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KNOWLEDGE NEEDS OF AGRICULTURAL EMPLOYEES FOR WATER HARVESTING TECHNOLOGIES IN NINEVEH GOVERNORATE AND THEIR RELATIONSHIP WITH SOME VARIABLES

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Abstract

The study aimed to identify the knowledge needs of agricultural employees for water harvesting technology in Nineveh Governorate, arrangement fields the knowledge needs of agricultural employees for water harvesting technology according to their relative importance, and identify the correlation between the knowledge needs of agricultural employees in Nineveh governorate for water harvesting technology and each of the following variables: (age, gender, educational qualification, participation in training courses, Attitudes towards water harvesting technology, agricultural information sources related to water harvesting). The study population included all agricultural employees working in the Nineveh Agricultural Directorate and the agricultural divisions affiliate it (30) divisions and the extensional center in Nineveh and thus the total community size (397) agricultural, simple, proportional, random sample (75%) of the total community was selected. Thus, the final sample of the study is (275) respondents. The data was collected by a questionnaire, which consisted of two parts: the first part included the personal characteristics of the respondents. The second part included (58) items to measure the knowledge needs of agricultural employees in Nineveh Governorate in the field of water harvesting technology. After that data was collected, classified and discharged using Excel, then it was statistically analyzed using SPSS Where many statistical methods have been used, such as (Range, arithmetic mean, weighted mean, standard deviation, Pearson's Correlation Coefficient, Alpha- Cronbach coefficient, Chi-Square). The results of the study showed that more than (95%) of the respondents had knowledge needs in the field of water harvesting technology was high tending to the moderating and that the field of (water harvesting technology design) came in the first rank with an mean is (58,582), while came in the fifth and last rank The field of (water harvesting technology maintenance) with mean is (27,655). The results also showed that there was a significant correlation between the knowledge needs of the respondents with water harvesting technology and each of the following variables (gender, participation in training courses, agricultural information sources), while there was no correlation between the knowledge needs of the respondents with water harvesting technology and each of the following variables (Age, educational qualification, Attitudes towards water harvesting technology).

Key words: Plant; agriculture; knowledge; water harvesting technologies

Introduction

Water resources are one of the most important ingredients for building societies and developing them, as the oldest civilizations have grown and developed in river basins in Egypt, China and Iraq (Kamel *et al.,* 2012). As the main cause of the emergence of ancient Iraqi civilizations was mainly due to the abundance of water in which Iraq has gone through, the two immortal rivers, the Tigris and Euphrates, had a major role in the development of civilization (Jawdat *et al.,* 2016). For this reason, appreciation and planning for the preservation of water resources have become one of the most important and basic topics in human life, because the presence and distribution of water determines the distribution of the population and the nature of their activities and its importance increases with the passage of time, Because of the growth in the size of the population and the growing development requirements and the need to provide food security, the achievement of which depends on the availability of water for the agricultural sector (Lahibi and Firas, 2016). Therefore, irrigation water and its abundance and methods of use are among the most important elements needed for the development of the

