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The Impact of Climate Change on Agricultural Operations: an Applied Study on Crops in the Jordan Valley

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Abstract

Climate change, as manifested through its multifaceted dimensions encompassing economic, social, and security effects, on agricultural activities within the Jordan Valley region. The research sample encompassed a group of 9000 agricultural practitioners residing in the Jordan Valley region. Employing the well-established Morgan model, a representative subset of 368 individuals was selected through a random sampling technique. The questionnaires were disseminated among the participants of the study, resulting in the retrieval of a total of 350 questionnaires. Upon careful examination, it was determined that 340 of these questionnaires were deemed valid and suitable for analysis. A meticulously crafted survey instrument was devised to systematically gather firsthand information. The research employed a quantitative (descriptive analytical) methodology to examine the data and evaluate hypotheses by employing suitable statistical techniques available in the Statistical Package for Social Sciences (SPSS). The findings of the study indicate a noteworthy and statistically significant relationship between climate change and agricultural operations. The analysis yielded a substantial coefficient of determination (R^2=68.5%), suggesting that approximately 68.5% of the changes observed in agricultural operations can be attributed to the influence of climate change. The study proposes a strategic approach to enhance farmers' understanding of the indirect impact of climate change on various economic sectors, including manufacturing, energy production, transportation, and other services. This can be achieved through the implementation of educational initiatives, such as seminars and awareness sessions, which actively engage farmers in the learning process.

Introduction

Global, regional, and local scales all see climate change as a major issue because of the damage it poses to food supplies. High temperatures and varying levels of precipitation are symptoms of climate change, which may be caused by either natural or human processes (Al-Zoubi and Benny Domi, 2022). Jordan is one of the nations thought to be influenced by climate change. As a result, there will be a dramatic rise in the emissions of gases that disrupt ecosystems. As a result, correct agricultural practices before, during, and after the cultivation operation are essential for achieving food security and food safety (Al-Ashry, 2022). This highlights the importance of innovation and non-traditional solutions in the field of agriculture.

From choosing seeds to gathering the crop, there are various tasks involved in agriculture. To achieve the transition from conventional to organic farming, agricultural operations aim to improve farmers' access to markets and lower production costs through the continuous development of production systems and the rationalization of the use of pesticides and chemical fertilizers. Since the employment of contemporary irrigation techniques increases soil fertility and its capacity to retain irrigation water, agricultural activities help to rationalize agriculture's

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overall water usage (Kononen & Arias, 2020). Incorrect farming practices can contribute to global warming because of the greenhouse gases they release into the atmosphere, as well as because of the pesticides and chemical fertilizers they use, which degrade air quality by creating noxious byproducts like ammonia, phosphorus, and nitrates (Abu Al-Qasim, 2020). Therefore, the purpose of this research was to confirm the effect of climate change phenomena on agricultural operations in the Jordan Valley throughout its dimensions (economic, social, and security).

Problem of the study

Climate changes have had a negative impact on the agricultural sector, with high air temperature and wind causing soil erosion and an increase in evaporation rates. Agricultural specialists have called for the cessation of certain agricultural operations and avoiding practices that increase the amount of carbon-containing materials in the upper soil layers. This study aims to find out the impact of climate change on agricultural operations to answer the main study question:

Is there a statistically significant effect at the level of significance ($\alpha \geq 0.05$) for the phenomena of climate change represented by its dimensions (economic, social, security) on agricultural operations in the Jordan Valley?

Objectives of the study

The research aims to show the effect of the impact of climate change phenomena represented by its dimensions (economic, social, and security) on agricultural operations in the Jordan Valley, where there are many data and information related to climate changes and agricultural operations.

