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Farmers' Awareness, Attitude, and Role Towards Climate Change: Case of Olive Production in Egypt

Basma Hassan Saad[1], Mai Mustafa Hassan Morsi[2], and Sherin Sherif[3]

1 Department of Rural Development, Faculty of Agriculture, Alexandria University, Egypt.
2 Department of Economics and Agribusiness, Faculty of Agriculture, Alexandria University, Egypt.
3 Department of Economics and Agribusiness, Faculty of Agriculture, Alexandria University, Egypt.

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ABSTRACT: Egypt has a long history with olive cultivation traces back to ancient and till today. Egypt is currently the world's second-largest producer of table olives, while Egypt wants to lead the world in table olive production. Climatologists believe that climate change may adversely impact agricultural and food production including Olive production. Measuring farmers' attitudes toward climate change informs policy, promotes sustainable practices, and contributes to building resilient agricultural systems. This study investigates the farmers' awareness and attitude regarding climate change and its possible impacts on olive production in the top 5 olive producing governorates in Egypt using the Likert quintuple scale on a random sample of 256 olive farmers by a specific questionnaire based on three Indicators, The first Indicator measures farmers knowledge and attitudes towards climate change which is measured by 10 Items, The second Indicator measures farmer's role to face anticipated climate change impacts on Olive production which is measured by 9 Items, The third Indicator measures Government role to combat the climate change effects on agricultural sector in general and on Olive production as a specific case which is measured by 7 Items. Results show that the indicator related to the role of the farmer to face the expected climate change is the first among the indicators of the scale at 82.16% followed by the indicator on the awareness of climate change and its potential impacts on the agricultural sector in general, including olives at 80.44%. the role of the government in combating the anticipated climate change impacts in the last place by 45.92%. As well as there is a clear difference between the third indicator and the other indicators at the level of the total sample in the study areas where the difference between the first indicator and the third indicator with 1.81 degrees, which means that the olive farmers in the study areas are highly aware of climate change and their important role to combat it but they are suffering from the weak role of the government to address the expected effects of climate change on olives or help farmers with a possible solutions for more future climate change adaptation.

Keywords: *Climate resilience, Farmer's attitude and awareness, Environmental responsibility, Climate perception, climate change adaptation.*

INTRODUCTION:

In Egypt, olive cultivation has increased considerably during the last three decades. This is due to the great efforts made for expanding olive cultivated areas with new cultivars in reclaimed areas. Egyptian olive has a rich history, dating back thousands of years ago. Some key points about olive's importance in Egypt are due to its ancient origins, its cultural significance, its economic impact, its geographical spread, and its Roman influence. The cultivation of olives in Egypt traces back to ancient times; where Egyptians believed that the goddess Isis bestowed the sacred olive tree upon humanity, providing knowledge on how to cultivate, harvest, and consume its fruits. Olives held cultural significance beyond their practical use. They were associated with peace and victory, symbolized by olive branches and crowns in ancient Olympic Games. Olives and olive oil were not only essential components of the ancient Mediterranean diet but also successful industries. Juan Vilar Hernández *et al.* (2018)

Egypt is currently the world's second-largest producer of table olives, following Spain. In the 2018/19 crop year, Egypt produced 450,000 tons of table olives, while Spain set a world record with 613,000 tons. Fierros-González *et al.* (2021). Egypt aims to become the world's top table olive producer by the end of the next decade. The country plans to increase olive production and cultivation, especially in desert lands. Egypt exported $70.9 thousand worth of olive oil in 2022, ranking 38th globally. The main destinations for Egyptian olive oil exports were the United Arab Emirates, Oman, and the Netherlands.

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Cartwright (2016). Despite fluctuations, Egypt's table olive production continues to trend upward. The average yield over the past three harvests (500,000 tons) surpasses any previous years. Fierros-González *et al.* (2021). It is further rumored that Egypt plans to plant around 100 million new olive trees by 2020 to achieve its ambitious goal, a statement that could not be verified by reliable sources and said to not happen in actuality. Fierros-González *et al.* (2021). In sum, olive cultivation in Egypt has deep historical roots, cultural significance, and economic impact. Egypt's efforts to boost production and its ranking in the olive industry demonstrate its commitment to this valuable crop.

RESEARCH PROBLEM:

While policies for responding to climate change impacts need the support and cooperation from the public who may be affected by governmental policies, understanding the general public's opinion is important and can help form feasible action plans. In agriculture, the sole producer of food and timber, an important part of this public is the farmers. Olive is a major fruit crop that is preferred by fruit producers worldwide due to its resistance to drought and salinity conditions, in addition to low fertilization needs compared with other fruit trees. Climatologists believe that climate change may adversely impact agricultural and food production. Olive production is no exception. Measuring farmers attitudes and perception towards climate change impact on olive production is important to acknowledge and measure. It is believed that the involvement of all stakeholders in the making of environmental policies is vital for policies success and effectiveness. Farmers climatic awareness is anticipated to be high in the developed world. However, is this the case for the less-developed Egyptian farmers, in general, and olive producers, in particular? This research addresses this attitude issue quantitatively. The next section shows why it is important to assess olive growers' attitudes towards climate change.

Measuring farmers' attitudes toward climate change is crucial for several reasons:

- Understanding farmers' attitudes helps policymakers and researchers make informed decisions about climate change adaptation and mitigation strategies. By knowing their perspectives, one can tailor interventions to address specific challenges faced by farmers.
- Farmers' attitudes influence their behavior. If they perceive climate change as a significant threat, they are more likely to adopt adaptive practices. Conversely, if they believe in human ingenuity to tackle climate challenges, they may be less motivated to change their practices.
- Assessing attitudes allows for the identification of gaps in knowledge or misconceptions. By addressing these gaps, one can enhance farmers' resilience to climate-related risks, i.e., promoting awareness about climate change consequences can encourage proactive adaptation measures.
- Farmers play a crucial role in mitigating greenhouse gas emissions. Their attitudes toward sustainable practices, such as soil conservation, agroforestry, and efficient resource use, impact overall emissions. Positive attitudes can drive adoption of eco-friendly techniques.
- Not all farmers respond the same way to climate change. Some may be more receptive to adaptation strategies, while others may resist change. Measuring attitudes helps design targeted interventions that resonate with specific farmer groups.
- Finally, policies aimed at climate resilience rely on behavioral change. By assessing attitudes, one can evaluate the effectiveness of existing policies and adjust them as needed, i.e., if farmers perceive adaptation measures positively, it indicates policy success.

In sum, understanding farmers' attitudes toward climate change informs policy, promotes sustainable practices, and contributes to building resilient agricultural systems. It is a vital step toward locking food security and environmental sustainability in the face of a changing climate.

