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Analysis of Wheat Farmers' Knowledge Level of Advanced Irrigation Systems in The Al-Na'imah Area of Salah Al-Din Governorate

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Citation: Abdullah R. R. Analysis of Wheat Farmers' Knowledge Level of Advanced Irrigation Systems in The Al-Na'imah Area of Salah Al-Din Governorate. American Journal Of Botany And Bioengineering 2026, 3(3), 23-31.

Received: 10th Dec 2025Revised: 11th Jan 2026Accepted: 21th Feb 2026Published: 05th Mar 2026

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Abstract: This research aimed to identify the level of wheat farmers' knowledge of advanced irrigation systems in the Al-Na'imah area of Salah al-Din Governorate. It also analyzed the relationship between this knowledge level and several independent variables, namely: age, educational attainment, years of experience in agriculture, cultivated area, type of land ownership, and access to information sources. The research population consisted of all 200 wheat farmers in the area, from which a simple random sample of 12.5% was selected, resulting in a sample size of 25 farmers. The study employed a two-part questionnaire; the first part contained data related to the independent variables. The second part consisted of (23) items to measure knowledge levels using a two-choice scale (yes/no), where (1) was awarded for a (yes) answer and (0) for a (no) answer. The results showed a significant knowledge gap among farmers, with approximately 80% falling within the medium to low knowledge levels. The results also revealed a positive and significant correlation between knowledge level and both academic achievement. The number of years of farming and access to information sources indicate that higher levels of these variables are associated with higher levels of knowledge. Conversely, a significant negative correlation was found between knowledge levels and age, suggesting that advancing age is associated with lower levels of knowledge. Regarding cultivated area and land ownership, no significant correlation was found between them and knowledge levels, reflecting the limited influence of these two variables on farmers' agricultural knowledge. In light of these findings, the research recommends strengthening extension services and providing modern and diverse information sources to enhance farmers' knowledge and encourage them to adopt modern irrigation techniques in the region.

Keywords: Wheat Cultivation, Modern Irrigation Techniques, Knowledge

Introduction

Research Problem

Agriculture is a cornerstone of the Iraqi economy, playing a vital role in ensuring food security, providing employment opportunities, and enhancing food security for the community. Wheat cultivation tops the list of strategic crops upon which the agricultural economy is based. Given its nutritional, economic, and social importance, as it represents a key component of the Iraqi food basket

[1], and despite the vast areas cultivated with this crop, productivity levels remain below expectations. This is attributed to several factors, most notably the reliance on traditional irrigation methods, which lead to significant water waste and uneven distribution, negatively impacting production efficiency. With escalating climate challenges, increasing water scarcity, and changing hydrological patterns in Iraq, the need to adopt modern irrigation technologies that contribute to water conservation and waste reduction, such as sprinkler and drip irrigation systems, has become urgent [2]. The importance of these technologies stems from their ability to conserve significant amounts of water, reduce weed infestation, and improve nutrient uptake by plants [3]. However, introducing these technologies into traditional agricultural environments cannot achieve the desired results unless farmers possess sufficient knowledge about their use, advantages, and maintenance. Farmers' agricultural knowledge is a crucial element in the success of any modern technology, as their acceptance of a new technology is directly linked to their level of familiarity with it [4], [5], [6], [7]. This is where agriculture extension services play the part of bringing about transfer of this information through awareness programs, training courses and field visits. According to a study, farmers hesitate adopting modern irrigation systems because they do not know how it works [2]. The authority of wheat is a prominent source for the people Salah al-Din Governorate, especially in Al-Na'imah area. During a time in which the region has also been frapped with recurring droughts and insufficient water, this begs the question: what is agricultural knowledge to use modern irrigation practices to cultivate this crucial crop? For the following reasons, the present research is a contribution to gaining insight into the depth of this knowledge [8]. We must therefore trace the origins of these technologies and identify barriers to their deployment. Understanding the awareness level of farmers concerning modern forms of irrigation is critical to advising more targeted and proactive extension programs that could improve water use efficiency, wheat yield and local food security. Moreover, it allows to establish agricultural strategies according the real farmers needs and reinforces chances for reaching sustainable agrarian growth [9]. Indeed, although the government and associated agencies have attempted to deploy modern irrigation technologies across much of Iraq's agricultural sector its implementation rates remain low, Ahmed in 2025. This includes the Na'imah region. There are several reasons for this weakness, the most important of which is that farmers do not have enough awareness and technical background on climate-smart agriculture and there are no continuous and adequate technical and financial assistance. And this is neither available nor applicable type of knowledge, since it requires understanding operational and maintenance procedures of such modern irrigation practices for wheat farming as well as soil characteristics, crop requirement (growth stage wise) and water application—much knowledge which is out of reach to a large section of farmer population in the region. According to the studies, farmers, in general, have a weak knowledge of irrigation techniques (2) there is find with some farmers to know an ultralight information from a very unscientific sources, such as using experience not approved by science [10]. Additionally, the widespread isolation and absence of dedicated training programmes within this domain results in solidification of wrong beliefs as well as discouraging farmers from adopting modern technologies [11]. On the other hand, a number of farmers face difficulties related to the unavailability of necessary equipment or its high cost, which makes them hesitant to invest in these technologies, especially given their limited understanding of the long-term returns they can generate [12]. In light of these factors, there is a clear need to study the current state of agricultural knowledge regarding modern irrigation, to determine the extent of farmers' awareness of this knowledge, the sources from which they acquire it, and the obstacles they face in its application. Hence, the current research problem is encapsulated in the following main question:

