The level of knowledge Of Wheat Farmers in Axial Irrigation by Applying Practical Recommendations in The Upper Euphrates / Anbar Governorate (2020/2021)

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Abstract. The research aimed to determine the knowledge level of wheat Farmers with pivotal irrigation by applying scientific recommendations in regions of the upper Euphrates/Anbar Governorate in general, and to identify the correlation coefficient between knowledge of farmers and some independent variables, as well as to determine the relationship of regression between knowledge of farmers and the group of variables studied. The regions of the upper Euphrates region were chosen to conduct the current research. The research population included all farmers who use pivotal sprinkler irrigation systems in the upper Euphrates in Anbar Governorate, and are officially registered in the Anbar Agriculture Directorate, whose number are (741) farmers\textsuperscript{*} distributed among (7) agricultural divisions. A proportional random sample was selected from each division, with percentage of (20%) becomes of (140) farmers who represent the research sample. For the purpose of collecting data from the respondents a questionnaire form composed of two parts was prepared, first part: it included a number of questions to obtain data related to some independent variables related to the respondents, and the second, included (50) standard items to measure the respondents' knowledge distributed into four field, which is System configuration, operation, irrigation, maintenance and fertilizer use. The results showed that The general level of farmers' knowledge of the scientific recommendations related to pivot sprinkler irrigation is high, tending to medium. From this it follows the farmers' awareness of the importance of information and knowledge related to pivot irrigation, and there are 37.2\% of the respondents are in the medium and low categories. The researcher recommended, that necessity to provide material and moral support to farmers with a high level of knowledge in order to continue implementing the scientific recommendations as well as to motivate farmers in the middle and lower categories to work as their peers from the superior farmers, and necessity to prepare and implement extension activities for farmers with a low level of knowledge.

1. Introduction and research problem

The world is witnessing increasing pressure on food, and more than (500) million people suffer from food shortages, as the problem of food shortage and the widening food gap has become the focus of attention of many conferences, organizations and bodies interested in the topic of providing food for people, including the (1996) conference held under the slogan (Food for All). The food gap is constantly increasing, as the number of hungry people in the world, according to the (2008) statistics, reached about one billion [1].

The focus was on intensifying the production of the three basic crops for global food security: corn, rice and wheat [2]. Agriculture is the main basis for achieving food security because of its importance in producing agricultural crops to meet the population's food consumption needs. The wheat crop is the first strategic crop in The world, which is one of the cereal crops that are used as daily food for
most of the world's population, including Iraq [3], as well as Iraq has faced many problems, which have a great impact on agricultural production, foremost of which is the poor use of water, which resulted in the waste of this wealth and the deterioration of agricultural lands, a decrease in the productivity of the wheat crop, as well as "the climatic impacts that the world witnessed during the other two decades of the last century, which affected their effects. It is evident on production due to the lack of rainfall [4].

Among the most important challenges and problems facing the agricultural sector is the issue of water and its optimal utilization, as the use of traditional methods of irrigation of crops and the failure to use modern mechanization in its correct manner leads to a large loss of water [5], and the scarcity of water resources is one of the biggest challenges. Agriculture in Iraq is facing in particular due to the severe shortage of imports of the Tigris and Euphrates rivers and the lack of precipitation from rain and snow. The reason for water scarcity is the intense competition between the different areas of water use [6].

Since the uses of water through irrigation exceed its human uses by no less than ten times [7]. The need to rationalize the use of water according to water regulations for irrigation of agricultural crops by following modern methods, including sprinkler irrigation, which is one of the important methods in Rationalizing the use of water for the purposes of irrigation of agricultural crops and reducing waste, with the possibility of mixing fertilizers with irrigation water, spraying pesticides and controlling the quantities of water and its arrival time [8]. The use of modern irrigation technologies reduces the problem of salinity, the degradation of agricultural lands and the lack of fertility, as well as their role in raising the efficiency of the use of water and fertilizers, The use of modern irrigation technologies reduces the problem of salinity, the degradation of agricultural lands and the lack of fertility, as well as their role in raising the efficiency of the use of water and fertilizers, which makes agricultural activity environmentally sound by rationalizing the use of agricultural chemicals while increasing agricultural production of crops [9,10,11].

