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KNOWLEDGE LEVEL OF AGRICULTURAL EXTENSION WORKERS REGARDING ENVIRONMENTAL PROTECTION LEGISLATION AND AGRICULTURAL POLLUTANTS: A CASE STUDY IN THE KINGDOM OF SAUDI ARABIA

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ABSTRACT: The Kingdom of Saudi Arabia is continuously making concerted efforts to deliver environmentally sound farming practices through its dynamic extension staff. This research aims to gauge their awareness and knowledge levels regarding environmental laws. With a reasonable knowledge of environmental laws, they can evaluate farming practices and observe the extent of the implementation of the environmental laws by the farmers. All the extension workers (266) on the payroll of the Saudi government were included in the study. Data were collected by using the pre-tested questionnaire. In order to understand the findings of the study, data were analyzed for, arithmetic average and standard deviation in addition to the simple Pearson correlation coefficient. The results showed that high percentage of young and middle-aged respondents, accounting for about 74% of the total respondents. More than half of the study population (55.7%) were holding a bachelor's degree in agricultural sciences and about 70.2 percent of extension staff had professional experience from 1-13 years. However, they had a good grasp of the 5 most important environmental legislations. About 41.9 % of the respondents knew about the wrong practices that could cause environmental pollution. The study reveals that knowledge regarding the punishment/penalties significantly depends on the variable “knowledge of legislation”. A positive and significant correlation between "the number of years of experience in agricultural extension" and the extension workers' awareness levels of environmental protection legislation was realized. The study indicates that most of the respondents are relatively young and inexperienced having low levels of knowledge of environmental legislations. However, they have a greater inclination to learn and practice. Based on the findings of the study, it is recommended to organize extensive training courses for the extension staff on environmental legislations to make them well-conversant with environmentally friendly and sound agriculture so that while working with the farmers, they may transmit the principles and practices of pollution-free farming comfortably.

Keywords: Environmental pollution, knowledge levels, extension staff, training courses, health issues.

INTRODUCTION

Today Environmental pollution is viewed as one of the great issues due to its deleterious and damaging effects on human health. Environmental pollution happens from pesticides, fertilizers, and dead animals and their remnants. Farmers do burn agricultural crop residues to bring more area under cultivation. Farmers use high amounts of fertilizers, and heavy doses of pesticides to reduce the damage caused by insects, diseases, weeds, fungi viruses and nematodes, rodents, locusts, etc., and to obtain abundant good quality food production (**Shalaby, 2012**).

The relationship between man and the environment throughout the history of mankind has passed through several stages, some of

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which were positive in line with the delicate balance and homogeneous system of the various elements of the environment and its various components, while some were negative and unjust to the elements and components of the environment (**Al-Sunaidi, 2000**). Therefore, the concept of environmental awareness must be holistic, starting from the knowledge of environmental problems to establishing values and beliefs that direct human behavior to be more environmentally friendly and more rational in consuming resources. **Al-Asemi (2015)** defines environmental awareness as the individual's awareness of his role in confronting the environment and helping social groups and individuals to gain more awareness of the environment and its problems. It is an awareness based on knowledge of environmental relationships and problems in terms of their causes, effects, and means of solving them to control the human relationship with his spatial environment and how he deals with his surroundings. Legislations and laws have acquired great importance due to their role, capacity, and power to help Human-beings to improve the environment in which they live and work (**Al-Mathhagi, 2010**). The agricultural extension is also involved in the education and training of farmers and the residents of rural and urban areas to contribute effectively to realizing sustainable development. Such training and awareness programs can help move forward and contribute towards economic, social, and environmental aspects in both rural and urban areas for a better life. Therefore, awareness creation through extension must be compatible with the requirements of development and meet the real needs of rural and urban dwellers.

Some previous research and studies have shown that inappropriate farming practices of the farmers led to environmental pollution, which could be due to the agricultural extension workers' lack of awareness of agricultural pollutants. A study conducted by **Al-Otaibi (2006)** clarified the insufficient role of agricultural extension agents in communicating information related to dealing with the pesticides like how to apply them, where to store them and how to deal with its remnants. The study of **Al-Zahrani and Al-Hajj (2007)** also showed that more than 60% of farmers emphasized their information needs and guidance regarding the correct use of fertilizers and their toxicities and application instructions for each fertilizer to be used on the farms to avoid negative effects on the environment and the penalty of law. Also, the study of **Radwan (2014)** revealed that a vast majority of the surveyed farmers (71%) confirmed the ineffectiveness of agricultural extension programs. They reported that the role of agricultural extension agents in educating farmers about the dangers of pesticides to their health was quite negligible. Based on this study, it was recommended that educational extension programs must be initiated on various aspects of the safe use of pesticides that could identify the risks and damages that pesticides cause to humans and the environment.