Model of the study

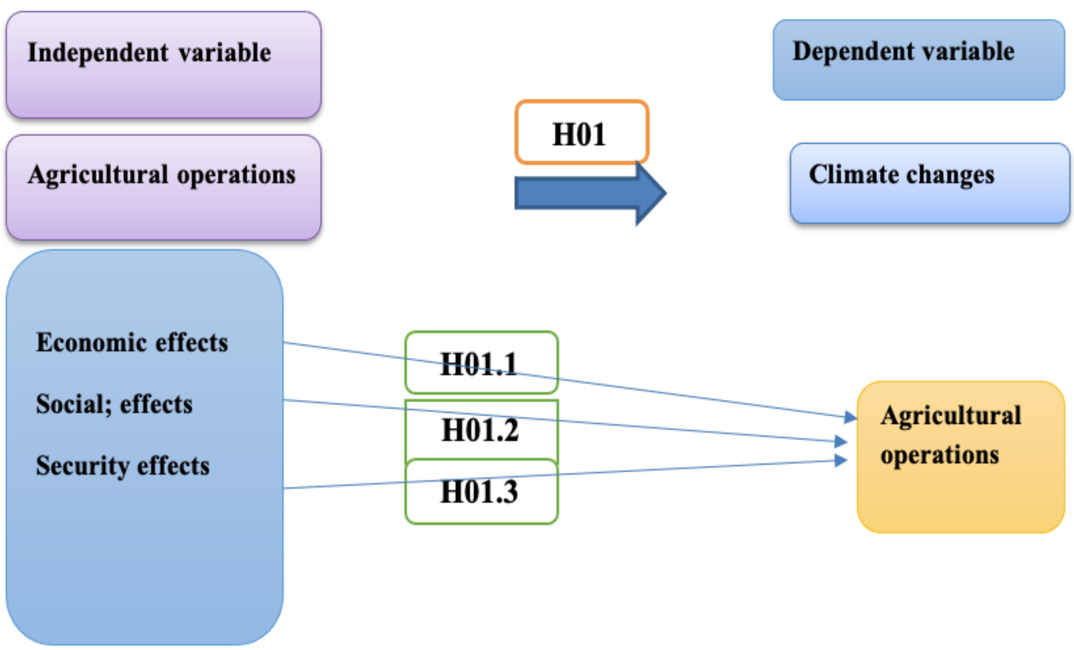

Figure 1. Study Model

The figure explains the elements of climate change (economic effects, social effects, and security effects) and its impact on agricultural operations. This model was adapted from the study of (Al-Jabali, 2020; Al-Rousan, 2021; Bouhajar, 2020).

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Hypotheses of the study

Based on the study problem, the main hypothesis of the study was formulated as follows:

The main hypothesis (H0.1): There is no statistically significant effect at the level of significance ($\alpha \geq 0.05$) of the phenomena of climate change represented by its dimensions (economic, social, and security) on agricultural operations in the Jordan Valley.

Out of the main hypothesis a number of sub-hypotheses branch: (1) The first sub-hypothesis (H1.1): There is no statistically significant effect at the level of significance ($\alpha \geq 0.05$) for the dimension of economic effects on agricultural operations in the Jordan Valley (2) The second sub-hypothesis (H1.2): There is no statistically significant effect at the level of significance ($\alpha \geq 0.05$) for the social effects dimension on agricultural operations in the Jordan Valley (3) The third sub-hypothesis (H1.3): There is no statistically significant effect at the level of significance ($\alpha \geq 0.05$) for the security effects dimension on agricultural operations in the Jordan Valley.

Limits of the study; (1) Spatial limits: Represented by all farms in the Jordan Valley; (2) Time limits: The period of conducting the study (2023-2024); (3) Human limits: Represented by all farmers in the Jordan Valley

Studies in Arabic

Qaidum and Jabbar (2021) examined the role of cities in mitigating climate change and limiting global warming. It found that the two largest economies were unable to come to an agreement on setting up a program to reduce greenhouse gas emissions. It recommended imposing taxes on companies and the international community to gather around a unified program, as well as following the example of some countries such as filtering air from carbon dioxide emitted from laboratories.

Al-Feki et al. (2021) used remote sensing and the Natural Variation Index of Vegetation Cover NDVI to monitor agricultural lands in the desert hinterland region of Buhaira Governorate. Results showed that agricultural development operations in the region went through three main stages, with the highest annual rates reaching 1614.23 feddans in 2000. Government intervention and legitimation of conditions increased cultivation rates to 53099.3 feddanss in 2020. The study recommended relying on modern technologies in studies of agricultural lands and land uses.