In view of the importance of this technology in increasing production and providing irrigation water, and its widespread spread among farmers in Anbar Governorate, especially the upper Euphrates regions, The agricultural component has two basic elements: the material component that includes the outcome of scientific and technical development in areas related to agricultural production, and the human component and the capabilities and skills it represents that enable it to use the material element efficiently in developing agricultural development [12]. However, achieving high efficiency from the use of this technology depends on two types of factors, including the non-controlling environmental factor. The second factor is the human factor that uses this technology with its information and experience and the extent of its application of scientific recommendations related to the operation, maintenance and use of this technology to achieve the highest productivity of it. What the farmers aim for in terms of using technology in terms of rationalizing water use and achieving productivity in terms of quantity and quality and achieving this goal requires knowledge of the application of recommendations related to pivotal irrigation technology, hence the idea of the current research to answer the following research questions.

1- What is the level of knowledge of wheat farmers in axial irrigation of scientific recommendations in the regions of the upper Euphrates / Anbar Governorate in general?  
2- What is the correlation relationship between the level of wheat growers' knowledge of pivotal irrigation and each of the following independent factors (age, educational level, number of years of use of the system, relevant information sources, the trend towards using modern irrigation technologies)  
3- What is the relationship of regression between the level of knowledge of wheat growers with pivot irrigation and the group of studied variables?
1.1 Research objectives
1- Determining the knowledge level of wheat growers with pivotal irrigation by applying scientific recommendations in the regions of the upper Euphrates / Anbar Governorate in general.
2- Identifying the correlation relationship between the level of knowledge of wheat growers with pivotal irrigation by applying scientific recommendations and each of the following independent factors: (age, educational level, number of years of using the system, information sources, the trend towards using modern irrigation technologies).
3- Determine the regressive relationship between the level of knowledge of wheat growers with pivotal irrigation and the group of independent factors

1.2 Research importance
This research comes within the framework of the scientific contribution to the development of the agricultural reality and the development of the cultivation of the wheat crop under the pivot irrigation system, which is the first strategic crop, by providing a database on the level of knowledge of wheat growers. Superior productivity in terms of quality and quantity.

1.3 Research hypotheses
1- There is no significant correlation between the level of knowledge of wheat farmers with age variable
2- There is no significant correlation between the level of knowledge of wheat farmers with the educational level variable.
3- There is no significant correlation between the level of knowledge of wheat farmers with use of the system variable.
4- There is no significant correlation between the level of knowledge of wheat farmers with relevant information sources variable.
5- There is no significant correlation between the level of knowledge of wheat farmers with the attitude towards the use of modern irrigation technologies.

1.4 Procedural definitions
1- The level of knowledge of wheat growers: the sum of the information and knowledge that the growers possess with the scientific recommendations related to the preparation and operation of the system, irrigation, maintenance, maintenance and system management.
2- Scientific recommendations: the results that emerged from studies and research that were tried in the field of wheat cultivation and which were transferred from research centers and universities to extension centers
3- Pivot sprinkler irrigation systems: They are towers that are carried on wheels that move around in circles that carry tubes to transport water from the source and end with diffusers (nozzles) from which water comes out in the form of spray.

2. Materials and methods
2.1 Research methodology
The descriptive approach is appropriate in order to achieve the research objectives in order to obtain detailed data and diagnose the existing phenomena or situations about the needs of the target at a specific time [13]. The descriptive approach monitors the current reality as it helps to change the conditions that control the phenomenon [14].