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agricultural sector and its prosperity, as it is the most specific factor for agricultural production, and is one of the main pillars for achieving agricultural development and food security for society. (Dahesh, 2016). There are many technologies that rationalize the use of rain water and increase its retention and its efficient use is essential to any integrated research and development project, including water harvesting technology, where water harvesting can play an important role in achieving these goals.Humans knew the importance of harvesting rain water from ancient times, so they built dams and reservoirs on the valley streams in order to make the best use of torrential water to take advantage of the water that collects in its lakes (Arab Organization for Agricultural Development, 2013). Water harvesting is defined as the process of collecting rainwater and floods over a specific area of land in the form of surface runoff and this water is either used directly for different uses, whether for human or animal use, or for irrigation of crops, or indirectly represented by storing it for the purpose of using it when needed (Ibrahim, 2014). Since agricultural Extension provides knowledge and skills necessary for farmers to be able to adopt and apply the most successful and useful methods of agricultural and animal production to increase their production and raise their standard of living (Russell, 1986). Agricultural Extension usually functions through a range of activities through which its workers interact with farmers to introduce them to new agricultural practices and techniques and to more sophisticated techniques. Productivity and providing them with continuous Extension messages useful to them under administrative or technical supervision through continuous support through a structured Extension device that reflects its objectives clearly within the framework of its own Extension system (Hameed and Dhoha, 2020). As a result of the low and uneven annual rainfall in the Nineveh governorate, it is necessary to follow some Technologies that conserve and reduce rainwater resources The area of natural pastures in the Nineveh governorate About a million hectares depend on rain to provide cover In addition to overgrazing, successive drought has led to The occurrence of an environmental and agricultural disaster in these areas, therefore Recognition of normal life in these areas has become things It is very important because the damage from these areas has started Creeps to nearby cities through desertification and pat from Necessary to develop a program to save these areas through Plans to harvest rainwater (Rugbo and Salem, 2012). Based on the above and in the absence of any study in the research area, this study was conducted.

Objectives of the Research

1. Identify Knowledge needs of Agricultural employees for water harvesting technologies in Nineveh Governorate.
2. arrangement fields the knowledge needs of agricultural employees for water harvesting technology according to their relative importance.
3. identify the correlation between the knowledge needs of agricultural employees in Nineveh governorate for water harvesting technology and each of the following variables: (age, gender, educational qualification, participation in training courses, Attitudes towards water harvesting technology, agricultural information sources related to water harvesting).

Materials and Methods

The study population included all agricultural employees working in the Nineveh Agricultural Directorate and the agricultural divisions affiliate it (30) divisions, and the extensional center in Nineveh, and thus the total community size (397) agricultural employees distributed to the Nineveh Agricultural Directorate and its agricultural divisions and the extensional center by (158), (193), (17) employees respectively, excluding the pre-test sample of (30) respondents, and thus the final community size became (367) respondents, and a simple, proportional, random sample (75%) of the total community was selected. Thus, the final sample of the study is (275) respondents. The data was collected by a questionnaire, which consisted of two parts: the first part included the personal characteristics of the respondents are : (age, gender, educational qualification, participation in training courses, Attitudes towards water harvesting technology, agricultural information sources related to water harvesting). The second part included (58) items to measure the knowledge needs of agricultural employees in Nineveh Governorate in the field of water harvesting technology. Where, The second part included a graded quadrilateral scale for measuring the dependent variableon the knowledge needs of agricultural employees in the field of water harvesting technology in Nineveh Governorate, where the scale consists of (58) items placed in front of each item (4) alternatives to measure the knowledge need of the respondents, which is (a high need, Medium need, little need, no need) it have given numerical values (3, 4, 2, 1) respectively, and these items were distributed to (5) fields which are: (9) items for the first field (Water harvesting system components), (11) items for the second field (Water harvesting techniques), (17) items for the third field (Water harvesting technology design), (8) items for the fourth field (Maintenance of water harvesting technology), (13) items for the fifth field (The comparative advantage of water harvesting technology). The questionnaire presented to experts in

the field of agricultural extension to achieve face validity, and to specialists in the field of soil and water resources (Department of Soil Science and Water Resources/ College of Agriculture and Forestry) and (College of Dams and Water Resources Engineering) and (Remote Sensing Center) at the University of Mosul and (Directorate of Water Resources/Nineveh), for the content validity. reliability was calculated using the Alpha Cronbach method, as its value (0.94). After that data was collected, classified and discharged using Excel, then it was statistically analyzed using Spss. Where many statistical methods have been used, such as (Range, arithmetic mean, weighted mean, standard deviation, Pearson's Correlation Coefficient, Alpha- Cronbach coefficient, Chi-Square).

Results and Discussion

Identify Knowledge needs of Agricultural employees for water harvesting technologies in Nineveh Governorate

The results of the study showed that the lowest numerical value of the knowledge needs of agricultural employees in the field of water harvesting was (134), and the highest numerical value (232). With an average mean (20.261) and standard deviation (18.878), the respondents were divided into three categories using the actual range, as shown in table 1.

