



Awareness of agricultural extension employees in Kirkuk province regarding the importance of spraying sour orange trees with the growth regulator Brassinolide.

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ABSTRACT

The research aims to determine awareness level among agricultural extension employees in Kirkuk Province of the importance of spraying sour orange trees with Brassinolide. It also aims to study the correlation among the awareness of agricultural extension employees in Kirkuk Province of the importance of spraying sour orange trees with Brassinolide and (age, educational attainment, length of service, workplace, and Participate in a training course).

The research is focused on discovering how much agricultural extension workers in Kirkuk Province understand the significance of applying Brassinolide to sour orange trees. It also seeks to find out how this awareness among the agricultural extension staff relates to factors such as age, education level, years of experience, workplace, and participation in training programs. The study involved all staff engaged in agricultural extension at the Kirkuk Agriculture Directorate Center and the Extension Training Center, totaling 60 employees. However, 20 of those employees were removed from the survey sample, leaving 40 employees who were included for the data collection aspect of the research. Data for the study was gathered through a questionnaire divided into two sections. The first section contained questions aimed at understanding the unique characteristics of the participants, while the second section featured a five-point Likert scale with 10 items. The information was collected through direct interviews and was then compiled and analyzed using various statistical techniques with SPSS software. The findings indicated that 60% of the agricultural extension workers had a moderate to low level of awareness regarding the significance of utilizing the growth regulator Brassinolide on sour orange trees. Additionally, there was a notable link observed between the agricultural extension workers' awareness in Kirkuk Province about the application of Brassinolide and factors such as years of experience, work location, and involvement in training courses. The study suggested organizing training sessions for agricultural extension staff to enhance their understanding of the importance of applying Brassinolide to sour orange trees.

Keywords: awareness, growth regulator Brassinolide, agricultural extension, sour orange trees, knowledge.

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INTRODUCTION

Sour orange (*Citrus aurantium* L.) trees are important citrus trees and are widely cultivated in various regions of the world. These trees are known for their many benefits. Their fruits are used in the production of juices, jams, and essential oils, while their leaves and flowers are also used in the medicinal and perfume industries. [1] To promote healthy growth and maximize the yield of sour orange trees, growers implement a variety of farming techniques designed to improve the surrounding environment and boost the trees' biological functions. One contemporary approach to support plant growth and development is the application of growth regulators. Brassinolides (BRs) are key steroidal growth boosters that significantly influence numerous physiological functions in plants, such as cell stretching, tissue formation, the creation of organs, and the ability to cope with different environmental challenges.. [2] Several recent studies have demonstrated the positive effects of spraying fruit trees with the growth regulator Brassinolide on improving vegetative growth, increasing flowering and fruit set, and improving fruit quality. [3] [4] To maximize the use of the growth regulator Brassinolide in sour orange orchards, agricultural extension employees

play a pivotal role in transferring knowledge and technical recommendations to farmers. Agricultural extension employees' awareness of the importance of these modern technologies and their benefits for the growth and productivity of sour orange trees represent the first step toward their widespread adoption and implementation [5]. The greater the awareness of agricultural extension employees of the importance of spraying the growth regulator Brassinolide, the more capable they will be of convincing sour orange orchard owners to adopt these modern agricultural practices, given their positive impact on improving the quality and quantity of production and, consequently, increasing economic returns. [6]

Convincing farmers to adopt new technologies requires a deep understanding of the tangible benefits of these technologies by agricultural extension employees, as well as the ability to communicate this information effectively and convincingly [7].

