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# NEGATIVE EFFECTS OF PESTICIDES ON THE ENVIRONMENT AND THE FARMERS AWARENESS IN SAUDI ARABIA: A CASE STUDY

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## ABSTRACT

The main goal of this study was to determine the levels of knowledge of the farmers on the effect of pesticides on environment in Dawadmi Province, Saudi Arabia. This is achieved through realizing some secondary objectives such as identification of the farmers' socioeconomic characteristics and its relation to some of the study variables, their attitude towards the negative effects of pesticides on the environment, their knowledge level about pesticides effect and their sources of information about pesticides use, storage and disposal. The study covered (6) locations/areas, and some 204 farmers were included as stratified random sample. The results revealed that the 5% farmers do not rely on agricultural extension but they seek information from other trustworthy sources. The farmers have a positive attitude towards learning about the negative effects of the pesticides on the environment. The study also showed that the most common method of pesticides application is spraying using axi-sprayers or portable sprayers. The results of the study establish the need for the launching of extension programs on the proper and safe methods for pesticides handling and application. The study also suggests the need for improving the existing agricultural extension service to make positive contributions to production and ensure the health of the farmers/farm workers while keeping the environment safe and clean. Also there is a communication gap between the farmers and research centers as observed in the study. Extension programs, brochures and field visits are the sources of information that farmers rely on. Farmers should be enlightened about the importance of the frequent and regular medical checking up of their workers and especially those dealing with the agricultural chemicals.

**Key word:** Sustainable Agriculture, Awareness, Clean Environment, Efficient Extension, Handling Pesticides.

## INTRODUCTION

Agriculture is one of the most important sectors and has experienced a tremendous and significant development since the Kingdom of Saudi Arabia came into being. Realizing the importance of agriculture, the kingdom exempted all agricultural equipment from customs' duties in early 1936 (Ministry of Agriculture, 1996). It was taken as an encouraging gesture on the part of the state and an appreciation for agriculture. With the passage of time and the continuation of the agricultural developmental process, interests in importing pesticides also emerged. Agricultural development achieved through these initiatives also developed an interest on the use of sophisticated machinery and technologies to replace old traditional agriculture with the modern high-input based agriculture.

The agriculture sector witnessed many praise-worthy achievements and realized the level of self-sufficiency in wheat. With the tremendous development in agriculture, the concepts of environmental conservation and maintenance of the soils also emerged as a big challenge in Saudi Arabia.. Ministry of Agriculture played its role in preserving the environment and framed rules for the importation and registration of chemical pesticides and fertilizers. These rules are in line with the rules issued by the designated commissioner.

Despite the presence of rules and regulations, it has been observed that pesticides are not used in an appropriate manner. Much of the portion of chemical pesticides goes to wastage during their use. However, statistics indicates an average annual increase in the quantity of pesticides imported in total imports to the kingdom (Ministry of Agriculture, 2005). Pesticides are used in various types of pests control; remain a big source of air, water and soil pollution, which may negatively affect human health and the living organisms in the environment.

Dawadmi region in Saudi Arabia is famous for growing a variety of crops and the farmers of area are known for their extensive use of different types of pesticides. Dawadmi area witnessed a remarkable agricultural development in the past twenty years and is still fortunate to maintain its production levels. It produces about 28% of the total production of Saudi Arabia of wheat, fodder crops and vegetables (Ministry of Agriculture, 2005). However, the introduction and expansion on diversification and intensification of crops cultivated in the area also resulted in the diversity and multiplicity of lesions and diseases that did not exist in this province before. Diversification of crops necessitated the use of different types of pesticides to

address this new wave of pests and diseases. An amount of about 9880 liters of pesticides was used by the directorate of agriculture in the province of Dawadmi in the year 2003-2004, and about 37885 kg of pesticides were used over an area of 101901 dunums, planted with trees (Ministry of Agriculture, 2005).

The preliminary survey revealed that many farmers in the area use the multiple types and variety of chemical pesticides to combat pests and diseases affecting crops just on the basis of the information provided to them by the dealers and sellers of agricultural inputs and they may not be aware of the fact that pesticides could cause serious damage to the farmers and the environment. It was also noted that the problem of pollution in the region (under study) needs remedial measures and awareness creation among the individuals to preserve the environment.