It is clear from the table above that the highest percentage of respondents fall within the category of high needs (200-232) and at a mean of (56,000%), followed by (39.273%) of respondents from the medium need category (167-199), while the lowest percentage was for the category Little need (134-166), which is (4.727%). This indicates that approximately (95%) of the respondents had high, to moderateknowledge needs in the field of water harvesting technology. This result is agree with (Al-Abbasi *et al.,* 2014), (Al-Ajili, 2013) and (Hameed, 2020). While it did not agree with (Al-Tuwaijri, 2014). This means that the majority of respondents in Nineveh Governorate lack agricultural knowledge and experience related to the use and application of water harvesting technology, perhaps the fact of that is due to the relatively recent modernity of this technology for researchers in the research area, and this is confirmed by (Rogers, 2003) that innovations or new or modern technologies do not It only needs knowledge, but it goes beyond that and needs a certain time, and during this period, the attitudes, whether positive or negative, towards new technologies are crystallizing to individuals, this is on the one hand and the lack of services and guidance activities such as the lack of specialized training courses in the use and application of this technology on the other hand, where The percentage of respondents participating in training courses on water resources topics in general, and water harvesting technology in particular, reached approximately (13%).

Table 1: Distribution of respondents according to knowledge needsfor water harvesting technologies.

Level of need	Frequency	Percentage	Mean of need
Low(134-166)	13	4.727	155.461
Medium(167-199)	108	39.273	186.231
High(200-232)	154	56.000	213.883
Total	275	100	

$\bar{x}$ = 20.261 SD = 18.878 n = 275

Arrangement fields the knowledge needs of agricultural employees for water harvesting technology according to their relative importance

Mean and rank were used for the main fields of knowledge needs of water harvesting technologies. The fields were arranged according to the mean as shown in table 2. The results showed in table 2 that the field of (water harvesting technology design) came first and with an mean of (58,582) and this indicates the importance of this field for the rest of the other fields for the respondents, and this result may be due to what this field requires from Many things are essential and important steps when starting any water harvesting project, such as determining the degree of slope or slope of the land, identifying the type of soil and its chemical and physical properties, determining the type of vegetation that exists in the region on which the project will be established, as well as determining the water needs of agricultural crops.

Then came the second and third rank the two fields (the comparative advantage of water harvesting technology) and (water harvesting techniques) with an

Table 2: Arrange fields water harvesting technology according to their relative importance.

The fields	Number of items in the field	mean	rank
Water harvesting technology design	17	58.582	1
Comparative advantage of water harvesting technology	13	45.204	2
Water harvesting techniques	11	37.291	3
Water harvesting system components	9	31.520	4
Maintenance of water harvesting technology	8	27.665	5

mean of (45.204) and (37,291), respectively, while the fourth ranked field (components of the water harvesting system) with an mean of (31,520), While the fifth and last rank came in the field (water harvesting technology maintenance) with mean of (27.665), perhaps the reason for this is that the field does not need to acquire knowledge for how to conduct maintenance, this process is considered an axiom in the field of water harvesting such as cleaning The course of water from dirt, cleaning and removing calcifications and sands deposited in the pipes or in the channels of water transfer. It also includes replacing the filters and filters in the system in the event of a break in it in addition to opening the blocked tubes.

Identify the correlation between the knowledge needs of agricultural employees in Nineveh governorate for water harvesting technology and each of variables

1- Age: Table 3 show that the lowest age of the respondents is (25) years and the oldest age is (63), where the respondents were classified into three age Categories, namely the age Categorie (25-37) years, which has percentage (45.8%) and the percentage of age Categorie (38-50) years was (38.6%), while the age Categorie (51-63) years (15.6%).

