Knowledge Needs of Agricultural Employees at the Directorate of Agriculture in Nineveh and Its Affiliated Agricultural Divisions in the Field of Hydroponic Farming Technologies

Bilqees Fares Hamed
A student at the University of Mosul
Mah_inf@uomosul.edu.iq

Maher Ibrahim Dawood
A lecturer at the University of Mosul
balqees.25agp141@student.uomosul.edu.iq

Abstract

This study aimed to determine the level of knowledge needs among agricultural employees in Nineveh Governorate in the field of hydroponic technologies, to rank these needs according to their relative importance, and to analyze their relationships with selected personal and occupational variables. It also sought to identify the major constraints hindering the dissemination of these technologies. The study population consisted of 335 agricultural employees working at the Directorate of Agriculture in Nineveh and its affiliated divisions. A simple random sample representing 54% of the population (181 respondents) was selected after excluding the pilot sample. Data were collected using a three-part questionnaire. The instrument's validity and reliability were confirmed, with a Cronbach's alpha coefficient of 0.97. Data analysis was conducted using SPSS.

The results indicated that the overall level of knowledge needs was moderate. The economic feasibility domain ranked first in importance, whereas the domain of hydroponic types and systems ranked last. The findings also revealed variation in the ranking of items within each domain, with higher needs concentrated in practical aspects such as growing media use, nutrient solution storage, project establishment costs, and technical problem diagnosis. Furthermore, the study identified several constraints facing agricultural employees that limit the dissemination of hydroponic technologies, highlighting the need to enhance training programs and technical support to improve their knowledge and facilitate effective technology transfer to farmers.

Key words : Hydroponic Agriculture, Knowledge Needs, Agricultural Employees, Ninawa, Iraq

Introduction and Research Problem:

Agricultural development plays a pivotal role in enhancing agricultural productivity and improving rural livelihoods through the adoption of advanced knowledge and modern production practices (**4**). It is fundamentally driven by strengthening human capacities and ensuring the efficient utilization of available resources(**1**). However, accelerating population growth continues to intensify pressure on global food

ISSN 2072-3857

systems, particularly under conditions of limited and degraded arable land.(9)

In this regard, hydroponics has gained increasing attention as an innovative soilless cultivation system that relies on nutrient solutions to support plant growth.(5) This technology offers substantial advantages, including improved water-use efficiency, higher productivity, and enhanced crop quality **(7**). Moreover, it represents a sustainable approach to addressing water scarcity challenges while improving both economic returns and environmental performance. (**8)**

Agricultural extension services constitute a critical mechanism for promoting the adoption of such technologies by facilitating knowledge transfer and building farmers' technical capacities.(3) The effectiveness of hydroponic systems is strongly associated with the quality of extension support, whereas inadequate extension efforts often hinder successful implementation (6).

Despite the recognized potential of hydroponic systems in enhancing agricultural productivity and resource efficiency, their adoption remains limited in several contexts due to insufficient knowledge and technical preparedness among agricultural personnel regarding hydroponic technologies. Furthermore, there is a lack of empirical, field-based studies that accurately assess the knowledge needs of agricultural staff in relation to hydroponic systems, particularly in developing agricultural contexts such as Ninawa Governorate.

Therefore, this study is conducted to systematically identify and analyze the knowledge needs of agricultural personnel regarding hydroponic technologies, in order to support effective technology transfer and enhance their capacity to promote and implement these systems.

Research Objectives:

This study aims to:

1- Assess the knowledge needs of agricultural personnel in the Directorate of Agriculture of Nineveh and its affiliated divisions regarding hydroponic technology.
2- Determine the relationship between selected variables (age, education level, years of service, prior training in hydroponics, extension specialization, and information sources) and the respondents' knowledge needs in hydroponic systems.
3- Identify the main constraints faced by agricultural personnel that hinder the dissemination of hydroponic technology among farmers.

Methodology

The study population comprised all agricultural employees working at the Directorate of Agriculture in Nineveh Governorate and its affiliated agricultural divisions, which include (34) agricultural divisions and (11) departments, with a total population of (335) employees.