While **Abd-Elwahed (2013**) study found that 60.7% of farmers in the Luxor governorate deal with agricultural waste in ways that cause environmental pollution. Primarily the most important source of information for farmers on some sources of environmental pollution was the national agricultural extension system represented by its agricultural extension workers. These extension workers were entrusted with the task of helping farmers to plan and implement agricultural extension programs on the proper and safe methods of disposal of agricultural waste to reduce environmental pollution. In a survey study by **Makhoul (2013)**, the surveyed farmers reported that the culture regarding environmental pollution was quite weak. His study revealed that 86.8% of the respondents had negative attitudes towards the information on the negative effects of pesticides on the environment, and most of the farmers did not adhere to the prohibition period, by ignoring the forbidden time between the harvest date and the marketing price of the crop. Regarding the effectiveness of the sources of information, the study showed that the extension agents and In-charge of selling agricultural pesticides were the most important ones for the farmers. **Al-Shayaa (2011)** concluded that most of the respondents (95.6%) do not support the use of treated wastewater in the irrigation of their farms, and recommended the need to increase the level of knowledge of farmers on the importance of

using treated wastewater to irrigate leafless crops by enhancing the role of the agricultural extension agency. He further suggested that the agricultural extension needs to conduct programs through various media to educate farmers to accept treated wastewater technology through various media.

In the scenario, it seems quite logical and imperative that agricultural extension workers' awareness of environmental protection legislation from agricultural pollutants also must reflect in the farmers' extension programs for these legislations in order to avoid the occurrence of environmental problems that affect human health. Since not very many studies in the Kingdom of Saudi Arabia in this respect have been conducted on this aspect, the present study was undertaken to determine the degree of awareness of agricultural extension workers in terms of environmental protection legislation and the agricultural pollutants impacting the environment. It is anticipated that the results of the study would present a clear picture to the decision-makers to take the necessary measures towards improving the level of awareness of agricultural extension officers towards these legislations. The awareness regarding the legislations could have their direct and indirect impact on protecting farmers in particular from legal accountability, and protecting the environment in general by reducing the danger of environmental degradation and food contamination by the pollutants that cause many health problems for humans. This research aims mainly to identify the level of knowledge of agricultural extension workers in legislation to protect the environment from agricultural pollutants, by achieving the following sub-goals: The study will provide information on the level of knowledge of the surveyed extension workers on environmental protection legislation; identifying the percentage of consistency between the components of environmental awareness of the respondents (knowledge, penalties, and effects) in relation to environmental protection legislation. Finally, the correlation between the independent variables of the study and the degree of the knowledge level of the informants under research regarding environmental protection legislation as a dependent variable.

Objectives

1- Identify the level of knowledge of Respondents about environmental protection legislation, the penalties for not applying them, and their effects.

2- Identifying the percentage of consistency between the environmental awareness components of the respondents (knowledge - penalties-effects) of environmental protection legislation.

3- Study the correlation between the independent variables studied and the degree of awareness of the surveyed extension workers of environmental protection legislation as a dependent variable.

Methodology

This research was conducted by including all 266 agricultural extension workers associated with the public administrations, directorates, and agricultural branches in all regions of the Kingdom of Saudi Arabia (**General Administration of Agricultural Extension, 2017**). The field data were collected by using a questionnaire (approved by the Ministry of Environment, Water, and Agriculture) from 248 agricultural extension workers, representing 93% of the total. Before sending it out to the extension workers, the stability, reliability, and constructive validity of the study tool were verified to ensure its high degree of stability and safe application in the field. The data obtained in the study were subjected to analysis by employing the Statistical Package for Social Science (SPSS) "version 20".

RESULTS AND DISCUSSION

The ages of the respondents ranged between 23 - 58 years, with a mean of 41.17 years and a standard deviation of 6.92 degrees. The distribution of the respondents based on their age groups is shown in Table 1. The study revealed that 14.5% of them fall in the youth group (less than 35 years old), while about 59.6% of the respondents fall in the middle age group between (35-46 years), about 25.9% of the respondents fall into the older age group between (47-58 years). The results reflect the

Table 1. Personal, Social and Economic Characteristics of the Researched Extension Workers (N = 248)

Characteristics	Number	%	Characteristics	Number	%
Age			**Social status**		
Youth category (less than 35 years old)	36	14.5	Married	240	96.8
Middle age group (35 to less than 47 years)	148	59.6	Unmarried	8	3.2
Senior age group (47 years and over)	64	25.9	**Current place of residence**		
Place of birth			Urban	2.3	81.9
Urban	156	62.9	Rural/countryside	45	18.1
Rural/countryside	92	37.1	**Educational level**		
Duration of stay in the countryside			Secondary Agricultural Sciences	100	40.3
From 1 year to 18 years	44	17.9	Bachelor of Agricultural Sciences	138	55.7
From 19 to 37 years	40	16.2	Master of Agricultural Sciences	10	4
More than 37 years	22	8.9	**Years of experience in agricultural extension**		
They did not live in the countryside	142	57	Under 13 years	174	70.2
Time devotion to work			From 13-24 years	55	22.2
Another irregular work is practiced	33	13.3	Over 24 years	19	7.6
Undertakes other work on a daily basis	61	24.6			
Completely free	154	62.1			