What is the level of wheat farmers' knowledge of modern irrigation systems in the Al-Na'imah area of Salah al-Din Governorate?

Research Objectives:

1. To determine the general level of knowledge regarding wheat cultivation using modern irrigation systems in the Al-Na'imah area of Salah al-Din Governorate.
2. To establish a correlation between the level of knowledge regarding wheat cultivation using modern irrigation systems in the Al-Na'imah area of Salah al-Din Governorate and the following independent factors: (age, educational attainment, number of years of cultivation, cultivated area, land ownership, and access to information sources).

Research hypotheses

There is no significant correlation between the level of knowledge about wheat cultivation using advanced irrigation systems in the Al-Na'imah area / Salah Al-Din Governorate and the following independent factors: (age, educational attainment, number of years of cultivation, cultivated area, land ownership, access to information sources).

Operational Definitions

1. Knowledge Level: In this research, this refers to the degree of information, understanding, and skills wheat farmers possess regarding the use of modern irrigation methods. This can be measured through their responses to a questionnaire specifically designed for this purpose, which includes sections such as: (knowledge of irrigation systems, their benefits, operating mechanisms, maintenance, and a comparison between traditional and modern methods).
2. Wheat Cultivators: These are the individuals who actively cultivate wheat in the Al-Na'imah area of Salah al-Din Governorate during the agricultural season under study. They perform all agricultural operations related to the crop, such as plowing, sowing, irrigation, fertilization, and pest control. They constitute the research sample, from which their knowledge of advanced irrigation systems is measured.
3. Advanced irrigation methods: These include non-traditional methods used in irrigating wheat crops that rely on modern technologies to conserve water and increase its use efficiency, such as: fixed and center-pivot sprinkler irrigation, and drip irrigation.

Research Area

The Al-Na'imah area in Salah al-Din Governorate was chosen as the research area due to its vast agricultural lands where wheat is the primary crop, the large number of wheat farmers, and the availability of groundwater suitable for irrigation. This makes it a significant and distinguished agricultural area within Salah al-Din Governorate for wheat cultivation using various irrigation techniques.

Research Population and Sample

The research population comprised all wheat farmers in the Al-Na'imah area, totaling (200) farmers. A simple random sample of (12.5%) was selected from this population, resulting in a sample of (25) wheat farmers from the area.

Preparation of the Questionnaire

To collect the necessary research data, a two-part questionnaire was developed, comprising:

- Part One: A set of questions to obtain data related to the personal, social, and economic variables of wheat farmers, including: (age, educational attainment, years of experience in agriculture, area cultivated with wheat, type of land ownership, and degree of access to agricultural information sources).
- Part Two: After reviewing several agricultural books and publications, in addition to some scientific research and discussions with specialists in wheat cultivation and the use of modern irrigation techniques, (23) items were identified to measure the farmers' level of knowledge about advanced irrigation systems in wheat cultivation, using a two-way scale (yes/no), where one point was awarded for a "yes" answer and zero for a "no" answer.

