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The Importance of Using Solar Energy in Achieving Sustainable Agricultural Development according to Perspective of Agricultural Extension Workers

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Abstract: This study aimed to identify the importance of using solar energy in achieving sustainable agricultural development according to perspective of agricultural extension workers in Ninawa Governorate, across the economic, agricultural, and environmental sectors. The research areas were arranged in descending order according to the average responses of the respondents. The study also determined the correlation between the importance of using solar energy in achieving sustainable agricultural development and some independent variables (age, educational qualifications, period of service, experience, training, and information sources). To achieve the research objectives, a questionnaire was distributed to agricultural extension workers in the Ninawa Agriculture Directorate and its affiliated agricultural divisions. A simple random sampling method was used to select the research sample, the total number of workers in the research community to (313). After excluding (30) employees from the total research community who were included in the stability sample for the research scale, a simple random sample of (60%) was taken, bringing the total number of workers in the research sample to (188). The data were analyzed using the SPSS program. Using statistical methods such as range, class length, frequency, percentage, arithmetic mean, Pearson's correlation coefficient, and Spearman's rank correlation equation,
The results showed that agricultural extension workers' opinions regarding the importance of using solar energy in achieving sustainable agricultural development in the economic and agricultural fields were moderately upward, while their opinions regarding the environmental field were moderately downward. The research results also showed that the correlations between agricultural extension workers' opinions regarding the importance of solar energy and the variables (age, educational qualifications, length of service, experience, and training) were insignificant. However, the correlations were significant with the variable of level of contact with information sources. The research concluded with several recommendations, the most important of which is the need to raise environmental awareness among workers about the importance of using solar energy and its role in achieving sustainable agricultural development. It is also necessary for workers to maintain close contact with various sources of information about solar energy technologies and their use in agriculture.
Key Words: Solar energy, Sustainable agricultural development, Agricultural

1. INTRODUCTION:

Agriculture has been considered the foundation for the growth and development of human societies and various civilizations since ancient times. With the advancement of technology and the continuation of scientific discoveries, the fields, methods, and practices of agriculture have evolved to reach their present state. To enhance the modern concept of modern agriculture and its continued development, the behavior of farmers and agricultural producers must be modified to suit the current situation, while continuing technical support is needed to clarify how to transition to more modern practices and strategies (Muhammad et al., 2024: 46). The agricultural reality in Iraq requires continuous development for several reasons, most notably the Iraqi economy's dependence on oil as the sole source of wealth, which is a temporary, rather than a strategic, option, and the neglect of other sectors, including the agricultural sector (Hassan, 2024: 14).

The use of fossil fuels in agriculture accelerates climate change due to the emission of significant greenhouse gases. This has prompted scientists, researchers, and academics to search for alternative and sustainable fuel sources in agriculture using renewable energy, such as solar panel technology, to mitigate the environmental problems that may result from global warming and climate change, and to alleviate the troubling concerns associated with the depletion of fossil fuels. While there are many potential sources of renewable energy, solar energy is the best form of energy that can be used almost everywhere on Earth. It is pollution-free and cost-effective, and the use of solar energy does not emit greenhouse gases, unlike fossil fuels. As a result, many developing countries are now turning to renewable energy, such as solar energy, which can be used for various purposes in agriculture, and even in all areas of agriculture and related processes. This will help reduce the environmental problems associated with agriculture (Aroonsrimorakot et al, 2020: 1-2). Since fossil fuels will one day run out, there is an urgent need to find alternative fuels. Renewable energy, as an alternative to fossil fuels, is currently attracting a great deal of attention. Among renewable energy sources, solar energy is the most important because it is available worldwide. This energy source is used in many industries, including agriculture, and can be used to grow crops in the most remote areas of the world. Furthermore, this fuel does not cause pollution, unlike fossil fuels. Solar energy can be used in all agricultural areas, which will certainly help meet the growing need for agricultural products as the population increases. Solar energy can be developed to produce electricity and exploit it in agriculture. Solar energy can also be used in agriculture to convert unusable land into greenhouses or animal barns in areas outside of cities (Torshizi & Atefeh, 2017: 234). The use of solar energy is fundamental to achieving food security, an important issue that must be addressed in all countries, whether developed or developing. It is worth noting that countries with agricultural economies have supported food security in implementation of the United Nations goals to combat poverty and hunger. These countries, including Iraq, seek to achieve this goal within their limited economic capabilities. However, there are agricultural and economic variables specific to each country that affect local agricultural production and stand in the way of achieving this goal. Among these variables is the availability of a continuous and sustainable energy source (Altalb and Batkowska, 2023; Bakhit et al., 2023: 1). Solar energy is currently used in many agricultural sectors, most notably in irrigating agricultural land, where solar-powered irrigation systems provide numerous benefits. They also provide heating for greenhouses during the winter, and reduce crop moisture (Panda et al., 2024: 13-14). Many agricultural machines and equipment are solar-powered. Solar-powered fence protection systems, spray pumps, insect and pest traps, cooling systems, milking machines, sensors, and control systems can also be operated (Panda et al., 2024: 16). Solar energy can be widely used in agriculture to produce and generate electricity (Al-Sharifi and Hoda, 2021: 23).