a high percentage of young and middle-aged respondents, accounting for about 74% of the total respondents. This characteristic/feature could have a positive impact on them in their extension work on the one hand, and the expectation of their increased levels of awareness of environmental protection legislation from agricultural pollutants on the other hand. As regards marital status, it was found that 96.8% of the respondents were married, while only 3.2% of the respondents were single or unmarried (single). This is a good indication of the spirit of determination, grasp, and responsibility for work, which may be reflected positively on the level of the respondents 'awareness of environmental protection legislation from agricultural pollutants, motivated by their parental concern for their families and their protection from the impact of pollutants. It was found that 62.9% were born in urban areas, while only 37.1% were with rural upbringing. **Al-Aadely (1983)** prefers that agricultural extension agents should come from the countryside. Support the opinion that extension agents with rural backgrounds will have more acceptance to work and live in the countryside. They could be more sensitive to the concerns and problems of the rural people, in addition to the possibility of their greater ability to solve the problems faced by them. The study revealed that 81.9% of the respondents reside in urban areas, while 18.1% of them reside in rural areas. Regarding the duration of residence of extension workers in the countryside (estimated in years), it was found that about 43% of the respondents had resided in the countryside for varying periods ranging from one year to 37 years, while more than half of the respondents 57% were living in the urban areas and did not live in the countryside. As regards the educational level, the data indicate that 40.3% of the surveyed extension workers have a high school of agricultural sciences, 55.7% have a bachelor's degree in agricultural sciences, while

only 4% have a master's degree in agricultural sciences. The previous results indicate that the respondents having good educational levels, may help in their ability to know the environmental legislation and thus the ability to communicate effectively with farmers to spread awareness about environmental legislation. It was found that 62.1% of the surveyed farmers were completely devoted to work, while 24.6% practiced other daily work, and 13.3% of them practiced other part-time work. The previous results reflect the respondents' enjoyment of sufficient time appropriate to the nature of work to carry out their role in raising awareness of environmental legislation. In the distribution of the respondents according to their years of experience, it was found that only 7.6% had more than 24 years of experience, and the vast majority of respondents 92.4% had years of experience of up to 24 years in extension work, which may have an impact on increasing their awareness of environmental legislation.

Knowledge of Environmental Impact

The data presented in Table 2 show the cognitive level of the environmental impact of the respondents when farmers engage in wrong practices and violate the environmental protection legislation from the studied agricultural pollutants. It is clear from this table that the respondents 'knowledge of the impact of malpractice in all the legislations studied came at an average level (with an arithmetic average ranging between 1.68 - 2.33 degrees).

The top five legislations in terms of the level of the respondents 'knowledge of the impact of malpractice on the environment came as follows: In the first place was the respondents' knowledge of "the environmental impact, when marketing or feeding humans or animals from plants treated with the pesticide before the end of the prohibition period," where the arithmetic mean of this effect was (2.27) A degree), and a standard deviation (0.81 degrees). The second is the "environmental impact, when disposing of the surplus pesticides and their empty containers by digging a hole in a place at a distance of no less than 160 m from the water source with a depth of not less than one meter" where the arithmetic mean was (2.25) A degree), and a standard deviation (0.78 degrees), followed by the third place, "the environmental impact, when the instructions on the pesticide container label are not implemented, especially with regard to the method of use and the period of prohibition," with an arithmetic mean of (2.24 degrees), a standard deviation (0.78 degrees), then the fourth "Environmental impact, when no room is designated for storing pesticides and is far from people and children in particular" with an average (2.23 degrees) and a standard deviation (0.80 degrees), and the fifth place is "the environmental impact, when using raw untreated wastewater for agricultural purposes." With the mean of my arithmetic b LG (2.20 degrees), standard deviation (0.82 degrees).

These results are in agreement with the study of **Al-Sayed (2005)** which was conducted in Egypt and demonstrated the average level of knowledge of agricultural extension workers regarding the negative effects of the increased use of agricultural pesticides and chemical fertilizers, and the lack of proper disposal of agricultural waste. The previous results were also in agreement with the study of **Abdel-Gawad *et al.* (2001)** in Egypt, which revealed that agricultural extension workers enjoy knowledge levels ranging from medium to high of the negative effects of not applying environmental legislation. At the same time, the previous results differed from the results of the study of **Bitar and Al-Rimawi (2005)** in Jordan, which concluded that agricultural extension workers in the public sector have low levels of awareness of the negative effects of not applying environmental legislation.

Knowledge of Punishment

The data presented in Table 3 refer to the cognitive level of the respondents regarding the penalties imposed on the farmer for violating the studied legislations. It is clear from this table that all the studied legislations came with a low level of knowledge on the part of the respondents (with an arithmetic average of less than 1.34 points).

The top five legislations in terms of the respondents 'knowledge of the penalties resulting from not applying them came from not disposing of the excess pesticides and their empty containers by digging a hole in a place beyond 160 m from the water source with a depth of not less than one meter Where the arithmetic mean of knowledge of this punishment

Table 2. Distribution of the respondents according to their knowledge of the negative effects of wrong practices on the environment arranged according to the arithmetic mean (n = 248)

