Knowledge and implementation of citrus growers concern recommendations reducing harmful impacts of pesticides in Al-Bustan region, Nubaria, Beheira Governorate

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ABSTRACT

The study aimed to identify knowledge and implementation levels of citrus growers concern recommendations to reduce the harmful effects of pesticides, and determine the relationship between each of degree of their knowledge and implementation as dependent variables with some studied independent variables.

This study was conducted in three agricultural co-operatives that commonly cultivate citrus fruits.

Sample size of respondents (256), were subjected to questionnaire through personal interviews during autumn 2019, and data were analyzed by using the Social Sciences Statistical Package (SPSS).

The results showed that, 59.0% of the respondents have moderate level of knowledge and 58.6% of them were of moderate levels of implementation for the recommendations to reduce adverse impact of pesticides. Furthermore, 50.0% of them have moderate level of agricultural experience, and 35.6% of them have moderate level of experience in pesticides practice. Positive relationship at 0.01 level was found between each of the degree of knowledge and implementation of the respondents and each of respondents' age, education, agricultural experience,

experience in pesticides practice, landholding, productivity average of citrus crop, the purpose of citrus cultivation, agricultural training courses, training courses in pesticide practices, the degree of formal social participation, and the degree of benefit from information sources.

Keywords: Knowledge; implementation; citrus growers; pesticides; Al-Bustan region; Beheira Governorate

Introduction

Food production is central to agricultural activities and this preserves the human being; therefore, in order to improve and maintain this important product, people have done a lot of things to increase and improve food production to meet their needs, Improving agriculture takes different forms and people have devised many strategies and methods to improve agriculture and its productivity to meet human needs (Matthews and Adesope 2008, P: 114). Pesticides have become an integral part of the agriculture sector and play a key role in increasing agricultural productivity (Jallow et al. 2017, P: 1). People in many developing countries even in some developed countries use unsafe methods in pesticides handling; thus, understanding farmer's knowledge of pesticides and safety practices is vital to provide valuable information aims to prevent or reduce the health and environmental hazards of pesticides (Sai et al. 2019, P: 32). Van Den Ban and Hawkins (1988, P: 79) mentioned that, acquisition of knowledge and development of understanding are the result of receiving extension advice. and it appears that there is a great importance of agricultural extension as a service educational device aims to solve the problems of low agricultural productivity and resisting pests and diseases through efforts educational guidance (Mahrous 2015, P:226).

Citrus fruits are considered one of the major crops in the world with global availability and popularity contributing to human diets (Liu et al. 2012,

P: 530). Egypt is one of the largest citruses producing countries, where the production reached 4.675.660 tons during 2018 (FAO 2020). There are many insect pests attack citrus and cause the fruit to be inedible, identifying these pests is the first step to produce healthy and delicious fruits (Kamel 2010, P: 107). Pest control represents one of the most important factors affecting the agricultural production, because it protects crops and thus achieves a satisfying outcome (APC 2017, P : 5). Generally, Vegetable and fruit crops are one of the most pesticide-consuming crops after corn crop in the world (Abdul Majeed 2013, P: 4). Chemical control is defined as the means by which chemicals or so-called pesticides are used when natural factors fail to control, and it is also defined as a chemical that is treated separately or mixed with other materials for the purpose of killing, preventing, removing, or reducing harms of pest infection (APC 2017, P: 20). Arab countries consume many types of pesticides in large quantities, even their use is increasing day by day, and the tendency for quick and abundant profit for many farmers is behind the conversion of many farms to fields pumping with multiple and dangerous chemicals (Ibrahim 2008, P: 68). Herbicides are the first in terms of global pesticides consumption in the agricultural sector, followed by insecticides and fungicides, the consumed amount of pesticides is about 5.2 million tons, where more than 85% is consumed in the agricultural sector (Abdul Majeed 2013, P: 2- 4).

The extensive and inefficient use of pesticides over the last several decades resulted in serious soil and water contamination and consequently led to toxic effects on living organisms (Liu et al. 2018, P: 60). Pesticides are responsible for 200.000 deaths every year from acute poisoning of which 99% are in developing countries, where health safety and environmental regulations are weaker and less stringent in terms of application, Also, it was found that, there is a link between exposure to pesticides and diseases e.g. cancer, Alzheimer's, hormone disorder,

developmental disorders and sterility, And pesticides may cause many neurological health effects such as memory loss, low visual ability, and decreased motor skills, It has other effects such as asthma, allergies, and their chronic effects may not appear for months or years after exposure (UN 2017, P: 3 - 6). To achieve the benefits of pesticides in the agricultural revival it is necessary to use synthetic pesticides in a sound scientific manner because of the high cost of their production in addition to lacking opportunities to obtain new compounds, without ignoring the fact that all pesticides are toxic substances that vary in toxicity according to their composition, and then we do not expect them to be harmless and it is difficult to find a balance between the benefits on one side and the risks on another side; therefore, decision is difficult to make in these extremely complex circumstances, and the solution remains always in deciding the considered decision, while trying to achieve a balance between benefits and risks (APC 2017, P: 20).

The study was conducted to achieve the following objectives:

1- Identify the level of knowledge of respondent citrus growers with recommendations to reduce the harmful effects on human health and environment associated with using pesticides

2- Identify the level of implement of respondent citrus growers with recommendations concern the above goal, and

3- Determine the relationship between the degree of each of knowledge and implement of respondent citrus growers as described above as dependent variables and the studied independent variables.

Materials and Methods

Significance of the research

The findings may assist in planning extension program to increase farmers' knowledge of recommendations to reduce human health and environmental harmful impact of pesticides.

The study hypotheses

To achieve the third objectives of the study, the following hypotheses were set:

1) There are correlations relationship between the degrees of respondents knowledge of recommendations to reduce human health and environmental harmful impact of pesticides as a dependent variable and each of the following independent variables: age, the respondent's education level, family size, family employment, the spending time on agricultural work, agricultural experience, experience in pesticide practices, landholding, productivity average of citrus crop, purpose of citrus cultivation, knowledge of citrus-pests infesting, satisfaction of economic return, number of the agricultural training courses, number of the training courses in pesticide practices, degree of formal social participation, varied of agriculture activities, and the degree of benefit from information sources as independent variables.

2) There are correlations relationship between the degree of respondents' implement of recommendations to reduce human health and environmental harmful impact of pesticides as a dependent variable and each of the above independent variables. These assumptions were tested using null hypotheses.

Quantitative processing of variables

First: Independent variables

1- The respondent's age: Measured by asking respondents about their age (complete years).

2- The degree of education of respondents: It was measured by giving the respondent one degree for each school year successfully completed, giving the illiterate zero, and the respondents who can read and write 4 degree.

3- Family size: Number of members of the respondent's family.

4- Family employment: Number of members of the respondent's family who help him in agricultural work.