It is clear from the table that most of the respondents are young ages. It also became clear that the highest average mean for the knowledge needs of the respondents was within the age group (25-37) years and its amount (202.523) and the lowest average among the large age group (38-50) years was (197.698). in order to find if there are relationship between the knowledge needs of agricultural employees for water harvesting techniques and the age. The Chi square was used as shown in table 3. As it was found that the calculated value of Chi square is less than the tabular value and thus we accept the statistical hypothesis (there is no significant correlation between the knowledge needs of water harvesting technology and age) and this agree with (Lloyd, 2015) and (Surya, et al., 2018). and dis agree with (Hameed and Dhoha, 2020) and (Hameed, 2020).

Table 3: Shows the distribution of the respondents according to the age Categories and the mean of knowledge need for water harvesting technology.

Variable	Categories	number	%	Mean of need	Mean	S.D	Chi - Square	significant
age	(25-37) year	126	45.8	202.523	40.810	8.969	4.548	n.s
	(38-50) year	106	38.6	199.953				
	(51-63) year	43	15.6	197.698				
	Total	275	100					

2-Gender: It is clear from table 4 that the percentage of male respondents (70.9%), while the percentage of females was (29.1%) and this indicates that more than two-thirds of the respondents are male and that the highest mean of the knowledge need was for the female category as it reached (203.625)) and the lowest mean knowledge need was for the male category, which amounted to (198,882). In order to find if there are relationship between the knowledge needs of agricultural employees for water harvesting techniques and thegender, The Chi square was used as shown in table 4.

Table 4: Shows the distribution of the respondents according to the gender Categories and the mean of knowledge need for water harvesting technology.

variable	Categories	number	%	Mean of need	Mean	S.D	Chi - Square	significant
gender	Male	195	70.9	198.882	-	-	6.318	*
	Female	80	29.1	203.625				
	Total	275	100					

As it was found that the calculated value of Chi square is greater than the tabular value and thus we reject the statistical hypothesis (there is no significant correlation between the knowledge needs of water harvesting technology and gender), there is a significant correlation relationship at the level (0,05), this agree with (Lloyd, 2015) and dis agree with (Nasir and Fekadu, 2017). This result may be due to the fact that the respondents from the agricultural employees working in the Directorate of Agriculture do not differ in their abilities to communicate and deal with others and transfer their experiences, but males have more fortune than females through seeking and communicating with farmers and farmers who apply this technology in villages and rural areas through field visits to them or By visiting some small water harvesting projects even if they are at a simple level in the research area, meaning that males are more involved than females in water harvesting projects and see their work mechanism.

3-Educational qualification: Table 5 shows the classification of respondents according to the educational qualification into four categories, where the percentage of respondents who have a certificate of preparatory education reached (10.9%), while the percentage of respondents who have an agricultural diploma and bachelor's degree reached (10.2%) and (48.0%), respectively, in When the percentage of respondents who have a higher degree reached (30.9%), this indicates that about two thirds of the respondents whose academic qualification is a college or a higher degree. The results also showed that the highest

mean of the knowledge need was for respondents who had a diploma where it reached (202.278), while it was low for respondents who had a certificate of preparatory where it reached (191.266).

In order to find if there are relationship between the knowledge needs of agricultural employees for water harvesting techniques and theeducational qualification. The Chi square was used as shown in table 5. As it was found that the calculated value of Chi square is less than the tabular value and thus we accept the statistical hypothesis (there is no significant correlation between the knowledge needs of water harvesting technology and educational qualification) and this agree with (Hameed and Dhoha, 2020) and dis agree with (Lloyd, 2015). This indicates that the educational qualification has no effect on the knowledge needs of the researchers, and this result may be due to the fact that formal education in all its stages is devoid of educational courses that are related to techniques in general and water harvesting technology in particular, therefore the high level of education of the respondents does not reduce or increase their knowledge needs. In the field of water harvesting.