Legislation	Knowledge level			Mean	Standard deviation
	Knows perfectly well	Knows to an extent	he do not know		
When marketing or feeding humans or animals of plants treated with the pesticide before the prohibition period ends.	50.4	26.6	23	2.27	0.81
When not disposing of the excess pesticides and their empty containers by digging a hole at a distance of no less than 160m from the water source, with a depth of not less than one meter.	46.8	31.9	21.1	2.25	0.78
When not implementing the instructions stated on the label of the pesticide container, especially with regard to the method of use and the period of prohibition.	45.2	33.5	21.4	2.24	0.78
When no room is designated for storing pesticides, and it is far from people and children in particular	46	31	23	2.23	0.8
When raw untreated wastewater is used for agricultural purposes.	46	27.8	26.2	2.2	0.82
When excessive use of chemical pesticides on farms.	43.5	33.1	23.4	2.2	0.79
When raw sewage is discharged into irrigation canals or agricultural drains.	43.5	31.5	25	2.19	0.8
When throwing empty pesticide containers into oases, ponds, or water channels.	43.5	30.2	26.2	2.17	0.81
When not preserving the soil and land and not limiting its degradation or pollution.	39.9	33.1	27	2.13	0.81
When unsanitary disposal of dead livestock or their remnants.	36.7	39.5	23.8	2.13	0.76
When not warning the owners of neighboring areas when carrying out the process of spraying pesticides.	37.1	37.5	25.4	2.12	0.78
When discharging raw sewage into wells.	41.1	29	29.8	2.11	0.83
When contamination or negative impacts are not immediately reported.	35.5	40.3	24.2	2.11	0.76
When flushing, purchasing, donating, or transporting infected or suspected animal livestock.	35.9	37.5	26.6	2.09	0.78
When using unauthorized medicines, veterinary pesticides and growth stimulants.	37.1	34.7	28.2	2.09	0.8
When discharging raw sewage into fissures areas of water-bearing layers, ravines or dams.	34.7	37.5	27.8	2.07	0.78
When pollution of surface, ground or coastal waters with solid or liquid wastes in any way.	34.3	37.1	28.6	2.06	0.79
When hormones are used to increase production (milk, meat) in livestock.	35.9	34.3	29.8	2.06	0.81
When failure to comply with the procedures set by the competent authority to stop and remove the violations or address their effects and prevent their recurrence.	19.8	35.9	30.2	2.04	0.8
When not complying with the time period specified by the competent authority to stop and eliminate the negative impact and address its effects on the environment.	17.7	36.7	37.9	1.88	0.78

Table 3. Distribution of respondents according to their knowledge of the penalties for violating environmental legislation

Penalties	known		he do not know		Mean	standard deviation
	N	%	N	%		
A fine or imprisonment (determined by the violation control committee), when not disposing of excess pesticides and their empty containers by digging a hole at a distance of no less than 160m from the water source with a depth of not less than one meter.	60	24.2	188	75.8	1.32	1.3
A fine or imprisonment (determined by the violation control committee), when feeding a human or animal from the plants treated with the pesticide before the expiry of the prohibition period.	72	29	176	71	1.29	0.45
A fine or imprisonment (determined by the violation control committee), for excessive use of chemical pesticides on farms.	64	25.8	184	74.2	1.26	0.43
The penalty is ten thousand riyals if the instructions stated on the label of the pesticide container are not implemented, especially with regard to the method of use and the period of prohibition.	62	25	186	75	1.25	0.43
A fine or imprisonment (determined by the violation control committee), when a room is not designated for storing pesticides and is far from people and children in particular	62	25	186	75	1.25	0.43
The penalty is fifty thousand riyals when using raw, untreated wastewater for agricultural purposes.	63	25	185	74.6	1.25	0.43
A penalty of ten thousand riyals, for failure to adhere to the procedures set by the competent authority to stop and remove violations or address their effects and prevent their recurrence.	60	24.2	188	75.8	1.24	0.42
A fine or imprisonment (determined by violation control committee), if the correct person is not warned, the penalty will be a fine or imprisonment determined by the violation control committee in the neighboring areas when spraying pesticides.	60	24.2	188	75.8	1.24	0.42
A fine or imprisonment (determined by the violation control committee), when empty pesticide containers are thrown into oases, ponds, or water channels.	59	23.8	189	76.2	1.24	0.42
Punishment of ten thousand riyals, with the removal of the violation, when the surface, groundwater, or coastal waters are contaminated with solid or liquid wastes in any way.	50	20.2	198	79.8	1.23	0.4
A fine or imprisonment (determined by the violation control committee) for flushing, buying, donating, or transporting infected or suspected livestock.	48	19.4	200	80.6	1.23	0.73
A fine or imprisonment (determined by the violation control committee), when using unauthorized medicines, pesticides, and growth stimulants.	54	21.8	194	78.2	1.22	0.41
A penalty of ten thousand riyals with the removal of the violation, for not reporting the occurrence of pollution or negative environmental impacts immediately.	193	77.8	55	22.2	1.22	0.41
Punishment of ten thousand riyals, with the removal of the violation, when the soil and land are not preserved, and the deterioration or pollution thereof is not reduced.	52	21	196	79	1.21	0.4
The penalty is fifty thousand riyals when disposing of raw sewage water in wells.	51	20.6	197	79.4	1.21	0.4
The penalty is fifty thousand riyals when raw sewage water is discharged into irrigation channels or agricultural drains.	49	19.8	199	80.2	1.2	0.39
A fine or imprisonment (determined by the violation control committee), when using hormones to increase production (milk, meat) in livestock.	45	18.1	203	81.9	1.18	0.38
A fine or imprisonment (determined by the violation control committee), when not disposing of the dead livestock or their remains.	43	17.3	205	82.7	1.17	0.37
The penalty is fifty thousand riyals when raw sewage is discharged into the rocky cracks of water-bearing layers, valleys, or dams.	43	17.3	205	82.7	1.17	0.37
A penalty of ten thousand riyals, for failure to comply with the time period specified by the competent authority to stop and remove the negative impact and address its effects on the environment.	39	15.7	209	84.3	1.16	0.36

