

## The Level of Wheat Farmers' Implementation of Agricultural Scientific Recommendations Related to Wheat Cultivation and Crop Maintenance in the Al-Mahawil District, Babylon province, and Its Relationship to Certain Variables

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### Abstract

The research aims to determine wheat farmers' implementation of scientific recommendations related to cultivation and crop maintenance operations in general, as well as to determine the level of implementation of each cultivation and crop maintenance operation: preparing and preparing the land for planting, planting the crop, fertilizing it, irrigating it, controlling it, and harvesting it. and to identify the relationship between the level of wheat farmers' application of the independent variables: area planted with wheat, type of agricultural land ownership, contribution to income, experience in crop cultivation, and participation in extension activities. It also aimed to identify the most important problems facing farmers. To achieve the research objectives, an application scale was constructed consisting of 36 items distributed over the agricultural operations mentioned above. Two points were assigned to each item, thus the scale scores ranged from 0 to 72 points. The research community included all wheat farmers in Al-Mahawil District Babylon province, numbering 749 farmers. A proportional stratified random sample of 75 farmers, representing 10% of the study sample, was taken. The results showed that wheat farmers' level of implementation was described as average, and that the level of implementation in the process of preparing and preparing the land for crop cultivation was the highest compared to other agricultural practices studied. There was a significant positive relationship between the level of implementation and the cultivated area, type of land ownership, contribution to income, and participation in extension activities. Furthermore, farmers face numerous problems, most notably the scarcity of irrigation water needed to irrigate the wheat crop. The researcher recommends that agricultural extension should undertake the task of teaching wheat farmers how to use production requirements to the best of their ability, which contributes to raising their level of implementation of scientific recommendations in the field. It is important to adhere to these recommendations continuously and not abandon them for any reason, in order to achieve record crop production levels.

**Keywords:** Scientific recommendations, agricultural operations, independent variables, wheat farmers.

### Introduction

Agricultural development occupies a special and exceptional position among the most important basic issues that many countries of the world, including Iraq, seek to achieve, and then achieve food security by working to increase production in quantity and quality, which guarantees that their people obtain the food they need to

enjoy a healthy and active life (36). Iraq is among the countries that have confronted the problem of food security and its modest production levels. Therefore, since the last quarter of the twentieth century, it has given this issue the appropriate degree of attention, considering it a vital and fateful issue that has topped the list of

priorities. It constitutes the cornerstone and first line of defense against the risks and challenges of economic, political, and social security, in addition to keeping pace with the train of development and civilization and actively participating in the progress of the international community (43). The interest in the agricultural sector, as a decisive factor in achieving food security, stems from the key position it occupies in the structural environment of the economy or its data. This has led to increased interest from the Ministry of Agriculture in providing financial support to research centers to develop modern and advanced technologies, especially in the field of wheat cultivation, in addition to implementing scientific recommendations provided to farmers by the advisory institution (38, 39), considering that any increase in grain production is the basic foundation for achieving self-sufficiency. Reports from the Ministry of Trade indicated that Iraq's need for wheat is approximately 5.2 billion tons annually, while the expected production for the 2024/2025 season is approximately 6.4 billion tons, meaning an increase of approximately 1.2 billion tons, which constitutes an important strategic reserve for Iraq, indicating that Iraq has achieved self-sufficiency in wheat production (44). In fact, this increase in wheat production came as a result of farmers planting wheat areas outside the agricultural plan and marketing the produced crop to the silos of the Ministry of Trade, which led to an increase in production without a change in agricultural productivity. This is evident from the agricultural productivity of the last three agricultural seasons 2023, 2024 and 2025, in which self-sufficiency was achieved, according to the Ministry of Agriculture, where productivity was (369, 504, 640) kg/dunum, respectively (11). Many officials in the agricultural field have doubted Iraq's ability to achieve self-

sufficiency in wheat, saying: If self-sufficiency in wheat has been achieved, why does Iraq still import approximately 2 million tons of wheat annually to be mixed with Iraqi wheat at a rate of 30%? And if there is a surplus in wheat production of 1-2 million, why is it not exported and provide hard currency for the country? (54) Iraq has sought to develop the productivity and production of wheat by including this crop in five-year plans to advance the agricultural reality in Iraq, leading to self-sufficiency in wheat production. As a result of this relentless effort, the national strategic plans developed by the Ministries of Agriculture and Planning and Development Cooperation came into being, which represent a central goal for the Ministry of Agriculture and the primary goal of its strategic plan for the years 2011-2014 (30) and 2015-2025 (31). Furthermore, it is a central goal in the national development plans for the years 2010-2014 (27) and 2013-2017 (28). The launch of the government's agricultural initiative in 2008 also resulted from these plans, which considered developing the production and productivity of wheat a priority, as it is a strategic crop. Although Iraq is one of the original places for the emergence of wheat, and despite being one of the countries that have the factors for the success of crop cultivation, its productivity is still low. The average production rate per dunum in Iraq ranged from 471 - 350 kg/dunum from 1989 to 2009, while the average production rate ranged from 336 - 640 kg/dunum and in a variable manner from 2010 to 2024 (5, 11), which is less than the global production rates and even the neighboring countries. For example, the average wheat production in Egypt is estimated at 1695 kg/dunum, in Saudi Arabia 1700 kg/dunum, in Kuwait 1338 kg/dunum (26), in China 1452 kg/dunum, in India 866 kg/dunum, in France 1732 kg/dunum, in Germany 1825 kg/dunum, in