ISSN 2072-3857

A pilot sample of (30) employees was excluded from the main study to ensure the reliability of the research instrument. A proportionate simple random sampling technique was adopted, and (200) employees were selected, representing (60%) of the total population. During data collection, (19) questionnaires were excluded due to incomplete responses, resulting in a final valid sample of (181) questionnaires, representing (54%) of the study population. The sample size was determined using Stephen's Equation as cited in(2**)**

Research Instrument and Statistical Analysis

A structured questionnaire was developed consisting of three parts. The first part covered the personal characteristics of the respondents. The second part included an (80)-item scale measuring knowledge needs related to hydroponic techniques across five domains: hydroponic systems, nutrient solutions, economic feasibility, problem diagnosis, and maintenance. The third part consisted of a (15)-item scale measuring constraints faced by agricultural employees in Nineveh Governorate. Both scales were measured using a four-point Likert scale ranging from (1–4).

Content validity was ensured through expert review from the College of Agriculture and Forestry, University of Mosul. Reliability was tested using Cronbach's Alpha, which yielded a coefficient of (0.97), indicating high internal consistency. Data were analyzed using SPSS software, employing Pearson correlation coefficient, Spearman rank correlation, standard deviation, and weighted mean.

Variables Measurement and Research Instrument

The study instrument consisted of three main sections. The first section included the independent variables, namely: age, educational attainment, years of service, training in hydroponic techniques, extension specialization, and sources of agricultural information. Age and years of service were measured using actual values. Educational attainment was coded from (1–5), extension specialization was coded as (2 = specialist, 1 = non-specialist), and training was coded as (2 = trained, 1 = not trained). Sources of agricultural information were measured using an 11-item three-point scale with weights ranging from (3–1).

The second section measured the dependent variable, namely knowledge needs of hydroponic techniques, using an 80-item scale distributed across five domains. A four-point Likert scale (4–1) was adopted to quantify respondents' levels of knowledge need.

The third section was designed to measure the constraints facing agricultural employees in disseminating hydroponic technology, using a four-point scale (4–1) to assess the degree of each constraint.

respondents were classified into three categories according to their levels of knowledge needs

ISSN 2072-3857

Table (1) shows the distribution of respondents according to the level of knowledge needs for hydroponic technologies.

Average need in each category	%	Frequency	Categories
147	3.31	6	121-183 Low
213	46.41	84	Medium 184-246
275	50.28	91	247-309 High
	100%	181	The Total

Mean = 247.834, Standard Deviation = 38.032, Highest Value = 309, Lowest Value = 121

Table (4) reveals that the majority of respondents were classified within the high category (247–309), representing (50.28%), followed by the medium category (184–246) at (46.41%), whereas the low category (121–183) recorded the lowest proportion at (3.31%).

These findings indicate that more than half of the respondents exhibit high levels of knowledge needs in hydroponic techniques, reflecting the emerging nature of this technology within the country. This situation underscores an urgent need to enhance extension and training interventions to effectively address these knowledge gaps and improve the professional capacity of agricultural employees in this field.

Results and Discussion

First Objective

The first objective aimed to identify the levels of knowledge needs of agricultural employees in hydroponic techniques.

Results of Objective 1

The results showed that the lowest value of knowledge needs in hydroponic techniques was (121), while the highest value reached (309). The mean score was (247.834) with a standard deviation of (38.032), indicating variability in the levels of knowledge needs among the respondents. Based on the actual score range, the respondents were classified into categories using equal intervals to determine the levels of knowledge needs. This result agrees with Adepoju and Adekunle in their study , who emphasized the need to improve knowledge of hydroponic technologies.

Second Objective The second objective aimed to examine the correlation between the knowledge needs of agricultural employees in hydroponic techniques and the independent variables included in the

ISSN 2072-3857

study, namely: age, educational attainment, years of service, previous training in hydroponic techniques, specialization in extension work, and sources of agricultural information**.**

Age Variable

The results indicated that the youngest respondent was (27) years old, while the oldest was (58) years old.

Respondents were classified into three categories: low (27–36 years) with (31.49%), medium (37–46 years) with (45.30%), and high (47–58 years) with (23.21%). The medium category represented the highest proportion at (45.30%), indicating that most respondents belong to a relatively active working-age group

Table (2) shows the distribution of respondents according to the age variable

P-value	R value	%	Frequencies	Age categories
0.636 Not significant	0.026	31.49	57	Year 36-27
		45.30	82	Year46-37
		23.21	42	Year58-47
		100	181	The Total

To examine the correlation between knowledge needs and age, Pearson's simple correlation coefficient was applied, which showed a weak and non-significant relationship (r = 0.026, p = 0.636). Accordingly, the null hypothesis was accepted, indicating that there is no statistically significant relationship between knowledge needs and age. This may be attributed to the predominance of younger respondents with limited practical experience, which is reflected in their lower level of knowledge regarding hydroponic techniques.