Agricultural extension employees' awareness of the latest research and developments related to the use of Brassinolide growth regulators on sour orange trees and other crops contributes to building their confidence in these technologies and enhancing their ability to provide sound and reliable technical recommendations to farmers [8]. Understanding the socioeconomic factors that influence farmers' decisions to adopt new technologies is also crucial to the success of agricultural extension efforts [9]. This includes their selection of extension methods that suit farmers' characteristics and contribute to raising their level of knowledge towards adopting modern agricultural technologies [10]. The level of agricultural extension employees' knowledge of the benefits of plant growth regulators (PGRs) is positively related to their recommendations to farmers to use them to improve crop productivity and quality. Continuous training plays an important role in enhancing this knowledge [11]. In a study on the level of knowledge and attitudes of agricultural extension employees toward the use of growth regulators in fruit production, it was found that the majority of employees have a positive awareness of their importance, but they face challenges in transferring this knowledge to farmers [12] [13]. These challenges may include the difficulty of convincing farmers and changing their attitudes toward adopting modern agricultural technologies and encouraging them to implement them on their farms [14] [15]. A previous study showed that agricultural extension employees' awareness of the nano-fertilization technology was moderate to weak, and that there was a significant correlation between their awareness of the nano-fertilization technology and the age and educational attainment of the respondents. This may represent a general pattern of awareness among employees in the province of other technologies, including the use of growth regulators [16].

Understanding the perspectives of agricultural extension employees is essential for developing effective extension programs that contribute to promoting the adoption of modern agricultural practices and improving the productivity of sour orange orchards in Kirkuk Province [17] [18]. This research aims to examine the awareness of agricultural extension employees in Kirkuk Province of the importance of spraying sour orange trees with the growth regulator Brassinolide, and them of the benefits of these technologies and their impact on the growth and productivity of sour orange trees, in addition to exploring the challenges and obstacles they may face in recommending their adoption to farmers.

By determining the level of awareness among agricultural extension employees of the importance of using the growth regulator Brassinolide, targeted training and awareness programs can be designed to enhance their knowledge and capabilities in this field. The results of this research can also contribute to guiding agricultural policies and strategies towards adopting sustainable technologies that contribute to achieving sustainable agricultural development in Kirkuk Province. [19] [20] Additionally, this research could encourage further studies on the impact of these technologies on local sour orange varieties and environmental conditions in Kirkuk Province.

The current study seeks to answer the following questions:

- Do agricultural extension employees in Kirkuk Province realize the importance of spraying sour orange trees with the growth regulator Brassinolide?
- What is the relationship between the awareness of agricultural extension employees in Kirkuk Province of the importance of spraying sour orange trees with the growth regulator Brassinolide and their distinctive characteristics (age, educational attainment, length of service, workplace, and Participate in a training course)?

Study Objectives:

The study seeks to achieve the following objectives:

First: - To identify the level of awareness of agricultural extension employees in Kirkuk Province of the importance of spraying sour orange trees with the growth regulator Brassinolide.

Second: - To study the correlation among the awareness of agricultural extension employees in Kirkuk Province of the importance of spraying sour orange trees with the growth regulator Brassinolide and their distinctive characteristics (age, educational attainment, length of service, workplace, and Participate in a training course).

Study Hypotheses:

The study tests the hypothesis that there is no significant relationship among the awareness of agricultural extension workers in Kirkuk Governorate of the importance of spraying orange trees with the growth regulator Bassinolide and

(age, educational attainment, length of service, place of work, and their participation in a training course).

Study Methodology:

The current study adopts a descriptive approach to attempt to uncover reality. This research approach contributes to providing detailed data and facts about the target group's awareness over a specific period of time [21]. Through this approach, the collected data and facts are carefully classified, processed, and analyzed, with the aim of extracting their meanings and arriving at comprehensive and accurate results and generalizations related to the phenomenon under study [22].

Study community and its sample:

The study included (60) employees, who are all employees working in agricultural extension who hold a preparatory agricultural certificate or higher, (35) employees from the extension department at the Kirkuk Agriculture Directorate Center, and (25) employees from the agricultural extension training center. (20) respondents were excluded from those who were part of the initial selection survey sample, which was chosen so that the final number of respondents would be (40) employees.

Preparing the questionnaire:

In order to gather research information, a survey was created that had two sections. The initial section gathered personal details about agricultural extension staff, such as their age, level of education, years in service, workplace location, and Participate in a training course. The following section featured a five-point Likert scale that included various items aimed at assessing agricultural extension employees' awareness of why it is important to apply the growth regulator Brassinolide on sour orange trees.