RESEARCH OBJECTIVES:

This study investigates the farmers' awareness and attitude regarding climate change and its possible impacts on olive production in Egypt. Farmers' roles are further investigated along with the government's role in combating the adverse impacts of climate change. A specific questionnaire has been prepared for the study using the Likert quintuple scale (Strongly agree, agree, neutral, disagree, strongly disagree) on three Indicators consisting of 26 items, The first Indicator measures farmers knowledge and attitudes towards climate change which is measured by 10 Items). The second Indicator measures farmer's role in facing anticipated climate change impacts on Olive production which is measured by 9 Items. The third Indicator measures Government role to combat the climate change effects on agricultural sector in general and on Olive production as a specific case which is measured by 7 Items.

LITERATURE REVIEW:

A few researchers investigated agricultural producers' and/or the public' attitudes towards climate change. Lee *et al.* (2014) focused on the agriculture industry, adaptation policies, as well as the willingness to pay (WTP). These three key dimensions distinguished their paper from prior work. The research identified the effect of an unusual warm spell event by various means. The paper showed how a warm spell event influenced the public attitudes toward climate change adaptation policy regarding two government levels, two crop types, and the WTP for government-sponsored adaptation programs. They used data based on a random sample general population poll in Michigan (USA), secondary sources, and an unseasonal fruit-crop damaging warm spell that occurred during the survey period to assess the effects of this short-term phenomenon on public attitudes and the WTP. Several time index variables were used to explore how the level of the respondents' exposure to the warm spell would affect the attitudes and WTP. Demographic variables and political ideology were used to control selection bias. Results showed that abnormally warm temperature deviation does affect the public attitude toward government's role on adaptation significantly, along with the variables of sub-periods or exposure of warm spell. However, the WTP was only affected significantly by these time index variables, while the temperature deviation was insignificant.

Taher *et al.* (2021) claimed that farmers' adaptation to adversities of weather is an indisputable and critical strategy, particularly in arid regions. The understanding of the process by which farmers decide to stand facing climate changes and probing into the determinants of the process provides research evidence for policymakers to assist farmers to adapt to climate change effects. They established a conceptual framework, inclusive of factors influencing farmers' decision-making to adapt to climate change and clarified causal relations among these factors. According to the results, household characteristics, economic factors, knowledge, motives and goals, perceived outcomes of adaptation, social, personal norms, perception of climate change, perceived risk and obstacles, attitude towards climate change, prospective perception of climate change, the evaluation of climate change, and adaptation initiatives could all influence farmers' decisions to adapt to climate change.

Tzemi and Breen (2016) claimed that farmers' awareness and acceptance towards climate change might be a significant barrier to voluntary adoption of best practice techniques in Irish livestock production. Their paper presented results from a supplementary survey of 747 Irish farmers conducted as part of the National Farm Survey (NFS) in 2014, with a view to understanding farmers' awareness of and attitudes to climate change and greenhouse gas (GHG) emissions. Survey results showed that there was a general uncertainty towards several agricultural GHG emissions related questions and that farmers' attitude towards GHG emissions reduction was not very positive. To further explore farmers' attitudes towards climate change, a multinomial logit model was used to examine the socioeconomic factors that affect farmers' willingness to adopt an advisory tool that would show the potential reduction in GHG emissions from the adoption of new technologies. Results showed that investment in machinery, awareness, region, environmental subsidies, use of social networking, and agri-training encouraged adoption, while off-farm income was negatively related to adoption.

Katona-Kovacs *et al*. (2009) emphasized that globalization, climate, and demographic changes, as well as the current global financial crisis, are likely to have a strong influence on the future of the Common Agricultural Policy (CAP). These processes are closely related to the three dimensions (environment, society, and economy) of sustainable development. Farmers across the EU are experiencing a period of change and uncertainty caused by changes to the CAP and compounded in the case of Hungary by EU accession. Theory suggests that the business development strategies of European farming households should be based on multifunctionality, diversification, and pluri-activity. However, the farming community is not normally recognized for its ability to embrace change, and in some regions support structures have been put in place to assist farmers to make the necessary transition. In late 2006 and early 2007, ADER conducted a questionnaire survey amongst its clients on their attitudes towards environmental, economic, and social sustainability in the light of probable future developments in agriculture, particularly with respect to CAP funding. The paper compares the attitudes of farmers in two regions to sustainability in the light of anticipated changes in agriculture.

Jänecke *et al*. (2015) focused on the attitude of German farmers towards climate change effects and aims to identify determinants affecting their perception of weather conditions. For this purpose, descriptive statistics and multiple linear regression approaches were applied. Data was collected using a questionnaire survey, which was

conducted in spring 2013 among 173 German farmers in the two regions Swabian Alb and Kraichgau. The analyses revealed that four main factors influence the perception of weather variability. Respondents' age, the region where the farm is located, the share of agricultural income and the farm profit are statistically related with the degree of support for the respective weather statements. The findings further indicated age of farmer, location of the farm, method of production and farm size as significant predictors concerning the farm leader's perception of climate change consequences. As descriptive statistics revealed, most farmers perceive for their location a change in weather conditions, an increase in weather variability as well as decreasing predictability of weather and expect consequences for their farming activities due to these developments.

Sauer (2011) contributed to the understanding of behavioral responses to climate change induced extreme weather events. The study suggested a micro econometric method for measuring flooding related risk preferences of affected individuals. The method is outlined using the empirical case of agricultural production in floodplains of the UK over 28 years. A quasi-experimental approach to measure differences in the risk attitudes of farmers located in high flooding risk areas versus farmers located in low flooding risk areas is followed. Changes in flooding risk related behavior over time are analyzed and marginal effects of different individual and disaster related characteristics for this behavior are investigated. Besides a moments-based risk estimation approach, the study also applies a dynamic panel estimator. The estimates suggest that the average farmer located in a high flooding risk area is prepared to pay about 6% more of his profit for insuring against the higher risk of flooding compared to farmers in low flooding risk areas. The significance of considering individual risk preferences for an efficient flood policy design is discussed using the example of voluntary agreements for the maintenance of flood defenses.

Pollock *et al*. (2018) examined the Australian Centre for Agricultural Health and Safety longitudinal study of 335 NSW farm enterprises to derive data on farm health and safety management and how it relates to farmer perceptions. The analysis reported in this paper benchmarked the perceptions of the study informants on the role and importance of health and safety on their farms and reviewed the safety performance of the study enterprises, focusing on management of safety systems and processes and control of major risks and hazards on their farms. The results not only challenged some apparent misconceptions, such as older farmers having more negative attitudes towards farm safety than younger farmers, but it also identified industries from within the study population that are performing well in the management of safety and the possible reasons behind their success. Importantly, it also observed an area of disconnect between having a positive attitude towards farm safety and its role and importance and implementing farm safety systems and management processes on the farm. These findings provide evidence for the possible benefits of tailoring farm initiatives and interventions based on gender, age, and industry.