Validity: The questionnaire was reviewed by faculty members from the Agricultural Extension Department, the Psychology Department, and the Field Crops Department to assess the validity of the items and their wording. Some items were modified based on expert feedback.

Preliminary Testing: After finalizing the questionnaire and making the necessary modifications, the researcher conducted a preliminary test on a randomly selected sample of 10 farmers. This sample was excluded from the main research sample to establish the scale's reliability. The correlation between odd and even items was determined, and the results were corrected using the Spearman-Brown formula. The scale's validity was calculated by taking the square root of the reliability coefficient, yielding a reliability coefficient of 0.78 and a validity coefficient of 0.88.

Measuring Research Variables

The independent variables were measured as follows:

1. Age: Measured by the number of years the respondent was in at the time of data collection.

2. Educational Level: Classified into seven educational levels: (illiterate, literate, primary, intermediate, preparatory, institute, college), and assigned the following numerical values respectively (1, 2, 3, 4, 5, 6, 7).
3. Years of Experience in Wheat Cultivation: Measured by the number of years the respondent had spent cultivating wheat.
4. Land Ownership: This was classified according to four ownership types: (ownership, contract, lease, and partnership), and assigned values of (0, 1, 2, and 3) respectively.
5. Cultivated Area: This was measured by the actual number of dunams used by the respondent for wheat cultivation during the agricultural season under study.
6. Access to Agricultural Information Sources: This variable was measured by identifying six potential agricultural information sources from which the respondent could obtain recommendations and guidance related to wheat cultivation and modern irrigation methods. Four response options were provided for each source: (always, sometimes, rarely, and never), and assigned values of (3, 2, 1, and 0) respectively.

Statistical Methods:

After data collection, tabulation, and processing, SPSS was used to analyze the data.

Results and Discussion

First Objective: To determine the level of knowledge regarding wheat cultivation using advanced irrigation systems in the Al-Na'imah area, Salah al-Din Governorate:

The lowest value representing the level of knowledge regarding wheat cultivation using advanced irrigation systems in the Al-Na'imah area, Salah al-Din Governorate, was found to be 8, while the highest value was 25. The respondents were divided into three groups based on range and group length, as shown in Table 1.

Table 1. Shows the distribution of respondents according to their level of knowledge.

Knowledge rate	Percentage	number	Category
9.71	24	6	(13 – 8) low
17.17	56	14	(19 – 14) middle
22.65	20	5	(25 – 20) High
	100%	25	Total

Table (1) shows that the majority of respondents fall within the category of moderate to low knowledge levels, with 80% of the total sample belonging to the moderate and low categories. This indicates that most wheat farmers lack much of the knowledge and experience related to applying scientific recommendations for using modern irrigation methods in cultivating this crop. This low level of knowledge may be attributed to the weakness of agricultural extension activities in the research area, whether in terms of field visits, training programs, or awareness publications, which negatively impacts the transfer of modern agricultural technology to farmers.

The second objective: To determine the correlation between the level of knowledge regarding wheat cultivation using advanced irrigation systems in the Al-Na'imah area of Salah al-Din Governorate and the following independent factors:

1. Age: It was found that the ages of the farmers ranged between (27-68) years, with a mean of (40). The respondents were distributed into three categories according to the range and length of the category, as shown in Table 2.

Table 2. Shows the distribution of respondents according to their ages.

Value R	Knowledge rate	Percentage	number	Category
	20	16	4	years(40 – 27)
*0.15-	18	52	13	years (54 –41)
	13	32	8	years (68 – 55)

100%	25	Total
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The relationship is significant at the 0.05 level.

Table (2) shows that the highest average knowledge level was among the youngest age group, indicating that younger wheat farmers possess greater knowledge of modern irrigation techniques compared to older groups. To verify the correlation between age and knowledge level, Pearson's correlation coefficient was used, yielding a value of -0.15 , indicating a weak inverse correlation. A t-test was used to test the significance of this relationship, and the results showed a significant correlation at the 0.05 level. This means rejecting the null hypothesis, which states: "There is no significant correlation between wheat farmers' knowledge level and age," and accepting the alternative hypothesis, which states that there is a significant inverse relationship between the two variables. This inverse relationship may be attributed to the fact that younger farmers are more receptive to modern agricultural innovations and technologies, and have a greater willingness to learn and engage with extension information sources, unlike older farmers who may tend to adhere to traditional farming and irrigation methods.