2.2 Search region
The areas of the upper Euphrates, which extend from the district of Heet to the east, through the districts of Haditha, Anna, Rawa and Rummana, then Al-Qaim and Al-Rutbah in the west, were selected to conduct the research, due to the failure to achieve optimal production despite the presence of a large number of farmers using pivotal sprinkler irrigation systems in them, as well as the presence of large agricultural areas and the validity of ground water for irrigation.
2.3 Population and Research Sample
The research included all the farmers who used the Pivot sprinkler irrigation systems in the upper Euphrates, Anbar Governorate, and were officially registered in the Anbar Agriculture Directorate, whose number was (741) farmers * distributed among (8) agricultural divisions., A proportional random sample was selected from (7) agricultural divisions at a percentage of 20%, The number of respondents who represent the research sample is (140) respondents, after excluding the Al-Hklania field cultivation division, , As shown in table (1).

| No. | division        | Population | Sample  |
|-----|-----------------|------------|---------|
| 1   | Al-Baghdady     | 8          | 2       |
| 2   | Al-HKLania      | 30         | Pre-test|
| 3   | Hdetha          | 26         | 5       |
| 4   | Ana             | 112        | 22      |
| 5   | Rawa            | 21         | 4       |
| 6   | Al-Romana       | 27         | 5       |
| 7   | AL-kaem         | 507        | 101     |
| 8   | Al-Rutha Total  | 7741       | 1140    |

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2.4 Preparing the questionnaire form
For the purpose of collecting the necessary data, a questionnaire form was prepared consisting of two parts: The first part: it included a number of questions to obtain data related to the variables related to the respondents using the pivotal sprinkler irrigation systems, namely: age, educational level, number of years of using the system, relevant sources of information, the attitude towards the use of pivot irrigation technologies.

The second part: After reviewing the literature from books, pamphlets, research and scientific studies related to the topic and discussing specialists in the field of pivotal sprinkler irrigation systems, the researcher identified four areas to measure the level of knowledge of wheat growers with pivotal irrigation and each field included a number of questions according to the relative importance of each field. The number of paragraphs of the field of preparation for the operation of the system (12) paragraphs, the field of irrigation (16) paragraphs, the field of maintenance and maintenance (16) paragraphs, and the field of fertilizer use (6) paragraphs, thus the number of paragraphs of the scale reached (50) standard paragraphs.

2.5 Instrument Validity
1- face validity: the apparent validity means that the scale measures what is required to be measured, meaning the extent to which the scale reaches the goal that was set [15]. Apparent validity has been achieved by presenting it to a group of specialists in the field of agricultural extension in order to show Their observations and suggestions on the paragraphs of the questionnaire in terms of the wording of the phrases, the nature of their writing and the extent of their clarity

2- Content validity: it means the level of representation of the components of the scale of the aspect for which it was set to measure, i.e. the extent to which the set objectives are achieved, The validity of the questions and their appropriateness to the content of the questionnaire and making observations by modification and addition or deletion, as shown in Table (2).

| No. | fields                  | weight field | Number Items | Weight Item |
|-----|-------------------------|--------------|--------------|-------------|
| 1   | Creating and operating the system | 26%          | 12           | 2.17        |
| 2   | Irrigation              | 32%          | 16           | 2           |
| 3   | Maintenance             | 32%          | 16           | 2           |
| 4   | Fertilizer use          | 10%          | 6            | 1.66        |
|     | Total                   | 100%         | 50           | 100%        |

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pre-test: After completing the form preparation and making amendments according to the experts' directives, a preliminary test was performed on a sample consisting of (30) farmers from the Field Cultivation Division. This initial test was conducted for the following reasons
1- For the purpose of ensuring the clarity of questions through the questionnaire form
2- To find the coefficient of stability and validity of the test items related to the phenomenon of the 2.6 subject of research

Reliability: After collecting the pilot sample data, then finding the correlation between the values of the odd and even paragraphs, using the Pearson equation whose value was (0.76), which represents the stability of the half of the scale. The quadratic coefficient of stability, where its value reached (0.92), and the stability coefficient is considered satisfactory if its value reaches more than (0.70) is more satisfactory the closer it is to one.