was (1.32 degrees), and a standard deviation (1.3 degrees). The second place is knowledge of the penalty, "a fine or imprisonment (determined by the violation control committee), when feeding humans or animals from plants treated with the pesticide before the end of the prohibition period", where the arithmetic average reached (1.29). A degree), with a standard deviation (0.45 degree), followed by the third rank defined as the penalty "a fine or imprisonment (determined by the violation control committee), for excessive use of chemical pesticides on farms" with a mean of (1.26 degrees), and a standard deviation (0.43) The degree), followed by the fourth and fifth rank, respectively, the definition of the penalty, "the penalty of ten thousand riyals, when the instructions stated on the label of the pesticide container are not implemented, especially with regard to the method of use and the period of prohibition," and knowledge of the penalty "a fine or imprisonment (determined by the Contravention Committee Fate), when no room is allocated for storing pesticides and it is far from people and children in particular, where the arithmetic mean of both penalties is equal to (1.25 degrees), and a standard deviation is (0.43 degrees).

The previous results are consistent with the study of **El-Shazly and Zarqa (1999)** that was conducted in Egypt from the low awareness of agricultural extension agents of penalties and regulations related to environmental legislation. As demonstrated by the study of **El-Salsely *et al.* (2001)** in Egypt the same result by revealing the reasons that lead to the decline in the role of extension agents in raising awareness about environmental legislation. The lack of knowledge about penalties is at the forefront of those reasons. The study of **Bitar and Al-Rimawi (2005)** that was conducted in Jordan recommended the necessity of coordination to hold training courses for agricultural extension workers, through which he explains the controls, types of violations and penalties for failure to implement environmental legislation.

The Knowledge Level of Agricultural Extension Agents with Legislation to Protect the Environment from Agricultural Pollutants

The data presented in Table 4 show that 19 of the studied legislations had a medium level of knowledge of respondents (with an arithmetic average ranging between 1.68 - 2.33 degrees), while only one legislation came with a low knowledge level (with an arithmetic average of 1.63 degrees).

The top five legislations in terms of the respondents' knowledge level were: The first one is not to dispose of excess pesticides and their empty containers by digging a hole in a place beyond (160 m) from the source of water with a depth of not less than one meter," with average arithmetic mean of 2.20 degrees and a standard deviation of 2.1 degrees. The second legislation is, "not to allocate a room for storing pesticides that is far from people and children in particular," with arithmetic mean (2.16 degrees) and a standard deviation (0.85 degrees). The third legislation is "Marketing or feeding humans or animals from plants." Treatment with the pesticide before the end of the prohibition period, with an arithmetic, mean of (2.11 degrees) and a standard deviation (0.85 degrees). Fourth legislation is "excessive use of chemical pesticides on farms" with arithmetic mean (2.01 degrees) and a standard deviation (0.84 degrees). The fifth legislation, "failure to implement the instructions stated on the pesticide container label, especially with regard to the method of use and the period of prohibition," with an arithmetic mean of (2 degrees) and a standard deviation of 0.83 degrees. From the results of the previous table, we find that the pesticide legislation has occupied the forefront in terms of the level of knowledge of the searched guides. Where four pesticide legislations came from among the legislations that occupied the first five ranks. However, the study of **Al-Sarar (2009)** in the Kingdom of Saudi Arabia differs from others as he found that the vast majority of surveyed agricultural workers had weak information about pesticide legislation when the legislation was framed. This result is consistent with the study of **Al-Sayed (2005)** conducted in Egypt indicated that water pollution issues became at the forefront of topics and established the need for the training of agricultural extension workers. Similar findings have been reported in the study conducted in Egypt by **Abdul-Jawad *et al.* (2001)**. They reported that agricultural extension workers had moderate awareness levels of knowledge regarding the agricultural legislations in most of the farming practices.

Table 4. Distribution of respondents according to their knowledge regarding environmental protection legislation from agricultural pollutants arranged according to the arithmetic means (n = 248)