Educational Attainment

Respondents were classified according to educational attainment into five categories: agricultural secondary certificate (2.8%), agricultural diploma (14.9%), bachelor's degree (55.2%), master's degree (19.9%), and doctoral degree (7.2%)).

ISSN 2072-3857

Table (3) shows the distribution of respondents according to the educational attainment variable.

p- value	Rs value	%	Frequencies	Educational attainment categories
0.899 Not significant	0.001	2.8	5	Secondary school
		14.9	27	Diploma
		55.2	100	Bachelor's degree
		19.9	36	Master's degree
		7.2	13	Doctoral degree
		100	181	The Total

To determine the correlation between knowledge needs and academic achievement, Spearman's rank correlation coefficient was used. The obtained value was (0.001), indicating a non-significant relationship between the two variables, as confirmed by the p-value (P = 0.899). Accordingly, the null hypothesis is accepted, which states that there is no statistically significant relationship between knowledge needs and academic achievement. This finding suggests that the level of academic achievement does not have a substantial effect on the knowledge needs of the respondents. This may be explained by the fact that the traditional agricultural education received by the respondents during different educational stages does not include specialized courses in hydroponic agriculture technologies, resulting in a relatively similar level of knowledge need among employees regardless of their academic qualification.

Years of Service

The years of service of the respondents ranged from (1–30) years and were classified into three categories: low (1–10 years) accounting for (21.55%), medium (11–20 years) accounting for (70.72%), and high (21–30 years) accounting for (7.73%). The results indicate that the majority of respondents fall within the medium category, reflecting a moderate level of experience among most employees

ISSN 2072-3857

Table (4) shows the distribution of respondents according to the number of years of service variable.

P-value	R value	%	Frequencies	Years of service categories
0.082 Significant	0.178	21.55	39	(year1_10)
		70.72	128	(21_11)year
		7.73	14	Year (21_30)
		100	181	The Total

To identify the relationship between knowledge needs and years of service, Pearson's correlation coefficient was applied. The calculated value was (0.178), which indicates a statistically significant relationship between the two variables. Consequently, the null hypothesis is rejected and the alternative ahypothesis is accepted, stating that there is a significant relationship between years of service and the knowledge needs of agricultural employees.

Previous Training in Hydroponic Agriculture Techniques

The findings revealed that 18.8% of the respondents had received training in extension work, whereas 81.2% had not participated in such training programs

Table (5) shows the distribution of respondents according to the previous training in hydroponics technologies variable.

P-value	Rs value	%	Frequencies	Categories of Trainees
0.220	0.092 Not significant	81.2	147	Trainee
		18.8	34	Non-traine
		100	181	The Total

To examine the relationship between knowledge needs and previous training in hydroponic agriculture techniques, Spearman's rank correlation coefficient was used. The obtained value was (0.092), indicating a non-significant relationship between the two variables, as confirmed by the p-value (p = 0.220). Accordingly, the null hypothesis is accepted, which states that there is no statistically significant relationship between knowledge needs and previous training in hydroponic agriculture techniques. This may be attributed to

ISSN 2072-3857

the fact that previous training programs did not include specialized courses or modules in hydroponic agriculture, which resulted in the absence of a meaningful relationship between respondents' training background and their knowledge needs in this field.

Sources of Agricultural Information on Hydroponic Agriculture Techniques

Table (6) shows the distribution of respondents according to the sources of agricultural information variable

P-value	Rs value	%	Frequencies	Categories of Agricultural Information Sources
0.180 Not significant	0.460	11.05	20	Low(11-18)
		53.04	96	(19-25)Medium
		35.91	65	High (26-33)
		100	181	The Total

To examine the relationship between knowledge needs and agricultural information sources regarding hydroponic agriculture techniques, **Spearman's** rank correlation coefficient was used. The obtained value was (0.460), indicating a statistically significant relationship between the two variables, with a p-value of (p = 0.180). Accordingly, the null hypothesis is rejected and the alternative hypothesis is accepted, which states that there is a significant relationship between knowledge needs and agricultural information sources related to hydroponic agriculture. This finding indicates that employees who rely on diverse information sources tend to have lower levels of knowledge needs, and that the use of varied information sources contributes to enhancing their experience and improving their competencies in various agricultural topics in general, and in hydroponic agriculture in particular.

