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Survey of Pesticides use practices and perceptions of Sohag governorate, Egypt. A case study

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Abstract

Pesticides are playing a pivotal role in meeting the increase in food consumption and cotton fiber demand for escalating population and control of vector-borne diseases. However, most of the applied pesticides get dispersed in the environment and affect the health of unprotected pesticide occupational workers. So, this study was designed to assess the understanding level of pesticide labels, their field application practices, and observance of safety procedures among farmers and pesticide applicators at Sohag Governorate, Egypt. In-depth field surveys were undertaken with 550 workers and complemented by focus group discussions, interviews, questionnaires, and field observation. Obtained data revealed that 65 % of farmers follow agriculture rotation, while majority of participants are reading the pesticide labels. Also, results showed that the insecticides were the highest used (41.7%) followed by herbicides (38.6%) and fungicides (19.7%) Organophosphates were the most frequently used pesticides followed by neonicotinoid and pyrothrid then carbamates. According to WHO pesticides toxicity classification, slightly hazardous compounds belonged to class U (unlikely to pose an acute hazard in normal use) were the most frequently used in study region followed by the moderately hazardous compounds (class II). 49.8% of the respondents claimed immediate health hazards after pesticide application. Also, about two third of participants referred they did not wear the personal protective equipments (PPE) because its high cost, while 32 % of them reported that it's discomfortable. The awareness of farm workers and authorities needs to be increased regarding the use of personal protective equipment (PPE) and correct storage procedures, handling, disposing of pesticides and empty containers.

Keywords:
Pesticides, farmers, pesticide retailers, pesticide applicators, labels, precautions safety.

INTRODUCTION

Pesticides are playing a pivotal role in meeting the increase in food consumption and cotton fiber demand for escalating population and control of vector-borne diseases. However, most of the applied pesticides get dispersed in the environment and affect the health of unprotected farmers and pesticide applicators. During 2018, approximately 11,000 tons (active ingredient) of pesticides (2200, 4510, and 4290 tons of fungicides, herbicides, and insecticides, respectively) in Egypt were utilized according to Egypt's Agricultural Pesticides Committee (APC, Egypt 2019 and Shalaby, *et al.,* 2022). The pesticide term is a complex word that includes all compounds that are applied to destroy or control pests; this includes insecticides (insects), herbicides (weeds), fungicides (fungi), acaricides (mites) …etc (Hassan and El Nemr, 2020). Questionnaires are an effective tools, a valuable method of collecting a wide range of information from a large number of individuals; also, it's are a series of questions to obtain statistically useful information about a given topic (Roopa and Rani, 2012). Through questionnaires, (Stimamiglio, *et al.*, 1998) reported that the information about pesticides, storage, dose and application and also the safety precautions taken by farmers during mixing and spraying pesticides. This survey achieved in assessing implementing appropriate safe use trainings in the context of farmer's perceptions and knowledge. Also, (Shalaby, *et al.,* 2012) reported that the level of awareness or knowledge has also been evaluated about the protective measures of the safety of pesticides. The field survey indicated that 40.0, 6.7 and 12.0 % of farmers, pesticide market and spraying workers, respectively, did not wear protective clothes. However, most of them (83.3%, 93.3% and 88.0 %) have knowledge of safety precautions that must be taken during the formulation of pesticides and application. In Malaysia, by using questionnaire, evaluation of the perception of the workers towards pesticide use and awareness regarding the health effects post-pesticide exposure. The survey questionnaire had five parts, namely, demographic profile of the workers, methods of applying pesticides, use of safety measures while applying pesticides, health profile, and perception about the environmental effects of pesticide usage (Sulaiman, *et al.,* 2019). The collected data were about the pesticide usage practices by two methods questionnaires and personal observation of the agricultural practices (Pesticide handling, spraying techniques, and waste disposal) in the farms, shops and dealers of pesticides. The results are about The classification of the pesticides based on the type of pests they control revealed that, insecticides are the most used group (57%), followed by fungicides (15%), acaricides (9%), and herbicides (6%) (Philbert *et al.,* 2019). The wrong application of pesticides has negative effects on human health, and adoption safety measures are necessary to avoid the harmful effects of pesticides and bicycles on the use of safe pesticides that greatly affect the level of knowledge of farmers on the safe use of insecticide (Mubushar, *et al.,* 2019). The perception of the levels and the behavior of farmers on the uses of pesticide pesticides and their related risks to the environment and human health among the Bangladesh farmers, and it have been observed a difference in the knowledge of farmers and their behavior towards the of pesticides. The survey study confirmed that revealed all the background variables (education, age, farming experience, and farm ownership) had a similar contribution towards understanding the danger of pesticides impact of health and environment (Shammi, *et al.,* 2020). Therefore, this study aimed to: 1) Screen the common pesticide types that workers use; 2) Evaluate the perceptions of farmers about pesticides handling, pesticides safety label and spraying field practices that could expose them to chemical risk; 3) Explore storage and disposal of old (expired) pesticide stocks and empty containers; 4) Survey the protective measure which is taken by participants in farms, inside shops, including using personal protective equipment.

MATERIALS AND METHODS

1. Study area

Sohag governorate is in the middle of the South Egypt between 26" 36" 26 N latitudes and 31" 47" 80 E longitudes Fig. (1) (Alsheikh, *et al.,* 2011) with an estimated 5.7 million inhabitants (C. A. P. M. A. S.). Agriculture is the main profession of the majority of the population of the selected location.

It is famous for the dense traditional cultivation of a large number of crops (rice, wheat, onion, sugar beets, potatoes, tomatoes, cabbage, alfalfa, corn ... etc.). Large amounts of pesticides are used annually to control pests attacking these crops.