In the fields of psychology and social sciences, this measuring instrument is highly favored among researchers. Current studies in psychological and educational evaluations indicate that this kind of scale is not only straightforward to create but also easy to score, which makes it very useful for achieving research goals [23]. After the first draft of the questionnaire was completed, it was sent to experts in agricultural extension at the University of Kirkuk to assess its superficial validity. Furthermore, professionals in soil science, water management, horticulture, and landscape engineering examined it to judge its content validity. Following some adjustments based on their feedback and to ensure both stability and validity, a preliminary test was conducted with 20 randomly selected employees from the study's population. Using the split-half method, the scale was divided into two sets: one with odd-numbered items and another with even-numbered ones. The stability coefficient achieved was 0.88, reflecting the significance of applying the growth regulator Brassinolide to sour orange trees. Subsequently, the validity coefficient was determined by taking the square root of the stability coefficient, resulting in a validity score of 0.94. This indicates that the scale is valid and that the questionnaire is ready for data collection.

Measuring study Variables:

First: Independent Variables:

1. Age: It is measured by the number of HG years from the birth of the respondent until the time of collecting the research data.

2. Educational Attainment: Measured by levels (preparatory agricultural school, agricultural diploma, bachelor's degree, higher diploma, master's degree, doctorate), and assigned the following weights: 1, 2, 3, 4, 5, 6.

3. length of service: Measure by assigning one numerical value to each year of the respondent's employment.

4. Workplace: Measured by two levels (Agriculture Directorate / Extension Department, Extension Training Center), and given the weights of 2 and 1, in that order.

5. Participate in a training course: Measured by two levels (trainee, non-trainee), and assigned the following weights: 2 and 1, respectively.

Second: Dependent variable (agricultural extension employees' awareness of the importance of spraying sour orange trees with the growth regulator Brassinolide).

To measure the dependent variable, a five-point Likert-type scale consisting of 10 items was used. The alternatives (Fully aware, Aware, Neutral, Unaware and Completely unaware) were placed in front of each item, and weights were given to them (5, 4, 3, 2, 1), respectively. This means that the theoretical range of the scale ranges from (10-50) points, and the total score of the respondent's answers to the scale items indicates the degree of their awareness of the importance of spraying sour orange trees with the growth regulator Brassinolide.

Data Collection and Analysis:

Once the questionnaire was finished, data was collected through personal interviews with agricultural extension employees for the period from 15 December 2024 to 26 January 2025. The data was then transcribed, tabulated, and analyzed using the Statistical Package for Social Sciences (SPSS). Different statistical methods and tools were used to achieve the study's objectives, such as the range, Average, Pearson's correlation coefficient, Spearman's correlation coefficient, and the t-test.

Results and Discussion

First: To identify the awareness of agricultural extension employees in Kirkuk Province regarding the importance of spraying sour orange trees with the growth regulator Brassinolide.

The findings indicated that the least score for the awareness among agricultural extension workers regarding the significance of applying the growth regulator Brassinolide on sour orange trees was (28). In contrast, the highest score recorded was (50), yielding an average of (41.52) and a standard deviation of (6.83).

The participants were categorized into three groups based on the laws of range and length, and the findings can be seen in Table (1).

Table (1): Distribution of respondents according to their awareness of the importance of spraying sour orange trees with the growth regulator Brassinolide

Categories of awareness	No	%	Average level of awareness
(28-35)Weak awareness	9	22.5	32
(36-43) Average awareness	15	37.5	40
(44 or more)High awareness	16	40	48.31
Total	40	100	
Average = 41.52			Standard deviation = 6.83

The findings presented in Table (1) reveal that the largest portion of participants, making up (40%) of those surveyed, displayed a high level of awareness, with an average score of (48.31) points. Coming in second, the average awareness group represented (37.5%) of all participants and achieved an average score of (39.5) points. In contrast, those with low awareness accounted for the smallest share, at (22.5%), with an average awareness score of (32). This suggests that over half of the participants, totaling (60%), had a level of awareness ranging from average to low regarding the significance of applying the growth regulator Brassinolide on sour orange trees. This highlights the necessity for specialized training sessions for agricultural extension workers on the use of Brassinolide in fruit farming. Additionally, it is important to carry out field trials in collaboration with agricultural researchers to boost their understanding of Brassinolide, including Brassinolide, and their application on citrus plants.