Specialization in Extension Work

The results indicated that 17.7% of the respondents were specialized in extension work, whereas 82.3% were non-specialists

ISSN 2072-3857

Table (7) shows the distribution of respondents according to the specialization in agricultural extension work variable.

P-value	Rs value	%	Frequencies	Specialization Categories in Extension Work
0.075 Significant	0.133	17.7	32	Specialized
		82.3	149	Non-specialized
		100	181	The Total

To determine the relationship between knowledge needs and specialization in agricultural extension work related to hydroponic agriculture, Spearman's rank correlation coefficient was employed. The obtained value was (0.133), indicating a statistically significant relationship between the two variables, with a p-value of ($p = 0.075$). Accordingly, the null hypothesis is rejected and the alternative hypothesis is accepted, which states that there is a significant relationship between knowledge needs and specialization in hydroponic agricultural extension work. This relationship may be attributed to the fact that extension workers possess an academic and organizational background aligned with the nature of their duties, which provides them with greater awareness of modern developments and technologies such as hydroponic agriculture. Consequently, their knowledge needs tend to be more clearly defined compared to non-specialists. In addition, their specialization fosters greater interest in the technical and applied aspects of their field, thereby contributing to a better understanding of their knowledge requirements.

5.4**Objective:** Identifying the Main Constraints Facing Agricultural Employees that Hinder the Dissemination of Hydroponic Agriculture Technology among Farmers

To identify the constraints hindering the implementation of hydroponic agriculture techniques in Nineveh Governorate, the fifth objective focused on analyzing these constraints in detail. The item "lack of farmers' awareness of the concept and benefits of hydroponic agriculture" ranked first among all items. This may be attributed to the limited number of extension workers in the study area specializing in hydroponic agriculture. The successful dissemination and adoption of this technology require the development and strengthening of supporting service institutions in the fields of agricultural extension, agricultural research, and knowledge exchange and training, in order to overcome the institutional and structural barriers that hinder the transition towards hydroponic agriculture

ISSN 2072-3857

Table (8) illustrates the ranking of items related to the main constraints facing agricultural employees that hinder the dissemination of hydroponic agriculture technology among farmers

Rank	Relative Importance	Weighted Average	Item	Sequence in Scale
1	71.60	3.58	Lack of farmers' awareness of the concept of hydroponic agriculture and its benefits	1
2	66.85	3.34	Limited experience of employees with modern hydroponic agricultural technologies	2
3	66.52	3.33	Insufficient specialized training courses in the field of hydroponic agriculture	3
7	64.42	3.22	Complexity of some technical and operational aspects, such as system installation and maintenance	4
4	66.41	3.32	Complexity of some technical and operational aspects, such as system installation and maintenance	5
5	65.08	3.25	Difficulty in obtaining financing or loans for farmers who wish to adopt hydroponic agriculture technology	6
11.5	62.32	3.12	Insufficient government support and incentives to encourage the adoption of this type of agriculture	7
11.5	62.32	3.12	Clear weakness in infrastructure (continuous supply of electricity and water).	8
14	59.12	2.96	Limited availability of agricultural raw materials (nutrient solutions, growing media, and suitable hybrid seeds).	9
15	56.80	2.84	Limited agricultural awareness and extension programs specialized in hydroponic farming.	10

ISSN 2072-3857

13	59.56	2.98	Weak continuous coordination between agricultural research centers, extension staff, and farmers.	11
6	64.53	3.23	mited extension materials (booklets, brochures, and practical videos) on hydroponic farming.	12
9	63.54	3.18	Weak field monitoring and follow-up of farmers after adopting hydroponic farming technology.	13
8	63.76	3.19	Resistance to change among some farmers who prefer traditional farming methods.	14
10	63.31	3.17	Limited successful local experiences that can be cited to convince farmers to adopt the technology.	15

While the item "limited awareness and agricultural extension programs specialized in hydroponic agriculture" ranked last, with a mean score of (2.84), this may be attributed to the weak presence or absence of supporting organizations—whether governmental or local—that promote hydroponic agriculture in the study area. This situation has led respondents to perceive this item as relatively less important compared to other constraints.