5- The spending time on agricultural work: full time (5) 3/4 time (4) 1/2 time (3) 1/4 time (2) Rarely (1).

6- Agricultural experience: Number of years of respondents in agricultural work.

7- Experience in pesticide practices: Number of years of respondents in pesticide practices.

8- Landholding: The total area allocated to the cultivation of citrus by the respondent, measured in feddan.

9- Productivity average of citrus crop: It is the production average of each feddan of citrus estimated in tons.

10- Purpose of citrus cultivation: The purpose of grow citrus, whether for export, local market or both, and the degree were given 3, 2, 1 according to their answers, export, export and local market, and local market, respectively.

11- Knowledge of citrus-pests infesting: Knowledge of the respondents with the pests that affects the citrus where gave one degree on each correct answer.

12- Satisfaction of economic return: The degree of satisfaction of the respondents on the economic return of the citrus was measured by giving a score out of 10 degrees about his satisfaction according to his point of view.

13- Number of the agricultural training courses: Rough Number of agricultural courses which received by respondent.

14- Number of the training courses in pesticide practices: Rough Number of the training courses in pesticide practices which received by respondent.

15- Degree of formal social participation: Participation of official social respondents whether he is an ordinary member, board member, chairman where given 1, 2, 3 degree respectively.

16- Varied of agricultural activities: It is mean agricultural activities carried out by respondent (field crops, vegetable crops, fruit, poultry, farm animals, rabbits, bees taking care) and has given one degree about every activity.

17- The degree of benefit from information sources: It means the degree of benefit from information sources about pesticides using; it was measured by giving a score out of 10 degrees according to respondent's point of view from each source of information which the respondent is exposed to, and then they were collected to express the overall degree of benefit from information sources.

Second: The two dependent variables

1- First dependent variable: The total degree of knowledge of citrus growers with recommendations to reduce the harmful effects on human health and environment associated with pesticides using. Measured by giving knows (1) degree and doesn't know (0) degree about each recommendation.

2- Second dependent variable: The total degree of implementation of citrus growers with recommendations to reduce the harmful effects on human health and environment associated with pesticides using. Measured by giving always (3) sometimes (2) seldom (1) none (0) degree.

The study area

Beheira Governorate was chosen to conduct the study, because it is considered one of the largest agricultural regions in Egypt, including El-Nubaria region, which is the first in terms of area and production of citrus fruits. Al-Bustan region was chosen, because it is one of the most important areas that grow these crops, amounted to 15425.25 feddan, represent 66.2% of the total cultivated area in Al-Bustan (Egyptian Ministry of Agricultural Report 2019). Three villages were randomly selected. Then an agricultural co-operative association was randomly selected from each of the three selected villages, where each village includes two agricultural co-operative societies as follows: Shabab Al-Bustan affiliated to Al-Sharawi Village (Zone 1), Imam Al-Shafi'i in the village of Imam Al-Ghazali (Zone 2) and Muhammad Refaat in the village of Muhammad Refaat (Zone 3).

The Study Sample

The sample of study was 256 respondents selected randomly from all zones according to formula (Krejcie and Morgan 1970, P: 607-610).

Data Collection Tools

Data were collected using a questionnaire by personal interviews. The questionnaire contained personal and socio- economic data of the respondent, and a set of recommendations to reduce the harmful environmental and human health effects of pesticides. Data were collected during autumn 2019.

Data analysis

Excel programs and Statistical Package for the Social Sciences (SPSS) were used to analysis and present data; Range, Arithmetic mean, Standard deviation, Simple correlation coefficient.

Results and discussion

Description of the studied sample

Figure (1) revealed that, 49.6% of the respondent farmers were over 47.0 years old, 55.9% of them had moderate level in education, 68.8% had family size (<7 individuals), 52.7% of the respondents had low family employment (1-3 individuals), most of the respondent farmers (80.1%) were full-time agriculture work, 50.0% had moderate level of agricultural experience, 35.6% with moderate level in experience of pesticide practices, 83.6% of them had landholding <7 feddan, 72.6% with moderate level of citrus productivity (9-17 ton), 45.3% intended the purpose of their cultivation of citrus for local markets, while 14.9% of them had purpose for export, 82.4% with moderate level of knowledge of pests infesting citrus fruits, most of respondent farmers (66.8%) had moderate level of satisfied of economic return, 55.9% did not received any agricultural training courses, the majority (70.7%) of the respondent farmers had not received any training in pesticide practices, while 1.2% were highly trained, majority (82%) of them with low level of formal social participation, 65.6% with low level of varied of agricultural activity (<3), and 68.4% of respondents with low level of benefit from information sources.

The level of the respondents' knowledge of the recommendations to reduce harmful human health and environmental impact of pesticides

The present findings indicated that most of the respondent farmers (59.0%) were of moderate levels of knowledge for the recommendation to

reduce harmful health and environmental impacts of pesticides (Table 1). In a similar finding, Embark and Mahmoud (2015, P: 122-123) indicated that 68.6% of respondents had a moderate level of knowledge of practices to rationalize pesticide in tomato pests control.

The level of the respondents' implementation of the recommendations to reduce harmful human health and environmental impact of pesticide

The present findings indicated that, most of the respondent farmers (58.6%) with moderate level of implementation of the above recommendations, while 13.3% of them with high level (Table 2). These results are in accordance with that obtained by Abdullah (2017, P: 86), where 71.8% of the respondents with moderate level of implementation of the technical recommendation for chemical control of pests in corn plants.

Relationship between respondent's knowledge and some independent variables.

The results showed that, there was a significant relationship between degree of the respondents' knowledge of the recommendations to reduce harmful human health and environmental impact of pesticides as a dependent variable and some independent variables (Table 3). It represents a statistically significant relationship at 0.01level between the degree of knowledge as a dependent variable and some independent variables as follows: respondent's age, [correlation coefficient (r)=0.336^{**}], education (r= 0. 371**), agricultural experience (r=$0.\ 0.251^{**}$), experience in pesticide practices (r=0.259^{**}), landholding (r=0.220^{**}), average of citrus productivity (r=0.284^{**}), purpose of citrus cultivation (r=0.364^{**}), number of agricultural training courses (r=0.427^{**}), number of training courses in pesticide practices (r=0.449^{**}), formal social participation (r=0.275^{**}), and degree of benefit from information sources (r=0.528^{**}). While, there is no statistically significant relationship at any of the two probability levels 0.01 and 0.05

with variables of family size, family employment, The spending time on agricultural work, knowledge of pests infesting citrus fruits, satisfaction of the economic return, varied of agricultural activities. Where simple correlation degree are -0.041,-0.121, 0.009, 0.088, 0.069, 0.023 respectively. The present results are in accordance with that obtained by El-Sebaey and Hashim (2014, P:1982), where there was relationship between the degree of knowledge of respondents farmers concerning the technical recommendations of citrus production and marketing, and each of size of agricultural land tenure, and education. Also, a study by Sharaf El-Din and Farag (2006, P: 63) found that there was a relationship between the degree of respondents' knowledge regarding technical recommendations for controlling onion pests and the number of years of respondents in crop planting. There was relationship between respondent's knowledge level concerning orange physiological disorders and agricultural cultivated land, size orange farm, number of respondent's experience years in orange cultivation, and orange productivity average (Sokar and Zayed 2017, P:68).