Legislation	Knowledge level			Mean	Standard Deviation
	Knows very well	Knows to some extent	Does not know		
Getting rid of excess pesticides and their empty containers by digging a hole at a distance of no less than 160 meters from the water source, with a depth of not less than one meter	37.9	32.3	29.8	2.20	2.1
Allocating a room to store pesticides, and it should be far from people and children in particular	45.6	25	29.4	2.16	0.85
Banning the marketing and feeding of humans and animals of plants treated with the pesticide before the end of the prohibition period	42.7	25.4	31.9	2.11	0.85
Applying excessive volumes of chemical pesticides on farms	35.9	29	35.1	2.01	0.84
Observing and executing the instructions on the label of the pesticide container, especially with regard to the method of use and the period of prohibition	34.7	30.2	35.1	2	0.83
Preventing the throwing of empty pesticide containers into oases, ponds, or water channels.	33.9	29.8	36.3	1.98	0.83
Preventing the use of raw, untreated wastewater for agricultural purposes	35.1	26.6	38.3	1.97	0.85
Preventing the sale, purchase, donation, or transfer of infected or suspected livestock	29.8	29.8	40.3	1.90	0.83
Preventing the unauthorized use of medicines, veterinary pesticides and growth stimulants	28.6	32.7	38.7	1.90	0.81
Preserving soil and land and limiting its degradation or pollution.	29.8	29.4	40.7	1.89	0.83
Preventing the discharge of raw sewage into irrigation canals or agricultural drains.	30.6	26.2	43.1	1.88	0.85
Warning the owners of neighboring areas when carrying out the process of spraying pesticides.	30.6	27	42.3	1.88	0.84
Sanitary disposal of dead livestock or their remnants	28.6	29.4	41.9	1.87	0.83
Preventing the discharge of raw sewage into wells	29	25.8	45.2	1.84	0.84
Preventing the use of hormones to increase production (milk, meat) in livestock	29.8	29.8	40.3	1.83	0.84
Preventing the contamination of the surface, ground, or coastal waters with solid or liquid wastes in any way	22.6	33.5	44	1.79	0.78
Immediately report the occurrence of pollution or negative impacts	16.1	38.7	45.2	1.71	0.72
Adhere to the procedures set by the competent authority to stop and eliminate violations or address their effects and prevent their recurrence	18.1	34.7	47.2	1.71	0.75
Preventing the discharge of raw sewage into the rocky cracks of water-bearing layers, valleys, or dams	19.8	30.2	50	1.70	0.78
Adhering to the time period specified by the competent authority to stop and eliminate the negative impact and address its effects on the environment	17.7	27	55.5	1.63	0.76

The Extent of Consistency between Knowledge of Legislation, Knowledge of Penalties, and Knowledge of the Impact of Wrong Practices on the Environment

The data presented in Table 5 indicate that 36.7% of the surveyed extension workers have low knowledge of legislation compared to 27% having high knowledge. The percentage of respondents with low knowledge regarding the penalties was 73% and only 9.3% of responding extension workers had high knowledge. The respondents with low level of knowledge about the impact of wrong practices on the environment were 24.2% and 41.9% were with high knowledge level.

The significance of the relationship between knowledge of legislation and knowledge of the penalties is shown in Table 6. The value of chi-square for independence was 59.73, which is a significant value at the level of 0.01. The value of the compatibility coefficient was 0.44, which is a significant value at the level of 0.01, indicating the strength of the association between knowledge of legislation and knowledge of penalties. The Sumer coefficient is used here on the grounds that knowledge of punishment due to a violation of legislation is a variable dependent on knowledge of legislation, reached 0.39, which is a significant value at 0.01 level. It reveals that knowledge regarding punishment significantly depends on the variable knowledge of legislation. The level of consistency attained a value of 53.2%, indicating that 53.2% of the respondents had complete consistency between their level of knowledge of the legislation and their knowledge of the penalties.

While the significance of the relationship between knowledge of legislation and knowledge of the impact of wrong practices is shown in Table 4, the value of Chi-square for independence was 112.59, which is a significant value at the level of (0.01). The value of the compatibility coefficient was 0.56, which is a significant value at the level of (0.01), which confirms the strength of the associative relationship between knowledge of legislation and knowledge of the impact of wrong practices. The value of Sumer coefficient (0.55), and is significant at the level of (0.01), indicates that knowledge of the impact of wrong practices on the environment is a significant dependence on the variable knowledge of legislation. The percentage of respondents who have complete consistency between their level of knowledge of legislation and their knowledge of the impact of wrong practices on the environment (61.3%) according to the percentage of consistency.

The significance of the relationship between knowledge of the penalties and knowledge of the impact of wrong practices is shown in Table 4. The value of Chi-square for independence was 34.87, which is a significant value at the level of 0.01. The value of the compatibility coefficient was 0.35, which is a significant value at the level of (0.01), which proves the strength of the associative relationship between knowledge of penalties and knowledge of the impact of wrong practices. The value of Sumer coefficient (0.32), which is a significant value at the level of (0.01), indicates that knowledge of the impact of wrong practices on the environment is a significant dependence on the variable knowledge of penalties. The percentage of respondents who have complete consistency between their level of knowledge of the penalties and their knowledge of the impact of wrong practices on the environment (38.3%) according to the percentage of consistency.