2.6 Measurement of independent variables
1- Age: It was measured by the number of years of age of the respondent at the time of data collection
2- educational level: The educational level was measured according to the following levels (illiterate, reading and writing, elementary, intermediate, preparatory, college, and higher degrees), and these levels were given the following weights (1, 2, 3, 4, 5, 6)
3- The number of years of using the pivot sprinkler irrigation system: It was calculated by the number of years the respondent using the pivot sprinkler irrigation system.
4- Knowing information sources: This variable was measured by placing (6) sources from which the respondent could obtain information about pivotal sprinkler irrigation systems and put in front of each of them the following alternatives (always, sometimes, rarely, no contact). And given to these alternatives’ values (3,2,1,0), the theoretical range of (0-18).
5- The attitude towards the use of pivotal irrigation technologies: This variable was measured by placing (6) paragraphs. Values (1, 2, 3) for positive paragraphs. Values (3,2, 1) were given for negative paragraphs, and the theoretical range was (6-18).
6- Data collection process: The data collection process was carried out through a questionnaire form in the manner of a personal interview with the respondents, as the data collection process took place during the period from (15/9/2020) until (15/11/2020).

3. Results and Discussion
first objective: to determine the level of knowledge of wheat growers with pivotal irrigation by applying scientific recommendations in the upper Euphrates / Anbar Governorate in general.
The results of the research showed that the lowest degree expressing the level of knowledge of wheat farmers in pivotal irrigation by applying scientific recommendations was (23.80) degrees, the highest was 82.08 degrees, with an average of (62.27) and a standard deviation of (14.68), the respondents were divided into three categories using the law of range, and it appears that the highest percentage is within the category of high knowledge, as shown in Table (3).

Table 3. Shows the distribution of the respondents according to the level of knowledge

| No. | categories          | Frequency | %  | Average |
|-----|---------------------|-----------|----|---------|
| 1   | Low (23.80-43.22)   | 20        | 14.3 | 31.70   |
| 2   | Medium (43.23- 62.65) | 32    | 22.9 | 57.28   |
| 3   | High (62.66- 82.08) | 88        | 62.8 | 71.52   |
|     | Total               | 140       | 100% |         |

Table (3) showed that the highest percentage (62.8%) of the respondents into the high category, followed by the medium category with (22.9%), Therefore, the knowledge level of the respondents is
described as high, tending to medium, this interest may be focused in order to obtain an economic return equivalent to the costs of the agricultural process and achieve profits for farmers as a motive for the continuation of agricultural work.

second objective: identify the correlation between the level of knowledge of wheat farmers and each of the following independent variables.

3.1 Age
The results showed that the ages of the respondents were limited to (25-76) years with an average of (47.45) years, and a standard deviation of (10.148). The respondents were distributed into three categories using the range law, and the highest percentage appeared within the middle age group, as shown in Table (4).

| No. | Categories         | Frequency | %  | Average | r-value  | t-cal | Sig   |
|-----|--------------------|-----------|----|---------|----------|-------|-------|
| 1   | Low (25-41)        | 38        | 27.1 | 67.69   | -0.21**  | -2.52 | 0.01  |
| 2   | Medium (42-58)     | 84        | 60  | 61.09   | -0.21**  | -2.52 | 0.01  |
| 3   | High (59- more)    | 18        | 12.9 | 58.69   |          |       |       |
|     | Total              | 140       | 100 |         |          |       |       |

**Significant with level 0.01

To find the correlation relationship between the level of knowledge and the age variable, the Pearson correlation coefficient was used, whose value was (-0.21), indicating a negative relationship between the two variables. To test the significance of the relationship, the law of (t) was used, since the calculated value of (t) was (-2.52), which is higher than the tabular value of (t) at a probability level of (0.01), Therefore, rejects the null hypothesis and accepts the alternative hypothesis that states (there is a significant correlation relationship between the two variables), and the reason for this may be that middle category and young farmers are more receptive and more interested in modern agricultural techniques and therefore they are more knowledgeable and experienced than the elderly group who are often clinging to the ancient traditions, This study is consistent with the findings of [16].