Also, there was relationship between respondents' knowledge degree concerning maize pest management recommendations and degree of formal participation and degree of exposure to information resources (Rageh 2014, P: 12). However, there was relationship between knowledge degree concerning Artichoke post-harvest recommendations and respondents' goal of growing Artichoke (Elghazaly 2011, P: 784). There was a relationship between the degree of respondents' knowledge of control method for the tomato insect, Tuta absoluta and average of tomato productivity (Zayed 2017, P: 658 - 659). Elsaey et al. (2017, P: 724) stated that, there was relationship between fishermen's knowledge of fishing laws and regulatory decisions for fishing process and attending training courses. Based on these findings, the previous null hypothesis can be refuse and the researcher hypothesis can be accepted for each of the

independent variables with a statistically significant correlation, farmer's age, educational, agricultural experience, experience in pesticide practices, landholding, average of citrus productivity, purpose of citrus cultivation, agricultural training courses, training courses in pesticide practices, formal social participation , and degree of benefit from information sources, while null hypothesis can't be refused for the variable of the spending time on agricultural work, knowledge pests infesting citrus fruits, satisfaction with the economic return, varied of agricultural activity, family size and family employment.

Relationship between Respondents implementation and some independent variables.

Table 4 represents a statistically significant relationship at 0.01 level between the degree of implementation of the respondents to recommendations for reducing human health and environmental harmful impact of pesticides as a dependent variable and some independent variables. Respondent's age, [correlation coefficient (r)= 0.373^{**}], education (r= 0.292^{**}), agricultural experience (r=0. 0.289^{**}), experience in pesticide practices (r=0.314^{**}), landholding (r=0.266^{**}), average of citrus productivity (r=0.302^{**}), purpose of citrus cultivation (r=0.375^{**}), number of agricultural training courses (r=0.381^{**}), number of training courses in pesticide practices (r=0.398^{**}), formal social participation (r=0.207^{**}), and degree of benefit from information sources (r=0.531^{**}). While, there is no statistically significant relationship at any of the two probability levels 0.01 and 0.05 with variables of family size, family employment, the time spending on agricultural work, knowledge of pests infesting citrus fruits, satisfaction of the economic return, varied of agricultural activities, Where simple correlation degree are 0.018, −0.109, 0.044, 0.107, 0.111, 0.022 respectively. This is consistent with study by Habib et al (2016, P: 222). The results showed

that the degree of implementation of citrus growers was of a positive correlation with cultivated area, years of experience in citrus cultivation, degree related category education, and the degree of exposure to sources of agricultural information. Also, these findings are consistent with a study by El-Sebaey and Hashim (2014, P:1984), where it was found that there is a relationship between the degree of implementation of respondents farmers concerning the technical recommendations for the production and marketing of citrus crops and the size of agricultural land tenure. Also, there was relationship between respondents' implementation degree concerning maize pest management recommendations and degree of formal participation and degree of exposure to information resources (Rageh 2014, P: 12-13). There was a relationship between the degree of respondents' implementation of control method for the tomato insect, *Tuta absoluta* and average of tomato productivity (Zayed 2017, P: 665). Elsaey et al (2017, P: 726), showed that there was relationship between fishermen's implementation of fishing laws and regulatory decisions for fishing process and attending training courses. Based on these findings, the previous null hypothesis can be refuse and the researcher hypothesis can be accepted for each of the independent variables with a statistically significant correlation, farmer's age, educational, agricultural experience, experience in pesticide practices, landholding, average of citrus productivity, purpose of citrus cultivation, agricultural training courses, training courses in pesticide practices, formal social participation, and degree of benefit from information sources, while null hypothesis can't be refused for the variable of the spending time on agricultural work, knowledge pests infesting citrus fruits, satisfaction with the economic return, varied of agricultural activity, family size and family employment.

Distribution of the respondents according to their knowledge of the recommendations for reducing harmful human health and environmental impact of pesticides

Regarding the respondent's knowledge of each of the recommendations related to reducing harmful human health and environmental impacts of pesticides, the recommendations were divided into five main axes as shown in Figure 2. It was found that, the farmers' knowledge of the recommendations regarding the precautions to be observed when preparing the spray solution ranged from 85.2% to 43.4% (Figure 2a), as follows: Reading of pesticide instruction (85.2%), Correct preparation of wettable powder (WP) solutions (79.7%), And correct preparation of emulsion (EC) solutions (43.4%). As for the recommendations regarding precautions during the spraying process, they ranged from 94.9% to 65.6%, as follows: Correct spray practice (workers or machines proceed in a regular way) (94.9%), Good timing of spraying (92.2%), Avoid spray in thirst fields (92.2%), Avoid use salt water in solutions (91.1%), Consuming the amount of the spray solution to a specific area standard (89.5%) and optimum spray distribution (86.7%), Cleaning of machine after application (83.9%), Estimation of spray volume (82.8%), Good storage of spray machine (82.4%), Use sticks to mix pesticide (80.1%), Don't use the pesticide machine in herbicide application (78.9%), Avoid spraying during flowering (68.8%), And use recommended rate of pesticide (65.6%) (Figure 2b).

As for the respondents' knowledge of the precautions for protection against pesticide poisoning (Figure 2c), they ranged from 97.3% to 12.9% as follows: Avoid throwing residue of spray solutions into the irrigation canals and drainage (97.3%), Do not use empty containers in food and / or drinks (92.6%), Avoid using weeds of treated fields as animal foodstuff

(92.6%), Safe disposal of washing water (91.4%), Exclude farm animals while spraying pesticide (90.6%), Close pesticide containers well during transport (90.2%), Keep pesticides in the original container (89.1%), Spray in the direction of the wind (87.9%), clean of pesticide-contaminated clothing separately (87.1%), Avoid eating, drinking and smoking during handling (83.9%), Harvesting fruits after permissible safety period (82.4%), And don't wash pesticide-contaminated clothing in the surface water (81.3%). Avoid transfer of pesticides with foodstuffs (77.3%).

Moreover, the respondents displayed the following knowledge: Using a long arm sprinkler to spray trees (75.0%), Not Repeat application of the same pesticide (73.1%), Stop working inside the sprayed parts until the pesticide dries (70.3%), Healthy applicators (67.6%), Avoid squatting under trees while spraying (65.6%), Applicators does not have wounds (59.4%), Avoid breathing gases of the opening container (46.1%). Gradually open the pesticide container (42.9%), Avoid touching face during spraying (42.6%), Period of spraying work did not exceed 6 hr (41.8%), Use the personal protective equipment (gloves, mask, rubber shoes) (38.7%), Annual examination of applicator's health status (25.0%), Presence of first aid kit while spraying (15.6%), And put of signs on the sprayed areas (12.9%).