Ukraine 1133 kg/dunum, and in Russia 1000 kg/acre (46), Which prompted the government to include it in the plan for developing the agricultural reality in Iraq. The Food and Agriculture Organization of the United Nations considered achieving sustainable increases in agricultural productivity as one of the most important basic principles of sustainable agricultural development (32). The world today is following various approaches and strategies to achieve food security and sustainable development, foremost among which is achieving sustainable increases in productivity in the plant and animal sectors, which is also among the major challenges facing the world in agriculture (33). The Ministry of Agriculture considered the decline in agricultural productivity one of the most important challenges facing the agricultural sector in Iraq (30, 31). The National Development Plan (2018-2022) clearly indicated that the goals of the National Development Plan 2013-2017 had not been achieved in the agricultural sector and that this sector still faces major challenges, foremost among which is the decline in agricultural productivity (29). Many studies conducted inside and outside the country indicate that the most important reasons related to the decline or increase in production and productivity of the wheat crop is the farmer, as he is primarily responsible for applying or not applying the scientific recommendations recommended for the success of its cultivation correctly. Modern agriculture requires techniques that adapt scientific knowledge in agriculture and thus is the only way to solve the agricultural problems that many farmers suffer from in rural areas where agricultural operations are still carried out in traditional ways. The transition from the traditional method to the scientific method is a problem facing the agricultural sector (35). Researchers and agricultural economics experts in Iraq have indicated

that the agricultural methods and techniques used in wheat cultivation are still primitive and lack the necessary components. Modern and advanced agriculture, the majority of farmers still follow primitive methods and techniques in wheat cultivation, and it is clear that these methods and techniques are fraught with some shortcomings until they reach modern and advanced levels (19), as well as the farmers' failure to adhere to the application of scientific recommendations for planting and servicing the wheat crop from the appropriate planting dates and not using improved seeds and not using the correct methods in modern agriculture from fertilization, control and harvesting operations... etc. (25). As for Fayyad (20), the existence of weakness among farmers in applying scientific recommendations related to the processes of planting and servicing the wheat crop in general and each agricultural process of planting and servicing the crop separately. While Al-Jubouri (7, 8, 9) that there was weakness in applying scientific recommendations in wheat cultivation in the processes of planting wheat seeds, fertilization and control of pests and wheat weeds, in addition to the lack of interest of farmers in applying these scientific recommendations. As for Muhammad and Al-Ta'i (24), they pointed out the lack of interest of wheat farmers in applying scientific recommendations related to combating weeds spread in wheat fields. Since the farmer He is primarily responsible for implementing scientific recommendations related to the cultivation and service of wheat crops with the aim of improving its productivity and quality. Most farmers in Iraq are poor due to low agricultural productivity (27). Therefore, the state must pay attention to reforming this segment of society and work to improve the conditions and characteristics of agriculture and farmers in Iraq by moving towards implementing some

appropriate approaches or strategies with the aim of making the extension system in Iraq effective and highly beneficial, increasing and sustainable for farmers and the rest of the rural community in the field of developing their activities, productivity and agricultural production while preserving and maintaining natural resources, and improving their incomes in a way that contributes to improving their rural lives and achieving the strategic goals sought by the Ministry of Agriculture (15). The reform of the characteristics of agriculture and farmers must also be appropriate and adapted to the local conditions of the country (40).

Agricultural extension has a distinctive impact on increasing the productivity of one dunum of wheat and expanding its cultivation through educational and extension programs that contribute to improving farmers' knowledge, skills, and attitudes to make the best use of available resources and capabilities (37). Therefore, assessing the level of farmers' implementation of scientific recommendations related to wheat cultivation and servicing is the basis for building successful, grounded extension programs. Accordingly, this research aims to address the following questions:

1. What is the level of wheat farmers' implementation of scientific recommendations related to cultivation and crop servicing operations in the Al-Mahawil, Babylon Province ?
2. What is the level of wheat farmers' implementation of scientific recommendations for each cultivation and crop servicing operation in the Al-Mahawil, Babylon Province ?
3. What is the relationship between wheat farmers' level of implementation of scientific recommendations with independent variables: (area planted with wheat, type of agricultural land tenure,

wheat cultivation's contribution to annual income, wheat cultivation experience, and participation in extension activities)?