4- Participation in training courses: Table 6 shows the distribution of respondents according to their participation in training courses into two categories, where the percentage of respondents participating in training courses reached (13.5%), while the percentage of respondents who did not participate in training courses was (86.5%). This indicates that more than two thirds of the respondents were not participating in the training sessions. The highest mean of the knowledge need was for the respondents who not participating in the training courses as it reached (201,675) and the lowest mean for knowledge need was for the respondents who participating in the training courses where it reached (200,042). In order to find if there are relationship between the knowledge needs of agricultural employees for water harvesting techniques and theparticipation in training courses, The Chi square was used as shown in table 6.

As it was found that the calculated value of Chi square is greater than the tabular value and thus we reject the statistical hypothesis (there is no significant correlation between the knowledge needs of water harvesting technology and participation in training courses), there is a significant correlation relationship at the level (0,01), this agree with (Al-Tuwaijri, 2014) and (Samurai, 2011) and disagree with (Al-Abbasi, *et al.,* 2017). This may be due to the fact that participation in training courses is one of the main sources that provide the respondents with the necessary information and technical knowledge to participate in water harvesting projects in the optimal way, as it improves and increases their experiences and thus increases the level of their efficiency in performing their work, which in turn is reflected in reducing the knowledge needs of the respondents.

5- Attitudes towards water harvesting technology: Table 7 shows the distribution of the respondents according to their attitudes towards water harvesting technology into three categories, where the percentage of respondents who had negative attitudes (23-28) (28.727%), while the percentage of respondents whose attitudes were neutral (29-34) (46.545) %), While the percentage of respondents whose attitudes were positive (35 and over) was (24.727%). This indicates that nearly half of the respondents' attitudes towards neutral water harvesting technology tend to be negative. The highest mean of the knowledge needs was for the respondents, whose attitudes were positive as it reached (205,582) and the lowest mean for the knowledge needs was for the respondents whose attitudes were negative as it reached (197.962).

In order to find if there are relationship between the knowledge needs of agricultural employees for water harvesting techniques and theattitudes towards water harvesting technology. The Chi square was used as shown in table 7. As it was found that the calculated value of Chi square is less than the tabular value and thus we accept the statistical

Table 5: Shows the distribution of the respondents according to the educational qualification Categoriesand the mean of knowledge need for water harvesting technology.

variable	Categories	num-ber	%	Mean of need	Mean	S.D	Chi - Square	signi-ficant
educational qualification	preparatory	30	10.9	191.266	-	-	9.442	n.s
	diploma	28	10.2	202.178				
	college	132	48.0	200.666				
	higher	85	30.9	202.176				
	Total	275	100					

Table 6: Shows the distribution of the respondents according to the participation in training courses Categoriesand the mean of knowledge need for water harvesting technology.

variable	Categories	number	%	Mean of need	Mean	S.D	Chi - Square	signi-ficant
participation in training courses	participant	37	13.5	200.042	-	-	37.803	**
	Not participant	238	86.5	201.675				
	Total	275	100					

Table 7: Shows the distribution of the respondents according to the attitudes towards water harvesting technology Categoriesand the mean of knowledge need for water harvesting technology.

variable	Categories	num-ber	%	Mean of need	Mean	S.D	Chi - Square	signi-ficant
attitudes towards water harvesting technology	(28-23) negative	79	28.727	197.962	31.356	3.830	5.460	n.s
	(29-34) neutral	128	46.545	198.914				
	(35 more than) positive	68	24.727	205.582				
	Total	275	100					

hypothesis (there is no significant correlation between the knowledge needs of water harvesting technology and attitudes towards water harvesting technology), This indicates that the knowledge needs of the respondents are not affected by their different attitudes, whether negative or positive towards water harvesting technology.

6- Agricultural information sources: It is clear from table 8 that the lowest value was (11) and the highest value is (30) and when distributing the respondents according to the categories of agricultural information sources, the high percentage of respondents in the middle category (18-24) was found to have reached (53.818%), while it reached The percentage of the low category (11-17) (6.182%) only, while the high category (25 and more) reached (40,000%), this indicates that approximately (93%) of the respondents depend on their information and knowledge on information sources with an moderateand high degree.