3.2 Educational level
The respondents were distributed into seven categories according to their educational level, and the highest percentage appeared within a primary category, as shown in Table (5).

| No. | Categories       | Frequency | %  | Average | r-value  | t-cal | Sig   |
|-----|------------------|-----------|----|---------|----------|-------|-------|
| 1   | Literate         | 12        | 8.6 | 44.72   |          |       |       |
| 2   | Primary          | 7         | 5   | 63.38   |          |       |       |
| 3   | Reads and write  | 37        | 26.4 | 60.56   |          |       |       |
| 4   | medium           | 26        | 18.6 | 63.38   |          |       |       |
| 5   | Middle school    | 32        | 22.9 | 67.71   |          |       |       |
| 6   | College          | 3         | 16.4 | 65.46   |          |       |       |
| 7   | M .A             | 2         | 2.1 | 73.20   |          |       |       |
|     | Total            | 140       | 100 |         |          |       |       |

**Significant with level 0.01

To find the correlation relationship between the knowledge level and the educational level variable, Spearman's hierarchical correlation coefficient was used, whose value was (0.22), indicating a positive relationship between the two variables. To test the significance of the relationship, the law of (t) was used, since the calculated value of (t) was (2.65), which is higher than the tabular value of (t) at a
probability level of (0.01), There for, rejects the null hypothesis and accepts the alternative hypothesis that states (there is a significant correlation between the two variables). The reason for this may be that the educated respondents are more knowledgeable and interested in obtaining information and knowledge related to the application of scientific recommendations related to the pivot irrigation system, and this study agrees with what It was reached by Muhammad [17] and disagree with the findings of [5].

3.3 Number of years of used the pivotal irrigation
The values expressing the number of years of using the system were limited to (2 - 26) years with a mathematical average of (9.78) years and a standard deviation of (4.91), The respondents were distributed into three categories using the law of range, and it appeared that the highest percentage within low category was the number of years of using the pivotal irrigation, as shown in the table (6).

Table 6. shows the distribution of respondents according to years of using pivotal irrigation

| No. | Categories     | Frequency | %    | Average | r-value | t-cal | Sig  |
|-----|----------------|-----------|------|---------|---------|-------|------|
| 1   | Low (2-9)      | 82        | 58.6 | 58.82   | 0.40    | 5.12  | 0.01 |
| 2   | Medium (10-17) | 41        | 29.3 | 65.86   |         |       |      |
| 3   | High (18-more) | 17        | 12.1 | 72.77   |         |       |      |
| 4   | Total          | 140       | 100% |         |         |       |      |

**Significant with level 0.01

To find the relationship between the level of knowledge and number of years of using pivotal irrigation, Pearson’s law was used, as it was found that the value of the correlation coefficient is (0.40), which indicates a positive relationship between the level of knowledge and the number of years of use of pivotal irrigation. To test the significance of the relationship, the (t) law was used, as the calculated (t) value was (5.12), which is higher than the (t) value Tabular at the level of (0.01) and thus rejects the null hypothesis and accepts the alternative hypothesis that states (there is a significant correlation relationship between the two variables)., The reason for this may be that the repeated practice of cultivating wheat under the pivot irrigation system increases the knowledge and information of the respondents on how to apply the scientific recommendations and that the increase in the accumulation of knowledge through work is a natural matter, The study is disagree with the findings of [4].

3.4 Sources of information
The values expressing the sources of information were limited between (2- 17), with an average of (10.99) years and a standard deviation of (3.51), the respondents were distributed into three categories using the law of range, and the highest percentage appeared within category of high sources, as shown in Table (7).