4. What problems do the wheat farmers surveyed face in their agricultural activity?

#### Research Objectives

1. To determine the level of implementation of scientific recommendations by wheat farmers in Al-Mahaweel District related to the cultivation and maintenance processes in the Al-Mahaweel , Babylon Province .

2. To determine the level of implementation of scientific recommendations by wheat farmers for each cultivation and maintenance process in the Al-Mahaweel , Babylon Province .

3. To identify the relationship between wheat farmers' level of implementation and each of the following independent variables: area planted with wheat, type of agricultural land tenure, wheat cultivation's contribution to annual income, wheat cultivation experience, and participation in extension activities.

4. Identify the problems faced by the wheat farmers surveyed in their agricultural activity.

#### Research Hypotheses

There is a correlation between the level of wheat farmers' implementation of scientific recommendations related to crop cultivation and maintenance operations and each of the following independent variables:

1. Area planted with wheat.
2. Type of agricultural land ownership.
3. Contribution of wheat cultivation to annual income.
4. Experience in wheat cultivation (number of years practicing wheat cultivation).

## 5. Participation in extension activities.

### Significance of the Research

The importance of this research from determining wheat farmers' level of implementation of scientific recommendations related to crop cultivation and maintenance in general, determining the level of implementation of each cultivation and maintenance process, and the relationship between wheat farmers' implementation level and their individual independent factors. Furthermore, it identifies the most important problems faced by the wheat farmers surveyed, which can identify shortcomings or reveal deficiencies in the application of the correct scientific recommendations used in wheat cultivation and maintenance processes. It also identifies the most important reasons that prevent wheat farmers from implementing the correct scientific agricultural recommendations used in wheat cultivation and maintenance. This can then lead to the development of successful solutions and treatments that enable wheat farmers to better implement the correct scientific recommendations in cultivation and maintenance of the crop.

## Materials and Methods

**Research Methodology:** The research falls within the framework of survey research using the descriptive approach. This approach is suitable for obtaining detailed data and facts about the needs of individuals at a specific time (18). **Research community and sample:** Al-Mahawil district, was selected as the research area, as it is one of the central regions famous for wheat cultivation in the north of Babylon Province. The research community included all wheat farmers in the Al-Mahawil district, 749 farmers for the 2024/2025 agricultural season, distributed across five sectors: (Al-Jihad, Al-Nasr, Al-Faiha, Babylon, and Al-Thaer Al-Arabi) (42). A proportional stratified random sample was drawn from the farmer community at a rate of 10% in each district affiliated with the aforementioned sectors. Thus, the research sample size became 75 farmers, representing ten agricultural districts (Dulaimi, Bad'at Al-Musayyib, Hisn Ja'far, Al-Fandiya, Al-Khatuniya, Abu Sadira, Al-Sheetiya, Al-Sa'idiya, Al-Bad' Al-Kabir, and Al-Bad' Al-Saghir). This is shown in Table (1).

**Table 1. Number of wheat farmers surveyed and sample size in the Al-Mahawil district.**

No.	Sector	District	Farmers Number	Number of sample members
.1	Jihad	Dulaimi	125	11
.2	Victory	Musayyab Bid'ah	260	24
3	Al-Faihaa	Ja'far's Fortress	29	3
.4	Babylon	Al-Fandiya	70	6
		Al-Khatuniya	40	5
		Abu Sadira	35	4
.5	althair alearabia	Al-Shatiya	50	4
		Al-Sa'idiya	50	3
		Al-Bid'a Al-Kabir	50	5
		Al-Bid'a Al-Saghir	40	4
total			749	75

Research Tool: After reviewing the scientific literature, research, and advisory bulletins related to wheat crops, and consulting with professors specializing in the subject from the Department of Field Crops at the College of Agriculture/University of Baghdad and the College of Agriculture/Al-Qasim Green University, a scale was developed to measure the level of application of wheat farmers. It consisted of 36 items distributed across six agricultural operations, as follows:

1. Land preparation for cultivation: This process was measured using 11 items representing the process of preparing the land for planting the crop. This included the use of crop rotation or the method of crop rotation, planting the crop in well-drained, salt-free, loamy soils, and the presence of effective drainage to remove excess water and prevent its accumulation in the field. The soil was also tamped before plowing, which is the process of watering the soil to a state of saturation, allowing it to be left for a specific period during which harmful weeds grow. When the soil dries, the soil is plowed and the soil is turned over to eliminate the roots of the growing weeds. This method can eliminate a large proportion of weeds, leading to increased production. Plowing was carried out when the soil became easily friable by hand using a rotary disc plow, twice perpendicularly, or once deep to reduce costs, to a depth of at least 25-30 cm. The soil was smoothed immediately after plowing and leveled using a ploughman or laser leveler. The field was also divided into equal sections according to the soil type and leveling method, and the main and secondary ditches were opened (43). The final grade for the process ranged from 0 – 22 degrees.