As for the respondents' knowledge of the precautions to be observed when storing pesticides (Figure 2d), they ranged from 56.6% to 6.3% as follows: Store pesticides separately from the housing (56.6%), carry out an inspection on the pesticides container during the storage to detect a leakage or damage (37.9%), Store of each type of pesticide separately (33.6%), Pesticide stores should be opened gradually when bringing pesticides (32.4%), Not entering the stores immediately after opening them (28.9%), Storage place only for pesticide (28.1%), The necessity of taking

precautions for fighting fires (23.1%), Store pesticides off the ground on wooden floors or shelves (15.2%), Pesticide storage areas are marked with signs (10.2%), And use some materials to remove pesticide leakage (6.3%).

As for the respondents' knowledge of the precautions that must be taken into consideration when disposing the empty pesticide container (Figure 2e), they ranged from 94.1 to 11.7% in the order: Washing empty pesticide container and putting washing water in spray machine (94.1%), Safe disposal of small empty container (31.2%), And safe disposal of large empty container (11.7%).

Distribution of the respondents according to their implementation of the recommendations for reducing harmful human health and environmental impact of pesticides

Regarding the respondents' implementation of each of the recommendations related to reducing the harmful effect of human health and environmental pesticides, the recommendations were divided into five main axes as shown in Table 5. It was found that, the farmers always implement the recommendations for the precautions that must be taken into account when preparing the spray solution ranged from 60.2% to 27.3% as follows: Farmers read the instructions on pesticide containers (58.6%), correct preparation of wettable powder (WP) solutions (60.2%) and correct preparation of emulsion (EC) solutions (27.3%).

As for the recommendations for precautions during the spraying process, they ranged between 85.1% and 20.3% as follows: Correct spray practice (workers or machines proceed in a regular way) (76.1%), Avoid spray in thirst fields (85.1%), Good timing of spraying (70.3%), Avoid use salt water in solutions (43.7%), Consuming the amount of the spray solution to a specific area standard (55.9%), Optimum spray distribution (53.5%),

Cleaning of machine after application (58.9%), Estimation of spray volume (43.4%), Use sticks to mix pesticide (60.9%), Do not use the pesticide machine in herbicide application (50.8%), Good storage of spray machine (58.2%), Avoid spraying during flowering (26.6%), And use recommended rate of pesticide (20.3%).

As for the precautions to prevent the risk of poisoning with pesticides, they ranged from 95% to 3.1 % as follows: Avoid throwing residue of spray solutions into the irrigation canals and drainage (95.0%), Do not use empty containers in food and / or drinks (89.1%), Avoid using weeds of treated fields as animal foodstuff (87.9%), Safe disposal of washing water (88.3%), Exclude farm animals while spraying pesticide (79.3%), Close pesticide containers well during transport (84.4%), Spray in the direction of the wind (69.5%), Keep pesticides in the original container (74.6%), Clean of pesticide-contaminated clothing separately (78.5%), Avoid eating, drinking and smoking during handling (69.5%), Avoid transfer of pesticides with foodstuffs (37.1%), Don't wash pesticide-contaminated clothing in the surface water (69.1%), Harvesting fruits after permissible safety period (51.6%), Using a long arm sprinkler to spray trees (58.6%), Not repeat application of the same pesticide (53.9%), Stop working inside the sprayed parts until the pesticide dries (50.0%), Healthy applicators (44.9%), Avoid squatting under trees while spraying (30.9%), Applicators does not have wounds (18.8%), Avoid breathing gases of the opening container (18.0%), Gradually open the pesticide container (23.1%), Period of spraying work did not exceed 6 hr (25.4%), Avoid touching face during spraying (7.4%), Use the personal protective equipment (gloves, mask, rubber shoes) (3.1%), Annual examination of applicator's health status (8.6%), Presence of first aid kit while spraying (6.3%), And put of signs on the sprayed areas (6.6%).

As for the precautions to be observed when storing pesticides, they ranged from 49.2% to 5.1% as follows: Store pesticides separately from the housing (49.2%), carry out an inspection on the pesticides container during the storage to detect a leakage or damage (31.7%), Store of each type of pesticide separately (22.7%), Pesticide stores should be opened gradually when bringing pesticides (12.5%), Not entering the stores immediately after opening them (10.9%), Storage place only for pesticide (19.2%), The necessity of taking precautions to fight fires (17.6%), Store pesticides off the ground on wooden floors or shelves (11.7%), Pesticide storage areas are marked with signs (7.8%), And use of some materials to remove pesticide leakage (5.1%).

As for the precautions that must be taken into account when disposing of empty pesticide containers, they ranged from 87.5% to 3.1% as follows: Washing empty pesticide container and putting washing water in spray machine (87.5%), Safe disposal of small empty container (21.1%), And safe disposal of large containers (3.1%).

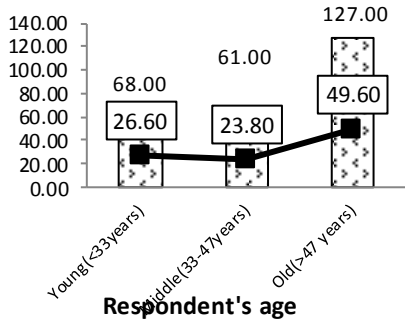
Conclusion and recommendations

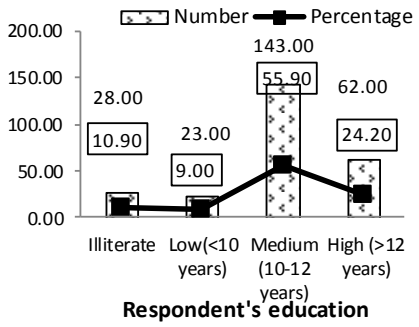
The results showed that, 59.0% of the respondents with moderate level of knowledge and 58.6% of them with moderate level of implementation of the recommendations to reduce the health and environmental harmful impact of pesticides, among citrus growers of Al-Bustan region. Also results showed that less than 50% respondent know the recommendations concerning Avoid breathing gases of the opening container, Gradually open the pesticide container, Avoid touching face during spraying, Period of spraying work did not exceed 6 hr, Use the personal protective equipment (gloves, mask, rubber shoes), Annual examination of applicator's health status, Presence of first aid kit while spraying, And put of signs on the sprayed areas, carry out an inspection on

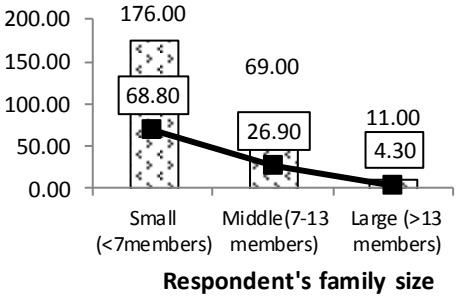
the pesticides container during the storage to detect a leakage or damage, Store of each type of pesticide separately, Pesticide stores should be opened gradually when bringing pesticides, Not entering the stores immediately after opening them, Storage place must be for pesticide only, The necessity of taking precautions for fighting fires, Store pesticides off the ground on wooden floors or shelves, Pesticide storage areas are marked with signs, And use some materials to remove pesticide leakage, Safe disposal of small empty container, And safe disposal of large empty container. Therefore, it is necessary to plan extension programs to raise their knowledge level about that recommendations. Because the study results showed that, there are a statistically significant correlation between the degree of knowledge of recommendations to reduce the health and environmental harmful impact of pesticides and number of training courses received in pesticide practices.