Sustainable agricultural development is an integrated and comprehensive process for advancing the agricultural sector in Iraq, achieving large quantities of production and high yields without harming non-renewable agricultural resources, and working to sustain and preserve them (Ahmed and Batkowska, 2023). This leads to food security and supports the growth and development of other economic sectors. However, achieving agricultural development in Iraq faces many structural and non-structural obstacles within the agricultural sector and related sectors (Ahmed et al., 2016; Muhammad, 2020: 370). In this field, agricultural extension seeks to achieve rural and agricultural development in its various dimensions by bringing about desirable behavioral changes in the knowledge, skills, and attitudes of the target groups through extension work (Altalb and Batkowska, 2023; Al-Khadraji, 2018: 2). Agricultural extension workers are the cornerstone of the extension process within the agricultural extension organization. Agricultural extension also serves as an important link between science in research centers and farmers in rural areas. This is achieved through communication and interaction between agricultural extension workers, researchers, and farmers within an integrated work system in which each party influences and affects the other, with the goal of achieving agricultural development (Ibrahim and Iman, 2024:5; Ahmed and Batkowska, 2023).

Solar energy technology has been used in agriculture in various countries around the world that are interested in innovating agricultural technologies. These countries have adopted this technology due to its positive characteristics. It has subsequently been adopted by some regional countries, including Iraq, which has used this technology in recent years in some governorates renowned for agriculture and boasting vast areas of agricultural land. Given that Nineveh Governorate is considered one of the most important agricultural governorates in Iraq and possesses vast areas of cultivated land spread across the governorate's districts and sub-districts, some districts, sub-districts, and regions have begun to use this technology (solar energy technology) and incorporate it into the cultivation of arable land. Its use began with the self-sufficiency of farmers and has spread from one region to another within Nineveh Governorate. Given the significant importance of solar energy in agriculture, as previously mentioned, it is necessary to study the reality of its use, its methods of dissemination, and the obstacles that stand in the way of its use. Through the researcher's knowledge and interest in the topic of solar energy use, his communication with farmers, employees, and energy users from the Nineveh Agriculture Directorate and its affiliated divisions, and consultation with specialists, the researcher formed a picture of a flaw in the general vision for the use of this technology. As a result of this, the researcher intended to conduct this research formally as a scientific study to ascertain the opinions of extension workers distributed across the centers of the Nineveh Agriculture Directorate, divisions, and extension centers, and to understand and evaluate the reality of the use of this technology in agriculture in Nineveh Governorate.