2.Crop cultivation: This process was measured using eight items representing the crop cultivation process, including the

source of the wheat seeds to be planted, the type of wheat seeds, the quantity of seeds used per dunum, the date or time of crop cultivation in the area, the absence of impurities in the seeds, the soundness of the seeds, and the absence of disease or insect infestations. The seeds were also dusted, and the seed was used for planting, with a distance of 15-20 cm between rows and a depth of 3-6 cm (43). The final score for the process ranged from 0 – 16 degree.

3.Crop Fertilization: This process was measured using five items representing the crop fertilization process, including the source of the chemical fertilizer used, the type of fertilizer, the amount of fertilizer applied per dunum, the method of fertilizer application, and the date or time of application. The final score for the process ranged from 0 – 10 degrees..

4.Crop Irrigation: This process was measured using five items representing the crop irrigation process, including irrigation methods such as flood irrigation, the use of pumps, or modern irrigation systems. Irrigation was administered immediately after planting the seeds, supplemental irrigation for germination in the event of rainfall two weeks later, 6-8 irrigations during the season, and removal of excess water within a maximum of 20 hours of irrigation. The final score for the process ranged from 0 –10 degrees..

5. Weed and Crop Pest Control: This process was measured using five items representing the process of weed and crop pest control, including the source of the chemical pesticide used, the type of pesticide, the quantity used, the method of application, and the date or time of application. The final score for the process ranged from 0 – 10 degrees. .

5.Crop Harvest: This process was measured using two items representing the harvesting process, namely the appropriate

date for harvesting the crop and the method of harvesting the crop. The final score for the process ranged from 0 – 4. A score was assigned to each item on the scale, ranging from 0 to 2. Two points were assigned for correct application, one point for partially correct application, and zero for incorrect application. Thus, the maximum score for the scale was 72 points, and the minimum score was 0 points, with an average of 36 points. The level of application of the surveyed farmer was determined by the total score obtained, which determined his level of application of the items related to wheat cultivation and crop maintenance.

**Validity of the scale:** In order to reach the desired results of the research, a questionnaire was prepared that included a number of questions aimed at obtaining data related to wheat farmers' application of scientific recommendations for growing and servicing the crop. After completing the initial formulation of the questionnaire, it was presented to a number of professors specializing in field crops and agricultural extension at the College of Agriculture/University of Baghdad and Al-Qasim Green University, totaling 6 professors specializing in field crops and 4 professors specializing in agricultural extension (to verify the content validity and apparent validity of the questionnaire and the extent to which it achieved the research objectives. Apparent validity is when it measures what it was designed to measure, i.e., the extent to which the scale achieves the objective for which it was designed. Content validity, on the other hand, refers to the extent to which the

scale components represent aspects of the measured aspect, i.e., the extent to which the objectives set forth are covered (1, 2).

**Data Collection and Statistical Methods:** Data were collected in 2025 using the questionnaire prepared for this purpose. The questionnaire was distributed to the research sample, and responses were obtained from all 75 respondents. A number of appropriate statistical methods were used to analyze the research data, including standard deviations, arithmetic means, frequencies, percentages, simple correlation coefficient, and t-test (17).

### Results and Discussion

**First Objective:** Determine the level of application by farmers. Wheat farmers' level of application of scientific agricultural recommendations related to wheat cultivation and crop maintenance in the Al-Mahawil area, Babylon Province .

The results showed that the highest numerical value for the level of application of scientific agricultural recommendations related to wheat cultivation and crop maintenance in the Al-Mahawil was 66, and the lowest numerical value was 14, on an application scale consisting of 36 items with numerical values ranging from (0 – 72) points, with an average of 35.41 points and a standard deviation of 5.831. 69.34% of the respondents' numerical values for their level of application of these recommendations fell within the average level, with an average of 36.33 points, which is higher than the mean value of the scale's scores, which is 36 points, as shown in Table (2).

**Table 2. Distribution of respondents according to the level of application of scientific agricultural recommendations related to wheat cultivation and crop maintenance.**

Application Level	degree limits	Average application score	farmers Number	%
Weak	0 — 23	18.21	14	18.67
Average	24— 47	36.33	52	69.34
High	48 — 72	65.88	9	12
Total	0 — 72	35.41	75	100

It is concluded from Table 2. More than two-thirds of the wheat farmers surveyed described their level of implementation of scientific agricultural recommendations related to wheat cultivation and crop maintenance as average. This result is consistent with several studies on the same subject in previous years (7, 9, 22, 20), which indicated that the level of farmers' implementation was average. This means that there has been no change in the level of farmers' implementation for decades, and that agricultural guidance, whose role is to teach farmers how to properly utilize the land and use agricultural supplies, has not fulfilled its role as it should. Moreover, the productivity of a dunum of wheat has remained close for long periods, with figures much lower than the production of neighboring countries, at the very least. This clearly indicates that the level of farmers' implementation of scientific recommendations is still below the required level. In general, this result may be attributed to several reasons, including:

1. Wheat farmers' adherence to some traditional methods in agriculture, perhaps due to the scarcity or high prices of seeds, fertilizers, supplies, and various agricultural technologies (such as modern irrigation technologies, fertilized seeds, laser leveling devices, etc.), such that they have become beyond the farmers' capabilities, and thus led to Failure to

implement these agricultural requirements at the required level.