Second: To study the correlation among the awareness of agricultural extension employees in Kirkuk Province of the importance of spraying sour orange trees with the growth regulator Brassinolide and their distinctive characteristics (age, educational attainment, length of service, workplace, and Participate in a training course).

1- Age: The results showed that the oldest participants were 54, while the youngest ones were only 23, leading to an average age of 35.88 and a standard deviation of 5.73. The participants were divided into three categories according to the length of the range and class time, with the outcomes displayed in Table 2.

Table (2) The relationship between the respondents' age and their awareness of the importance of spraying sour orange trees with the growth regulator brassinolide.

Age groups (in years)	Number	%	Average awareness	r value	Calculated t value	Significance level
Small(33-23)	14	35	42.5			
middle-aged(44-34)	23	57.5	41.78			
(45 or more) old	3	7.5	35			
Total	40	100				
Average = 35.88			Standard deviation = 5.73			

Table No. (2) shows that (57.5%) of the respondents were of middle-aged, ranging between (34-44) years, with an average awareness of (41.78) degrees regarding the importance of spraying sour orange trees with the growth regulator Brassinolide. The young age group came in first place with a percentage of (35%) and an average awareness of (42.5) degrees. As for the older age group, it came in last place with a percentage of (7.5%) of the total respondents and an average awareness of (35) degrees, which means that the majority of agricultural extension workers within the research sample are from the young age groups and are not more than 44 years old.

Pearson's correlation coefficient was used as a statistical tool to study the relationship between the age of agricultural extension employees in Kirkuk Province and their awareness of the importance of spraying sour orange trees with the growth regulator Brassinolide.

The r value was found to be (-0.272), indicating a negative correlation between the two variables, meaning that older people are less aware than younger people of the importance of spraying with the growth regulator. To confirm the significance of this relationship, the calculated t value was (1.742), which is not significant at either level. This indicates acceptance of the null hypothesis.

2- Educational attainment:

Table (3) The relationship between the respondents' academic attainment and their awareness of the importance of spraying sour orange trees with the growth regulator brassinolide.

Age Categories (years)	Number	%	Average awareness	r value	Calculated t value	Significance level
Agricultural Preparatory School	1	2.5	44			
Agricultural Institute	1	2.5	43			
Bachelor's	10	25	40.4			
Master's	26	65	41.76	0.009	0.055	n.s
PhD	2	5	42			
Total	40	100				

The findings in Table (3) indicate that the largest group of respondents holds a master's degree, accounting for (65%) of all respondents. Their level of knowledge regarding the significance of treating sour orange trees with the growth regulator Brassinolide had an average awareness score of (41.76). Following them, individuals with a bachelor's degree make up (25%) of the responses, with an average understanding of (40.4) concerning the importance of applying Brassinolide on sour orange trees. In contrast, the participants who possess either a preparatory agricultural certificate or an agricultural institute degree were the fewest, each representing (1%) of the total respondents, showing average awareness levels of (44 and 43) for the growth regulator Brassinolide and (50 and 45) for humic acid. This suggests that the majority of workers in agricultural extension have either a bachelor's or a master's degree.

Spearman's correlation coefficient was used to determine the relationship between the educational attainment of agricultural extension workers and their awareness of the importance of spraying sour orange trees with the growth regulator brassinolide. The r value was (0.009), which is not statistically significant at either level, while the calculated t value was (0.055). This indicates acceptance of the null hypothesis is accepted.

3- Length of Service:

The results showed that the longest service period for the respondents was (23) years, while the shortest service period was only one year, and the average service period was (4.025) years, with a standard deviation of (4.48). The respondents were divided into three categories Using the range and interval method, and the results were as shown in Table (4).