Figure

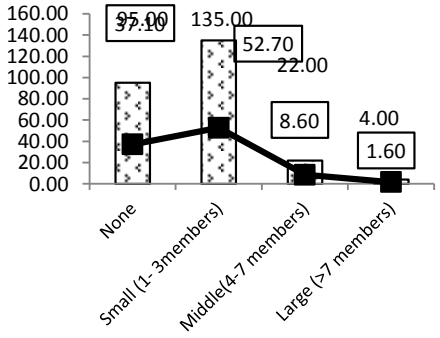
Figure 1: Distribution of citrus respondent growers based on socio-economic characteristics (n=256)



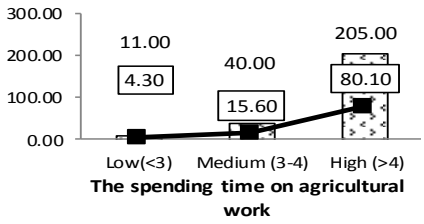




Respondent's family size



Respondent's family employment



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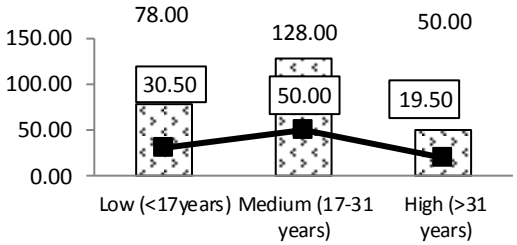
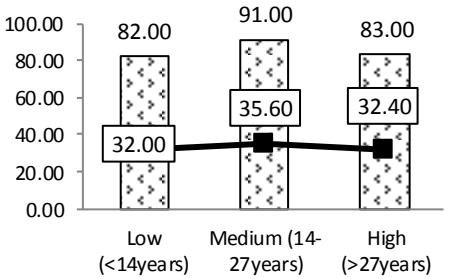
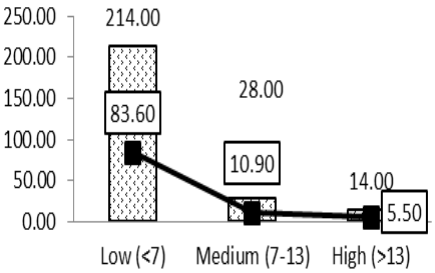


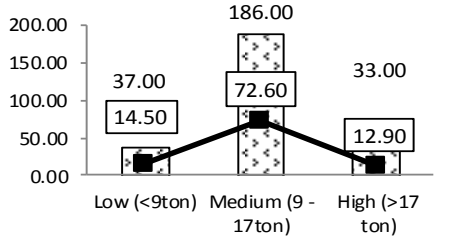
Respondent's agricultural experience



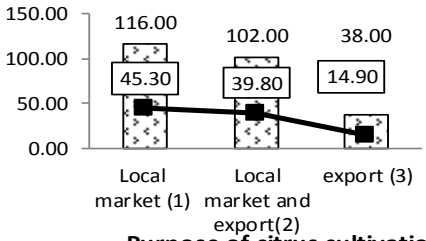
Respondent's experience in pesticide practices



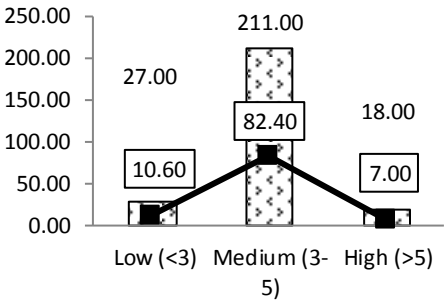
Landholding



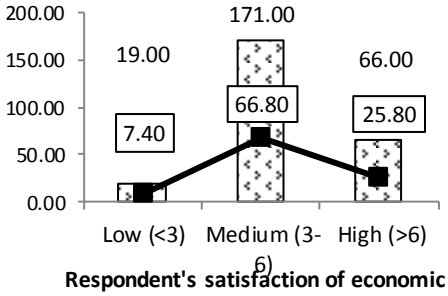
productivity average of citrus crop



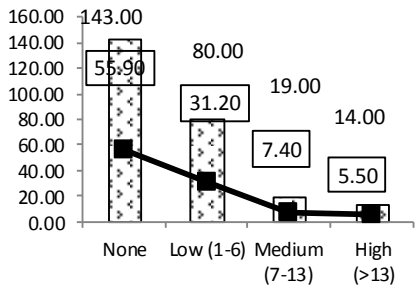
Purpose of citrus cultivation



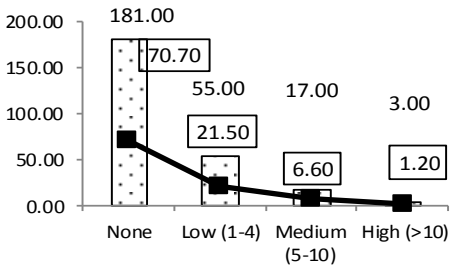
Respondent's knowledge of citrus crop pests



