The degree of knowledge among vegetable growers in Al-Alam District and Salah al-Din Governorate about the dangers of climate change and how it relates to certain independent elements

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Abstract

The purpose of the study was to determine how much knowledge vegetable farmers in Al-Alam District and Salah Al-Din Governorate had about the dangers of climate change and how they relate to certain independent factors. A sample of 152 vegetable farmers, or 60% of the entire study population of 250 farmers, participated in the descriptive method research. Using a professionally constructed questionnaire comprising four primary areas relating to climate change, namely rising temperatures, dust storms, high winds, dropping temperatures, and fluctuations in rainfall rates, its validity and reliability were evaluated. The research results showed that the level of awareness among vegetable farmers regarding the risks of climate change was moderate to high, due to the majority of farmers possessing an acceptable level of knowledge and information related to climate change, which they acquired through accumulated practical experience resulting from long agricultural practice. The correlation analysis's findings demonstrated the presence of strong correlations between farmers' awareness levels and each of the independent variables pertaining to the study's topic. These findings demonstrate that a variety of personal, economic, informational, and behavioral factors affect vegetable farmers' awareness of climate threats, and that greater income, experience, and information sources increase this awareness. Given their active role in promptly and efficiently providing farmers with climate and extension information, the researcher suggested that the General Authority for Agricultural Extension encourage the use of contemporary communication techniques and digital technology in extension work.

Keywords: independent factors, climate change hazards, and vegetable growers' awareness

Introduction and research problem:

Many environmental, economic, and social aspects are seriously threatened by current environmental issues, chief among them climate change. This is particularly true of the agricultural sector, which is a key pillar of many nations' economies. The attainment of sustainable development goals is hampered by these changes, which result in a decline in agricultural output and the ensuing worsening of poverty, food insecurity, and environmental degradation. Since its primary components—solar radiation, temperatures, winds, relative humidity, and rainfall—control a variety of agricultural processes, climate is one of the most significant natural factors influencing agricultural activity. Depending on the local climate, the significance of these components changes from crop to crop and from area to region (1). Due to a variety of human activities, particularly the burning of

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fossil fuels, which has increased greenhouse gas emissions and given rise to a number of detrimental environmental phenomena, the world has seen a remarkable worsening of the phenomenon of climate change in recent years (2). Since the Industrial Revolution, the concentration of heating gases has rapidly increased, causing global warming and raising concerns about the ensuing climatic changes (3). According to Nada Abdel Zaher (4), one of the biggest obstacles to achieving the Sustainable Development Goals is climate change. This is especially true for developing nations because of their limited capacity to adapt to the effects of these changes and the potential serious consequences that may arise in the future, including drought and changes in the global agricultural production map(5). The goal of eradicating hunger and guaranteeing food security is hampered by climate change, which also directly threatens global food security and adversely impacts the sustainability of food production systems (6). According to international reports, Iraq is one of the nations most impacted by climate change, as rising temperatures and environmental stress put its food security at greater risk than the rest of the world. These factors will have an impact on the country's economy and population in the ensuing decades (7).One of the industries most impacted by climate change is agriculture, particularly vegetable farming, since conventional farming methods and the use of chemical inputs exacerbate the adverse effects of these changes, necessitating research into adaptation strategies and mitigating their effects (8). According to some research, heat and water stress brought on by climate change reduce the productivity of vegetable crops (9). Given that farmer awareness is essential to implementing climate-smart agricultural practices and reducing the adverse effects of these changes, it is evident how important it is to research vegetable farmers' awareness of the dangers associated with climate change (10). Based on the above, the study challenge can be phrased in the following question:

• Is there a relationship between vegetable farmers' understanding of climate change threats in the Al-Alam area and Salah Al-Din Governorate?

Research objectives:

1- To identify the level of awareness of vegetable growers regarding the hazards of climate change and its relationship to specific independent factors in Al-Alam district / Salah Al-Din Governorate.

2. Ranking the study areas according to percentage weight in descending order.

3. Determining the relationship between vegetable farmers' awareness of climate change risks in Al-Alam District/Salah Al-Din Governorate and the independent variables under study, which are: (Number of years of work in vegetable crop cultivation, area of land cultivated with vegetables, annual income from vegetable crop cultivation, percentage of income resulting from vegetable crop cultivation to the farmer's annual income, level of contact with information sources).