2. Educational Attainment: The respondents were distributed according to their educational attainment into seven categories as follows:

Table 3. Shows the distribution of respondents according to educational attainment.

Value R	Knowledge rate	Percentage	number	Category
	10	16	4	ignorant
	13	8	2	Reads and writes
	16	20	5	primary
**0.20	17.9	20	5	Medium
	18.2	16	4	Preparatory school
	21	4	1	institute
	22.1	16	4	college
		100%	25	Total

Indicates that the relationship is significant at the (0.01) level.

Table (3) shows that the highest average knowledge level was among wheat farmers who were college graduates, indicating a positive relationship between the farmer's educational level and their knowledge of advanced irrigation systems. To analyze the relationship between the two variables (educational achievement and knowledge level), Spearman's correlation coefficient was used, yielding a value of (0.20), which indicates a weak positive correlation between the two variables. To test the significance of this relationship, Spearman's test was also used, and the results showed that the relationship is significant at the (0.01) level. Therefore, the null hypothesis, which states: "There is no significant correlation between the knowledge level of wheat farmers and educational achievement," is rejected.

The alternative proposing a significant positive correlation is accepted. This correlation may be attributed to the fact that farmers with higher levels of education possess a better ability to understand and interpret scientific recommendations and are more willing to adopt modern agricultural technologies compared to those who are uneducated or have a lower level of education. This contributes to raising their level of agricultural knowledge, especially regarding the use of modern irrigation methods.

3. Number of Years of Experience: It was found that the values representing the number of years of experience ranged between (1-30) years. The respondents were distributed into three categories according to the range and length of the category, as shown in Table 4.

Table 4. Shows the distribution of respondents according to years of experience.

Value R	Knowledge rate	Percentage	number	Category
*0.12	15	52	13	Years (9 - 1) low
	17.9	32	8	Years (19 - 10) middle
	19.2	16	4	(And more –year 20) High
		100%	25	Total

*Indicates that the relationship is significant at the (0.05) level.

Table (4) shows that the highest average knowledge level was within the third category of years of farming experience, indicating a positive relationship between the number of years of farming experience and the level of knowledge about advanced irrigation systems. To analyze the relationship between the two variables (number of years of farming experience and knowledge level), Pearson's correlation coefficient was used, yielding a value of (0.12), which indicates a slight correlation between the two variables. Testing the significance of this relationship using the (t) test, the relationship was found to be significant at the (0.05) level. Therefore, the null hypothesis, which states: "There is no significant correlation between the knowledge level of wheat farmers and the number of years of farming experience," is rejected.

The alternative hypothesis, which confirms a significant correlation between the two variables, was accepted. This is because farmers' knowledge and skills gradually increase with the accumulation of experience over years of practice, contributing to raising their level of understanding regarding the application of scientific recommendations and the use of modern irrigation methods in wheat cultivation.

4. Cultivated Area: The values representing the cultivated area for barley ranged between (2-40) dunams. The respondents were divided into three categories according to the cultivated area, as shown in Table 5.

Table 5. Shows the distribution of respondents according to the cultivated area.

Value R	Knowledge rate	Percentage	number	Category
0.08 g.m	14	60	15	15-2
	17.9	24	6	27-16
	19	16	4	30-28
		100%	25	Total

*Indicates that the relationship is not significant at the (0.05) level.

Table (5) shows that the highest average knowledge level was within the third category in terms of cultivated area. The relationship between the two variables (cultivated area and knowledge level) was analyzed using Pearson's correlation coefficient, which reached a value of (0.08), indicating a very weak correlation. Testing the significance of the relationship using the (t) test revealed that the relationship was not significant at the (0.05) significance level. Therefore, the research hypothesis, which states: "There is no significant correlation between the knowledge level of wheat farmers and the cultivated area," is accepted. This may be because farmers seek information and knowledge related to wheat cultivation and the use of modern irrigation methods, regardless of the size of the cultivated area, whether large or small. The need for agricultural knowledge remains important for every farmer, regardless of the size of the land they cultivate.