2. Absence or limited extension activities for farmers in the Al-Mahaweel on the research topic. Despite the presence of an agricultural extension unit in the Agricultural Division, the presence of a demonstration farm in Al-Mahaweel, and an agricultural research station in Al-Mahaweel, the research area witnessed only three extension activities during the years 2023-2025 on the research topic, at a rate of one extension activity per year. None of the respondents participated in any training activities on the aforementioned topic. This indicates the weakness of extension institutions in the process of educating and guiding farmers in growing and serving wheat crops. This has led to a weakness in the farmers' implementation of scientific recommendations, which is an important indicator of weak extension activity (41).

3. Weak or absent follow-up from the relevant agricultural units, particularly in the Agricultural Division, and the agricultural departments in the research area, regarding farmers' fields in general and farmers during their agricultural operations. This is due to the lack of adequate transportation, limited field work requirements, and the shortage of specialized agricultural staff. This is necessary to assist farmers in meeting their needs for the necessary knowledge and

skills, improving their field practices, and identifying and addressing their problems in real time.

Second Objective: To determine the level of wheat farmers' implementation of scientific recommendations for each wheat cultivation and service process, as follows:

1.Preparing and preparing the land for cultivation: The research results showed that the levels of implementation of the

farmers' responses to the process of preparing and preparing the land for cultivation ranged between 4 – 20 points, with an average of 11.63 points and a standard deviation of 3.449, on a scale whose two points ranged between 0 – 22 points. It appeared that 73.34% of them described their application level as average, with an average of 11.92 points, which is higher than the average value of the scale's points, which is 11 points, Table (3).

**Table 3. Distribution of respondents according to the level of wheat farmers' application of agricultural scientific recommendations related to preparing and preparing the land for wheat cultivation.**

Application Level	degree limits	Average application score	farmers Number	%
Weak	0 – 7	6.08	12	16
Average	8 – 15	11.92	55	73.34
High	16 – 22	18	8	10.66
Total	0 – 22	11.63	75	100

2.Crop Cultivation: The research results showed that the farmers' application scores for the crop cultivation process ranged from 2 – 14 points, with an average of 8.24 points and a standard deviation of 3.141, on a scale whose scores ranged

from 0 – 16 points. It was found that 65.34% of them described their application level as average, with an average of 8.75 points, which is higher than the median value of the scale, which is 8 points, Table (4).

**Table 4. Distribution of respondents according to the level of wheat farmers' application of agricultural scientific recommendations related to wheat cultivation.**

Application Level	Degree limits	Average application score	Farmers Number	%
Weak	0 — 5	3.75	16	21.33
Average	6 — 11	8.75	49	65.34
High	12 — 16	12.90	10	13.33
Total	0 — 16	8.24	75	100

3.Crop Fertilization: The research results showed that the farmers' application scores for the crop fertilization process ranged from 2 – 9, with an average of 5.45 and a standard deviation of 2.049, on a scale whose scores ranged from 0 – 10. It was

found that 61.34% of them described their application level as average, with an average of 5.71, which is higher than the median value of the scale, which is 5, as shown in Table (5.)

**Table 5. Distribution of respondents according to the level of wheat farmers' application of agricultural scientific recommendations related to wheat crop fertilization.**

Application Level	Degree limits	Average application score	Farmers Number	%
Weak	0 – 3	2.64	17	22.66
Average	4 – 7	5.71	46	61.34
High	8 – 10	8.41	12	16
Total	0 – 10	5.45	75	100

4.Crop Irrigation: The research results showed that the farmers' application scores for the crop irrigation process ranged from 2 – 9, with an average of 5.97 and a standard deviation of 1.955, on a scale ranging from 0 – 10. It was found that

65.34% of them described their application level as average, with an average of 6.38, which is higher than the median value of the scale, which is 5, as shown in Table (6).