Research methodology:

The descriptive technique was utilized to attain the research aims, as this method is the most suitable for research methods. Its objective is to diagnose real-world phenomena or circumstances. This approach stands out because it keeps an eye on reality in order to assist in altering the circumstances that govern the phenomena in the future (11).

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In order to extract its implications and produce adequate and correct results and generalizations about the research issue, the descriptive technique carefully categorizes, processes, and analyzes data (12).

Study population and sample:

The 253 vegetable producers who are registered under the Science Agriculture Division's agricultural plan make up the research population. A sample of (152) farmers was tested, based on the sample size determination table of (Krejcie and Morgan, 1970).

According to the table, populations of 250–259 individuals are appropriate for a sample size of 152. According to Table (1) below, this sample accounted for 60% of the entire study population

Table 1: Study Sample and Research Population

The village	Research community	The sample size is 60%
Al-Kharjah (Court Center)	28	17
Samrah	42	25
Al-Khuzamiyah	37	22
Al-Rabidah	40	24
Al-Dulaim	51	31
Tell Al-Sibbat	35	21
Al-Khuzayfi	20	12
Total	253	152

***Agriculture Division al alm**

Testing for validity and stability:

A preliminary test (pre-test) was administered to a pilot sample of twenty vegetable growers in the Science Agriculture Division following completion of the initial version of the questionnaire. They were not included in the final sample, and data from the pilot sample was gathered in November 2025 for the following reasons:

1. Make sure the questions on the questionnaire are understandable to the responders.

2. Identifying weak vertebrae and attempting to strengthen or alter them.

3. Determine the data gathering instrument's dependability coefficient.

The reliability coefficient, which is regarded as acceptable if its value is (0.70) or more and the degree of acceptance increases as the value gets closer to one, was 0.881 when reliability was statistically calculated using Cronbach's alpha method (Al-Zuba'i, 1986: 85). By taking the square root of the reliability coefficient, the validity coefficient was also computed. Its value, 0.938, shows that the research instrument has a high degree of validity and reliability, making it ready for the final data collection.

Technique for determining awareness level:

The sum of the respondents' ratings in the four study areas—rising temperatures, dropping temperatures (frost), strong winds and dust storms, and variations in rainfall rates—was used to determine vegetable producers' understanding of the dangers associated with climate change.

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A three-tiered scale with high, medium, and low alternatives was used for this, and The total score was considered a reflection of the respondents' general level of awareness. The fundamental steps involved in creating the awareness scale are depicted in Figure (1):

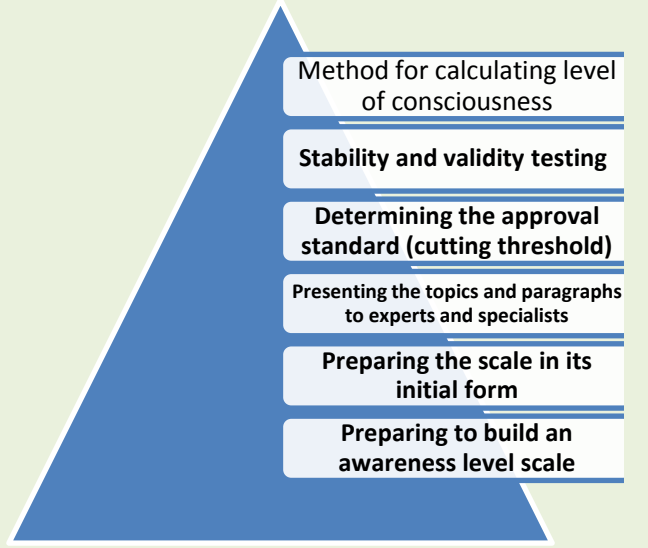

Figure (1): Stages of the process of building a scale for vegetable farmers' awareness level

Assessing the research variables:

1. Years of work in vegetable crop cultivation: The number of years the farmer worked in vegetable crop cultivation was used to measure this variable.
2. The amount of land used for vegetable cultivation: This variable was determined by counting the farmer's dunams.
3. Vegetable crop yearly income: The income was divided into three categories (high, medium, and low). These levels were assigned the corresponding weights of 1, 2, and 3.
4. The goal of producing vegetables was determined by splitting them into three categories: for sale, for domestic use, and both. The weights assigned to each category were 3, 2, and 1, respectively.
5. The percentage of the farmer's yearly income that comes from cultivating vegetable crops was calculated by splitting it into three categories: large, medium, and small. The weights assigned to each category were 1, 2, and 3.
6. Contact with information sources: Ten sources were positioned in front of each other on a three-point scale (always, sometimes, never contact) to measure this variable. Its theoretical range was (10-30) points since it was assigned numerical values of (1, 2, 3).