Respondent's satisfaction of economic return



Number of agricultural training courses



Number of the training courses in pesticide

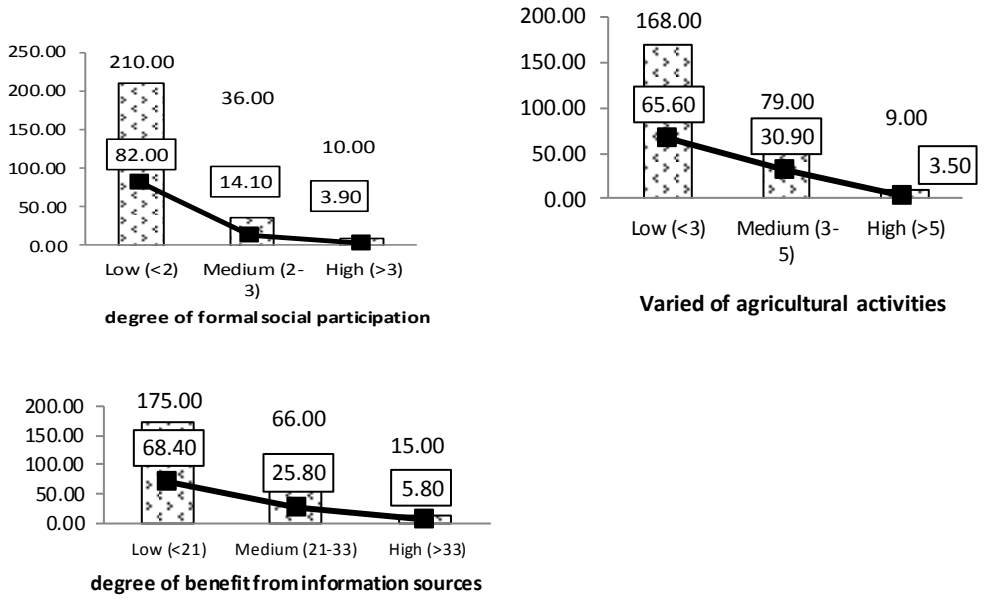
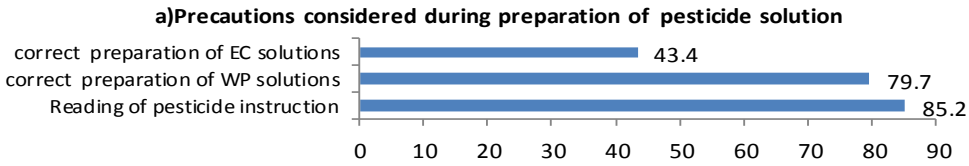
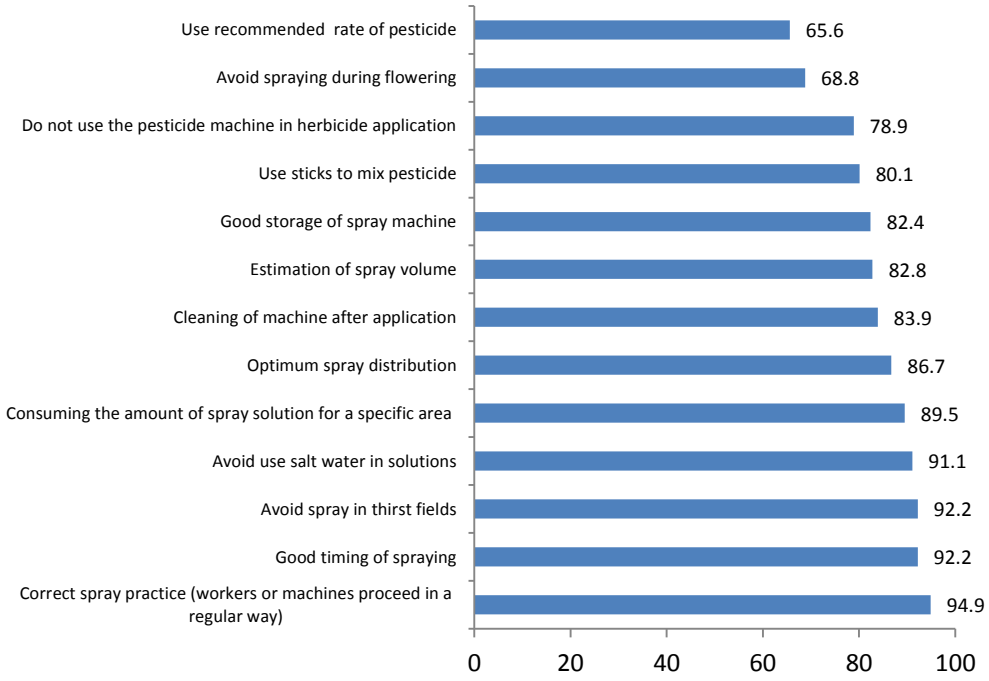


Figure 2: Distribution of the respondents according to their knowledge of the recommendations for reducing harmful impact of pesticides



b) Precautions considered during spraying



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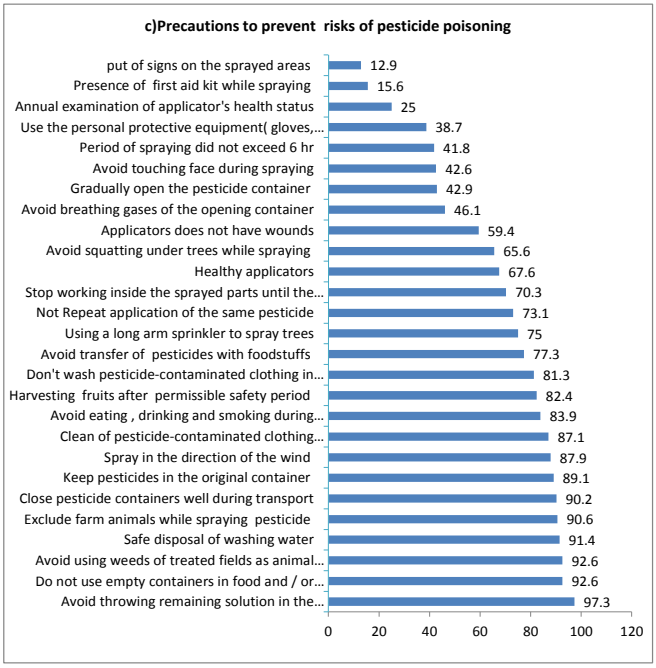
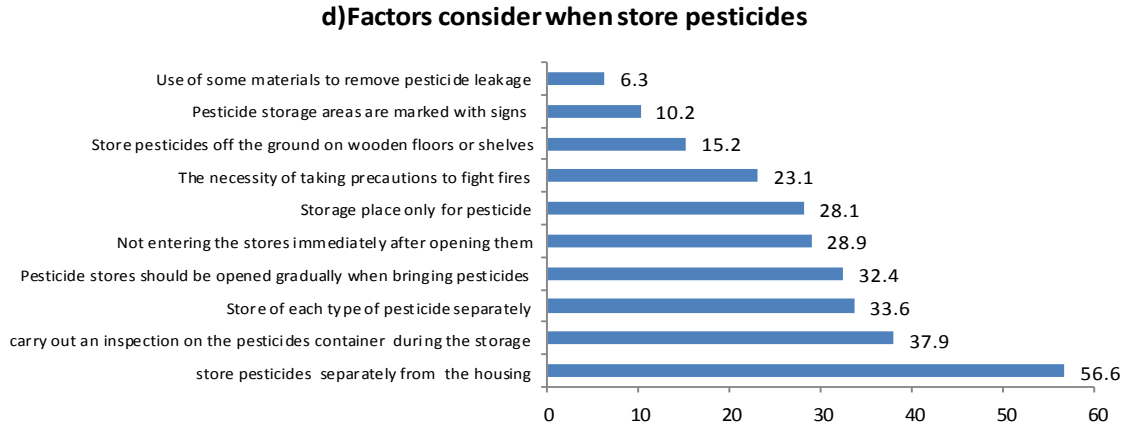
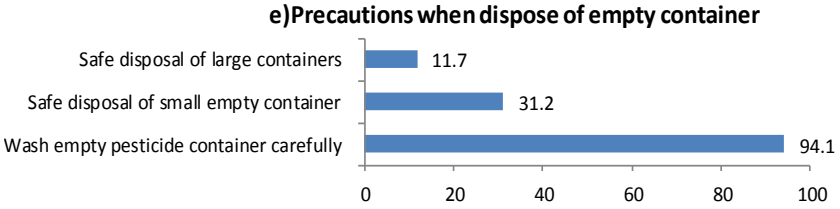