Table 7. Distribution of respondents according to contact with relevant information sources

| No. | Categories    | Frequency | %     | Average | r-value | t-cal   | Sig  |
|-----|---------------|-----------|-------|---------|---------|---------|------|
| 1   | Low (2-6)     | 14        | 10    | 65.03   |         |         |      |
| 2   | Medium (7-11) | 59        | 42.1  | 53.77   | 0.20**  | 2.51    | 0.01 |
| 3   | High (12- more)| 67       | 47.9  | 69.82   |         |         |      |
|     | total         | 140       | 100%  |         |         |         |      |

**Significant with level 0.01

To find the relationship between the level of knowledge of the farmer and the relevant information sources, the Pearson correlation coefficient was used with a value of (0.20), To test the significance of the relationship, the law of (t) was used, as the calculated value of (t) was (2.51), which is higher than the tabular value of (t) at the level of (0.01), which indicates a positive relationship between the two variables. He rejects the null hypothesis and accepts the alternative hypothesis that states (there is a significant correlation relationship between the two variables). The reason for this may be that the respondents 'acquaintance with multiple and varied sources of information related to the content of
their material with pivot irrigation increases their knowledge and experience in applying scientific recommendations, this study is consistent with [15].

3-5 The attitude towards the use of modern irrigation technologies

The values expressing the attitude were limited between (8 - 14), and with an average of (3.51), the respondents were distributed into three categories according to range law, and the highest percentage appeared within the category of neutral attitude, as shown in Table (8).

Table 8. Shows the distribution of the respondents according to the attitude towards the use of modern irrigation technologies

| No. | Categories         | Frequency | %  | Average | r-value | t-cal | Sig  |
|-----|-------------------|-----------|----|---------|---------|-------|------|
| 1   | Negative(6-9)     | 14        | 10 | 50.49   | 0.29**  | 3.54  | 0.01 |
| 2   | Natural(10-13)    | 92        | 65 | 62.73   |         |       |      |
| 3   | Positive(14-more) | 35        | 25 | 66.67   |         |       |      |
|     | Total             | 140       | 100|         |         |       |      |

**Significant with level 0.01

In order to find the correlation relationship between the level of knowledge and the attitude towards using modern irrigation technologies, the Pearson correlation coefficient was used with a value (0.29), indicates a positive relationship between the two variables. To test the significance of the relationship, the law of (t) was used, as the calculated value of (t) was (3.549), which is higher than the tabular value of (t) at the level of (0.01), The null hypothesis accepts the alternative hypothesis that states (there is a significant correlation relationship between the two variables). The reason may be that the more the respondents tended to use the pivot irrigation system, the more interested they were to obtain information and knowledge related to the application of scientific recommendations related to pivot irrigation.

Third objective: Determine the regression relationship between knowledge with independent variables

Multiple regression analysis was used in order to determine the regression relationship between the level of knowledge of the respondents who use pivot sprinkler irrigation systems and the group of independent factors included in the analysis in order to know the effect of each independent factor in the presence of other factors on the level of knowledge, as well as to identify the total variance that all variables explain on Knowledge level. The results of the multi-stage regression analysis were as shown in Table (9).

Table 9. Shows the stages of regression analysis for the level of knowledge and the group of independent variables.

| No. | Variables                      | R   | R²  | Adj R² | M.S.E | B     | F    | Sig  |
|-----|--------------------------------|-----|-----|--------|-------|-------|------|------|
| 1   | constant                       | 0.402| 0.271| 0.235  | 13.49 | 50.84 | 26.53 | **   |
|     | Used system                    |     |     |        |       | 1.199**|      |      |
| 2   | constant                       | 0.494| 0.384| 0.343  | 12.85 | 15.98 | 22.125| **   |
|     | Used system                    |     |     |        |       | 1.113**|      |      |
|     | Attitude                       |     |     |        |       | 3.197**|      |      |
|     | constant                       |     |     |        |       | 6.64  |      |      |
|     | Used system                    |     |     |        |       | 1.080**|      |      |
|     | Attitude                       |     |     |        |       | 3.256**|      |      |
|     | Information sources            |     |     |        |       | 0.819**|      |      |
|     | constant                       |     |     |        |       | 20.84 |      |      |
|     | used system                    |     |     |        |       | 1.107**|      |      |
|     | Age                            |     |     |        |       | 2.918**|      |      |
|     | Information sources            |     |     |        |       | 0.703*|      |      |
|     | constant                       |     |     |        |       | -0.199*|      |      |
|     | Attitude                       |     |     |        |       |      |      |      |
|     | Information sources            |     |     |        |       |      |      |      |
|     | constant                       |     |     |        |       |      |      |      |
|     | used system                    |     |     |        |       |      |      |      |
|     | Age                            |     |     |        |       |      |      |      |
Table (10) showed that the regression relationship for the best coefficients when entering the variables alone, which was the comparison based on the differentiation measures based on the significant of the model, the least experimental error and the highest value of the determination coefficient \( R^2 \), as it was found that the best independent variables in their effect are the changes in the level of knowledge when entered alone. It is the number of years of using the system, as the value of the coefficient of determination was (0.271), and if the number of years of using the system increased by one unit, the level of knowledge increased by (1.199), as shown in the following equation:

\[ Y^\wedge = 50.84 + 1.199 \text{used system} \]

And upon introducing the binary combinations of the independent variables, it was found that the best equation was made by relying on the values of \( R^2 \) and the significance of the model and the least experimental error (M.S.E). In explaining the changes in the level of knowledge for each of the two variables, the number of years of using the system and the trend, as the value of \( R^2 \) was (0.384), which means that (38.4%) of the changes in the knowledge level were through these two variables, and that the number of years of using the system increased by one unit in the presence of the direction variable The level of knowledge increases significantly by (1.113) and that the trend increases one unit with the presence of the variable number of years of using the system, the level of knowledge increases significantly by (3.197), and as shown in the following equation:

\[ Y^\wedge = 15.98 + 1.113 \text{used system} + 3.197 \text{attitude} \]

When entering the triple combinations of the independent variables, it is noticed that the best equation is based on the values of \( R^2 \) and the significance of the (F) form, and the least experimental error (M.S.E). In explaining the changes in the level of knowledge, the number of years of use of the system, the sources of information, the trend towards the use of modern irrigation technologies, with a value of \( R^2 \) (0.443), which means that (44.3%) of the changes in the knowledge level were the result of these variables, as shown in the following equation:

\[ Y^\wedge = 6.64 + 1.080 \text{used system} + 3.256 \text{attitude} + 0.819 \text{information sources} \]

when all the studied variables were entered to explain the variance, the variables showed a significant increase at the level of probability of (0.01) years of using the system, information sources, the trend towards using modern irrigation technologies, as shown in the following equation:

\[ Y^\wedge = 20.84 + 1.107 \text{used system} + 2.918 \text{Attitude} + 0.703 \text{information} + (-0.199) \text{Age} \]

The total of the studied variables included in the analysis interpreted 51.5% of the changes in the level of knowledge, as the value of \( R^2 \) was 0.515, and the result of the interpretation indicated that the remaining percentage may be due to other quantitative variables that are not studied or to some descriptive factors that are not included in the analysis, and the variables differed in The extent of its interpretation of the variation in the level of knowledge according to the strength of the influence of each of the studied factors and in each stage of the regression with all possible possibilities.

4. Conclusions and Recommendations

4.1 Conclusion

1- The results showed that The general level of farmers 'knowledge of the scientific recommendations related to pivot sprinkler irrigation is high, tending to medium. From this it follows the growers’ awareness of the importance of information and knowledge related to pivot irrigation.

2- The results showed that 37.2% of the respondents are in the medium and low categories. From this it is deduced that the farmers 'knowledge is weak within the two categories. From this, it is concluded
that there is a need to prepare extension activities targeting farmers with low and medium knowledge levels.

3- The necessity of taking into account the studied variables in the preparation of extension activities, because they showed moral relations with the level of knowledge of wheat growers with pivotal irrigation.

4- It was found that most of the variables explain the changes occurring in the level of knowledge of the respondents the variable number of years of using pivot irrigation.

**Recommendations**

A- The need to support farmers with a high level of knowledge with production requirements in order to continue implementing the scientific recommendations and motivate the rest of the farmers to better implement the recommendations.

B- The necessity to prepare and implement extension activities for farmers with a low level of knowledge.