- Research objectives:

1. To identify the importance of using solar energy in achieving sustainable agricultural development from the perspective of agricultural extension workers in the economic, agricultural, and environmental fields.
2. To arrange the research areas in descending order according to the average responses of the respondents.
3. To determine the correlation between the importance of using solar energy in achieving sustainable agricultural development and the independent variables: (age, educational qualification, academic specialization, period of service in agricultural extension, training in the use of solar energy systems, and sources of information on the use of solar energy).

2- MATERIALS AND METHODS:

Nineveh Governorate was chosen as the research area, as it is the second largest governorate in Iraq and one of the governorates famous for agriculture. The Nineveh Agriculture Directorate (directorate headquarters and its affiliated agricultural divisions) was chosen as the research area. The research population included all agricultural employees working in agricultural extension at the Nineveh Agriculture Directorate headquarters and its affiliated agricultural divisions, totaling (343) agricultural employees. A simple random sampling method was used to select the research sample. After excluding (30) employees from the total research population, they were included in the stability sample for the research scale. Thus, the total number of employees in the research population reached (313). A simple random sample of (60%) was taken, bringing the total number of employees in the research sample to (188).

To identify the areas and topics for the research, sources, research, and books related to the subject of solar energy were reviewed. After consulting with specialists in the Renewable Energy Department, the Technical Institute of Technology, and the Agricultural Extension Department, a questionnaire was prepared for this purpose.

- Components of the research tool (questionnaire):

The questionnaire consisted of (2 parts) as follows

A. Part One: Includes data related to the independent variables of the employees' personalities (age, educational qualifications, academic specialization, length of service in agricultural

extension, training on the use of solar energy systems, and sources of information on the use of solar energy).

B. Part Two: This part included the dependent variable (the importance of using solar energy in achieving sustainable agricultural development from the perspective of agricultural extension workers). This part includes three domains: (the economic domain, the agricultural domain, and the environmental domain), with (47) items. For each field, a set of paragraphs was prepared for the researcher to answer, covering the scientific scope of the field. The total number of paragraphs included in the fields was (47) paragraphs, distributed across the three research fields, as shown in the following table:

Table (1) Distribution of paragraphs across solar energy research fields

Field	Number of paragraphs
First field: Economic field	17
Second field: Agricultural field	17
Third field: Environmental field	13

- Validity and Reliability:

After completing the questionnaire in its initial form, it was presented to researchers specializing in agricultural extension to verify the apparent validity of the scale's items. It was also presented to solar energy specialists to ensure the scientific integrity of the items. Based on the specialists' comments, some items were modified to ensure they were appropriate for achieving the research objectives. To establish reliability, a random survey sample of (30) employees was selected from the total research community. The reliability of the research areas and the overall scale was calculated using Cronbach's alpha using SPSS. The reliability value reached (0.92). Data for the reliability sample was collected from November 1, 2024, to December 1, 2024.

- Measuring Research Variables:

A. Measuring Independent Variables:

1. Age: This was measured by the number of years the respondent was aged at the time of data collection.
2. Educational Qualification: This was measured according to the following levels: a graduate of a secondary school of agriculture was given one (1) score; an agricultural institute graduate was given two (2) scores; a college of agriculture graduate was given three (3) scores; and postgraduate degrees were given four (4) scores.
3. Length of employment in agricultural extension: This was measured by the number of years of employment at the time of data collection.
4. Experience in solar energy systems: By asking the respondent whether he has experience, is familiar with the basics, or is an expert in the subject.
5. Training in the use of solar energy systems: This was measured by assigning two alternatives: a trainee was given one (1) score; and a non-trainee was given two (2) scores.
6. Sources of information on the use of solar energy: This was measured by posing several questions in a table format, with four alternatives: always (4), sometimes (3), rarely (2), and never (1).

B. Measurement of the dependent variable:

(The importance of using solar energy in achieving sustainable development in Ninewa Governorate) in the economic, agricultural, and environmental fields. The level of application was measured by assigning the following alternatives to each item: (very strongly agree, strongly agree, moderately agree, slightly agree, disagree), and assigning them numerical values (5, 4, 3, 2, 1), respectively. By summing each respondent's responses to the domain items, we obtain the final score for each respondent on the research domain items, which represents the final score for each respondent on the research domains. This result represents the opinion of agricultural extension workers regarding the importance of using solar energy in achieving sustainable development in the research domains in Nineveh Governorate.