Statistical methods:

To accomplish the goals of the study, the data had to be tabulated, categorized, and statistically analyzed using SPSS statistical analysis software in order to produce precise results and display them in their final form. To do this, a variety of statistical techniques were applied.

Results and discussion

The first objective: To identify the level of awareness among vegetable farmers regarding the risks of climate change and its relationship to some independent factors in Al-Alam district / Salah Al-Din Governorate in general:

According to the statistical study, vegetable farmers' general awareness scores ranged from 69 to 207, with a mean of 157.49 and a standard deviation of 32.58. Based on the range and class size, the respondents were split into three groups. Table (2) illustrates the results, which indicate that the majority of respondents belonged to the middle group.

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Table (2) shows the distribution of farmers by general awareness level categories.

Categories of awareness	Number	Percentage%	average awareness	x^-	s.d
Low awareness (69-114)	5	3.30	101	157.49	32.58
average awareness (115-160)	108	71	147.15		
High awareness (161-207)	39	25.70	193.38		
TOTAL	152	100%			

According to Table 2's results, the majority of vegetable farmers—108 respondents, or 71% of the sample as a whole fell into the medium awareness category. The low awareness group finished last with five respondents, or 3.30%, while the high awareness category came in second with 39 respondents, or 25.70%.As a result, vegetable farmers' understanding of climate change risks and mitigation strategies might be characterized as moderate, with a tendency toward higher levels. This is explained by the fact that most farmers have a fit level of climate change knowledge and information, which they have gained throughout years of agricultural activity and collected real-world experience The fact that the level of awareness remains within the average category, despite its upward trend, may be attributed to the weakness of agricultural extension programs, as well as the limited presence of agricultural extension agents in the study area. The categories of awareness levels are shown in Figure (2):

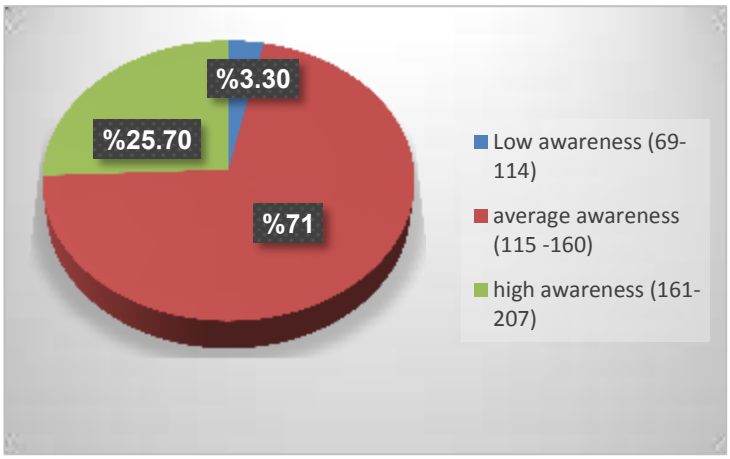

Figure (2): Categories of general vegetable growers' awareness levels

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The second goal is to order the study areas according to decreasing percentage weight.

The average awareness of each field was divided by the maximum score for that field to get the percentage weight of each field of study for vegetable growers. The result was then multiplied by 100%. The study areas were then ranked in descending order according to their percentage weights. The goal of this process is to highlight the fields with greater awareness than others. Table (3) displays the ranking of the disciplines of study based on the results.