C- Taking into consideration the independent variables when preparing extension activities for farmers because of their importance in the level of knowledge of pivotal irrigation farmers.

D- Paying attention to pivotal wheat growers who have a number of years of using pivot irrigation

E- All the variables explained 51.5% of the changes in the level of knowledge.

**References**

[1] Al-Asadi, S. J. 2008. The Scientific Research Ethics in the Human, Educational and Social Sciences, 2nd ed., Wraith Cultural Foundation, Department of Studies and Research, Iraq.

[2] Ma'touk, S. S. 2015. Production of strategic grains in Iraq and its impact on food security. *Maysan Research Journal*. 11(21), 236-246.

[3] Abbas, D. F., Hamda, A. S. A., Elham, M. J., Shatha, S. M., Ahmad, A. S. and Rana, S. A. 2019. Assessment of the Impact of Changes in the Available Water on Crop Yields in Iraq. Food and Agriculture Organization of the United Nations.

[4] Hanoush, L. J. H. 2017. The level of farmers' knowledge in Najaf governorate about some irrigation methods and methods of rationalizing water use. *Kufa Journal of Agricultural Sciences*, 9(3), 224-236.

[5] Al-Daini, M. K. 2004. The knowledge level of the farmers concerning the use of semi-constant sprinkler irrigation technology in Baladruz project in Diyala province/Baladruz district, Master thesis, Department of Agricultural Guidance and Education, College of Agriculture, University of Baghdad.

[6] Al-Saad, I. H. 2000. The level of potato growers. Adoption of the two Dezri and Draha sorts of recommended techniques for cultivating the crop (a field study in Anbar governorate), the General Authority for Agricultural Guidance and Cooperation, Wheat growing technology "Instructive leaflet".

[7] Al-Ansari, A. M. S. and Hazem, A. A. 2001. Adding chemical fertilizers using drip irrigation technologies, *Iraqi Agriculture Journal*. 2(3), 14-23.

[8] Al-Mohammadi, S. M. 2015. A field study to assess the performance of pivot sprinkler irrigation systems under the conditions of the desert region in western Iraq. *Iraqi Journal of Agricultural Sciences*, 46(5), 847-853.
[9] Al-Kubaisi, A. M. 1999. Instructions and Technical Information about the Specifications of Field Irrigation Technologies According to the Circumstances of Iraq. "Instructive leaflet".

[10] Al-Saad, I. H. H. 2011. The knowledge level of Anbar farmers about sprinkler irrigation techniques and their relationship to some variables. *Anbar Journal of Agricultural Sciences*, 9 (2), 1-6.

[11] Al-Fadhel, M. M. 2010. The Goals of the Modern Director of Educational and Administrative Institutions, Al-Hamid House for Publishing and Distribution, Jordan.

[12] Walker, W. R. 2003. *Surface Irrigation Simulation Evaluation and Design. Guide and Technical Documentation*. Logan, Utah (USA): Utah State University (USA).

[13] FAO, Food and Agriculture Organization 2016. A Guide to Sustainably Producing Grains, Corn, Rice and Wheat, Rome.

[14] Odeh, K., Muhammad, A. S. K. and Karim, J. T. 2019. A practical study of the effect of using an automated sprinkler irrigation system on reducing water consumption, *Al-Rafidain University College for Science*. 44, 136-148.

[15] Al-Badri, B. H. and Amer, A. R. R. 2011. Measuring the impact of the lost water in irrigated agriculture on water scarcity in Iraq for the 2009 agricultural season. *Journal of Administration and Economics*, 87, 1-12.

[16] Al-Mohammadi, S. M. H. 2007. Estimation of evaporation losses for pivot sprinkler irrigation system under desert conditions in Iraq. *Anbar Journal of Agricultural Sciences*, 5 (1): 28-32.

[17] Muhammad, A. K. J. 2014. The Knowledge level of the farmers using pivotal sprinkler irrigation systems in Al-Jazeera region/Tikrit District, Master Thesis, College of Agriculture, University of Tikrit.