Research Data Collection and Statistical Analysis:

The research data were collected during the period from January 1, 2025 to February 1, 2025. After completing the data collection, transcribing, and tabulation, it was analyzed using the statistical analysis program (SPSS). Since the research data were normally distributed, the following parametric statistical methods were used: range, class length, frequency, percentage, arithmetic mean, Pearson's correlation coefficient, and Spearman's rank correlation equation. Table (2) shows the domains and paragraphs of the scale.

Table (2): Domains and Items of the Scale

Fields	Paragraphs	P. Sequence in Field	P. Sequence in Scale
Economic	Solar energy reduces the government's burden of subsidizing petroleum derivatives	1	1
	The availability of cheap solar energy leads to long-term economic development	2	2
	Government support for solar energy projects creates a favorable environment for investment and economic recovery	3	3
	Solar energy plays a role in reducing production costs, thus achieving a greater profit margin for farmers	4	4
	One of the benefits of using solar energy is solving the problem of fuel price fluctuations	5	5
	Solar energy is economically more efficient than any other energy source.	6	6
	The use of solar energy leads to improved energy production efficiency and regulation	7	7
	The use of solar energy is important because it leads to achieving the desired economic feasibility	8	8
	Solar energy projects can contribute to economic diversification	9	9
	The maintenance of solar-powered stations is less expensive than the maintenance of conventional fuel-powered stations	10	10
	Solar energy is the most important source of electricity production due to its low cost	11	11
	The use of solar energy is limited by the government for farmers	12	12
	Use Solar energy improves the competitiveness of agricultural products	13	13
	Solar energy is important and economical because it does not require periodic maintenance	14	14
	Solar energy has a significant impact on farmers' GDP	15	15
	The economic importance of solar energy is increasing due to the possibility of selling surplus electricity generated	16	16
	The consumption rate in solar energy systems decreases over the years	17	17
Agricultural	The use of solar energy improves the investment environment in the agricultural sector	1	18
	Solar energy is important in irrigating crops on farms	2	19
	Solar energy is one of the most important types of energy that can be exploited to achieve sustainable agricultural	3	20

	development		
	An important role of solar energy is its use in heating greenhouses	4	21
	By adapting to solar energy, sustainable agricultural production can be ensured	5	22
	Solar energy can be used to heat poultry	6	23
	Solar energy is important in cold storage for fruits and vegetables	7	24
	Solar energy can be used in sensors and control systems	8	25
	The use of solar energy improves the competitiveness of agricultural products	9	26
	Solar energy improves the efficiency of irrigation water use	10	27
	The importance of solar energy is increasing in operating agricultural equipment	11	28
	Solar energy is important in drying some agricultural products by heating	12	29
	The use of solar energy helps in traps for insects and agricultural pests	13	30
	The use of solar energy plays a role in creating new job opportunities on the farm	14	31
	Solar energy can be used in milking machines for farm animals	15	32
	Solar energy can be used to protect the farm through an electric fence protection system	16	33
	Solar energy can be used in lawn mowing equipment on the farm	17	34
Environmental	The use of solar energy reduces the incidence of health problems resulting from fuel	1	35
	Solar energy technology plays an important role in reducing greenhouse gas emissions	2	36
	The use of solar energy is cleaner than the use of fossil fuels	3	37
	The use of solar energy does not produce any waste that is harmful to the environment	4	38
	The use of solar energy leads to... Solar Energy for Environmental Sustainability	5	39
	Using solar energy to preserve the environment is every individual's responsibility	6	40
	Using solar energy promotes a culture of protecting non-renewable natural resources	7	41
	Solar energy leads to rational human interaction with the environment	8	42
	Using solar energy to pump groundwater contributes to facilitating its extraction and flow	9	43
	Connecting energy to water stations leads to the provision of potable water	10	44
	Solar panels can add an aesthetically pleasing appearance to cities and rural areas if installed on exterior walls and roofs	11	45
	Solar energy can be used in water desalination	12	46
	Solar energy promotes ecotourism	13	47

3- RESULTS AND DISCUSSION:

First Objective: To identify the importance of using solar energy in achieving sustainable agricultural development from the perspective of agricultural extension workers in the economic, agricultural, and environmental fields.