It also show that the highest mean for the knowledge needs of the respondents was within the high category as it reached (207.247) and the lowest mean for the knowledge needs was for the low category (190,588).in order to find if there are relationship between the knowledge needs of agricultural employees for water harvesting techniques and theagricultural information sources, The Chi square was used as shown in table 8. There is a significant correlation relationship at the level (0,01), this agree with (Lloyd,2015) (Hameed, 2020). Perhaps this result is due to the fact that the more the respondent increases the multiplicity and diversity of using sources of information that are rich in information and experiences regarding the concept of water harvesting technology, the more knowledge and understanding of it and the greater his awareness through it, as it is important for the individual to have one or more sources from which he takes his knowledge He learns from him and is convinced of him.

Table 8: Shows the distribution of the respondents according to the agricultural information sources Categoriesand the mean of knowledge need for water harvesting technology.

Variable	Categories	num-ber	%	Mean of need	Mean	S.D	Chi - Square	signi-ficant
agricultural information sources	(11-17)low	17	6.182	190.588	23.665	4.193	25.125	**
	(18-24) moderate	148	53.818	196.255				
	high (more than25)	110	40.000	207.247				
	Total	275	100					

Conclusion

1- The results showed that the vast majority of agricultural employees in Nineveh Governorate have a great lack of information and knowledge in the field of water harvesting, as approximately (95%) of the respondents were in the two categories of large and medium need, which led to a clear knowledge gap between the reality The information they have and what they should be.

2- Weakness of knowledge level of agricultural employees in Nineveh Governorate in the fields of water harvesting that were studied in accordance with the sequence (water harvest design, the relative advantage of water harvesting, water harvesting techniques, components of the water harvesting system, maintenance of the water harvesting system), especially the first three fields.

3- The field of water harvesting technology design has received the attention of the respondents more than the rest of the fields studied in the study because it includes the basic and important first steps when implementing any water harvesting project.

4- Most of the respondents from the agricultural employees are of young ages and lack the experience and knowledge of water harvesting technology.

5- Male respondents have a better chance of females to getting knowledge of water harvesting technology through their more effective participation than females in field and exploratory visits to water harvesting projects.

6- The results showed that there is a significant relationship between participation in training courses and the knowledge needs of agricultural employees, whereby the greater the participation of the respondents in the training courses, the more this leads to the accumulation of experiences and the increase of their information and skills, which leads to reducing their knowledge needs in the field of water harvesting.

Recommendations

1- Intensifying the establishment of

training courses related to water harvesting technology by the Nineveh Agriculture Directorate to all agricultural employees in the governorate and its agricultural divisions and research centers and with the participation of specialists, whether they are (Remote Sensing Center - College of Agriculture and Forests - College of Dams and Water Resources - Directorate of Water Resources).

2- Choosing the moderen and new designs for water harvesting technology that are commensurate with the nature and topography of the region, ensuring the greatest economic return with the lowest costs.

3- Participation of farmers in training courses related to water harvesting technology and clarifying its importance for them as farmers in terms of the expected economic returns from applying this technology.

4- That the agricultural extension in the Nineveh Agricultural Directorate or the the extension center in the governorate publish agricultural publications specialized in water harvesting technology and communicate some important information about this technology in a simple and understandable way to farmers and motivate them to apply them.

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References

Al-Abbasi, Amel Fadel and Amira Younis Hussein Al-Sheikh ammi Al-Taie (2014). The knowledge needs of agricultural employees in Nineveh Governorate in the fields of environmental awareness. *Tikrit University Journal for Agricultural Sciences,* **41(2):** pp. 261-269.

Al-Abbasi, Amel Fadel and Talal Saeed Al-Khaffaf and Doha Mustafa Abdul-Faraj (2017). The knowledge needs of agricultural staff in Nineveh Governorate in the field of controlling the white fly insect. *Rafidain Agriculture Journal,* **45(2):** pp. 1-10.