Ayuya (2010) claimed that despite some carbon sequestration projects have been started in Kenya, it is still not yet a vibrant investment in spite of the available suitable biophysical land. Njoro district has no such project regardless of being affected by deforestation. One inevitable result has been the unpredictable rainfall pattern constituting overall climate change, increased surface run off, the low water levels in river Njoro, loss of biodiversity, and the increased poverty in the region. It is still not clear if such projects are to be initiated, the small-scale farmers would be willing to accept and adopt them. There was a need therefore to assess the willingness of small-scale farmers to accept and adopt the carbon trade tree project to understand farmer's decision-making process. The study used multi-stage sampling procedure to select 150 small-scale farmers in Njoro district. Both primary and secondary data sources collected using observations and interviews with the help of a semi-structured questionnaire. Data analysis was done using descriptive statistics, ordinal logit model and the double hurdle model using STATA computer programs. The results indicated that 29% of the farmers practiced tree planting/agro-forestry as voluntary CDM practice in the study area. On the level of awareness, the result indicates that 58% of the farmers were not aware of the project, 23% were aware and correct and 19% of the farmers were aware but wrong signifying low levels of awareness of the CDM project among farmers. Age, extension contacts, attitude towards risk, land tenure and perception towards the technology influenced to the extent the farmer is willing to adopt.

Tate and Mbzibain (2011) maintained that bioenergy enterprises have been granted an official role in the UK to make a significant contribution to sustainability targets. Yet, understanding of attitudes amongst farmers and rural entrepreneurs to these enterprises is yet to be fully understood. Financial support, electricity

tariffs, the availability of advice, and the profit foregone from other enterprises have all fluctuated. The level of adoption of the new technology is not as advanced as in other EU countries. This study seeks to discover why this could be by exploring the entrepreneurial, financial, and motivational environments that bioenergy adopters are working in. Some hypotheses have been developed. This study extends and applies the concepts of entrepreneurship environment and country institutional profiles to a specific domain of entrepreneurship in the land-based bioenergy sector in the UK.

The above sums up the findings of some of the literature related to attitudes towards climate change impacts by farmers in different regions of the world. The study in hand handles the farmers attitudes measurements of the olive growers in Egypt.

This section of the paper adheres to the theoretical and analytical framework of the study.

DATA RESOURCES AND METHODOLOGY:

A cross-sectional random sample elicited from five Egyptian Governorates is attained. The five Governorates are Matrouh, Behera, Giza, Fayoum and Ismailia. These Governorates are known for being major olive producing regions.

A field survey composed of 256 olive farmers. The study relied mainly on the Likert quintuple scale (Strongly agree, agree, neutral, disagree, strongly disagree) and the questionnaire was based on three Indicators consisting of 26 items.

The Likert scale is used to measure the farmers' attitude towards climate changes phenomenon. Two types of scales are used: namely, the interval scale and the nominal scale. In the interval scale, the answers are given 5 codes standing Strongly Agree=5, Agree=4, Neutral=3, Disagree=2, and Strongly Disagree=1. The answers are categorized by calculating the outcome of dividing the range, which is (5-1=4), by the number of sets which is equal to 5, the length of sets is equal to 0.80, and the weighted mean per every scale starts from 1: 1.79, and 1.80: 2.59.

On the nominal scale, the answers are divided into three levels, considering the answers strongly disagree and disagree mean low level of attitude from olive farmers towards the climate changes phenomenon, and the neutral scale mean moderate level, and the answers agree and strongly agree are high level attitude towards climate changes phenomenon.

Estimated weight according to the Quintuple Likert Scale

Likert scale					
response score	Strongly Disagree 1	Disagree 2	I do not know 3	Agree 4	Strongly Agree 5

Weighted Likert scale			
Response	Interval Scale		Nominal Scale
	Weighted Mean	Interval Length	Level
Strongly Disagree	1: 1.79	0.79	Low
Disagree	1.80: 2.59	0.79	
I do not know	2.60: 3.39	0.79	Moderate
Agree	3.40: 4.19	0.79	High
Strongly Agree	4.20: 5	0.79	

The study attempted to identify the views of olive farmers' attitudes towards climate change in the study areas, and the results obtained from the respondents to know their opinions and trends and their view of their role and the role of the government in the face of climate change through a set of questions distributed on three indicators (awareness of climate change and its potential impact on the sector, The role of the farmer in facing the expected climate changes, especially the olives, and the role of the government in facing the expected climate changes).

The study will depend on three indicators:

1- Farmers knowledge and attitudes of climate change (10 Items).
2- Farmer's role to face anticipated climate change impacts on Olive production (9 Items).
3- Government role to combat the climate change effects on agricultural sector in general and on Olive production as a specific case (7 Items).

FINDINGS AND DISCUSSION:

First Indicator: Farmers knowledge and attitudes of climate change.

This indicator tries to measure the farmers awareness and attitudes towards climate change, this indicator measured with 10 items consists of statements about their awareness and attitudes towards climate change and farmers answered

these statements with (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) according to quintuple Likert scale.