**Table 6. Distribution of respondents according to the level of wheat farmers' application of agricultural scientific recommendations related to wheat crop irrigation.**

Application Level	Degree limits	Average application score	Farmers Number	%
Weak	0 – 3	2.73	15	20
Average	4 – 7	6.38	49	65.34
High	8 – 10	8.54	11	14.66
Total	0 – 10	5.97	75	100

5.Weed and Crop Pest Control: The research results showed that the farmers' application scores for weed and crop pest control ranged from 2 – 9, with an average of 5.48 and a standard deviation of 2.063, on a scale ranging from 0 – 10. It

was found that 62.67% of them described their application level as average, with an average of 5.74, which is higher than the median value of the scale, which is 5, as shown in Table (7).

**Table 7. Distribution of respondents according to the level of wheat farmers' application of agricultural scientific recommendations related to weed and wheat crop pest control.**

Application Level	Degree limits	Average application score	Farmers Number	%
Weak	0 – 3	2.64	17	22.66
Average	4 – 7	5.74	47	61.34
High	8 – 10	8.72	11	16
Total	0 – 10	5.48	75	100

6.Crop Harvest: The research results showed that the farmers' application scores for the crop harvesting process ranged from 1 – 4, with an average of 2.92 and a standard deviation of 1.773, on a scale whose scores ranged from 0 – 4. It was

found that 69.34% of them described their application level as average, with an average of 2.73, which is higher than the median value of the scale, which is 2, as shown in Table (8).

**Table 8. Distribution of respondents according to the level of wheat farmers' application of agricultural scientific recommendations related to wheat harvesting.**

Application Level	Degree limits	Average application score	Farmers Number	%
Weak	0 – 1	1	5	6.66
Average	2 – 3	2.73	52	69.34
High	4	4	18	24
Total	0 – 4	2.92	75	100

The third objective: To determine the relationship between the level of application of wheat farmers and each of the following independent variables:

1. Area planted with wheat: To determine the relationship between the area planted with wheat and the level of application of the wheat farmers surveyed, a simple correlation coefficient was used, with a value of 0.365, indicating a positive correlation. To verify the significance of the relationship, a t-test was used, with a calculated value of 3.379, which is higher than the tabular t-value of 1.99, which means it is significant at a probability level of 0.01%. This means that the level of application of scientific agricultural recommendations by the respondents for wheat cultivation and crop maintenance increases with the increase in the area

planted with wheat. This result is consistent with the findings of Al-Bayati and Al-Jumaili (4), Al-Jubouri (6), and Haji and Al-Khazraji (12). This result may be attributed to the fact that large areas have a high economic return if properly utilized, which encourages farmers to access information and expertise and use modern agricultural technologies, leading to an increase in their level of implementation of scientific recommendations. To describe the level of implementation of the surveyed farmers according to the area planted with wheat, the cultivated areas were divided into four categories. It was found that 84% of them had areas ranging from 1 to 30 dunums, with an average application score of 15.17 (Table (9)).

**Table 9. Distribution of respondents according to the categories of area planted with wheat and its relationship to the level of implementation.**

Cultivated area categories	Average application score	Farmers Number	%
15 — 1	10.51	41	54.66
30 — 16	23.86	22	29.34
45 — 31	41	7	9.34
60 — 46	54	5	6.66
Total	20.17	75	100

2. Type of holding of cultivated land: To know the relationship between the type of holding of land cultivated with wheat and the level of application of the researched wheat farmers, a simple correlation coefficient was used, and its value was 0.450, which indicates the presence of a positive correlation. To verify the significance of the relationship, a t-test

was used, whose calculated value was 4.368, which is higher than the tabular (t) value of 1.99, which means that it is significant at a level of 0.01%. This means that the type of holding has a positive relationship with the level of their application of wheat cultivation and service operations, which means that farmers whose lands are owned by them

are more motivated to benefit from them. This result is explained by the fact that the farmer's ownership of the land encourages him to apply new agricultural practices and technologies, as the farmer is more stable on his land and has freedom of action in the field of using his land, unlike the rest of the agricultural reform laws. This result is consistent with what Al-Jubouri (3), Al-Badri and Abdullah Al-Shaikhli (8), Karmasha and Al-Khazraji

(23) reached. To describe the level of application of the surveyed farmers according to the type of land holding cultivated with wheat, agricultural holdings were divided into three categories (ownership, contract, and lease). It appeared that 82.67% of them fell into the category of freehold ownership, representing the absolute majority of the other categories, with an average application score of 21.92 . Table (10).