Based on the previous results, two important facts can be reached: The first one establishes that the components of environmental awareness are consistent with each other in the sense that correct knowledge of environmental legislation leads to knowledge of the penalties resulting from it, and then awareness of its harmful impact on the environment in case of violation of the legislation. The second fact reveals that the problem of declining environmental awareness must be dealt with by focusing on each of its components. It means directing integrated guidance messages that include the text and scope of the legislation, the penalties for violating it, in addition to the goal or significance of the legislator's approval of it, which is of course protecting the environment

The results of the present study are consistent with the findings of **Salama and Keneber (2012)**. They emphasized the need for the components of environmental awareness to be consistent

Table 5. Distribution of respondents according to their levels of knowledge of legislation, penalties and the environmental impact (N = 248)

The level	Knowledge of legislation		Knowledge of penalties			
	Number	%	Number	%	Number	%
Low	91	36.7	181	73	60	24.2
Average	90	36.3	43	17.3	84	33.9
High	67	27	24	9.7	104	41.9
Total	248	100	248	100	248	100

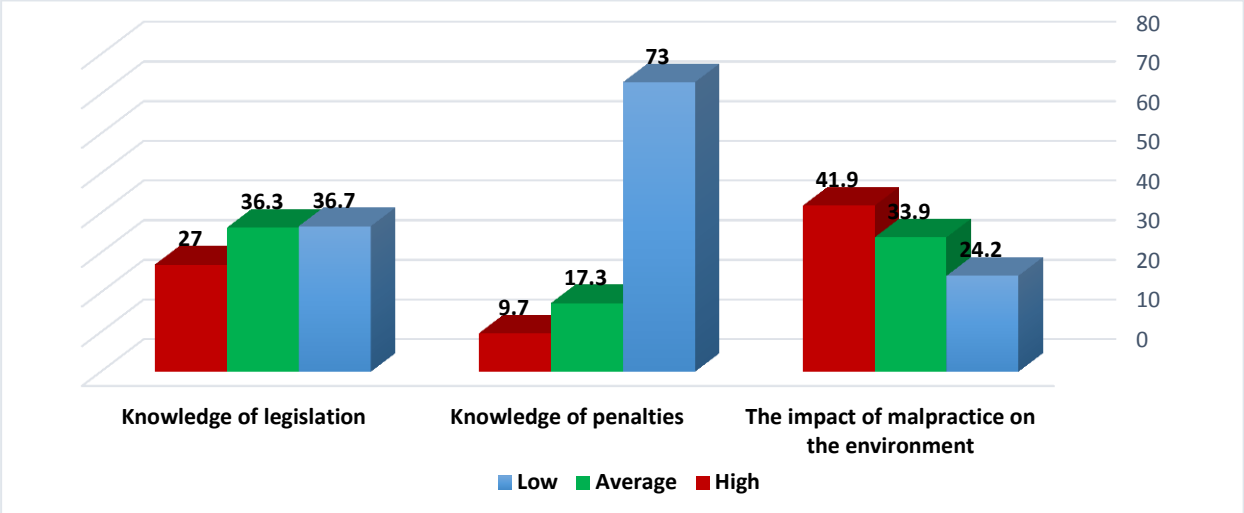

Fig. 1. Shows the distribution of respondents according to their levels of knowledge of legislation, penalties, and the environmental impact

Table 6. The relationship between the components of environmental awareness (knowledge of legislation, punishment, and environmental impact) (N = 248)

Level		Knowledge of legislation× Knowledge of penalties			Knowledge of legislation× The impact of malpractice on the environment			Knowledge of penalties× The impact of malpractice on the environment		
		Low	Average	High	Low	Average	High	Low	Average	High
Low	Number	88	58	35	49	10	1	58	2	-
	%	48.6	32	19.3	81.7	16.7	1.7	96.7	3.3	-
Average	Number	3	26	14	27	47	10	63	17	4
	%	7	60.5	32.6	32.1	56	11.9	75	20.2	4.8
high	Number	-	6	18	15	33	56	60	24	20
	%	-	25	75	14.4	31.7	53.8	57.7	23.1	19.2
Total	Number	91	90	67	91	90	67	181	43	24
	%	36.7	36.3	27	36.7	36.3	27	73	17.3	9.7
		Chi square = 59.73** Coefficient of compatibility = 0.44** Sumer coefficient = 0.39** Ratio of consistency = 53.2%			Chi-square = 112.59** Coefficient of compatibility = 0.56** Sumer coefficient = 0.55** Ratio of consistency = 61.3%			Chi square = 34.87** Coefficient of compatibility = 0.35** Sumer coefficient = 0.32** Ratio of consistency = 38.3%		

with each other (knowledge, skills, and trends) to ensure rational environmental behavior. Ecological that harms the environment. The results of the study are also in agreement with those obtained by **Janmaimool and Denpaiboon (2016)** in Thailand. They concluded that the most predictable determinant of the behavior of rural people in participating in environmental protection programs and activities is the consistency between the components like prevailing values, and associated knowledge of legislation, and knowledge of possible alternatives to wrong behavior. Therefore, the study recommended developing environmental strategies that take into account the integration of the previous components in order to achieve the desired environmental behavior.

The Correlation Between the Independent Variables Studied for the Respondents and the Degree of Their Awareness of Environmental Protection Legislation from Agricultural Pollutants as a Dependent Variable

Table 7 shows the of the correlation between the agricultural extension workers' awareness of environmental protection legislation from agricultural pollutants as a dependent variable, and the independent variables studied using the simple correlation coefficient of Pearson. The data presented in Table 7 show that there is a positive significant correlation between "the number of years of experience in agricultural extension" and the extension workers' awareness of environmental protection legislation at the probability level (0.05). Regarding the rest of the independent variables, "age, marital status, place of birth, degree of ruralness of the respondents, and full-time agricultural work," had no significant correlation relationship with the respondents' awareness levels.