Conclusions

Based on the findings of the study and the statistical analysis, the researcher reached the following conclusions:

1. The level of knowledge needs among agricultural employees in the Directorate of Agriculture of Nineveh and its affiliated divisions regarding hydroponic agriculture techniques was found to be high, with the majority of respondents falling within the high-need category. This indicates the existence of a clear knowledge gap that requires systematic and well-structured scientific intervention.
2. The results revealed no statistically significant relationships between knowledge needs and the variables of age, academic achievement, and previous training. This suggests that these factors do not exert a direct influence on the level of knowledge needs in the field of hydroponic agriculture.
3. A statistically significant relationship was found between knowledge needs and specialization in agricultural extension work, highlighting the importance of professional specialization in enhancing the understanding of modern

ISSN 2072-3857

agricultural technologies and their associated knowledge requirements.

4. The results indicated a statistically significant relationship between knowledge needs and the diversity of agricultural information sources. This finding can be interpreted as the diversity of information sources enhancing agricultural workers' awareness of their knowledge needs by providing multiple channels for accessing and comparing information. Such diversity contributes to reducing the knowledge gap and improving professional competence by enabling workers to more accurately identify deficiencies in their knowledge and address them more effectively
5. The study identified several key challenges hindering the dissemination of hydroponic agriculture technology in Nineveh Governorate, most notably the limited awareness of farmers regarding its concept and benefits, weaknesses in specialized training programs, high establishment costs, and insufficient institutional and extension support.

Recommendations

1- The Directorate of Agriculture of Nineveh is advised to provide the necessary technical and institutional support, in addition to supplying training facilities and essential equipment, in order to facilitate the implementation of hydroponic agriculture techniques in the study area and to address the knowledge gap revealed by the study findings.

2- The agricultural divisions in the study area are encouraged to intensify extension efforts related to hydroponic agriculture through the use of various extension tools, such as posters, brochures, scientific leaflets, and workshops, with the aim of raising farmers' awareness and knowledge and promoting the adoption of these modern techniques.

3- Strengthening cooperation among research institutions, universities, and agricultural extension bodies is recommended in order to develop specialized programs in hydroponic agriculture, facilitate the transfer of modern technologies, and promote knowledge exchange, thereby enhancing the efficiency of agricultural personnel and increasing the effectiveness of implementing these techniques in Nineveh Governorate.

Sources

1- Al-Ghunaimi, Mohammed Riyadh (2017). Theories and Trends of Integrated Approaches to Rural Development in Integrated Development Studies. Rural Development Series, Dar Al-Ta'leef Publishing House.

ISSN 2072-3857

2- Al-Taie, Hassan Abdul Karim (2012). Research Methods in Educational and Psychological Sciences. Amman: Dar Al-Masirah for Publishing and Distribution.
3- Hussein, Safaa Ismail (2018). The Effectiveness of Agricultural Extension in Farmers' Adoption of Modern Technologies in Plant Production. University of Mosul – College of Agriculture and Forestry.
4- Mahmoud, Mohammed Abdullah Abdul Salam (2024). The Agricultural Sector and Its Role in Agricultural Economic Development. Scientific Journal of Financial and Administrative Studies and Research P52..
5- MILLER, A. G. (2019). OPTIMIZATION OF GREENHOUSE HYDROPONIC LETTUCE PRODUCTION. MASTER'S THESIS, PURDUE UNIVERSITY, PP. 12-13
6- Mohammed, Maha Adel (2019). The Role of Agricultural Extension in Farmers' Adoption of Modern Agricultural Technologies. University of Baghdad – College of Agriculture.
7- Resh, H. M. (2022). Hydroponic food production: a definitive guidebook for the advanced home gardener and the commercial hydroponic grower. CRC press.
8- ROSENBAUM, C. (2020). DESIGN OF A DEEP FLOW TECHNIQUE HYDROPONIC SYSTEM AND AN EVALUATION OF WATER USE EFFICIENCY. MASTER'S THESIS, UNIVERSITY OF ARKANSAS, P. 7.
9- SAFA, TAQWA J. (2019). HYDROPONIC FORAGE PRODUCTION AND WATER USE EFFICIENCY OF SOME FORAGE CROPS UNDER PALESTINIAN CONDITIONS. MASTER'S THESIS, AN-NAJAH NATIONAL UNIVERSITY, P. 1

ISSN 2072-3857