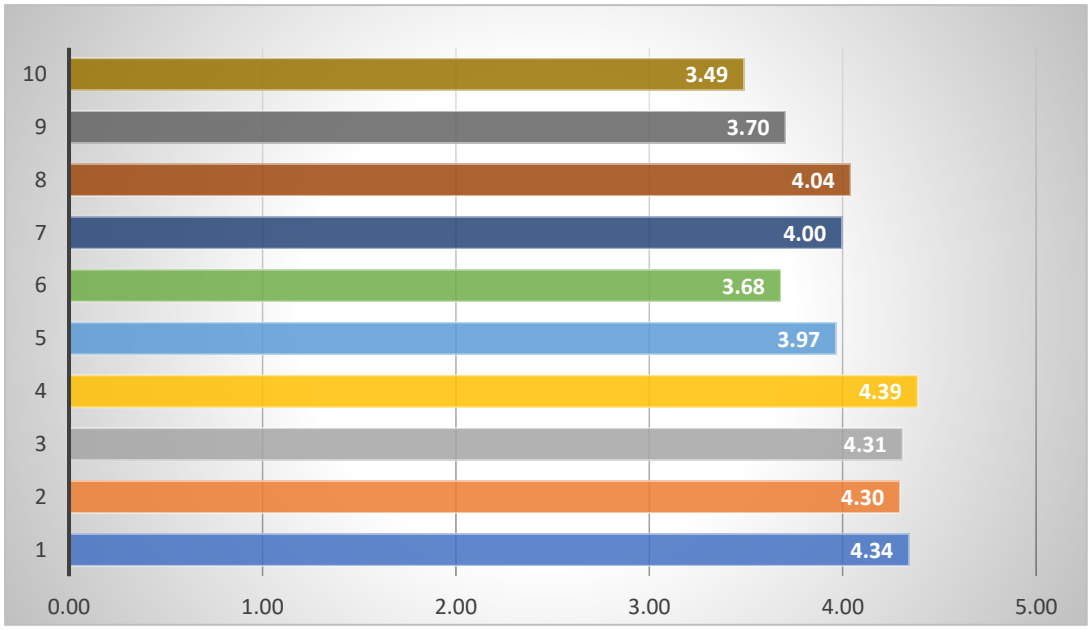
as displayed on Table (1) the statement No. (4) came in first place with an arithmetic mean of (4.39), which corresponds to a strongly agree answer according to what was stated in the estimated weight of the quintuple Likert scale, and the standard deviation was (0.62) with a total of (134) strongly agree to (142) agree out of (294 respondents), and statement No. (1) came in second place with an arithmetic mean of (4.75), which corresponds to a strongly agree according to what was stated in the estimated weight of the Likert quintuple scale, and the standard deviation was (0.75) Respectively with a total of (149) strongly agree to (98) agree out of (294 respondents), and the statement No. (3) came in third place with an arithmetic mean of (4.61), which corresponds to strongly agree according to what was stated in the estimated weight of the quintuple Likert scale, and the standard deviation was (0.66) with a total of (124) strongly agree to (137) agree out of (294 respondents) and statement No. (10) came in last place with a standard deviation (0.76) and an arithmetic mean (3.49), which corresponds to agree according to what was stated in the estimated weight of the Likert quintuple scale with a total of (33) strongly agree and (89) agree according to what was stated in the estimated weight of the quintuple Likert scale with a total of (33) strongly agree, (89) agree and (164) Neutral out of 294 respondent. Statement No. (6) came in the penultimate place with a standard deviation of (0.67) and an arithmetic mean (4.00), which corresponds to the total of (59) strongly agree, (84) agree and (149) neutral out of 294 respondents. That means, this indicator is considered in the high level according to table Weighted Likert scale. As displayed in Figure (1).

Table (1) Descriptive Statistics and Relative and percentage Frequency Distribution for Climate Change items on a sample of Olive Farmers in Egypt

	Farmers' Awareness of Climate Changes Items		Frequencies						Score		
			Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total (N)	Mean	Standard Deviation	Rank
1-	Climate change is probably the biggest challenge facing Egypt in this century	N	149	98	46	1	0	294	4.34	0.75	2
		%	50.68	33.33	15.65	0.34	0.00	100.00			
2-	Climate change has a clear impact on all the crops grown	N	126	136	25	7	0	294	4.30	0.72	4
		%	42.86	46.26	8.50	2.38	0.00	100.00			
3-	Rising temperatures would negatively impact the production of all agricultural crops	N	124	137	33	0	0	294	4.31	0.66	3
		%	42.18	46.60	11.22	0.00	0.00	100.00			
4-	It is expected that irrigation water consumption would increase with increases in temperatures	N	134	142	16	2	0	294	4.39	0.62	1
		%	45.58	48.30	5.44	0.68	0.00	100.00			
5-	Climate change would lead to the spreading or pests and diseases in agriculture	N	85	117	90	1	1	294	3.97	0.80	7
		%	28.91	39.80	30.61	0.34	0.34	100.00			
6-	Egyptian food security status would worsen with climate change	N	59	84	149	2	0	294	3.68	0.80	9
		%	20.07	28.57	50.68	0.68	0.00	100.00			
7-	It is anticipated that soil salinity would increase because of climate change	N	58	183	48	4	1	294	4.00	0.67	6
		%	19.73	62.24	16.33	1.36	0.34	100.00			
8-	Desertification would increase because of climate change	N	66	175	52	1	0	294	4.04	0.64	5
		%	22.45	59.52	17.69	0.34	0.00	100.00			
9-	Sea level would rise because of climate change	N	50	118	117	7	2	294	3.70	0.80	8
		%	17.01	40.14	39.80	2.38	0.68	100.00			
10-	The Delta Region would be the area most impacted by climate change	N	33	89	164	5	3	294	3.49	0.76	10
		%	11.22	30.27	55.78	1.70	1.02	100.00			

Source: collected and computed from sample data.

Figure (1) Olive Farmers awareness and attitudes of climate change in Egypt.



Source: Table (1)

Second Indicator: Farmer's role in facing anticipated climate change impacts on Olive production.

This indicator tries to measure the role which farmers take it to face the anticipated climate change impacts on Olive production, this indicator measured with 9 items consists of statements about their role to face the anticipated climate change impacts on Olive production and farmers answered these statements with (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) according to quintuple Likert scale.

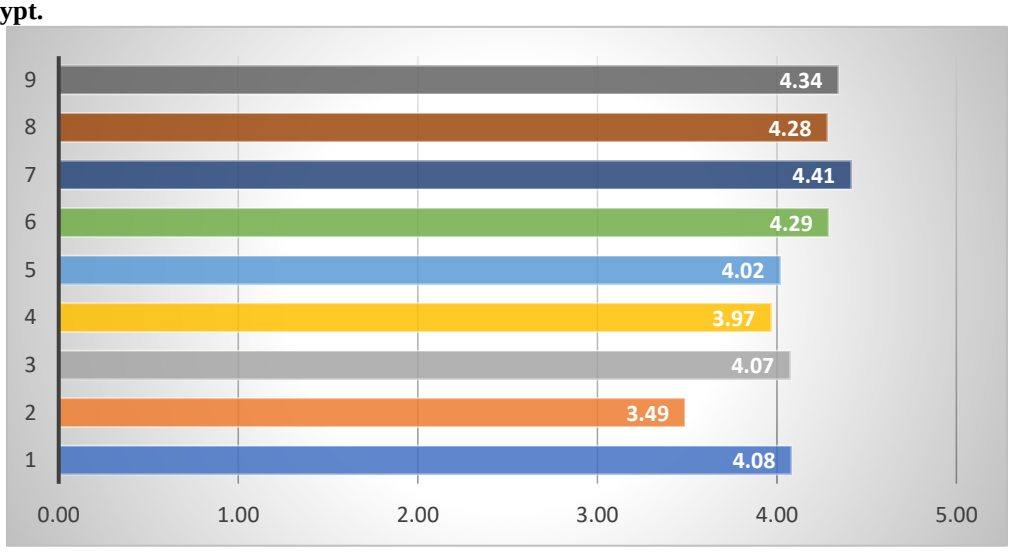
It is clear from Table (2) that statement No. (7) came in first place with an arithmetic mean of (4.41), which corresponds to a strongly agree answer according to what was stated in the estimated weight of the Likert quintuple scale, and the standard deviation was (0.68) with a total of (151) strongly agree to (118) agree out of (294 respondent), and statement No. (9) came in second place with an arithmetic mean of (4.34), which corresponds to a strongly agree answer according to what was stated in the estimated weight of the Likert quintuple scale, and the standard deviation was (0.71) with a total of (140) strongly agree to (117) agree out of (294 despondent). Statement No. (6) came in third place with an arithmetic mean of (4.29), which corresponds to a strongly agree answer according to what was stated in the estimated weight of of the Likert quintuple scale, and the standard deviation was (0.77) with a total of (132) strongly agree to (125) agree out of (294 respondent).