Respondents were divided into categories according to their opinions on the importance of using solar energy in achieving sustainable agricultural development in the economic, agricultural, and environmental fields, as shown in Table (3).

Economic field: The results showed that the highest numerical value obtained by the respondents was (85) and the lowest (17), with an average of (66.670). (72.87%) of the respondents fell within the medium category (56-76), (15.43%) within the high category (77-85), and (11.70%) within the low category (17-54). It is clear from the above that the medium and high categories constituted (88.30%) of the total number of respondents. This means that the opinion of agricultural extension staff regarding the importance of using solar energy in achieving sustainable agricultural development in the economic field is average and tends to increase. According to this result, agricultural extension workers have a good knowledge of the techniques of using solar energy in the economic field and its important role in achieving sustainable agricultural development. **Agricultural Field:** The results showed that the highest numerical value obtained by the respondents was (85) and the lowest (17), with an average of (65.500). (71.28%) of them fell within the medium category (55-75), (18.09%) of them fell within the high category (76-85), and (10.46%) of them fell within the low category (17-54). It is clear from the above that the medium and high categories constituted (89.37%) of the total number of respondents. This means that the opinion of agricultural extension staff regarding the importance of using solar energy in achieving sustainable agricultural development in the agricultural field is average and tends to increase. According to this result, agricultural extension workers have a good knowledge of the techniques of using solar energy in the agricultural field and its important role in achieving sustainable agricultural development.

Environmental field: The results showed that the highest numerical value obtained by the respondents was (95), and the lowest value was (13) with an average of (53.016), where the percentage of (61.70%) of the respondents fell within the medium category (46-61), and the percentage of (19.68%) of them fell within the low category (13-45), while the percentage of (18.62%) of them fell within the high category (62-95). It is clear from the above that the medium and low categories constituted (81.38%) of the total number of respondents. This means that the opinion of agricultural extension workers on the importance of using solar energy in achieving sustainable agricultural development in the environmental field is average and tends to decline. According to this result, the environmental awareness of agricultural extension workers is still deficient. Their main orientation was on the importance of solar energy and its tangible benefits, both economically and agriculturally, directly. As for the environmental repercussions, they lacked some awareness. However, the closeness of the percentages between the low and high categories indicates that the awareness of the environmental benefits of the concept of cleanliness in using solar energy is developing well. Therefore, repeating the questionnaire after a period of time should give better results.

Table (3): Distribution of respondents according to their opinions on the importance of using solar energy in achieving sustainable agricultural development in the economic, agricultural, and environmental fields of the research.

Field	Scope Categories (numerical values)	Number	Percentage %	Std Deviation	Sort by average
Economic	Low (17-55)	22	11.70	10.080	66.670
	Medium (56-76)	137	72.87		
	High (77-85)	29	15.43		
	Total	188	100%		
Agricultural	Low (17-54)	20	10.64	10.649	65.500
	Medium (55-75)	134	71.28		
	High (76-85)	34	18.09		
	Total	188	100%		
Environmental	Low (13- 45)	37	19.68	8.427	53.016
	Medium (46-61)	116	61.70		
	High (62-95)	35	18.62		
	Total	188	100%		

Second Objective: Arranging research fields in descending order according to the average of respondents' responses:

Table (4): Distribution of research fields according to the arithmetic mean of respondents' responses regarding the importance of using solar energy in achieving sustainable agricultural development:

Field	Arithmetic mean	Field sequence according to arithmetic mean	sequence in the questionnaire
Economic field	66.670	1	1
Agricultural field	65.500	2	2
Environmental field	53.016	3	3

The results also showed in Table (4) that the arithmetic means of the research fields according to respondents' responses ranged between 53.016 and 66.670, with the economic field coming in first place. With the highest average of 66,670, followed by the agricultural sector at 65,500, and the environmental sector at last with an arithmetic average of 53,016. These results are explained by the importance of solar energy in the economic field, as it has multiple advantages that make it the best source of energy due to its low cost, i.e., its low accessibility, and its availability in most areas of Nineveh Governorate. Based on these advantages, its importance increases, especially given the limited availability of traditional energy sources. The uses of solar energy in the economic field vary between generating and producing electricity and thermal uses, and then in the agricultural field, especially in irrigation, heating, drying, and operating agricultural machinery. The environmental aspect, despite its high importance, comes in third place in terms of importance.

Third Objective:

To determine the correlation between the importance of using solar energy in achieving sustainable agricultural development and the independent variables of the research.

Table (5) shows the distribution of respondents according to the independent variables studied and their relationship to their opinions on the importance of using solar energy in achieving sustainable agricultural development.

Age: The research results showed that the highest age of the respondents was (60) years, and the lowest was (30) years, with an average of (42) years. The respondents were divided according to

their age into three age groups using the range and length of the group. The highest percentage of respondents was in the low age group (30-39) years, reaching (43.1%), followed by the middle age group (40-49) at (37.8%), while the high age group (50-60) had the lowest percentage (19.1%). The results showed no significant correlation between the agricultural extension workers' opinions on the importance of using solar technology to achieve agricultural development and their age regarding the importance of using solar energy in achieving agricultural development. The value of the simple Pearson correlation coefficient was (-0.014), which is not significant. This indicates that the respondents' opinions are not affected by age. This means that the ages of agricultural extension workers do not differ in their views on the importance of using solar energy in achieving sustainable development, and this may depend on other variables.

Academic Qualification: The highest percentage of respondents were College of Agriculture graduates (44.1%), followed by those with postgraduate degrees (34.6%), then those with an institute certificate (13.8%), while those with a secondary school certificate in agriculture represented the lowest percentage (7.4%). The results showed no significant correlation between the opinion of extension workers regarding the importance of using solar energy in sustainable agricultural development and academic qualifications. The Spearman's rank correlation coefficient was (-0.018), which is not significant. This means that workers' perceptions of the importance of solar energy in achieving agricultural development are equal regardless of academic qualifications.

Period of Service in Agricultural Extension: The results showed that the highest length of service for the respondents was (30) years, and the lowest was one year, with an average of (12) years. The respondents were divided according to their length of service into three age groups. The highest percentage was in the middle age group (11-20 years) at 68.1%, followed by the low age group (1-10 years) at 27.1%, while the high age group (21-30) had the lowest percentage (4.8%). The research results showed no significant correlation between agricultural extension workers' perceptions of the importance of using solar energy in achieving sustainable agricultural development and length of service. The simple Pearson correlation coefficient was 0.010, indicating that workers are aware of the importance of solar energy in achieving sustainable agricultural development, regardless of length of service.

Experience in solar energy systems: The highest percentage of respondents were in the category with medium experience in solar energy systems, at 41.0%, followed by those with extensive experience (35.1%). The low-experience group represented 21.8%, while the lowest percentage was in the category with no experience (2.1%). The results showed that there is no significant correlation between the opinion of agricultural extension workers on the importance of using solar energy in achieving sustainable agricultural development and the experience variable. The Spearman correlation coefficient value was (-0.082), which indicates that there is no significant correlation between the opinion of workers on the importance of using solar energy in achieving sustainable agricultural development and the experience variable. This is attributed to the fact that the level of experience of agricultural extension workers in solar energy systems did not affect their management.