c)Precautions to prevent risks of pesticide poisoning
put of signs on the sprayed areas 12.9
Presence of first aid kit while spraying 15.6
Annual examination of applicator's health status 25
Use the personal protective equipment(gloves,... 38.7
Period of spraying did not exceed 6 hr 41.8
Avoid touching face during spraying 42.6
Gradually open the pesticide container 42.9
Avoid breathing gases of the opening container 46.1
Applicators does not have wounds 59.4
Avoid squatting under trees while spraying 65.6
Healthy applicators 67.6
Stop working inside the sprayed parts until the... 70.3
Not Repeat application of the same pesticide 73.1
Using a long arm sprinkler to spray trees 75
Avoid transfer of pesticides with foodstuffs 77.3
Don't wash pesticide-contaminated clothing in... 81.3
Harvesting fruits after permissible safety period 82.4
Avoid eating , drinking and smoking during... 83.9
Clean of pesticide-contaminated clothing... 87.1
Spray in the direction of the wind 87.9
Keep pesticides in the original container 89.1
Close pesticide containers well during transport 90.2
Exclude farm animals while spraying pesticide 90.6
Safe disposal of washing water 91.4
Avoid using weeds of treated fields as animal... 92.6
Do not use empty containers in food and / or... 92.6
Avoid throwing remaining solution in the... 97.3
0 20 40 60 80 100 120





Tables

Table 1: Distribution of respondents according to their level of knowledge for recommendations to reduce harmful human health and environmental impacts of pesticides

Level of knowledge	No. of respondents	%
Low (<31)	53	20.7
Moderate (31-42)	151	59
High (>42)	52	20.3
Total	256	100

-Range=20-53, arithmetic mean=37.02 and standard deviation=7.1

Table 2: Distribution of respondents according to their level of implementation for recommendations to reduce harmful human health and environmental impacts of pesticides

Level of implementation	No. of respondents	%
Low (<85)	72	28.1
Moderate (85-115)	150	58.6
High (>115)	34	13.3
Total	256	100

-Range=55-145, arithmetic mean=95.3, and standard deviation=19.9

Table3: The Relationship between the degree of the knowledge of the recommendations for reduce harmful human health and environmental impact of pesticides and Some Independent variables

Independent variables	Simple correlation coefficient
Age	0.336**
Education	0.371**
Family size	-0.041
Family employment	-0.121
The time spending on agricultural work	0.009
Agricultural experience	0.251**
Experience in pesticides practice	0.259**
Landholding	0.220**
Average of citrus productivity	0.284**
Purpose of citrus cultivation	0.364**
Knowledge of crop pests	0.088
Satisfaction with the economic return	0.069
Number of agricultural training courses	0.427**
Number of training courses in pesticide practices	0.449**
Degree of formal social participation	0.275**
Varied of agricultural activities	0.023
Degree of benefit from information sources	0.528**

** Statistically significant relationship at level 0.01

* Statistically significant relationship at level 0.05

Table 4: The Relationship between the degree of the implementation of the recommendations for reduce harmful human health and environmental impact of pesticides and Some Independent variables

Independent variables	Simple correlation coefficient
Age	0.373**
Education	0.292**
Family size	0.018
Family employment	-0.109
The time spending on agricultural work	0.044
Agricultural experience	0.289**
Experience in pesticides practice	0.314**
Landholding	0.266**
Average of citrus productivity	0.302**
Purpose of citrus cultivation	0.375**
Knowledge of crop pests	0.107
Satisfaction with the economic return	0.111
Number of agricultural training courses	0.381**
Number of training courses in pesticide practices	0.398**
Degree of formal social participation	0.207**
Varied of agricultural activities	0.022
Degree of benefit from information sources	0.531**

** Statistically significant relationship at level 0.01

* Statistically significant relationship at level 0.05

Table 5: Distribution of respondents according to their implementation the recommendations related to reducing human health and environmental harmful impact of pesticides

Recommendations	Implementation							
	Always		Sometimes		Seldom		None	
	Number	%	Number	%	Number	%	Number	%
Precautions considered during preparation of pesticide solution								
Reading of pesticide instruction	150	58.6	52	20.3	9	3.5	45	17.6
Correct preparation of WP solutions	154	60.2	47	18.3	2	0.8	53	20.7
Correct preparation of EC solutions	70	27.3	35	13.7	3	1.2	148	57.8
Precautions considered during spraying								
Correct spray practice (workers or machines proceed in a regular way)	195	76.1	41	16.1	3	1.2	17	6.6
Good timing of spraying	180	70.3	52	20.3	1	0.4	23	9.0
Avoid spray in thirst fields	218	85.1	16	6.3	2	0.8	20	7.8
Avoid using salt water in solutions	112	43.7	111	43.4	8	3.1	25	9.8
Consuming the amount of spray solution for a specific area	143	55.9	81	31.6	4	1.6	28	10.9
Optimum spray distribution	137	53.5	80	31.3	2	0.8	37	14.4
Cleaning of machine after application	151	58.9	50	19.5	14	5.5	41	16.1
Estimation of spray volume	111	43.4	94	36.7	5	1.9	46	18.0
Good storage of spray machine	149	58.2	31	12.1	17	6.6	59	23.1
Use sticks to mix pesticide	156	60.9	46	18	2	0.8	52	20.3
Do not use the pesticide machine in herbicide application	130	50.8	60	23.4	9	3.5	57	22.3
Avoid spraying during flowering	68	26.6	96	37.5	5	1.9	87	34.0
Use recommended rate of pesticide	52	20.3	64	25.0	34	13.3	106	41.4
Precautions to prevent risks of pesticide poisoning								
Avoid throwing remaining solution in the irrigation canals and drainage	243	95	6	2.3	0	0	7	2.7

Continue Table 5: Distribution of respondents according to their implementation the recommendations related to reducing human health and environmental harmful impact of pesticides