Table (2) Descriptive Statistics and Relative and percentage Frequency Distribution for Climate Change items on a sample of Olive Farmers in Egypt

	Farmers' Awareness of Climate Changes Items		Frequencies						Score		
			Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total (N)	Mean	Standard Deviation	Rank
1-	I am willing to change my lifestyle to reduce the losses anticipated as a result of climate change	N	67	192	27	8	0	294	4.08	0.65	5
		%	22.79	65.31	9.18	2.72	0	100.00			
2-	I am willing to donate money to contribute to the efforts made to combat climate changes	N	23	135	103	29	4	294	3.49	0.83	8
		%	7.82	45.92	35.03	9.87	1.36	100.00			
3-	It is better to grow the types of crops suitable to rising temperatures and low water needs	N	53	212	27	2	0	294	4.08	0.54	5
		%	18.03	72.11	9.18	0.68	0	100.00			
4-	It is better to change the geographical distribution map of agricultural crops to adapt to climate changes	N	55	181	54	2	2	294	3.98	0.68	7
		%	18.71	61.57	18.37	0.68	0.68	100.00			
5-	It is better to change cultivation times and harvesting times for some agricultural crops to lessen the impacts of climate change	N	70	169	46	7	1	294	4.03	0.72	6
		%	23.89	57.68	15.70	2.39	0.34	100.00			
6-	I am willing to change my olives agricultural practices to reduce the anticipated losses because of climate change	N	132	125	27	10	0	294	4.30	0.75	3
		%	44.90	42.52	9.18	3.40	0	100.00			
7-	I see that it is better to grow the olive varieties which suits rising temperatures and low water needs	N	151	118	21	4	0	294	4.43	0.68	1
		%	51.36	40.14	7.14	1.36	0	100.00			
8-	I see that the geographical map of olives must be changed to adapt to climate changes	N	140	110	32	11	1	294	4.29	0.83	4
		%	47.62	37.42	10.88	3.74	0.34	100.00			
9-	It is better to change the treatments which help increasing flowering and harvesting to lessen the bad impacts of climate change	N	140	117	35	2	0	294	4.35	0.71	2
		%	47.62	39.80	11.90	0.68	0	100.00			

Statement No. (2) came in last place with a standard deviation (0.83) and an arithmetic mean (3.49), which corresponds to agree according to what was stated in the estimated weight of the Likert quintuple scale with a total of (23) strongly agree and (135) agree and (103) Neutral out of 294 respondents. Statement No. (4) ranked in the penultimate place with a standard deviation of (0.68) and an arithmetic mean (3.97), which corresponds to the answer agree with a total of (55) strongly agree, (181) agree and (54) neutral out of 294 respondents. That means, this indicator is considered in the high level according to table Weighted Likert scale. As displayed in Figure (2).

Figure (2) Farmer's role in facing anticipated climate change impacts on Olive production in Egypt.



Source: Table (2).

Third Indicator: Government's role in combating the anticipated climate change effects on agricultural sector in general and on Olive production as a specific case.

This indicator tries to measure the role which government take to face the anticipated climate change impacts on agricultural sector in general and on Olive production as a specific case , this indicator measured with 7 items consists of statements about the government role to face the anticipated climate change impacts on Olive production and farmers answered these statements with (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) according to quintuple Likert scale.

It is clear from Table (3) that statement No. (7) came in first place with an arithmetic mean of (4.52), which corresponds to a strongly agree answer according to what was stated in the estimated weight of the Likert Quintuple scale, and the standard deviation was (0.99) with a total of (229) strongly agree to (12) agree out of (294 respondent).

Table (3) Descriptive Statistics and Relative and percentage Frequency Distribution for Climate Change items on a sample of Olive Farmers in Egypt

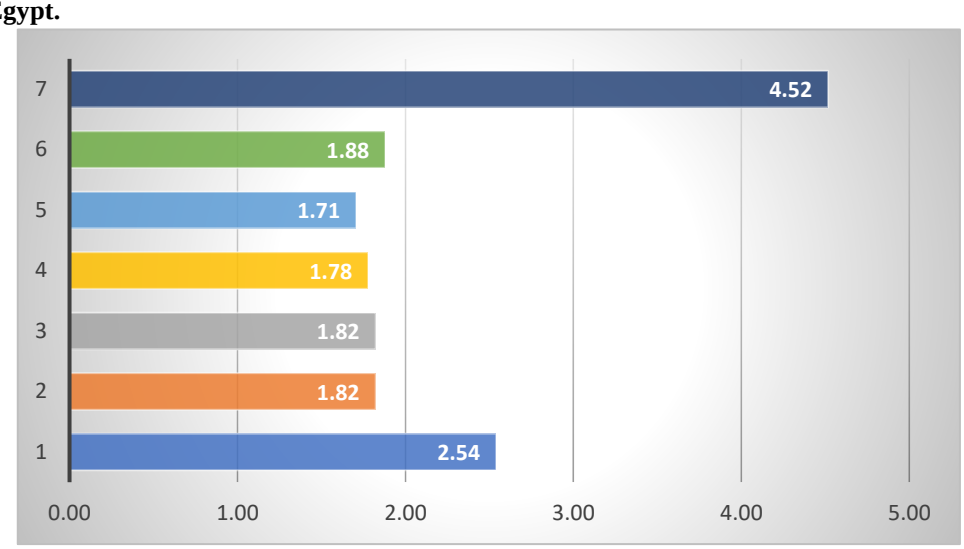
	Farmers' Awareness of Climate Changes Items		Frequencies						Score		
			Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total (N)	Mean	Standard Deviation	Rank
1-	The government has taken some steps towards limiting climate change impacts	N	6	10	172	55	51	294	2.54	0.89	2
		%	2.04	3.40	58.50	18.71	17.35	100.00			
2-	The government financially compensates in cases where farmers experience losses because of climate change	N	8	11	67	43	165	294	1.82	1.08	4
		%	2.72	3.74	22.79	14.63	56.12	100.00			
3-	The media has a significant role in increasing the awareness of farmers to climate change impacts	N	5	22	54	48	165	294	1.82	1.08	4
		%	1.70	7.48	18.37	16.33	56.12	100.00			
4-	Agricultural extension has a great role in limiting the impacts of climate change and really help the farmers	N	10	6	64	43	171	294	1.78	1.07	5
		%	3.40	2.04	21.77	14.63	58.16	100.00			
5-	Agricultural coops and associations have a great role in providing farmers with the information needed to do the good agricultural practices needed in case of climate change	N	7	9	55	43	180	294	1.71	1.03	6
		%	2.38	3.06	18.71	14.63	61.22	100.00			
6-	Egypt is on the correct line adopted by the developed nations to overcome climate change impacts	N	2	18	81	35	158	294	1.88	1.05	3
		%	0.68	6.12	27.55	11.90	53.74	100.00			
7-	The cooperation and coordination of all parties associated with the agricultural sector would lessen the negative impacts of climate change	N	229	12	35	12	6	294	4.52	0.99	1
		%	77.89	4.08	11.90	4.08	2.04	100.00			