**Table 10. Distribution of respondents according to agricultural holding type categories and their relationship to the level of application.**

Agricultural holding types	Average application score	Farmers Number	%
Own	21.92	62	82.67
Contract	12.75	8	10.67
Lease	15.80	5	6.66
Total	20.57	75	100

3. Contribution of wheat cultivation to the annual income of farmers: To determine the relationship between the contribution of wheat cultivation to the annual income and the level of application of the wheat farmers surveyed, a simple correlation coefficient was used, and its value was 0.530, which indicates the presence of a positive correlation. To verify the significance of the relationship, a t-test was used, whose calculated value was 5.408, which is higher than the tabular (t) value of 1.99, which means that it is significant at a probability level of 0.01%. This means that farmers depend on their annual incomes on the wheat crop produced by their fields in the agricultural season. Therefore, the contribution of wheat cultivation to income helps raise the level of their application of wheat cultivation and service operations, which is reflected in the standard of living and

the introduction of modern practices and technologies that help farmers achieve better and continuous application of wheat cultivation and service operations. This result is consistent with what Salem and Al-Khazraji (14) and Al-Atbi and Mithal Abdul Latif (16) reached. In order to describe the level of application of the farmers surveyed according to the crop's contribution to income, the contribution was divided into Annual income was divided into three categories (low, medium, and large). It appeared that 57.33% of respondents fell into the medium contribution category, with an average application score of 57.32, and 25.34% fell into the large contribution category, representing more than two-thirds of the respondents. This confirms that farmers rely heavily on wheat cultivation for their income, and in some cases, they rely entirely on it .Table (11).

**Table 11. Table. Distribution of respondents according to wheat contribution to income categories and its relationship to the level of application.**

Income Contribution Categories	Average application score	Farmers Number	%
Low	40	13	17.33
Average	57.32	43	57.33
Large	76.84	19	25.34
Total	59.26	75	100

4.Crop Cultivation Experience: To determine the relationship between crop cultivation experience and the level of application of the wheat farmers surveyed, a simple correlation coefficient was used, with a value of 0.195, indicating a negative correlation. To verify the significance of the relationship, a t-test was used, with a calculated value of 3.710, which is higher than the tabular t-value of 1.99, which means it is significant at a probability level of 0.01%. This indicates that the level of application of scientific agricultural recommendations for wheat

cultivation and maintenance by the respondents increases with increasing experience in wheat cultivation. This result is consistent with the findings of Al-Jubouri (10), Hassan and Al-Badri (13), and Karmasha and Al-Khazraji (23). To describe the level of application of the farmers surveyed according to the number of years of experience, the years were divided into five categories. It was found that 73.34% of the farmers had experience ranging from 11 to 40 years, with an average application score of 27.20. Table (12).

**Table (12). Table 12. Table. Distribution of respondents according to experience categories in wheat cultivation and its relationship to the level of application**

Wheat cultivation experience categories	Average application score	Farmers Number	%
1 — 10	9.08	12	16
11 — 20	14.87	15	20
21 — 30	26.27	18	24
31 — 40	36.36	22	29.34
41 — 50	45.75	8	10.66
Total	26.28	75	100

5. Extension activities for wheat crop: To know the relationship between experience in growing the crop and the level of application of the wheat farmers surveyed, a simple correlation coefficient was used, and its value was 0.154, which indicates the presence of a positive correlation. To verify the significance of the relationship, a t-test was used, whose calculated value was 3.380, which is higher than the tabular (t) value of 1.99, which means that it is significant at a probability level of

0.01%. This means that the level of application of the respondents to the scientific agricultural recommendations for the cultivation and service of the wheat crop is arranged in an ascending order with the increase in participation in extension activities for the wheat crop. The reason may be that the increase in participation in extension activities increases the farmers' exposure to new knowledge and concepts in agriculture, which means a positive change in the level of application of the

scientific recommendations by farmers. This result is consistent with what Al-Jubouri (10), Qasim, Ronak, and Barhan (21), and Al-Kalabi and Al-Badri (22) reached. To describe the level of implementation of the farmers surveyed, based on the number of participants in

extension activities, the participants were divided into three categories. It was found that 53.34% of them had a level of participation in extension activities ranging from 1 to 5 (weak participation), with an average implementation score of 3.67. Table (13).

**Table 13. Distribution of respondents according to the categories of extension activities for wheat crops and their relationship to the level of implementation.**

Categories of participation in guidance activities	Average application score	Farmers Number	%
Weak (1 – 5)	3.67	40	53.3
Average (6 – 10)	7.71	21	28
High (11 – 15)	12.78	14	18.66
Total	6.50	75	100

Fourth objective: Identifying the most important problems facing the wheat farmers surveyed: It appeared that the wheat farmers surveyed face numerous problems in growing and maintaining the wheat crop, most notably the problem of (the scarcity or insufficient irrigation water needed to irrigate the wheat crop), which reached an average importance of 3.946 points. This was followed by the problem of (the reduction of areas planted with wheat in the farmers' agricultural plan due to the scarcity of irrigation water), with an average importance of 3.894 points. This was followed by the problem of (the scarcity of machinery, sprayers, pumps,

agricultural harvesters, and their spare parts, and their high prices), with an average importance of 3.840 points. The problem of (the low fertility of most agricultural soils, the high salinity in them, and their need for reclamation) came in second to last in terms of importance, with an average importance of 2.400 points. The problem of (the impact of adverse weather conditions on the quantity and quality of the produced wheat crop) came in last in terms of importance, with an average importance of 2.294 points. The problems were divided on a scale. The highest degree of importance is 4 and the lowest is zero, Table (14).