5. Land Ownership: The respondents were divided into four categories, with the highest percentage falling within the middle category, as shown in Table 6.

Table 6. shows the distribution of respondents according to land ownership.

Value R	Knowledge rate	Percentage	number	Category
0.04	16	16	4	owned

14.5	60	15	Rented
18	24	6	rent
0	0	0	sharing
	100%	25	Total

*Indicates that the relationship is not significant at the (0.05) level.

Table (6) shows that the highest average knowledge level was within the third category in terms of land ownership. The relationship between the two variables (land ownership and knowledge level) was analyzed using Spearman's correlation coefficient, which reached a value of (0.04), indicating a very weak correlation. Testing the significance of the relationship using Spearman's test revealed that the relationship is not significant at the (0.05) significance level. Therefore, the research hypothesis stating, "There is no significant correlation between wheat farmers' knowledge level and land ownership," is accepted. This may be attributed to the fact that farmers' knowledge level does not change with the type of land ownership. This is because cultivated areas are often limited, which makes interest in the crop and the use of modern irrigation methods similar among all farmers, regardless of the form of land ownership.

6. Information Sources: The values representing information sources were found to be between (3-15). The respondents were distributed into three categories according to the range and length of the category, as shown in Table 7.

Table 7. shows the distribution of respondents according to their access to information sources.

Value R	Knowledge rate	Percentage	number	Category
	15.2	32	8	(6 – 3) low
	18.7	52	13	(10 – 7) middle
*0.17	21	16	4	(15 – 11) High
		100%	25	Total

Table (7) indicates that the relationship is significant at the 0.01 level. The highest average knowledge level was within the third category related to information sources. To determine the correlation between the variables of information sources and knowledge level, Pearson's correlation coefficient was used, yielding a value of 0.17, indicating a weak positive correlation. Testing the significance of the relationship using the t-test, the correlation was found to be significant at the 0.01 level. Therefore, the research hypothesis stating, "There is no significant correlation between the knowledge level of wheat farmers and information sources," is rejected. Accepting the alternative hypothesis, which confirms a significant relationship between the two variables, is also important. This is because the multiplicity of information sources from which farmers obtain scientific recommendations regarding wheat cultivation and the use of modern irrigation methods significantly contributes to raising their level of knowledge. These sources help update their knowledge and provide accurate and practical information that enhances their ability to apply modern agricultural technologies.

Conclusion

1. The study results revealed a clear knowledge gap among the respondents, characterized by a lack of information and practical experience related to scientific recommendations for wheat cultivation. Approximately 80% of the sample fell into the intermediate and low knowledge levels, highlighting a pressing need to strengthen extension and training programs in the region.
2. The results demonstrated a statistically significant positive correlation between the respondents' knowledge level and each of the following: educational attainment, years of experience in agriculture, and access to information sources. This suggests that higher levels of education and

experience, along with a wider range of information sources, contribute to increased agricultural knowledge and improved efficiency.

3. The results revealed a significant negative correlation between knowledge level and age, indicating that advancing age is associated with a decline in knowledge. It can be concluded that younger farmers are more receptive to modern agricultural knowledge and technologies than older farmers.
4. The study showed no significant correlation between knowledge level and either cultivated area or land ownership type. This indicates that these two variables do not directly influence farmers' agricultural knowledge levels, as their level of interest and knowledge remains relatively similar regardless of land size or ownership status.

Recommendations

1. Work to revitalize the role of agricultural media and increase the number of diverse extension activities, in coordination with local media outlets such as radio and television in Salah al-Din Governorate, with the aim of disseminating agricultural awareness and enhancing farmers' knowledge regarding advanced irrigation systems and wheat cultivation.
2. Urge the Ministry of Agriculture to provide continuous support to farmers by supplying modern irrigation systems, fertilizers, and pesticides at subsidized and affordable prices, thereby encouraging them to adopt modern technologies and contributing to improved productivity.
3. Emphasize the importance of conducting similar studies periodically and at intervals to monitor changes in farmers' knowledge levels, enabling the development of agricultural training and extension programs according to their evolving needs and knowledge.

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