Source: collected and computed from sample data.

Statement No. (1) came in second place with an arithmetic mean of (2.54), which corresponds to answer agree according to what was stated in the estimated weight of the Likert quintuple scale, and the standard deviation was (0.89) respectively with a total of (6) strongly agree to (10) agree and (172) neutral out of (294 respondent), Statement No. (6) came in third place with an arithmetic mean of (1.88), which corresponds to a strongly disagree answer according to what was stated in the estimated weight of the Likert quintuple scale, and the standard deviation was (1.05) with a total of (2) strongly agree to (18) agree and (81) neutral out of (294 respondent). Statement No. (5) came in last place with a standard deviation (1.03) and an arithmetic mean (1.71), which corresponds to strongly disagree according to what was stated in the estimated weight of the Likert quintuple scale with a total of (7) strongly agree, (9) agree and (55) neutral out of (294 respondent). Statement No. (4) came in the penultimate place with a standard deviation of (1.08) and an arithmetic mean (1.78), which corresponds to the answer disagree with a total of (10) strongly agree, (6) agree and (64) neutral out of (294 respondent).

That means, this indicator is considered in the low level according to table Weighted Likert scale. As displayed in Figure (3).

Figure (3) Government's role in facing anticipated climate change impacts on Olive production in Egypt.



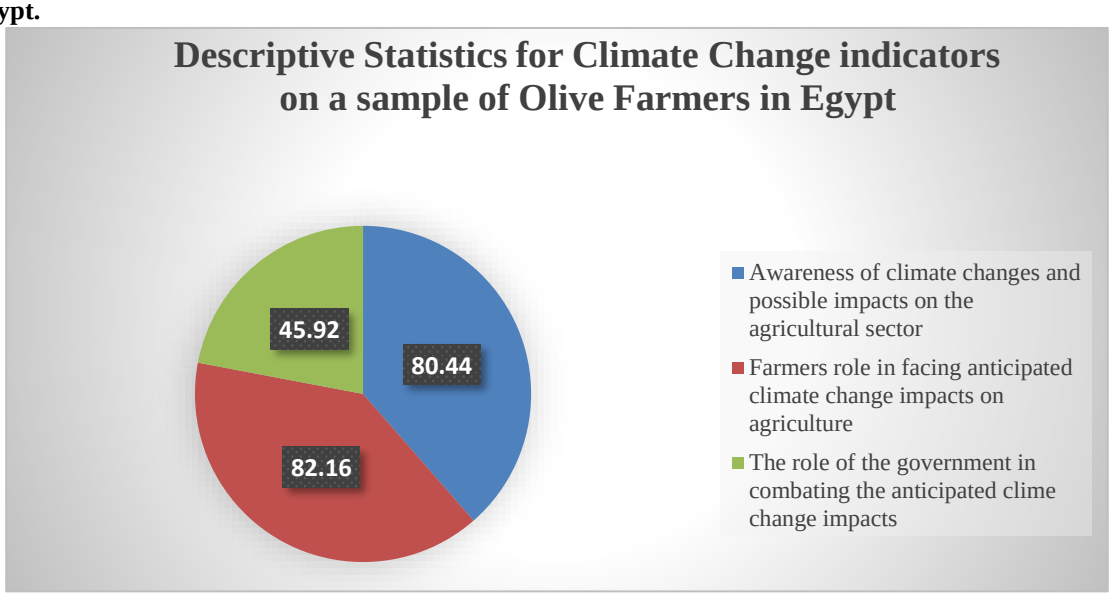
Source: Table (3).

At the level of the different indicators, the indicator related to the role of the farmer in facing the expected climate change is the first among the indicators of the scale at 82.16% followed by the indicator on the awareness of climate change and its potential impacts on thee agricultural sector in general, including olives at 80.44%. the role of the government in combating the anticipated climate change impacts in the last place by 45.92%.

Table (4) Descriptive Statistics for Climate Change indicators on a sample of Olive Farmers in Egypt

	Indicators	Score			
		Mean	%	Standard Deviation	Rank
1-	Awareness and attitude of climate changes and possible impacts on the agricultural sector	4.02	80.44	0.78	2
2-	Farmers role in facing anticipated climate change impacts on agriculture	4.11	82.16	0.76	1
3-	The role of the government in combating the anticipated climate change impacts	2.30	45.92	1.39	3

Figure (4) Descriptive Statistics for Climate Change indicators on a sample of Olive Farmers in Egypt.



Source: Table (4).

According to the different indicators it shows that there is a clear difference between the indicator related to the role of the government in facing the expected climate changes and the other indicators at the level of the total sample in the study areas where the difference between the first indicator related to the role of the farmer in facing the expected climate changes and the third indicator related to the role of the government in facing the climate changes expected 1.81 degrees, or in other words, the degree of the first indicator is more than half of the third indicator (see Table (4) that is, olive farmers in the study areas are highly aware of the issue of climate change expected and their important role to combat them as they see the weak role of the government to address the possible future climate change.

