and vector-borne diseases, exacerbates climate change, and leads to an increase in disease and pest outbreaks. In addition, many people see a potential link between climate change and health issues and recognize that climate change influences health behaviors. The scientific community widely recognizes, and research supports, that agricultural chemicals pose significant risks to human health, drive increases in certain pests, and contribute to critical markers of climate change, such as extreme weather patterns and increased greenhouse gas emissions (Matovo et al., 2020; Wu et al., 2021). In addition, climate-related disasters are known to trigger severe health problems, including respiratory diseases, infectious diseases, and escalation of cardiovascular complications (Smith et al., 2022). When viewed through the lens of the existing literature, the insights of the hazelnut farmers in this study reflect a strong awareness of agricultural pests and a deep understanding of the consequences that inappropriate chemical use has on both human well-being and the environment.

These farmworkers' perspectives on chemical use in hazelnut farming significantly explain 41.3% of the variance in the influence of climate change on health behaviors. Specifically, awareness of alternatives to chemical use and the belief that agricultural chemicals contribute to rising cancer rates emerge as key predictors of how climate change affects health-related behaviors.

Conclusion: This study provides a comprehensive exploration of the complex relationship between chemical use in hazelnut agriculture, climate change, and public health from the perspective of agricultural workers. A significant proportion of participants believe that chemical use in agriculture poses significant risks to human health, contributing to cancer rates, exacerbating climate change, and potentially linking climate change to broader health issues. Furthermore, their perceptions of chemical use in hazelnut farming account for a significant portion of the variance in how climate change affects health-related behaviors. To mitigate these risks, it is essential to promote the responsible and informed use of chemicals in agriculture, rigorously assess potential hazards, and promote alternative, non-chemical methods. With climate change being one of the most pressing challenges of the modern era, it is recommended to strengthen awareness-raising initiatives.

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