In the situation, it is very important to study the awareness level of the people on the use of pesticides and their impact on the humans and the environment. There is a literate deficit on the issues caused by the pesticides, their impact on farmers' health and environment; and their relationship with farmers' awareness level. Keeping in view the academic importance of the subject and to provide basic information on the use of pesticides the present study was undertaken with the objectives:

1- To identify the awareness level of the farmers on the use of pesticides and the damages to the environment and its components.
2- To estimate the level of knowledge of the farmers on the adoption of preventive measures when dealing with pesticides, storage, and disposal of pesticides.
3- To identify the social and economic characteristics of respondents, and their relationship to their knowledge regarding damage pesticides may cause and their effects on the environment.

## MATERIALS AND METHODS

Sample included all 4140 farmers residing in the province and served by the Department of Agriculture Services in Dawadmi area. The study area is quite vast and community farms are far away from each other. A stratified random sample of 5% of the community has been drawn (Krjcie and Morgan, 1970). Some 238 questionnaires were distributed among the farmers. Out of this representative sample selected, 34 questionnaires were turned in with incomplete information. Hence the study sample contained 204 farmers.

**The main variables of the study include**

**Level of knowledge of pesticide damage:** The study intended to determine the level of damage caused by the pesticides, respondents were classified into four levels of giving each and every one of them a numeric value ranging from (1-4) where the mean number (1) has no knowledge, (2) limited knowledge. (3) to medium (4) a good knowledge of, and the collection of all knowledge levels of farmers was to find the arithmetic average to represent the degree of knowledge of pesticide damage to the extent where the level of knowledge for each factor ranged between (1-4) and therefore the knowledge is limited if the arithmetic average less than 2, and the average if the arithmetic average of the range is between (2-3), and well, if the arithmetic average of more than 3, then the collection of all degrees of knowledge of each farmer to represent the level of knowledge of the farms damaged pesticides.

**Preventive action by the farmers when dealing with pesticides in the field:** The preventive actions taken by the farmers against the pesticides are measured on a scale from 1 to 4, as the figures or pictures not followed; the scale indicates like (1) is not used, (2) rarely, (3) sometimes (4) always used. Arithmetic averages to represent the degree of use and preventive actions taken by the farmers while dealing with the pesticides.

**Means, Percentages and Correlations were used to analyze the data:** A questionnaire was prepared by involving many faculty from the Departments of Agricultural Extension and Rural Sociology, and Plant Protection at the College of Food and Agricultural Sciences. To test the validity of questionnaire, 30 farmers were interviewed. The questionnaire carried the interview questions which were used as a means of collecting personal data, and the type of questions, reasonably helped achieving the objectives of research. Data were subjected to statistical analysis. The value of Cornbach's Alpha level for the knowledge and the process followed by the respondents, for the prevention when dealing with pesticides were 0.90 and 0.88, respectively.

**Statistical analysis:** The data were subjected to statistical analysis by using Statistical Package for Social Sciences (SPSS, 1990). Tests include: Standard deviation in addition to the frequencies and percentages to display the characteristics of respondents, the simple correlation coefficient between some characteristics of social, educational and economic status of the respondents and their relationship with their knowledge regarding pesticides damage and their effects on the environment.

## RESULTS AND DISCUSSION

**The level of knowledge of pesticide damage:** The data presented in Table -1 show the knowledge level of the respondents toward pesticides damage. The results clearly indicate that the respondent farmers had the knowledge on the effects of the use of pesticides. They were aware of the fact that pesticides cause pollution, can affect soil fertility and impose toxic effects on the soil. Razali (1997) reported that it is becoming difficult to

produce on many of the farms without using pesticides. That's why, farmers use different types of these pesticides. Therefore, it would be.