Table 3: Study fields ranked in descending order based on each field's % weight

Domain name	Number of paragraphs	Maximum	Average field	percentile weight	Rank
Fluctuations in rainfall rates	18	54	46.08	85.33	1
High temperatures	15	45	34.23	76.06	2
Dust storms and strong winds	18	54	39.39	72.94	3
Lower temperatures	18	54	37.88	70.14	4

Table 3's results make it evident that the field of rainfall rate fluctuations ranked highest among the study fields in terms of percentage weight, reaching 85.33%. This is explained by the direct influence of rainfall on different agricultural processes. This field is more crucial than others because of planting dates, irrigation water availability, and the abrupt swings between dry spells and periods of intense rainfall, which clearly reduce agricultural output. With a percentage weight of 76.06%, the field of high temperatures was ranked second. This is explained by the fact that farmers are highly aware of how this phenomenon affects agricultural crops. However, compared to rainfall fluctuations, its effects are frequently gradual and not immediate, which accounts for its relatively low percentage weight from the first rank. In contrast, the areas affected by dust storms, strong winds, and low temperatures have dropped to the third and fourth ranks. This is explained by the fact that, in contrast to other areas with a continuous and direct impact on agricultural activity, its impact is frequently less extensive, shorter in duration, and associated with particular seasons or time periods, which lowers farmers' awareness of its danger (see Figure (3) below).

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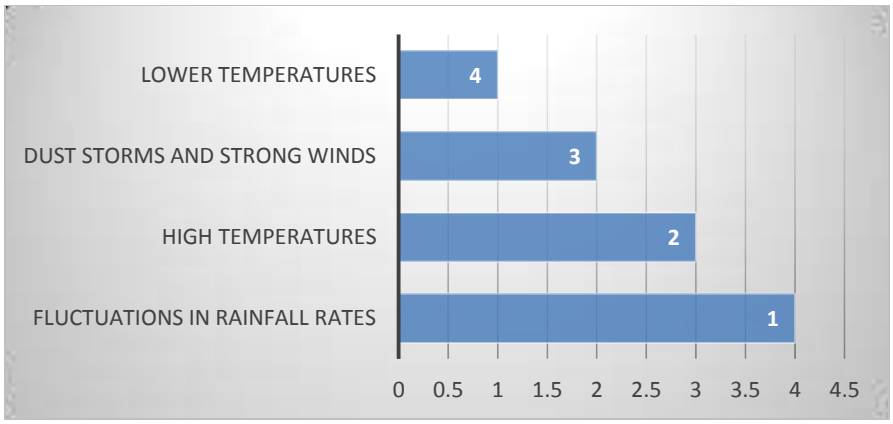

Figure (3): Ranking of study fields in descending order

The third goal is to determine the relationship between the following independent factors and vegetable growers' awareness of the dangers posed by climate change in the Al-Alam area and Salah Al-Din Governorate:

1-Area of land used for vegetable cultivation:

According to the findings, the respondents' largest land area was 31 dunams, while their smallest was 1 dunam. The range and class length algorithms were used to classify the responses into three groups, with the small land area category having the largest percentage, as Table (4) illustrates:

Table 4: Respondent Distribution by Land Area Variable

Categories	number	Percentage%	average awareness	value of r	value of T
Small (1-10)	138	90.80	155.057	0.25	**3.16
Medium(11-20)	12	7.89	175.5		
Large(21-31)	2	1.31	195.5		
TOTAL	152	%100			At level 0.01

According to Table (4), the majority of respondents fell into the small regions category, accounting for 90.80% of the sample as a whole. Using Pearson's correlation coefficient, the association between vegetable producers' awareness of climate change concerns and the land area variable was found to be 0.25. The (t) test was employed to confirm the significance of this association, and its computed value was

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(3.16). It was determined to be significant at a probability level of (0.01) when compared to the tabulated value. As a result, the null hypothesis—which claims that there is no relationship between vegetable producers' understanding of the dangers posed by climate change and their land area—is rejected. The alternative hypothesis is accepted, and this is explained by the fact that farmers' interest in managing agricultural risks is influenced by the size of their land. Farmers who own larger areas are more eager to follow developments related to climate change and implement strategies to lessen its effects in order to maintain production sustainability and minimize potential losses, which is positively reflected in their level of awareness compared to those who own smaller areas.