Al-Hassan (2020) identified the phenomenon of climate change, its causes, and its effects on agricultural lands, production, and water resources in the Asir region. Results showed an increase in annual average temperatures, a decrease in rain, and a decrease in high-quality agricultural lands.

Mahgoub (2018) aimed to identify the impact of extension activities used in improving the agricultural operations of date palms in Marwa, Northern State. The study recommended establishing an agricultural extension center, providing production inputs, providing extension service SMS to farmers, and activating appropriate extension activities.

Haque & Khan (2022) used a fixed-effect regression framework to estimate the impact of climate changes on crop yields in Saudi Arabia over the last 50 years. Results showed a significant increase in temperature, but no significant change in precipitation. Rainfall has a positive effect on all crops, but does not offset the harmful effects of temperature. Future research should focus on different regions.

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Addis & Abridew (2021) showed that small farmers responded to climate change and the majority used adaptation options, with sex, family size, farming environment, climatic information, crop spoilage, history and official extension service as important determinants.

Spanaki et al. (2021) found that AI-driven agricultural technology could disrupt agricultural operations and provide new avenues to agricultural practices. Operations scientists play a key role in future research to define and design the operational context around AI-driven agricultural technology.

Moysiadis et al. (2020) aimed to identify the basic terminology to describe mobile robotic applications used in autonomous field operations, provide basic planning aspects for mobile robotics in agricultural field environments, and formulate a brief glossary on a topic with practical implications. The results showed two RQs, one related to technical terms and one related to planning attributes

Importance of the study

The importance of the study, by reviewing and reviewing previous literature in both Arabic and English, springs from its focus on one of the most important economic sectors in Jordan. This study examines the impact of climate change on agricultural operations in the Jordan Valley, focusing on one of the most important economic sectors in Jordan. It explores the correlative and influencing relationships between climate change and agricultural operations to find strategies for agricultural operations to adapt to the effects of climate change.

Methods

This study aims to show the impact of climate change on agricultural operations in the Jordan Valley. It was conducted using an analytical descriptive approach, based on a field study, with cooperation from the National Center for Agricultural Research. Data was analyzed using statistical methods and hypotheses were tested and interpreted using SPSS. Sources of data collection: The study relied on two methods of data collection, namely: Primary Sources: In the process of collecting primary data, the study relied on a questionnaire that will be distributed to a group of (farmers) and then developed to achieve the objectives of the study, in addition to reviewing Arab and foreign studies related to the study. Secondary sources: These are books, articles, periodicals, statistics and tables issued by official institutions, refereed theses, and the Internet. These sources help cover the theoretical part and clarify the different dimensions and main concepts of the subject of the study. Study area: Jordan Valley. Study Tool: A questionnaire was developed to measure the independent and dependent variables of climate change and agricultural operations, using a 5 point Likert scale to measure respondents' attitudes and opinions. Study population and sample: The study population is represented by farmers in the Jordan Valley, which amounted to (9000) farmers, according to the records of the Farmers Union and the Ministry of Agriculture. After calculating the sample according to the Morgan model, the sample was (368) farmers. The questionnaire was distributed according to the following table .Table 1 Distribution of questionnaires among the study population

Table 1. Number of questionnaires distributed and valid for analysis

No. of questionnaires valid for analysis	No. questionnaires invalid for analysis	No. of recovered questionnaires	No. of distributed questionnaires	Sample size
340	10	350	368	368

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Since the Jordan Valley is the researcher's working region and he is in daily touch with farmers there, the high response rate to the (368) questionnaires provided to them is likely due to the researcher's persistent pursuit of their completion. We were able to retrieve (350) surveys. After reviewing the questionnaires, (10 were eliminated owing to the existence of bias in the replies, resulting in the same answer being provided in a high number of questions). At a rate of 92.3%, it was determined that (340) questionnaires are statistically reliable.