Al-Ajili, Ahmed Sakr Abdullah (2013). Extensional needs of honey beekeepers in Salah El-Din Governorate, Master Thesis, Tikrit University, Faculty of Agriculture, Department of Economics and Agricultural Extension.

Al-Tuwaijri, Walid Khaled Hussein (2014). Training needs of agricultural employees working in grain silos in Salah al-Din and Diyala governorate, Master Thesis, Tikrit University, Faculty of Agriculture, Department of Economics and Agricultural Extension.

Arab Organization for Agricultural Development (2013). National Workshop on Water Harvesting and Artificial Ground Nutrition in the Arab World, March 2013, Sultanate of Oman, p. 10.

Dahesh, Fadel Jawad (2016). Analysis of the impact of the use of modern irrigation technologies on investing water resources and developing agricultural production in Iraq. *Danars Magazine,* **1(8):** pp. 115-154.

Hameed, Talal Saeed (2020). Knowledge Level of Agricultural Extension Agents in Nineveh Governorate with Water Harvesting Technology. *Journal of University of Kirkuk For Agriculture Sciences,* **11(3):**.

Hameed Talal Saeed and Dhoha Mostafa Abd Al Faraje (2020). Cows Breeder's Awareness Of The Transitional Diseases That Affect The Farm Animals In Rabiaa District, Nineveh Governorate, Iraq. *Plant Archives,* **20(1):** Pp. 3455-3460. Department of Agriculture Extension & Technologies Transfer, College of Agriculture & Forestry, University of Mosul, Iraq.

Ibrahim, Mohamed Abdel-Fattah Mohamed (2014). Technological methods for water harvesting and means of utilizing it. Agriculture Research Center.

Jawdat, Nada Shaker, Saadia Akol Menakhy, Falah Hassan Shannon (2016). Water Harvesting and its Impact on the Development of Water Resources in Iraq, *Journal of Literature Kufa,* **1(29):** p. 115, p. 152.

Kamel, Ammar Hatem, Sadiq Aliwi Sulaiman, Khamis Naba Sail (2012). Hydrology Study of Western desert to Evaluate Water Harvesting Projects in the Region, *Iraqi Journal of Civil Engineering,* **7(2):** pp. 16-27.

Lahibi Hazem Muhammad and Firas Al-Ikoula (2016). The undeclared water war between Iraq and neighboring countries, p. 9, a study is published online at the following link http://www.hlrn.org/img/documents/Luhebe_Water_War_Iraq_Ar.pdf.

Lloyd James S. Baiyegunhi (2015). Determinants of rainwater harvesting technology (RWHT) adoption for home gardening in Msinga, KwaZulu-Natal, South Africa. *Water SA,* **41(1):** January.p: 33-40.

Nasir Siraj, Fekadu Beyene (2017). Determinants of Adoption of Rainwater Harvesting Technology: The Case of Gursum District, East Hararghe Zone, Ethiopia. *Social Sciences,* **6(6):** p: 174-181.

Rajbu, Abdul Sattar Asmair and Salem Younis Al-Nuaimi (2012). Promising plans for harvesting rain water in Al-Marai area in Nineveh Governorate, a technical and economic study submitted to the Nineveh Investment Commission by the University of Mosul/Iraq.

Rogers, E.M. (2003). Diffusion of Innovations, 5th Edition. IEd. A Division of Simon and Schuster, Inc. New York, NY 10020, Copyright 2003, pp. 12-543.

Surya, P. Adhikari, Krishna P. Timsina and Jeevan Lamichhane (2018). Adoption and impact of rain water harvesting technology on rural livelihoods: The case of Makwanpur district, Nepal. *Rural Extension and Innovation Systems Journal,* **14(1):** Research. P34-40.

Samurai, Rasha Raad Abdullah (2014). Extensional needs of agricultural employees working in agricultural extension, Master Thesis, Tikrit University, Faculty of Agriculture, Department of Economics and Agricultural Extension.