**Table 14. Distribution of problems according to their average degree of importance for the wheat farmers surveyed.**

Ranking	Average Importance	Agricultural Problems	no.
1	3.946	Scarcity or scarcity of irrigation water for wheat crops.	.1
2	3.894	Reduction in the area planted with wheat in farmers' agricultural plans due to scarcity of irrigation water.	.2
3	3.840	Scarcity of machinery, sprinklers, pumps, harvesters, and their spare parts, and their high prices.	.3
4	3.787	Scarcity of mechanical seed drills and laser leveling devices and their high prices.	.4
5	3.734	Scarcity of quantities and types of government-provided chemical fertilizers and their high prices.	.5
6	3.680	Scarcity of modern irrigation systems and their difficulty in	.6

		obtaining and their high prices.	
7	3.574	High costs of harvesting wheat with mechanical harvesters.	.7
8	3.467	Scarcity of government-provided chemical pesticides and their high prices in local markets.	.8
9	3.360	High costs of plowing due to high fuel prices and the scarcity of agricultural machinery.	.9
10	3.254	Weak and deteriorating efficiency of drainage networks, which require disinfection.	.10
11	3.200	Scarcity of quantities and varieties of improved seeds and their difficulty in obtaining them from reliable sources and their high prices.	.11
12	3.146	Scarcity of agricultural harvesters at the appropriate harvest time and the difficulty of obtaining them, resulting in delays in the wheat harvest process.	.12
13	3.040	The spread of weeds of all kinds in wheat-grown fields.	.13
14	2.934	The inefficient quality of some chemical pesticides and their expiration dates.	.14
15	2.826	Lack of government support for farmers in purchasing production inputs.	.15
16	2.774	Constant power outages and high fuel prices for agricultural pumps.	.16
17	2.720	Rivers and streams need lining to conserve water and prevent water loss.	.17
18	2.613	Lack of activities and advisory bulletins in the field of wheat cultivation and service.	.18
19	2.560	Weak follow-up and limited field visits by relevant extension and agricultural departments.	.19
20	2.507	Products marketed in silos are rejected and not received by farmers for various reasons, such as humidity, infestation, uncleanness, etc.	.20
21	2.400	The low fertility of most agricultural soils, their high salinity, and their need for reclamation.	.21
22	2.294	The impact of adverse weather conditions on the quantity and quality of the wheat crop produced.	.22

### Conclusions

1. The level of implementation of agricultural scientific recommendations related to wheat cultivation and crop maintenance by wheat farmers in the Al-Mahaweel region is described as average. This result is consistent with numerous studies on the same subject conducted in previous years, which indicated that farmers' implementation was average. This indicates that there has been no change in farmers' implementation over the past decades, up until the current study.

2. Agricultural extension, whose role is to teach farmers how to properly utilize land and use agricultural inputs, has not performed its effective educational guidance role as it should, nor has it persuaded farmers to adopt the best and most modern methods and techniques for growing and producing the crop, thereby improving their implementation of agricultural scientific recommendations. This is evident from the stability of farmers' implementation, with more than

two-thirds of them falling within the average level, which tends to decline without improving.

3. Wheat farmers' levels of application of the studied agricultural practices were average and tended to decline, despite slight variations between them. Land preparation and preparation for cultivation had the highest level of application, followed by crop harvesting, then planting and irrigating the crop, then weed and pest control, and finally, fertilization.

4. The results also showed that the area planted with wheat, the type of land ownership, wheat's contribution to annual income, and participation in extension activities had a significant positive correlation with farmers' levels of application.

5. Farmers suffer from numerous problems, foremost among which is the scarcity or insufficient irrigation water for wheat and the reduction of areas planted with wheat in farmers' agricultural plans due to scarcity of irrigation water, which has a negative relationship with wheat production.

#### Recommendations

1. Since wheat farmers are responsible for implementing scientific recommendations

related to wheat cultivation and maintenance to improve its quantitative and qualitative productivity, they face numerous problems that prevent this achievement. Therefore, the state, as the sponsor of these farmers, must work to solve these problems and overcome the various obstacles that hinder increasing wheat production and improving its quality.

2. Agricultural Extension, as the responsible body, should take on the task of educating wheat farmers on how to make the best use of production inputs to prevent waste and achieve the desired results. This should be achieved through the development of various extension programs and activities (extension seminars, field visits, training courses, field demonstrations, field days, workshops, etc.) that contribute to raising the level of farmers' implementation of scientific recommendations in the field, while emphasizing the importance of continuity and adherence to these recommendations, and not abandoning them for any reason, in order to achieve record crop production levels.

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