The statistical methods used: The following statistical tests (1) Descriptive statistics represented in the arithmetic means and standard deviations to describe the dimensions and variables of the study (2) Multiple regression test to test the hypotheses of the study.

Reliability of the study tool

The Cronbach's Alpha Coefficient was used to measure the reliability of the study tool. The alpha values ranged from (0.673) to (0.761) and were accepted in previous studies. Table (1) shows the stability coefficient for the study measures.

Table 2. Values of Cronbach's Alpha Coefficient reliability for the study variables

Variable	No. of paragraphs	Validity and reliability of the Crumbach Alpha questionnaire
Economic effects	5	0.704
Security effects	5	0.673
Social effects	5	0.744
Independent variable: Climate change	15	0.841
Dependent variable: Agricultural operations	10	0.761
Total	25	0.892

According to Table 2, the Cronbach alpha coefficient exhibited a range of values, with the lowest recorded value being 0.673 and the highest value reaching 0.761. The cumulative value obtained for the dataset was 0.892, indicating a substantial level of significance. This value was derived from the analysis of a total of 25 paragraphs, suggesting a robust sample size.

Results and Discussion

Gender

Table 3. Distribution of the study sample according to gender

Variable	Category	Number	Percentage
Gender	Male	280	82.4
	Female	60	17.6
Total		340	100%

It is noted from Table (3) that males constitute the largest percentage of the study sample at (82.4%) compared to (17.6%) for females.

Age

Table 4. Distribution of the study sample according to age

Variable	Age	Number	Percentage
Gender	less than 30	60	17.6
	From 30 to 40	146	42.9

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	From 41 to 50	127	37.4
	Over 50	7	2.1
Total		340	100%

The analysis of the data reported in Table 4 highlights a noteworthy finding pertaining to the distribution of ages within the sample population under consideration. The data clearly indicates that persons aged between 30 and 40 years constitute the biggest segment, comprising a notable 42.9% of the whole sample. Conversely, the demographic group consisting of persons who are 50 years of age or older comprises the least proportion, accounting for a paltry 2.1% of the total population.

Academic Qualification

Table 5. Distribution of the study sample according to academic qualification

Variable	Category	Number	Percentage
Academic qualification	High school or less	199	58.5
	Technical school	97	28.5
	BA	37	10.9
	Postgraduate studies	7	2.1
Total		**340**	**100%**

According to the data shown in Table 5, the biggest proportion of individuals in the research sample, accounting for 58.5%, had a high school education or below. Conversely, the smallest number, comprising just 2.1%, had completed postgraduate studies.

Source of Income

Table 6. The distribution of the study sample according to the source of income

Variable	Source of income	Number	Percentage
Gender	Agriculture only	206	60.6
	Agriculture and other sources	134	39.4
Total		**340**	**100%**

According to the data shown in Table 6, the research sample mostly consists of individuals whose only source of income is agricultural, accounting for the highest proportion at 60.6%. In contrast, those who get their income from both agriculture and other sources make up a smaller percentage of the sample, namely 39.4%.

Years of Experience

Table 7. Distribution of the study sample according to years of experience

Variable	Years of experience	Number	percentage
Years of experience	5 years or less	65	19.1
	From 6 to 10	87	25.6
	From 11 to 14	115	33.8
	15 years or more	73	21.5
Total		**340**	**100%**

According to the data shown in Table 7, the research sample exhibits a notable distribution in terms of years of experience. Specifically, those with 11 to 14 years of experience represent the biggest proportion, accounting for 33.8% of the sample. Conversely, those with 5 years of experience or less comprise the smallest percentage, amounting to 19.1%.

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Means and Standard Deviation

The arithmetic means and standard deviations of the respondents' answers to the economic effects paragraphs.