At the level of the items of each indicator, Table (2) shows that there is a clear positive tendency among the respondents towards most of the items, where the first item is that joining the efforts of the government and all parties related to the agricultural system will reduce the negative effects of climate change, followed by the item that It is preferable to cultivate olive varieties suitable for high temperatures and low water, followed by the item that the rates of irrigation water consumption are expected to increase with higher temperatures, where the answers of the respondents range from agree to strongly agree.

Figure (5) Arithmetic Mean for all Indicators.

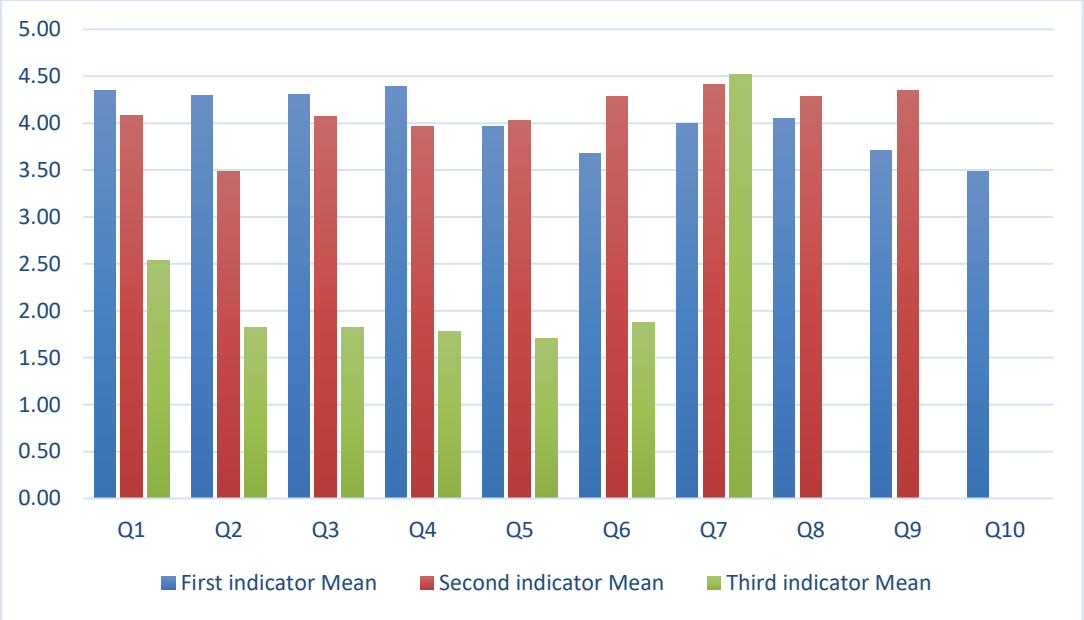
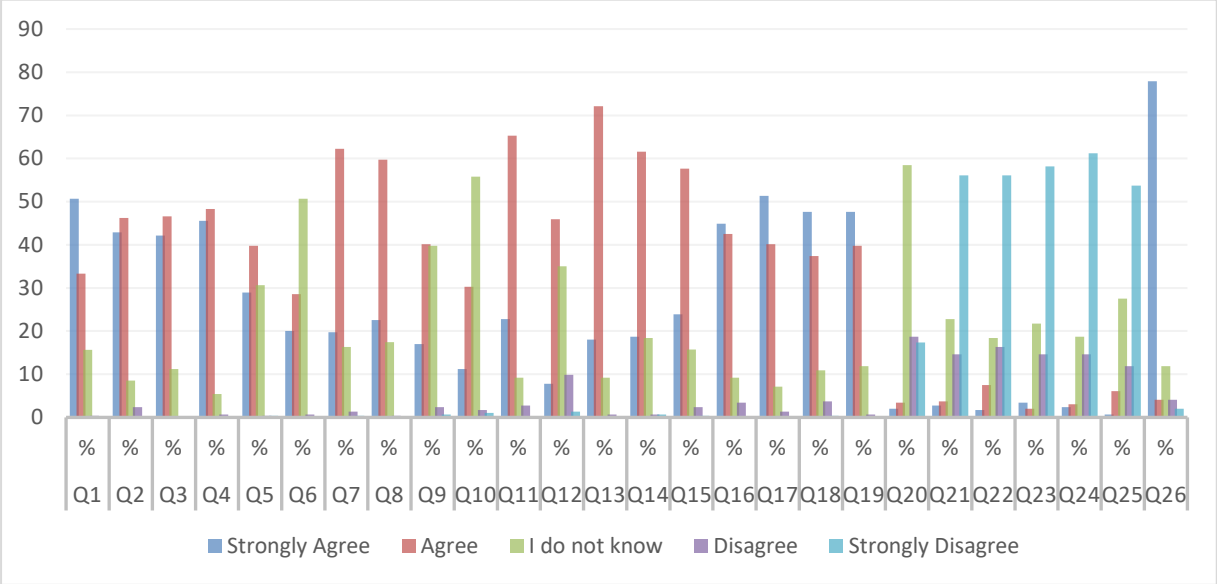


Figure (4) Arithmetic Mean for all Indicators.

Which means that there is a clear negative tendency among the members of the respondents. Preceded by the importance of the media in raising farmers' awareness of the issue of climate change, where the answers of the respondents range from disagreeable to strongly disagree.

By examining the degrees of the items of each indicator, it was found in the first indicator that the item that it is best to cultivate olive varieties that are compatible with the high temperature and lack of water came first among the items of the scale followed by in the second item the item that is better to change the factors that help to increase flowering and harvest to reduce The impacts of climate change are followed by the item that farmers are willing to change their olive cultivation practices to minimize climate change losses in the third place, and are primarily responsible for ranking this indicator first among the indicators of the scale.

Figure (6) Percentage Frequency Distribution for three indicators for climate change items on a sample of olive farmers in Egypt.



While in the second indicator, the item that is expected to increase the rates of consumption of irrigation water with rising temperatures in the first place, climate change is one of the biggest challenges facing Egypt at present in the second place, followed by the item that the expected increase in temperature will adversely affect on the productivity of agricultural crops ranked third.

While the items of the third indicator, we note that there is a tendency to disagree with most of these items and that the answers of the respondents ranges from disagree to strongly disagree, except the item on the need to join efforts of the government and all parties related to the agricultural system to reduce the negative effects of climate change has won only Strong approval, which caused this indicator to occupy the last rank of the three indicators.

In sum, we can say that 57.87% of the sample of olive farmers in the study areas (Egypt) were highly aware of the climate change phenomenon compared to 21.64% of the neutral degree of awareness compared to 20.49% of low awareness of the phenomenon of climate change.