The importance of using solar energy was emphasized, as the economic returns were clear and tangible for solar energy users, regardless of their individual experience or the institutional expertise of the extension staff.

Training on the use of solar energy systems: The results showed that the majority of respondents (91.5%) had not received training on the use of solar energy systems, while only 8.5% of respondents had received training. The results showed no significant correlation between agricultural extension workers' opinions on the importance of using solar energy in achieving sustainable agricultural development and the training variable. The Spearman's correlation coefficient was (-0.102), which is not significant. From the above, it is clear that training was not significant in influencing the opinions of agricultural extension workers. This is due to their awareness of the importance of solar energy through the tangible benefits

achieved in the economic and agricultural sectors of the region, as expressed by farmers who use solar energy compared to farmers who still rely on traditional energy sources. Training on the use of solar energy systems remains insignificant in influencing their views due to the ease of application by farmers who possess this technology.

Sources of information on the use of solar energy: The results indicated that the highest level of contact with information sources for the respondents was (28) and the lowest was (7). The respondents were divided according to their levels of contact with agricultural information sources into three categories using the range and length of the category. The highest percentage of respondents was in the medium category (14-20) at (85.1%), followed by the percentage of respondents in the low category (7-13) at (8.5%), followed by the percentage of respondents in the high category (21-28) at (6.4%), with an arithmetic mean of (16.995). The results showed a significant positive correlation between the agricultural extension workers' opinion on the importance of using solar energy in achieving sustainable agricultural development and the variable of agricultural information sources. The value of Pearson's simple correlation coefficient reached (*0.0153) and is significant at the (0.05) level, indicating the strong influence of the information source and the awareness of extension workers of modern topics in solar energy technologies affects their views on the importance of using agricultural solar energy.

Table (5) Distribution of respondents according to the independent variables and their relationship to their opinions on the importance of using solar energy in achieving sustainable agricultural development

Independent variable	Categories	Number	Percentage %	Mean	(r) or (rs)	Significance
Age	39– 30	81	43.1	42.00	**r=** - 0.014	0.849 ns
	49 –40	71	37.8			
	60 – 50	36	19.1			
Academic qualification	Secondary school of agriculture	14	7.4	-	**rs=** - 0.018	0.801 ns
	Agricultural institute graduate	26	13.8			
	College of agriculture graduate	83	44.1			
	Postgraduate degree	65	34.6			
Period of service	10– 1	51	27.1	12.00	**r=** 0.010	0.889 ns
	20–11	128	68.1			
	30 –21	9	4.8			
Experience	No experience	4	2.1	-	**rs=** - 0.082	0.265 ns
	Little experience	41	21.8			
	Moderate experience	77	41.0			
	High experience	66	35.1			

Training	Trained	16	8.5	-	**rs=** - 0.102	0.165 ns
	Untrained	172	91.5			
Sources of information	7-13 Low	16	8.5	16.995	**r=** 0.043*	0.036*
	14-20 medium	160	85.1			
	21-28 High	12	6.4			

4- CONCLUSIONS AND RECOMMENDATIONS:

- Conclusions:

-We conclude that the respondents' orientation was focused on the importance of solar energy and its tangible economic and agricultural benefits directly. However, their awareness of the environmental impacts was lacking.

-We conclude that the respondents are aware of the important role of solar energy on the economic front by increasing agricultural production, both quantitatively and qualitatively, and raising farmers' incomes.

-We conclude that, regardless of the age of the workers, their academic qualifications, length of service in agricultural extension, and their experience with solar energy systems, their views on the importance of using solar energy in achieving sustainable development do not differ.

-We also conclude that sources of information on the use of solar energy have a significant and effective influence on the respondents' opinions regarding the use of solar energy.

- Recommendations:

- It is necessary to raise the environmental awareness of workers about the importance of using solar energy and its role in achieving sustainable agricultural development, especially in the environmental field.

- It is necessary for workers to maintain close contact with various sources of information about solar energy technologies and their use in agriculture to keep up with all developments and innovations in this field.

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