Table 8. Arithmetic means and standard deviations of the respondents' responses to the effects of climate change

Rank	Paragraph	Arithmetic Mean	Standard Deviation	Relative Significance
	Security Effects	3.88	0.759	High
	Social Effects	3.88	0.759	High
	Economic Effects	3.80	0.694	High
	Total			

Table 9. Arithmetic means and standard deviations of the respondents' answers to the agricultural operations items

Item number	rank	Item	Arithmetic mean	Standard deviation	Relative significance
			3.94	0.823	High

Test the study hypotheses

Ho.1 First Main Premise

The study findings indicate that there is no statistically significant impact ($P \leq 0.05$) of climate change, as measured by its many aspects (economic impacts, security implications, social effects), on agricultural activities in the Jordan Valley.

In order to examine the aforementioned hypothesis, the researchers used the usual multiple linear regression test to assess the influence of climate change, as indicated by its many aspects (economic impacts, security effects, social effects), on agricultural activities in the Jordan Valley. The findings of this analysis are provided in Table 10.

Table 10. Standard multiple regression analysis to identify the impact of climate change represented by its dimensions (economic effects, security effects, social effects) on agricultural operations in the Jordan Valley

Depend-ent variable	Model summary		Variance [b]				Dimensions of the independent variable	Regression coefficients [a]		
	RRR Correlation coefficient	R^2 Coefficient of determin-ation	Degree of freedom		(F) Value	Sig F statistical significance		(B) Value	(T) Value	Sig t statistical significance
Independ-ent variable	0.828	0.685	Regre-ssion	3	243.883	0.000	Economic effects	0.190	4.456	0.000
			Resid-ual	336			Security effect	0.141	3.579	0.000
			Total	339			Social effect	0.520	18.040	0.000

[a]Independent variable (climate change) represented by its dimensions (economic variable effects, security effects, social effects)

[b]Dependent (agricultural operations)

Table 10 presents the results of the t-test, indicating that the sub-variables associated with climate change, namely economic impacts, security effects, and social effects, have a

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statistically significant impact on the level of agricultural activities. The computed (t) values obtained ranged from 3.579 n to 18.040, all of which were found to be statistically significant at the predetermined significance threshold ($p \leq 0.05$). The correlation coefficient ($R = 0.828$) indicates a strong positive association between climate change and its dimensions, namely agricultural operations. Additionally, the coefficient of determination ($R^2 = 0.685$) suggests that about 68.5% of the variability in agricultural operations may be explained by climate change. The independent variable, climate change, together with its many characteristics, accounts for 68.5% of the variability seen in the dependent variable, namely agricultural activities. The F value obtained from the calculation was 243.883, representing the value of the test statistic at a significance threshold of $p < 0.05$.

In order to assess the individual significance of each independent variable in relation to the influence of climate change on agricultural operations, a Stepwise Multiple Regression analysis was conducted. The results of this analysis, as shown in Table (11), indicate the sequential inclusion of the independent variables into the regression equation.

Table 11. Results of the stepwise multiple regression analysis to predict the level of agricultural operations through the dimensions of climate change

Model no.	Model summary	Variance			
	R Correlation coefficient	R^2 Determination coefficient	Degree of freedom	(F) value	Sig F statistical significant
1	0.778	0.606	1	519.337	0.000
2	0.821	0.673	2	347.254	0.000
3	0.828	0.685	3	243.883	0.000

Model number
1. Social effects
2. Social and economic effects
3. Social, economic and social effects

Upon examination of the data reported in Table 11, the dimensions pertaining to the independent variable "climate change" were ascertained. The primary factor accounting for the variability in agricultural operations was found to be the social effects, which accounted for 60.6% of the observed variation in the dependent variable. Following closely behind, the economic impacts were identified as the secondary factor, contributing to 67.3% of the variance in agricultural operations when combined with the social effects. The impact of security was shown to be the third most significant factor, behind social and economic consequences, in explaining 68.5% of the variability seen in agricultural operations. Consequently, the null hypothesis was invalidated while the alternative hypothesis was supported, indicating that there exists a statistically significant impact, at a significance level of $p \leq 0.05$, of climate change, as represented by its dimensions (economic effects, security effects, social effects), on agricultural operations. Table 12 shows the results of the transaction analysis.