Table (4) The relationship between the respondents' length of service and their awareness of the importance of spraying sour orange trees with the growth regulator Brassinolide.

length of service Categories (years)	Number	%	Average awareness	r value	Calculated t value	Significance level
(8-1) Few	34	85	42.61			
(9-16) Medium	5	12.5	35.4			
(17-23) Long	1	2.5	35	-0.383	2.555	0.05
40				Average = 4.025 Standard deviation = 4.48		

Table (4) shows that (85%) of respondents have little to no more than 8 years of work experience. Their average level of awareness of the importance of spraying sour orange trees with the growth regulator Brassinolide was (42.61). The average length of service, ranging from (9-16) years, ranked second, representing (12.5%) of the total employees, with an average awareness score of (35.4). The percentage of respondents within the long-term service category was (2.5%) of the total employees, with an average awareness score of (35) for the growth regulator Brassinolide. This means that the majority of the respondents working in agricultural extension within the research sample have little to average work experience.

Pearson's correlation coefficient was used to determine the relationship between length of service and the awareness of agricultural extension workers of the importance of spraying sour orange trees with the growth regulator Brassinolide. The r value was (-0.383). To confirm the significance of the relationship, the calculated t value was (2.555), which is significant at the probability level of (0.05). This indicates acceptance of the null hypothesis and accepting the alternative hypothesis. This may be due to the fact that the length of service of agricultural extension workers does not reflect their familiarity with modern agricultural techniques. Rather, curiosity and learning are characteristics of young people with short experience, possibly due to the novelty of the information they acquired through their studies at agricultural colleges.

4- Workplace:

Sixty percent of the respondents work in the Extension Training Center, and their average awareness of the importance of spraying orange trees with the growth regulator Brassinolide was (38.5) points. While the percentage of respondents from the Kirkuk Agriculture Directorate was (40%), and their average awareness was (46.06) points. The respondents were divided into two categories, and the results are shown in Table (5).

Table (5) The relationship between the respondents' workplace and their awareness of the importance of spraying sour orange trees with the growth regulator brassinolide.

workplace Categories	Number	%	Average awareness	r value	Calculated t value	Significance level
Extension Center	24	60	38.5			
Directorate of Agriculture	16	40	46.06	0.549	4.049	0.01
Total	40	100				

Spearman's correlation coefficient was applied to assess how well agricultural extension employees' awareness of the importance of spraying sour orange trees with the growth regulator Brassinolide and their workplace. The r value was found to be (0.549). To confirm the significant relationship, a t-test was used as a statistical method. The calculated t value was (4.049), which is significant at the probability level of (0.01). This indicates acceptance of the null hypothesis, the alternative hypothesis was accepted.

This may be due to the fact that agricultural extension staff in the Extension Department of the Directorate of Agriculture are more in touch with their colleagues in other departments, such as the Plant Production Department, who are concerned with plant nutrition, or are exposed to specialized training courses in plant nutrition more than agricultural extension employees at the Extension Training Center, which increased their level of awareness of the importance of spraying sour orange trees with the growth regulator Brassinolide.

5- Participate in a training course:

Respondents were divided into two categories according to their Participate in a training course. The results are shown in Table (6).

Table (6) The relationship between the respondents' Participate in a training course and their awareness of the importance of spraying sour orange trees with the growth regulator brassinolide.

Training Categories	Number	%	Average awareness	r value	Calculated t value	Significance level
Untrained	18	45	38.61			
Trained	22	55	43.90	0.390	2.610	0.05
Total	40	100				

The results in Table (6) show that (55%) of the total respondents are trainees and their average awareness of the importance of spraying sour orange trees with the growth regulator Brassinolide was (43.90) degrees, while the percentage of non-trainees (45%) of the total respondents had an average awareness of the importance of spraying sour orange trees with the growth regulator Brassinolide was (38.61) degrees. This means that more than half of the agricultural extension employees in the research sample are participants in training courses related to the importance of Brassinolide. In order to identify the correlation between employees' awareness of the growth regulator Brassinolide and Participate in a training course,

The Spearman correlation coefficient value was (0.390). To confirm the significance of the relationship, the calculated t value was (2.610), which is statistically significant at a significance level of 0.05. This indicates acceptance of the null hypothesis. This may be due to the fact that Participate in a training course on the importance of Brassinolide has led to raising the awareness of agricultural extension employees of the importance of using them in sour orange orchards.