Recommendations	Implementation							
	Always		Sometimes		Seldom		None	
	Number	%	Number	%	Number	%	Number	%
Do not use empty containers in food and / or drinks	228	89.1	9	3.5	0	0	19	7.4
Avoid using weeds of treated fields as animal foodstuff	225	87.9	10	3.9	0	0	21	8.2
Safe disposal of washing water	226	88.3	5	1.9	3	1.2	22	8.6
Close pesticide containers well during transport	216	84.4	7	2.7	1	0.4	32	12.5
Exclude farm animals while spraying pesticide	203	79.3	27	10.5	1	0.4	25	9.8
Keep pesticides in the original container	191	74.6	30	11.7	3	1.2	32	12.5
Spray in the direction of the wind	178	69.5	46	18.0	1	0.4	31	12.1
Clean of pesticide-contaminated clothing separately	201	78.5	16	6.3	6	2.3	33	12.9
Don't wash pesticide-contaminated clothing in the surface water	177	69.1	29	11.3	2	0.8	48	18.8
Avoid eating , drinking and smoking during handling	178	69.5	24	9.4	5	1.9	49	19.2
Harvesting fruits after permissible safety period	132	51.6	65	25.4	8	3.1	51	19.9
Avoid transfer of pesticides with foodstuffs	95	37.1	75	29.3	28	10.9	58	22.7
Using a long arm sprinkler to spray trees	150	58.6	33	12.9	5	1.9	68	26.6
Not Repeat application of the same pesticide	138	53.9	43	16.8	6	2.3	69	27.0
Stop working inside the sprayed parts until the pesticide dries	128	50.0	45	17.6	5	1.9	78	30.5
Healthy applicators	115	44.9	46	18.0	7	2.7	88	34.4
Avoid squatting under trees while spraying	79	30.9	69	26.9	20	7.8	88	34.4
Applicators does not have wounds	48	18.8	43	16.8	40	15.6	125	48.8
Avoid breathing gases of the opening container	46	18	44	17.2	20	7.8	146	57.0
Gradually open the pesticide container	59	23.1	28	10.9	19	7.4	150	58.6
Avoid touching face during spraying	19	7.4	70	27.4	16	6.3	151	58.9

Continue Table 5: Distribution of respondents according to their implementation the recommendations related to reducing human health and environmental harmful impact of pesticides

Recommendations	Implementation							
	Always		Sometimes		Seldom		None	
	Number	%	Number	%	Number	%	Number	%
Period of spraying did not exceed 6 hr	65	25.4	30	11.7	12	4.7	149	58.2
Use the personal protective equipment (gloves, rubber shoes, mask)	8	3.1	37	14.5	18	7.0	193	75.4
Annual examination of applicator's health status	22	8.6	16	6.3	14	5.4	204	79.7
Presence of first aid kit while spraying	16	6.3	8	3.1	10	3.9	222	86.7
Put of signs on the sprayed areas	17	6.6	6	2.3	1	0.4	232	90.7
Factors to consider when storing pesticides								
Store pesticides separately from the housing	126	49.2	4	1.6	0	.0	126	49.2
Carry out an inspection on the pesticides container during the storage to detect a leakage or	81	31.7	7	2.7	1	0.4	167	65.2
Store of each type of pesticide separately	58	22.7	20	7.8	2	0.8	176	68.7
Pesticide stores should be opened gradually when bringing pesticides	32	12.5	29	11.3	10	3.9	185	72.3
Not entering the stores immediately after opening them	28	10.9	27	10.6	11	4.3	190	74.2
Storage place only for pesticide	49	19.2	14	5.4	0	.0	193	75.4
The necessity of taking precautions to fight fires	45	17.6	2	0.8	1	0.4	208	81.2
Store pesticides off the ground on wooden floors or shelves	30	11.7	2	0.8	4	1.6	220	85.9
Pesticide storage areas are marked with signs	20	7.8	1	0.4	0	.0	235	91.8
Use of some materials to remove pesticide leakage	13	5.1	0	0	1	0.4	242	94.5
Precautions when dispose of empty pesticide containers								
Washing empty pesticide container and putting washing water in spray machine	224	87.5	16	6.3	1	0.4	15	5.8
Safe disposal of small empty container	54	21.1	18	7.0	7	2.7	177	69.2
Safe disposal of large empty container	8	3.1	7	2.7	4	1.6	237	92.6

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معرفة وتنفيذ زراع الموالح للتوصيات المتعلقة بالحد من الآثار الضارة للمبيدات في منطقة البستان بالنوبارية بمحافظة البحيرة

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المستخلص

تهدف الدراسة إلى التعرف على مستوى معرفة وتنفيذ زراع الموالح للتوصيات المتعلقة بالحد من الآثار الضارة الصحية والبيئية للمبيدات، وتحديد العلاقة بين درجة معرفتهم وتنفيذهم للتوصيات المتعلقة بالحد من الآثار الضارة الصحية والبيئية للمبيدات مع بعض المتغيرات المستقلة. وقد أجريت هذه الدراسة في ثلاث جمعيات تعاونية زراعية وهى: شباب البستان التابعة لقرية الشعراوي، والإمام الشافعي التابعة لقرية الإمام الغزالي، ومحمد رفعت التابعة لقرية محمد رفعت. وكان حجم العينة 256 مبحوث، وتم جمع البيانات بإستخدام الإستبيان بالمقابلة الشخصية خلال خريف عام 2019، وتحليلها بإستخدام الحزمة الإحصائية للعلوم الاجتماعية (SPSS). وأظهرت النتائج أن 59٪ من المبحوثين مستوى معرفتهم للتوصيات المتعلقة بالحد من الآثار الضارة الصحية والبيئية لمبيدات الآفات متوسط، و58,6٪ منهم مستوى تنفيذهم للتوصيات للحد من الآثارالضارة الصحية والبيئية لمبيدات الآفات متوسط. وعلاوة على ذلك، فإن 50% منهم يتمتعون بمستوى متوسط من الخبرة الزراعية، و35,6% منهم لديهم خبرة متوسطة في ممارسات مبيدات الآفات. وقد وجدت علاقة إرتباطية طردية عند المستوى الإحتمالى 0.01 بين كل من درجة معرفة المبحوثين ودرجة تنفيذهم للتوصيات المتعلقة بالحد من الأثار الضارة للمبيدات كمتغيرات تابعة وكل من المتغيرات المستقلة المدروسة التالية: سن المبحوثين، ودرجة التعليم، ودرجة خبرتهم الزراعية، وخبرتهم في ممارسات مبيدات الآفات، ومساحة الأرض الزراعية المنزرعة بالموالح، ومتوسط إنتاجية الموالح، والغرض من زراعة الموالح، والدورات التدريبية الزراعية، والدورات التدريبية في مجال ممارسات المبيدات، ودرجة المشاركة الإجتماعية الرسمية، ودرجة الإستفادة من مصادر المعلومات.