2. Years of experience growing vegetable crops:

According to the findings, the longest experience in growing vegetable crops was forty years, while the shortest was one year. The range and class length algorithm was used to split the responses into three groups. According to Table (5), the lowest category had the highest percentage:

Table 5: Respondent Distribution by Years of Vegetable Crop Cultivation Experience

Categories	number	Percentage%	average awareness	value of r	value of T
A few (1-13)	121	79.60	153.4	0.29	**3.71
Moderate(14-26)	19	12.5	162.96		
Large(27-40)	12	7.90	181.26		
TOTAL	152	%100			At level 0.01

According to Table (5), the category of few years of work (1–13) years had the largest percentage of respondents (79.60%) of the sample as a whole, followed by the group of medium years of work (14–26) years (12.5%). With a proportion of 7.90%, the category of long years of labor (27–40) years finished last. Pearson's correlation coefficient, which has a value of 0.29, was utilized to ascertain the association between the variable of years of employment in vegetable crop production and the degree of knowledge of climate change concerns among vegetable producers. The (t) test was employed to confirm the significance of this association, and its computed value was (3.71). It was determined to be significant at a probability level of (0.01) when compared to the tabulated value. As a result, the null hypothesis—which claims that there is no relationship between years of employment and vegetable farmers' understanding of the dangers posed by climate change—is rejected. The alternative hypothesis is accepted, and this is explained by the fact that years of work improve farmers' direct interaction with the climatic issues affecting agricultural production. This is because farmers' level of awareness gradually rises as a result of their accumulated practical experience, which makes it easier for them to observe climatic changes and their effects on vegetable crops.

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3. Vegetable crop revenue per year:

Three groups were created for the annual income variable from vegetable crops: low, medium, and high. Table (6) indicates that the medium category had the highest percentage:

Table 6: Respondent distribution based on the annual income variable

Categories	number	Percentage%	average awareness	value of r	value of T
Low	20	13.16	120.32	0.333	**4.28
middle	100	65.79	161.037		
High	32	21.05	172.21		
TOTAL	152	%100			At level 0.01

With 100 respondents, or 65.79% of the sample as a whole, the middle annual income category had the highest percentage of respondents, according to Table 6. With 32 respondents, or 21.05% of Total, the high income category came next, while with 20 respondents, or 13.16% of Total, the low income category finished last. Spearman's correlation coefficient, which has a value of (0.333), was utilized to ascertain the relationship between vegetable producers' awareness of the hazards associated with climate change and the yearly income variable. The (t) test was utilized to confirm the significance of this association, yielding a computed value of (4.28). It was determined to be significant at a probability level of (0.01) when compared to the tabulated value. As a result, the alternative hypothesis is supported and the null hypothesis—which claims that there is no relationship between vegetable farmers' awareness of the risks associated with climate change and their yearly income—is rejected. This is explained by the fact that farmers' ability to adopt suitable agricultural practices to deal with climate risks is influenced by their income level. Farmers with higher incomes have better access to modern agricultural inputs, follow preventive and adaptive technologies, and are more interested in following extension information, which is positively reflected in their level of awareness when compared to those with lower incomes.

4. The proportion of the farmer's yearly income that comes from growing vegetable crops:

Three categories (low, medium, and big) were used to categorize the variable of the income gained from the cultivation of vegetable crops to the farmer's annual income. According to Table (7), the majority of respondents were in the medium contribution category, which was followed by the large contribution category.

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Table 7 shows the respondents' distribution based on the variable of the revenue contribution from veggies.

Categories	number	Percentage%	average awareness	value of r	value of T
A few	20	13.15	123.55	0.281	**3.58
Moderate	101	66.45	159.22		
Large	31	20.40	187.25		
TOTAL	152	%100			At level 0.01

Approximately two-thirds of the respondents, or 101 respondents, or 66.45% of the sample, fall into the category of medium contribution to income resulting from the cultivation of vegetable crops in the farmer's annual income, according to Table (7). This is followed by the category of large contribution, which has 31 respondents, or 20.40%. In order to ascertain the relationship between the percentage of income contribution resulting from the cultivation of vegetable crops and the degree of awareness of vegetable farmers of the risks of climate change, the category of low contribution ranked last with 20 respondents and a percentage of 13.15%. The Spearman's correlation coefficient (0.281) was utilized. The (t) test, with a computed value of (3.58), was employed to confirm the significance of this connection. It was determined to be significant at a probability level of (0.01) when compared to the tabulated value. As a result, the alternative hypothesis is accepted and the null hypothesis—which claims that there is no relationship between vegetable farmers' awareness of the hazards associated with climate change and the amount of money they make from growing vegetable crops—is rejected. This is explained by the fact that, given the high economic return and quick capital turnover of vegetable crops, farmers' varying degrees of reliance on vegetable crops as a source of income make them more interested in monitoring climate risks affecting production and more eager to adopt practices that contribute to reducing the effects of these risks.