Conclusions

From the above, researchers concluded the following:

1. The awareness of agricultural extension employees in Kirkuk Province of the importance of spraying sour orange trees with the growth regulator Brassinolide is described as medium to weak, indicating the need to raise their awareness of the importance of using Brassinolide in agriculture.
2. Young individuals have a better understanding of contemporary farming methods, such as the application of growth enhancers in agriculture, highlighting the need for their participation in outreach initiatives designed to share farming

practices with sour orange growers and motivate them to adopt these methods.

3. The average awareness of extension employees in the Extension Department of the Kirkuk Agriculture Directorate was higher than that of agricultural extension employees. This suggests that their opinions and knowledge may be influenced by their contact with plant nutrition specialists in other departments of the directorate.
4. Participate in a training course has improved the awareness of agricultural extension employees, which necessitates the holding of functional training courses to raise the level of knowledge of agricultural extension employees and develop their skills in the use of plant Brassinolide.

Recommendations

Researchers recommend the following:

1. It is recommended to hold developmental training courses for agricultural extension workers to enhance their knowledge and skills on the importance of using plant Brassinolide, including those for bitter orange trees.
2. The Agricultural Extension and Training Department should focus on young agricultural extension workers in organizing extension activities to disseminate modern agricultural technologies among farmers.
3. It is important to cooperate and coordinate between the Agricultural Extension Department in the Kirkuk Agriculture Directorate and the Extension Training Center, and to communicate with other administrative units in the directorate to exchange ideas and participate in all activities related to the dissemination of modern agricultural technologies.

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إدراك العاملين في الارشاد الزراعي بمحافظة كركوك لأهمية رش أشجار النارنج بمنظم النمو

Brassinolide.

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³ قسم البيئة وهندسة الحدائق، كلية الزراعة، جامعة كركوك، كركوك، العراق.

الخلاصة

تهدف الدراسة الى التعرف على مستوى إدراك العاملين في الارشاد الزراعي بمحافظة كركوك لأهمية رش أشجار النارنج بمنظم النمو، فضلاً عن التعرف على العلاقة الارتباطية بين إدراك العاملين في الارشاد الزراعي بمحافظة كركوك لأهمية رش أشجار النارنج بمنظم النمو وكل من المتغيرات الآتية: (السن، والتحصيل الدراسي، ومدة الخدمة الوظيفية، مكان العمل، والمشاركة في الدورات التدريبية)، شملت الدراسة جميع الموظفين العاملين في الارشاد الزراعي في قسم الارشاد بمركز مديرية زراعة كركوك والمركز التدريبي الارشادي والبالغ عددهم (60) موظف، وقد استبعد (20) منهم بعد ان شملتهم العينة الاستطلاعية وبذلك أصبح عدد المنشولين بجمع بيانات الحيث 40 موظفاً عاملًا في الارشاد الزراعي، تم جمع بيانات الدراسة باستخدام استبيان تكونت من جزئين، تضمن الجزء الأول منها مجموعة من الأسئلة للتعرف على بعض الخصائص المميزة للمبحوثين، في حين تضمن الجزء الثاني مقياساً من نوع ليكert الخماسي يتكون من (10) فقرات، تم جمع بيانات الدراسة بالمقابلة الشخصية وتم تبويتها وتحليلها باستخدام مجموعة من الوسائل الإحصائية باستخدام برنامج SPSS.

وأظهرت النتائج إن (55%) من المبحوثين العاملين في الارشاد الزراعي كان ادراهمهم لأهمية استخدام منظم النمو براسينوليد على أشجار النارنج الفتية متوسط إلى ضعيف، كما أظهرت النتائج وجود علاقة ارتباط معنوية بين إدراك العاملين في الارشاد الزراعي بمحافظة كركوك لأهمية رش أشجار النارنج بمنظم النمو براسينوليد وبين كل من (مدة الخدمة الوظيفية، ومكان العمل، والمشاركة في الدورات التدريبية)، واوصت الدراسة بضرورة إقامة دورات تدريبية وظيفية للعاملين في الارشاد الزراعي لتوسيعهم بأهمية رش أشجار النارنج بمنظم النمو.

الكلمات المفتاحية: الإدراك، منظم النمو براسينوليد، الارشاد الزراعي، أشجار النارنج، المعرفة.