**Table 1: Distribution of respondents according to level of knowledge about pesticide damage s (n = 204)**

| Level of knowledge Expression | No knowledge | | Limited knowledge | | Medium knowledge | | Good knowledge | | Mean |
|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | |
| Effects of the use of pesticide contamination of soil and fertility | 51 | 25 | 40 | 19.6 | 64 | 31.4 | 49 | 24 | 2.54 |
| The damage of toxic pesticides contamination on the soil | 50 | 24.5 | 44 | 21.6 | 69 | 33.8 | 41 | 20.1 | 2.50 |
| Pesticide damage to organisms in the soil | 53 | 26 | 68 | 33.3 | 44 | 21.6 | 39 | 19.1 | 2.34 |
| The damage of toxic pesticides on living organisms | 39 | 19.1 | 84 | 41.2 | 55 | 27 | 26 | 12.7 | 2.33 |
| Pesticides linked to the injury of human blindness | 56 | 27.5 | 73 | 35.8 | 57 | 27.9 | 18 | 8.8 | 2.18 |
| Relationship of pesticides in plant burns | 66 | 32.4 | 75 | 36.8 | 40 | 19.6 | 23 | 11.3 | 2.10 |
| Relationship between pesticides and the injury of the human paralyzed | 52 | 25.5 | 106 | 52 | 28 | 13.7 | 18 | 8.8 | 2.06 |
| Effects of the use of pesticides on the toxic air pollution | 80 | 39.2 | 63 | 30.9 | 43 | 21.1 | 18 | 8.8 | 2 |
| Pesticides linked to defect peaks developing plants | 96 | 47.1 | 54 | 26.5 | 34 | 16.7 | 20 | 9.8 | 1.89 |
| Pesticides damage the layer atmosphere (ozone) | 87 | 42.6 | 74 | 36.3 | 21 | 10.3 | 22 | 10.8 | 1.89 |

important for all the farmers to have awareness on the appropriate use of various pesticides needed on different crops.

In some areas, pesticides have created the pollution problems and the environmental issues due to their excessive use. The fertility had the highest mean value of 2.5 and similarly the damage of toxic pesticides contamination on the soil also attained a mean value of 2.5; however, farmers had the lowest level of knowledge on the pesticides damage on atmospheric layer/cover and the growing plants with a mean value of 1.89. Elzimaity (1998) reports that change in one or more of the physical, chemical properties, or all or some of the vital components of the environment would lead to adverse effects to humans, plants and animals.

**Table 2: Distribution of respondents according to the digital value of their knowledge about the damage of pesticides**

| The Numerical value | No. | % |
|---|---|---|
| Less than 20 (limited knowledge) | 61 | 30 |
| From 20 to less than 30 (medium knowledge) | 122 | 60 |
| 30 and more (good knowledge) | 21 | 10 |
| Total | 204 | 100 |

**Table -3 Precautionary methods used when dealing with pesticides**

| Extent of use | Not used | | Rarely | | Sometimes | | Always | | Mea |
|---|---|---|---|---|---|---|---|---|---|
| Method of use | No. | % | No. | % | No. | % | No. | % | n |
| **Automatic central** | 0 | 0 | 10 | 4.9 | 23 | 11.3 | 171 | 83.8 | 3.79 |
| Spraying machines and portable trailer | 9 | 4.4 | 7 | 3.4 | 36 | 17.6 | 152 | 74.5 | 3.62 |
| Machine dorsal | 55 | 27 | 31 | 15.2 | 55 | 27 | 63 | 30.9 | 2.62 |
| Compressed air guns | 76 | 37.3 | 35 | 17.2 | 49 | 24 | 44 | 21.6 | 2.30 |
| The application of machines almahbbat | 54 | 26.5 | 52 | 25.5 | 90 | 44.1 | 8 | 3.9 | 2.25 |
| Disseminators almahbbat | 54 | 26.5 | 52 | 25.5 | 90 | 44.1 | 8 | 3.9 | 2.25 |
| Allarat | 74 | 36.3 | 34 | 16.7 | 77 | 37.7 | 19 | 9.3 | 2.20 |
| Machine high-pressure | 71 | 34.8 | 45 | 22.1 | 75 | 36.8 | 13 | 6.4 | 2.15 |
| Aerosols generators | 73 | 35.8 | 46 | 22.5 | 83 | 40.7 | 2 | 1 | 2.07 |
| The vog avhat | 76 | 37.3 | 87 | 42.6 | 39 | 19.1 | 2 | 1 | 1.84 |
| Intermittent pressure machine | 135 | 66.2 | 29 | 9.8 | 28 | 13.7 | 21 | 10.3 | 1.68 |
| Machine with the pressure arm | 143 | 70.1 | 35 | 17.2 | 18 | 8.8 | 8 | 3.9 | 1.47 |
| Allavhat spray | 135 | 66.2 | 48 | 23.5 | 19 | 9.3 | 2 | 1 | 1.45 |
| Micro-machine sized | 138 | 67.6 | 50 | 24.5 | 15 | 7.4 | 1 | 0.5 | 1.41 |
| Machine constant pressure | 162 | 79.4 | 22 | 10.8 | 9 | 4.4 | 11 | 5.4 | 1.36 |
| Syringes remaining soil | 165 | 80.9 | 22 | 10.8 | 15 | 6.4 | 14 | 2 | 1.29 |
| Aerosol bomb | 196 | 99.1 | 2 | 1 | 1 | 0.5 | 5 | 2.5 | 1.09 |