5. Contact level with sources of information:

According to the study's findings, the maximum level of communication with information sources was 24 degrees, while the lowest was 8 degrees. In order to ascertain the levels of contact with information sources, the respondents were divided into three groups according to the range and class length law. Table (8) illustrates that the majority of respondents belonged to the medium communication category.

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Table 8: Respondent distribution based on categories of information source contact levels

Categories	number	Percentage%	average awareness	value of r	value of T
Low connection (8-12)	34	22.37	131.3	0.492	**6.93
Medium connection (12-18)	95	62.5	157.23		
High connection (19-24)	23	15.13	189.56		
TOTAL	152	%100			At level 0.01

According to Table 8's results, the majority of farmers fall into the category of medium contact with information sources, with 95 respondents, or 62.5% of all respondents. The category of low contact, with 34 respondents, or 22.37%, comes in second, and the category of high contact, with 23 respondents, or 15.13%, comes in third. Spearman's correlation coefficient, which has a value of 0.492, was used to determine the association between vegetable farmers' awareness of the hazards associated with climate change and their access to information sources. The (t) test was performed to determine the significance of this association; the computed value of (6.93), which is greater than the tabular value, indicates that the relationship is significant at a probability threshold of (0.01). As a result, the alternative hypothesis is accepted and the null hypothesis, which claims that there is no relationship between vegetable farmers' understanding of the dangers of climate change and their access to information sources, is rejected. This could be explained by the variety and quantity of information sources that farmers use to gain their agricultural expertise. This helps increase their understanding of climate challenges and strategies for addressing them

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Conclusions:

1. The majority of vegetable farmers fell into the category of intermediate awareness of the risks associated with climate change, with a moderate awareness leaning towards high awareness levels according to the research results. This leads to the conclusion that vegetable farmers have a respectable degree of climate awareness as a result of their real-world experience; yet, organized guiding support is still required to elevate this knowledge to a high level.

2. The findings indicated that, in terms of percentage weight, the area with fluctuating rainfall rates ranked first, followed by the area with high temperatures, the area with dust storms and strong winds, and the area with low temperatures. This suggests that vegetable farmers are more aware of climate phenomena that have a direct and ongoing effect on agricultural output than they are of phenomena that have a seasonal or transient effect.

3. The study's findings demonstrated a strong relationship between vegetable farmers' awareness levels and each of the following: the number of years they have worked, their yearly income, the reason they grow vegetables, the percentage of their income that comes from vegetables, and

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their degree of interaction with information sources. This leads to the conclusion that a variety of personal, economic, behavioral, and informational characteristics influence vegetable farmers' awareness of climatic hazards; increased income, experience, and information sources increase this awareness, while aging reduces it.

Suggestions: The researcher suggests the following in light of the study's findings and conclusions:

1. Given their active role in promptly and efficiently providing farmers with climate and extension information, the study suggests that the General Authority for Agricultural Extension encourage the use of contemporary communication techniques and digital technologies in extension work, such as electronic platforms and social media.
2. To lessen the detrimental effects of varying rainfall rates, the study advises the Salah al-Din Governorate local government to support and improve agricultural infrastructure, particularly rainwater gathering projects and enhancing irrigation and agricultural drainage networks.

3. The study suggests that the Ministry of Trade create stable marketing strategies for vegetable crops, guaranteeing a decrease in price swings and making up for farmers' losses brought on by climate change.

4. In order to increase the degree of response to climate change and lessen its detrimental effects on the production of vegetable crops, the study suggests that the Ministry of Agriculture, the General Authority for Agricultural Extension, and the local government in Salah al-Din Governorate strengthen joint institutional coordination among themselves by exchanging climate data and information and connecting the findings of scientific research to the practical reality of farmers.

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