Table 12. Results of multiple linear regression gradient coefficients to detect the impact of climate change and its dimensions on agricultural operations

Model		Regression coefficients		
		(B) value	(T) value	Sig t statistical significance
1	Social effects	0.645	22.790	0.000
2	Social effects	0.533	18.325	0.000

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	Economic effects	0.284	8.345	0.000
3	Social effects	0.520	18.040	0.000
	Economic effects	0.190	4.456	0.000
	Security effects	0.141	3.579	0.000

The analysis of Table 12 reveals that the estimated values of variable B at various levels of variable T in the three models exhibit statistical significance ($p < 0.05$). Specifically, all the calculated values of B demonstrate significance at a level of $p = 0.000$, which is lower than the predetermined threshold of 0.05. This observation validates the importance of the coefficients. Based on the aforementioned analysis, it is evident that the initial null hypothesis cannot be upheld, while the alternative hypothesis, positing a statistically significant impact of climate change on agricultural operations, can be accepted. This impact is measured through various dimensions, namely economic effects, security effects, and social effects.

Sub-hypothesis testing

Ho1.1 The first sub-hypothesis: There is no statistically significant effect at a significant level ($P \leq 0.05$) of the economic effects on agricultural operations in the Jordan Valley.

To test this hypothesis, the Simple Regression test was used to identify the relationship between the economic effects of agricultural operations in the Jordan Valley. Table (13) is illustrative.

Table 13. Results of the simple linear regression test to detect the impact of economic effects on agricultural operations

Dependent variable	Model summary [b]		Variance [b]				Regression coefficients [a]		
	RRR Correlation coefficient	R^2 Coefficient of determin-ation	Degree of freedom		(F) value	Sig F statistical significan ce	(B) value	(T) value	Sig t statistical significan ce
Independe nt variable	0.590	0.348	Regressi on	1	180.21 3	0.000	0.572	13.42 4	0.000
			Residual	338					
			Total	339					

Upon examination of Table 13, it is evident that the correlation coefficient (R) between the variables of economic impacts and agricultural operations yielded a value of 0.590, indicating a positive association between the two variables. This elucidates that the magnitude of the economic impacts has a positive influence on the dependent variable "agricultural operations". The coefficient of determination (R^2) exhibited a value of 0.348, indicating that about 34.8% of the variation in agricultural activities may be attributed to climate change. The estimated value of variable F was determined to be 180.213, with a level of statistical significance of 0.000. This result is found to be less than the predetermined threshold of $p \leq 0.05$. This finding substantiates the importance of the regression analysis. Based on the aforementioned findings, the null hypothesis was rejected, hence accepting the alternative hypothesis. There exists a statistically significant effect, with a significance level of $P \leq 0.05$, of the economic impacts on agricultural activities in the Jordan Valley.

Ho1.2 The second sub-hypothesis**:** There is no statistically significant effect at a significant level ($P \leq 0.05$) of security effects in agricultural operations in the Jordan Valley.

To test this hypothesis, the Simple Regression test was used to identify the relationship between security effects in agricultural operations in the Jordan Valley. Table (14) shows this.

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Table 14. Results of the simple linear regression test to detect the impact of security effects on agricultural operations

Dependent variable	Model summary [b]		Variance [b]				Regression coefficients [a]		
	RRR Correlation coefficient	R^2 Coefficient of determination	Degree of Freedom		(F) value	Sig F statistical significance	(B) value	(T) value	Sig t statistical significance
Independent variable	0.537	0.288	Regression	1	136.791	0.000	0.489	11.696	0.000
			Residual	338					
			Total	339					

[a] Independent variable (Security effects)

[b] Dependent change (agricultural operations)

Upon careful examination of Table 14, it is evident that the findings indicate a correlation coefficient (R) value of 0.537 between the variables of security impacts and agricultural activities. Furthermore, the analysis demonstrates a positive association between these variables. This elucidates that the magnitude of the security impacts has a positive correlation with the agricultural activities, which serves as the dependent variable. The coefficient of determination (R^2) indicated that 28.8% of the variation in climatic change and agricultural activities could be explained by the variables in the model. The computed F value was 136.791, which was statistically significant at a level of $p<0.05$. This finding validates the importance of the regression analysis. Based on the aforementioned findings, the null hypothesis was rejected, and the alternative hypothesis was accepted. The findings indicate a statistically significant impact of security measures on agricultural activities in the Jordan Valley, as shown by a considerable degree of significance ($P\leq0.05$). Ho1.3 The third sub-hypothesis: There is no statistically significant effect (at a significant level ($P\leq0.05$) of the social effects on agricultural operations in the Jordan Valley. To test this hypothesis, the Simple Regression test was used to identify the relationship between social effects in agricultural operations in the Jordan Valley. Table (15) illustrates this.