Similarly Table -2 shows the distribution of respondents with numeric values on their knowledge on the damage of pesticides. Most of them (60%) had medium level of knowledge. Researchers like Alam, (1996); Cornwall et al., (1995), also reported the risk of pesticides on the environment and public health in the developing countries.

While dealing with the pesticides, and the precautionary measures adopted by the farmers are presented in Table-3. Mandel et al., (1996) conducted a study on 502 farms using pesticides in Minnesota, USA. It was observed that 95% of them realized the importance of wearing protective clothing or wears; 88% knew about exposure to pesticides could cause the potential damage; 56% were wearing protective gloves for chemicals and 22% wore gloves for other farm operations; and 75% of the time during the process of pesticide application. Regarding the use of machines for applying pesticides, the results indicate that automatic central spraying machines and portable trailers were with the highest mean values of 3.79 and 3.62 respectively whereas residues of spraying remains in soil; and aerosol contaminants had the lowest mean values of 1.09 and 1.29 respectively. The results do not match with Mandel et al., (1996) may be because the literacy and awareness levels among the farmers are high in USA.

**The practice of preventive measures when dealing with the pesticide:** As shown in Table - 4, more than 60% of the respondents rely on the information and the cautionary measures for a particular pesticide available on the instruction labels. Reading of the labels and adherence to the instructions/precautions had the highest mean values, with the mean values 3.56 and 3.49 respectively. While the farm animals are allowed to graze and roam freely after spraying received the lowest value of 1.18 and the ability to determine type of insect damage and sickness due to a particular pesticide had received a mean values of 1.49 as revealed. Researchers like Alam, (1996); Cornwall et al., (1995), also reported the risk of pesticides on the environment and public health in the developing countries. The illiteracy among farmers and agricultural workers is quite low as indicated by many studies. The agricultural workers in many third world countries are illiterate and cannot read a pesticide instruction labels, lack trainings on the application methods of safe use of pesticides, do not wear any protective clothing, and are ignorant on safe storage and appropriate disposal of residuals (Dossari, et al., 2004).

**Table–4. Distribution of respondents according to the usual preventive measures when dealing with pesticides (n = 204)**

| Extent of use | Not used | | Rarely | | Sometimes | | Always | | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Method of use | No. | % | No. | % | No. | % | No. | % | |
| Read the card DDT | 13 | 6.4 | 6 | 2.9 | 38 | 18.6 | 147 | 72.1 | 3.56 |
| Adherence to the prohibition | 8 | 3.9 | 14 | 6.9 | 52 | 25.5 | 130 | 63.7 | 3.49 |
| Confirmation of the date of the authority | 13 | 6.4 | 28 | 13.7 | 38 | 18.6 | 125 | 61.3 | 3.35 |
| Non-use of the hands without the confusion and prevention | 43 | 21.1 | 19 | 9.3 | 18 | 8.8 | 124 | 60.8 | 3.09 |
| The expense of the required amount of spray | 37 | 18.1 | 33 | 16.2 | 35 | 17.2 | 99 | 48.5 | 2.96 |
| Spray cleaning tools after the completion of the process of spraying | 52 | 25.5 | 31 | 15.2 | 58 | 28.4 | 63 | 30.9 | 2.65 |
| Shower with soap and water after the completion of the process of spraying | 53 | 26 | 37 | 18.1 | 63 | 30.9 | 51 | 25 | 2.55 |
| Cover the hands and feet only when dealing with DDT | 62 | 30.4 | 53 | 26 | 45 | 22.1 | 44 | 21.6 | 2.35 |
| Wear protective clothing during spraying | 65 | 31.9 | 53 | 26 | 50 | 24.5 | 36 | 17.6 | 2.28 |
| Add hoc use of tools for mixing | 85 | 41.7 | 52 | 25.5 | 38 | 18.6 | 29 | 14.2 | 2.05 |
| Periodic disclosure on the employment of spray | 110 | 53.9 | 46 | 22.5 | 27 | 13.2 | 21 | 10.3 | 1.80 |
| Determine the type of insect injury and sickness | 158 | 77.5 | 16 | 7.8 | 7 | 3.4 | 23 | 11.3 | 1.49 |
| Allow farm animals directly after spraying | 182 | 89.2 | 14 | 6.9 | 2 | 1 | 6 | 2 | 1.18 |