Abdel-Gawad *et al.* (2001) conducted a study in Egypt and concluded that the degree of knowledge of agricultural extension agents related to the legislation for protecting the rural environment was positive and also significant at the level (0.01) for both the variables i.e. the degree of frequency of information sources exposed related to the legislation on protecting the rural environment and the degree of education of the respondent. The previous results also differed from the results of the **El-Salsely *et al.* (2001)** study in Egypt, whose results showed that the role of agricultural extension agents in the field of educating rural families in the field of legislation for protecting the rural environment had a positive and significant relationship at the level of (0.05) with each of the two variables of exposure to mass communication methods. And the degree of job satisfaction. The two previous studies found that the variable number of years of experience in agricultural extension was not significantly related to awareness of environmental legislation, unlike the case in the current study.

Conclusions and Recommendations

Conclusions

The study reveals that about 74 percent of the respondents fall in the young and middle-aged groups. They seem to have professional work experience from 1 to 13 years, having low levels of knowledge of environmental legislations. However, being young they could be better learners and more motivated to learn and reflect in the field. It is anticipated that extension workers having a better understanding of environmental legislations can create awareness on environmental legislations among the farmers. The well-conversant extension staff can help farmers practice environmentally safe, sound and sustainable agriculture without damaging the environment and putting farmers' health at risk.

Recommendations

The study suggests organizing extensive training courses for the extension staff on environmental legislations to elevate their knowledge levels to enable them to advocate environmentally friendly and sound agriculture. Such upgradation in their skills and knowledge on environmental issues and laws to prevent them will in turn help the educating the farmers. Such in-service initiatives will enhance their working abilities and efficiencies to discharge their professional duties with greater motivation and confidence.

Table 7. The relationship between the studied independent variables and the respondents' awareness level

Independent variables	Pearson Correlation Coefficient	The probability value
Age	-0.016	0.799
Social status	-0.033	0.61
Place of birth	0.122	0.056
The rural degree of the respondent	0.118	0.063
Educational level	-0.059	0.356
Full-time agricultural work	-0.03	0.64
Number of years of experience in agricultural extension	0.125*	0.048

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المستوى المعرفي للمرشدين الزراعيين بتشريعات حماية البيئة من الملوثات الزراعية: دراسة حالة المملكة العربية السعودية

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تبذل المملكة العربية السعودية جهودًا متضافرة بشكل مستمر لتقديم الممارسات الزراعية السليمة بيئيًا من خلال طاقمها الإرشادي الديناميكي، يهدف هذا البحث بصفة أساسية إلى قياس المستوى المعرفي للمرشدين الزراعيين بتشريعات حماية البيئة من الملوثات الزراعية وذلك من خلال التعرف على مستوى معرفتهم بتشريعات حماية البيئة، ومدى الاتساق بين مكونات الوعي البيئي للمبحوثين (المعرفة – العقوبات - الآثار) الخاص بتشريعات حماية البيئة، وقد أجري هذا البحث على جميع المرشدين الزراعيين في الإدارات العامة والمديريات والفروع الزراعية بجميع مناطق المملكة العربية السعودية المختلفة والبالغ عددهم (266) مرشداً زراعياً من خلال استبانة بعد التأكد من الصدق والثبات لها، من أجل توضيح نتائج الدراسة استخدم في التحليل المتوسط الحسابي والانحراف المعياري بالإضافة إلى معامل ارتباط البسيط لبيرسون. أظهرت النتائج ارتفاع نسبة المستجيبين الشباب ومتوسطي العمر نحو 74% من مجموع المستجيبين. أكثر من نصف مجتمع الدراسة (55.7%) كانوا حاصلين على درجة البكالوريوس في العلوم الزراعية وحوالي 70.2% من موظفي الإرشاد لديهم خبرة مهنية من 1-13 سنة. ومع ذلك، فقد كان لديهم وعي جيد لأهم 5 تشريعات بيئية، حوالي 41.9% من المبحوثين علموا بالممارسات الخاطئة التي يمكن أن تسبب تلوث البيئة. كشفت الدراسة أن المعرفة المتعلقة بالعقوبات/العقوبات تعتمد بشكل كبير على متغير "المعرفة بالتشريع". وقد تحققت علاقة ارتباط موجبة معنوية بين "عدد سنوات الخبرة في الإرشاد الزراعي" ومستويات وعي المرشدين بقوانين حماية البيئة، تشير الدراسة إلى أن معظم المبحوثين هم من الشباب نسبياً وقليلي الخبرة ولديهم مستويات منخفضة من المعرفة بالتشريعات البيئية، ومع ذلك، لديهم ميل أكبر للتعلم والممارسة، بناءً على نتائج الدراسة، يوصى بتنظيم دورات تدريبية مكثفة للعاملين في الإرشاد حول التشريعات البيئية لجعلهم ملمين بالزراعة السليمة والصديقة للبيئة حتى يتمكنوا أثناء العمل مع المزارعين من نقل مبادئ وممارسات الزراعة الخالية من التلوث بالشكل المناسب.

الكلمات الإسترشادية: التلوث البيئي، مستويات المعرفة، المرشدون، الدورات التدريبية، القضايا الصحية.

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