Table 15. Results of the simple linear regression test to detect the impact of social effects on agricultural operations

Dependent variable	Model summary [b]		Variance [b]				Regression coefficients [a]		
	RRR Correlation coefficient	R^2 Coefficient of determination	Degree of Freedom		(F) value	Sig F statistical significance	(B) value	(T) value	Sig t statistical significance
Independent variable	0.778	0.606	Regression	1	519.377	0.000	0.645	22.790	0.000
			Residual	338					
			Total	339					

[a]Independent variable (Social effects)

[b] Dependent variable (Agricultural operations)

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Upon examining Table 15, it is evident that the correlation coefficient (R) between the variables of social impacts and agricultural activities was determined to be 0.778. Furthermore, this connection was found to be positive in nature. This elucidates that the dimension of social impacts has a beneficial impact on the dependent variable "agricultural activities". The coefficient of determination (R^2) showed a value of 0.606, indicating that 60.6% of the variation in agricultural operations can be attributed to climate change. Additionally, the estimated F value was 519.377, which was statistically significant at the 0.000 level. This implies that the relationship between climate change and agricultural activities is significant, since the p-value (P) was less than or equal to 0.05. This finding underlines the importance of the regression analysis. Based on the aforementioned findings, the null hypothesis was refuted, and the alternative hypothesis was supported, indicating that there exists a statistically significant impact, at a significance level of $P \leq 0.05$, of social factors on agricultural activities in the Jordan Valley.

Conclusion

(1) The results of the study indicate that the economic effects dimension obtained a high degree of approval, as the arithmetic mean was (3.8). It causes high temperatures, droughts, floods and landslides .(2) The results of the study show that the security effects dimension obtained a high degree of agreement, with the arithmetic mean reaching (3.88). This indicates that the study population is aware of the importance of the impact of the security dimension of climate change on agricultural operations. This is highlighted by the state's political commitment to confront the impact of change climate, preserving climate security for future generations, finding the necessary solutions to face emergencies related to diseases and what threatens the strategic stock of food security, and exacerbating losses and severe damage that could harm society .(3) The results of the study reveal that the social effects dimension obtained a high degree of agreement, with the arithmetic mean reaching (3.89). This indicates the study population is of the importance of the impact of the social dimension of climate change on agricultural operations. This is highlighted by considering that climate change is an issue related to human rights and causes harmful consequences on the right to life, health, food and human life requirements. This results in a change in human behavior and social phenomena that individuals follow .(4) The results of the study explain that the agricultural operations variable obtained a high degree of approval, with arithmetic mean (3.94). This indicates that the study population is aware of the importance of agricultural operations that are carried out for crops without any factors affecting them. This is highlighted by the farmers' observation of a the decline of soil fertility resulting from the use of chemical fertilizers as a result of the association of planting dates with climate changes.

Recommendations

The study recommended a set of recommendations to work on, as follows (1) Educating farmers that climate changes affect economic activities indirectly, such as manufacturing, energy production, transportation and other services, by involving them in awareness seminars or courses. (2) Work on training farmers on a set of strategies to mitigate and adapt to climate changes. (3) Work to find radical solutions to confront the effects of climate change, such as rising droughts, floods and storm (4)Supporting the poor communities most affected by climate change, as they live in weak ecosystems, which have a close relation between nature and their lands on which they depend for their livelihoods. (5) Developing effective systems to track the development of agricultural production, and setting up an early warning system. (6) Work on generalizing the use of new technologies in irrigation that help save water.

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