Taj-al-Din et al., (1999) mentioned that most farmers follow the instructions available on the packaging labels. They find out information on pesticides application methods and precautions necessary to do so, while relatively few of them read the labels to determine the components of the pesticide, and anti-poison cautions. They stressed that pesticides packaging must contain all the information on the use and its application method, and its toxicity level. Information on application method, the doses, periods of prohibition and all the necessary precautions to be taken before, during and after the use must be printed on the labels. The distribution of respondents expressing the extent of their use of preventive measures while dealing with the pesticides has been presented in Table -5. Results indicate that the highest percentages or the numerical values were given

the respondents using medium level of pesticides and only 17 percent respondents were using few pesticides. According to the Arab Organization for Agricultural Development, (1992) that the intensive use of pesticides has become an integral and important feature of the most agricultural activities carried out in the Gulf states.

**Table – 5 Distribution of respondents according to the numerical value expressing the extent of their use of preventive measures when dealing with pesticides**

| The numerical value | No. | % |
|---|---|---|
| Less than 26 (the use of a few) | 35 | 17.16 |
| From 26 to less than 39 (the use of mid-level) | 129 | 63.24 |
| 39 and over (use a lot) | 40 | 19.6 |
| Total | **204** | **100** |

| The numerical value | No. | % |
|---|---|---|
| **8.33 less than the use of a false** | **76** | **37.2** |
| From 8.33 to 11.67 lower than the use of a reasonable degree to some | 122 | 59.8 |
| 11.67 increasingly used correctly | 6 | 3.0 |
| Total | 204 | 100 |

The personal characteristics of the respondents like their social and economic status are reported in Table - 6. Arab Organization for Agricultural Development (1992) estimated that cost of controlling the pests would be between 20 to 35% and the pesticides are reported the most important tools of modern technology used by farmers depending upon their socio-economic conditions for the eradication of pests that attack crops of various kinds.

**Table - 6 Personal characteristics, social and economic development of farmers respondents (n = 204)**

| Characteristic | No. | % | Characteristic | No. | % |
|---|---|---|---|---|---|
| **Age** | | | **No. of foreign labor** | | |
| Less than 30 years | 6 | 2.9 | None | 9 | 4.4 |
| 30 – less than 40 | 30 | 14.7 | One labor | 62 | 30.4 |
| 40 – less than 50 | 41 | 20 | 2-4 labors | 51 | 25.0 |
| 50 – less than 60 | 62 | 30.3 | 5-7 labors and more | 25 | 12.25 |
| 60 – less than 70 | 55 | 26.9 | 8-10 labors | 44 | 21.6 |
| 70 years and over | 10 | 4.9 | 10 labors and more | 13 | 6.5 |
| Place of birth | | | Quality of Agricultural holding | | |
| Countryside | 161 | 78.9 | Owned | 184 | 90.2 |
| Urbanites | 43 | 21.1 | Rented | 14 | 6.9 |
| Working place of residence | | | Shared | 6 | 2.9 |
| Urbanites | 109 | 53.4 | Owned | 184 | 90.2 |
| Countryside | 95 | 46.6 | Agricultural activity | | |
| Social situation | | | Field crops | 193 | 94.6 |
| Married | 196 | 96.1 | Feed secondary | 173 | 84.8 |
| Unmarried | 8 | 3.9 | Palms | 161 | 78.9 |
| Family size | | | Vegetable crops | 135 | 66.2 |
| Less than 5 (simple family) | 29 | 14.2 | Fruit crops | 69 | 33.8 |
| 5-less than 10 (medium family) | 125 | 61.3 | Animal production | 69 | 33.8 |
| 10 and more (big family) | 50 | 24.5 | Total area of the farm | | |
| Educational level | | | Less than 50 hectare | 84 | 41.2 |
| Illiterate | 18 | 8.8 | 50-less than 100 hectare | 57 | 27.9 |
| Read and write | 65 | 31.9 | 100-less than 150 hectare | 28 | 13.7 |
| Primary | 28 | 13.7 | 150-less than 200 hectare | 9 | 4.4 |
| Secondary | 18 | 8.8 | 200 hectare and more | 26 | 12.7 |
| High School | 24 | 11.8 | Annual income | | |
| University | 50 | 24.5 | Less than 100 thousands | 53 | 26.0 |
| Graduate | 1 | 0.5 | 100-less than 200 thousands | 90 | 44.1 |
| Basic occupation | | | 200 thousands and more | 61 | 29.9 |
| Not farmer | 160 | 78.4 | | | |
| Farmer | 44 | 21.6 | Working in the farm | | |
| Secondary occupation | | | Working individually in farm with agricultural workers | 144 | 70.6 |
| Not farmer | 153 | 75 | Working with his family and agricultural workers | 48 | 23.5 |
| Farmer | 51 | 25 | Working farm with his family only | 9 | 4.4 |
| No. of family members working in agriculture | | | Working farm only | 3 | 1.5 |
| None | 56 | 27.5 | | | |
| One person | 112 | 54.9 | | | |
| 2-3 persons | 24 | 11.8 | | | |
| 4 person and more | 12 | 6.0 | | | |