Independent Variables:

1- Personal Data

Variables	Frequencies	%
Age		
Less than 35	67	26.17
from 35 to 50	119	46.48
more than 50	70	27.34
Total	256	100.00
Education level		
Illiterate	32	12.50
Read and write	77	30.08
Average Academic Degree	82	32.03
Above Average Educational Degree	19	7.42
High Educational Degree	46	17.97
Total	256	100.00
Have you obtained training sessions or workshops in the climate change field?		
Yes	19	7.42
No	237	92.58
Total	256	100.00
Have you attended awareness symposiums or the like in the field of climate change?		
Yes	19	7.42
No	237	92.58
Total	256	100.00
Owned Assets		
Company	19	7.42
Processing Plant (factory)	3	1.17
Farm	161	62.89
No Owned Assets	73	28.52
Total	256	100.00

Variables	Chi^2	Significance Level	Yule's Q
Age	87.935	0.363	
Education level	126.954	0.002**	-1.38
Have you obtained training sessions or workshops in the climate change field?	25.963	0.208	
Have you attended awareness symposiums or the like in the field of climate change?	39.625	0.008**	-1.06
Owned Assets	92.613	0.009*	0.06

*** Significant on 0.05.** **** Significant on 0.01.**

The study supposed that there is a significant relationship between the independent variable and dependent variables which includes (Age, Education level, climate change field training sessions or workshops, climate change awareness symposiums, Owned Assets) chi square used to investigate these relationships and the results of **Chi^2** showed that there are 3 variables had a statistically significant relationship with Farmers' Knowledges, Attitudes and Roles towards Climate Change, these variables were (Education level, farmers' attendance climate change awareness symposiums, Owned Assets).

Yule's Q coefficient values which is express correlation between (Education level, farmers' attendance climate change awareness symposiums, Owned Assets) and Farmers' Knowledges, Attitudes and Roles towards Climate Change appears that there are weak and negative relationships between the variables of education level and farmers' attendance climate change awareness symposiums, there are strong and positive relationship between the variables of owned assets and independent variable which is mean that highly educated farmers shows a less knowledge and awareness to climate changes more than Illiterate or moderates, in addition to farmers who attended awareness symposiums or the like in the field of climate change were less aware of climate change than others who didn't attend awareness symposiums or the like in the field of climate change, and farmers who owned

assets shows more knowledge and awareness to climate changes than others who owned assets.
Yule's Q is one of the coefficients which is called PRE (Proportional Reduction in Error) which can explain the variance in the independent variables in the core of the bilateral relationship between dependent and independent variables. Yule's Q is indeed a coefficient used in statistics, specifically known as a measure of association between two dichotomous variables that have only two categories or levels, such as (yes/no). The value ranges between the binary numbers from the negative (-1) to the positive number line (+1). Any value between this range determines the relationship between the variables (Lutz, 1983). So, we can say that the variable of owned assets explains 6% in the variance of farmers' knowledge and awareness to climate changes, while the variable of farmers' education and the variable of farmers' attendance awareness symposiums explain 14% and 11% in the variance of farmers' knowledge and awareness to climate changes respectively.

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الملخص العربي

دراسة وعي وإتجاهات المزارعين ودورهم نحو تغير المناخ: دراسة حالة لإنتاج الزيتون في مصر

بسمة حسن سعد[1], مي مصطفى حسن مرسي[2], و شيرين شريف[3]

1–قسم التنمية الريفية، كلية الزراعة، جامعة الإسكندرية، مصر.
2–قسم الاقتصاد والأعمال الزراعية، كلية الزراعة، جامعة الإسكندرية، مصر
3–قسم الاقتصاد والأعمال الزراعية، كلية الزراعة، جامعة الإسكندرية، مصر

تتمتع مصر بتاريخ طويل مع زراعة الزيتون منذ القدم وحتى اليوم. وتعد مصر حالياً ثاني أكبر منتج لزيتون المائدة في العالم، لكنها تطمح في أن تقود العالم في إنتاج زيتون المائدة. يعتقد علماء المناخ أن تغير المناخ قد يؤثر سلبا على الإنتاج الزراعي والغذائي بما في ذلك إنتاج الزيتون لذا فإن قياس وعى وإتجاهات المزارعين تجاه تغير المناخ يساعد في رسم السياسات الزراعية المختلفة، ويعزز الممارسات المستدامة ، ويساهم في بناء أنظمة زراعية قادرة على الصمود أمام تغير المناخ. تحاول هذه الدراسة بحث وعي المزارعين وإتجاهاتهم نحو تغير المناخ وتأثيراته المحتملة على إنتاج الزيتون في أكبر 5 محافظات منتجة للزيتون في مصر باستخدام مقياس ليكرت الخماسي على عينة عشوائية من 256 مزارع زيتون من خلال استبيان محدد يعتمد على ثلاثة مؤشرات وهى: المؤشر الأول ويقيس معرفة المزارعين واتجاهاتهم تجاه تغير المناخ الذي يقاس ب 10 بنود ، والمؤشر الثاني ويقيس دور المزارعين في مواجهة الآثار المتوقعة لتغير المناخ على إنتاج الزيتون الذي يقاس ب 9 بنود ، بينما يقيس المؤشر الثالث دور الحكومة في مكافحة آثار تغير المناخ على القطاع الزراعي بشكل عام وعلى إنتاج الزيتون كحالة محددة ويقاس ب 7 بنود. وتشير النتائج إلى أن المؤشر المتعلق بدور المزارع في مواجهة التغير المناخي المتوقع هو الأول بين مؤشرات المقياس بنسبة 82.16٪ يليه مؤشر الوعي بالتغير المناخي وتأثيراته المحتملة على القطاع الزراعي بشكل عام بما في ذلك الزيتون بنسبة 80.44٪. دور الحكومة في مكافحة آثار تغير المناخ المتوقعة في المرتبة الأخيرة بنسبة 45.92٪. وكذلك هناك فرق واضح بين المؤشر الثالث والمؤشرات الاخرى على مستوى العينة الكلية في مناطق الدراسة حيث يقدر الفرق بين المؤشر الاول والمؤشر الثالث ب 1.81 درجة مما يعني ان مزارعي الزيتون في مناطق الدراسة على وعي كبير بالتغير المناخي ودورهم المهم في مكافحته لكنهم يعانون من ضعف دور الحكومة في معالجة الآثار المتوقعة لتغير المناخ على إنتاجية الزيتون أو مساعدة المزارعين بحلول ممكنة لمزيد من التكيف مع تغير المناخ في المستقبل.

الكلمات المفتاحية: مرونة المناخية ، وعى وإتجاهات المزارعين ، المسئولية البيئية ، التكيف مع تغير المناخ.