The correlations between certain characteristics like social, economic and educational advancement of knowledge and respondents toward the damaged of pesticides are shown in table (7).

**Table 7 Correlations between personal characteristics of respondents and their level of knowledge regarding the damage of pesticides**

| Dependent variables Independent Variables | Level of knowledge of respondents about the damage of pesticides |
|---|---|
| Level of education | **0.240 |
| Total area of the farm | **0.415 |
| Type of farm | 0.038 |
| Total of annual income | **0.331 |

* Level of significance 0.05
** Level of significance 0.01

There is a direct correlation between the level of education, the total area of the farm, and the annual income level regarding respondent knowledge (as independent variable) of pesticide damage (as the dependent variable) and the potential level, with 0.01 correlation coefficient 0.240, 0.415, 0.331, respectively. This means that the farmers with higher the higher levels of education will have increased annual income. Increased level of knowledge; the adverse effects of pesticides and the high level of income and education were important factors to have the assessment of mental approach of the farmers and the usefulness of material about the adoption of modern methods and practices. Educated farmers can easily deal with pesticides and are their awareness level on the consequences of using the incorrect pesticides and the negative effects inappropriate use on the environment is certainly higher (Rogers, 1983).

As revealed in Table – 7, there is positive correlation between personal characteristics of respondents and their level of knowledge regarding the damage of pesticides. The level of knowledge of respondents about the damage of pesticides is significantly influenced by the parameters like the level of education, total area of the farm and total annual income. Researchers like Alam, (1996); Cornwall et al., (1995), also reported that literacy among farmers and agricultural workers is quite low. The agricultural workers in many third world countries are illiterate and cannot read a pesticide instruction labels.

**Recommendations:** Based on the findings of the study, the following recommendations are made:

1. There is a dire need of designing, launching and implementation of outreach extension programs on the safe use of chemical pesticides.
2. Regular programs in the media, written and audio-visual are needed for the farmers to make them aware of the dangers of such materials and the safety measures to adopt while dealing with them.
3. The need to raise awareness levels among workers on the application of pesticides, the negative effects that may result from the erroneous use of pesticides and the spraying operations. It is important to know that trained laborer with the sufficient skills and knowledge on dealing with these chemicals can help avoiding the dangers that may otherwise result by adopting the wrong procedures.
4. Awareness levels on the importance of periodic health check-ups of workers on the farms, especially those dealing directly with pesticides need to be enhanced.

The study recommends the need for designing and executing extension. Programs on the proper and safe methods for pesticides handling and application are needed in the kingdom. Improvements on agricultural extension efficiency and better communication with farmers and between research centers need to be made. More emphasis should be placed on the sources that farmers rely on. Brochures and field visits as means of sources of information have received more attention in the extension programs. Farmers should be enlightened on the importance of the periodic check-up of their workers especially those who are dealing with pesticides.

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