Fig. (1). Map of Sohag governorate

2. The basic design and sample size

550 healthy male individuals in the age group of 35-60 years comprising of 370 farmers, 120 pesticide applicators, and 60 pesticide retailers were selected for the present study. The participants chosen had a history of exposure to pesticides during a period ranging from 10 to 20 years at least.

3. Field survey

Face-to-face interviews were used to collect data using a questionnaire, the questionnaire contained four sections: 1st) was designed to collect information about pesticides mostly used in the study area, crops were cultivated by study subjects; 2nd) was focused on workers knowledge and understanding pesticide labels; 3rd) was assess the worker's pesticides handling, dispose of empty containers, pre-harvest period; 4th) was evaluating the safety practices during pesticide application such as: eat or smoke during work; protective cloths or equipment. The participants were interviewed in their fields, each interview was taking about 20 -30 min to complete and all were conducted from 2019 - 2020. The study subjects were asked to report the pesticides by trade names or local names. Data collectors checked the pesticide names from the containers or labels when participants failed to do so.

4. Ethical statement

Permission for the study to be conducted was also obtained from the mother villages at Sohag governorate. Participants received explanations of the purpose of the study in the Arabic language (their mother tongue). Informed approval was obtained from study individuals before starting each interview, and no personal identification was registered. We prepared an informed verbal consent that involved the purpose of the research, the expected duration of the interview, and a description that the individuals could withdraw at any time from the interview without any risk and no payment for their recruitment. We read this statement to each study participant before starting the interview and requested their permission to be involved in the study.

RESULTS AND DISCUSSION

The obtained data were collected from questionnaire forms after interviews with the target workers and all data and results were recorded on copies of the questionnaire during interviews (Tables 1 - 4).

1. Pesticides used in the study region

Obtained data were collected on the type of pesticides used (insecticides, herbicides and fungicides), sources of information about pesticides, training in the proper use of pesticides. The questionnaire focused on identify types of consumed pesticides, assessing knowledge, attitudes and practices of these farm workers with regard to safe use of insecticides, safety and health factors. Table (1) showed the most frequently used pesticides, their trade and common names; chemical groups and their toxicity classification according to World Health Organization (WHO, 2019). The present study revealed that the farmer uses 125 of pesticides under different trade names belonging to different chemical groups. About 53.2 % of the used pesticides are classified by the World Health Organization as toxicity class U (unlikely to pose an acute hazard in normal use) were the most frequently used in study region (WHO, 2019), followed by the moderately hazardous (25.4 %) compounds (class II), while (16.7 %) belong to class III and (4.8 %) of the used pesticides are under toxicity class IB (highly hazardous). Insecticides is the main pesticides used (42%), followed by herbicides (38%) then fungicides (20%) Fig. (2). The obtained results revealed that Organophosphate and glyphosate-diammonium were the most frequently used pesticides followed by Neonicotinoid and Sulfonylurea then parathyroid and carbamate. In the same respect, data obtained by (Ngowi, *et al.*, 2007) showed those farmers' practices (Northern Tanzania), perceptions and related cost and health effects on vegetable pest management using pesticides. The types of pesticides used by the farmers in these areas were insecticides (59%), fungicides (29%) and herbicides (10%) with the remaining (2%) being rodenticides. Pesticides were bought from pesticides shops (60%), general shops (30%) and cooperative shops (10%). Also, data obtained by (Mahob, *et al.*, 2014) revealed that the safe use of pesticides in the cocoa sector in Cameroon, the data showed that 35 different chemical pesticides were marketed in Cameroon for use in cocoa: 4 herbicides, 11 fungicides and 20 pesticides. 96.8 % of farmers said that they used pesticides on their farms while 3.2 % didn't use pesticides. Fungicides were the most used (61.8 %), followed by insecticides (38.2%) by farmers. Likewise, eight active ingredients, despite their official ban, were still used on cocoa plantations.

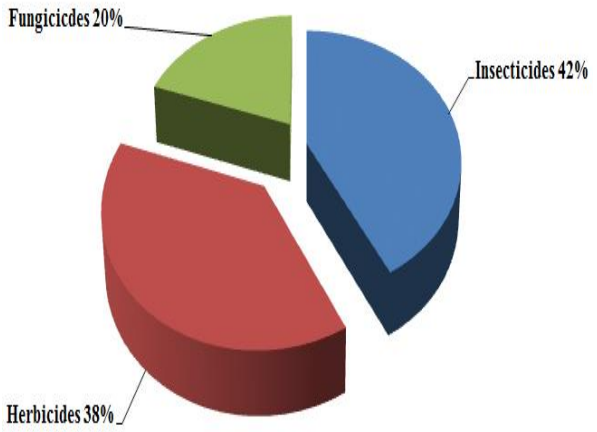

Fig. 2: Mostly used pesticides classification according to the type of pest in the study region.

Obtained results are accordance with those obtained by (Yadav and Dutta, 2019), who reported that organophosphate was the most frequently used pesticides followed by neonicotinoid and Pyrothrid, and the insecticides are consumed higher than that of herbicides, followed by fungicides.

2. Safety practices, protective clothes, and precautions against pesticide exposure

Pesticide labels serve as the primary point of interaction between the manufacturer and the product's end-user, which is conveying vital safety information and using guidelines (FAO and WHO, 2015). Results of the assessment of workers knowledge on pesticide labels indicated that, the majority of them read the pesticide labels (74.1 %), while (25.9 %) did not read it (Table 2), because they may be incapable to read and comprehend meanings of the label, the long list of instructions and guidelines were unclear and the font sizes on the labels were hard to read as they were tiny.

Table 1. Frequently used Insecticides in Sohag Governorate

No.	Trade name	Common name	Type of formulation	WHO classification	Chemical group
1.	Abantin 1.8%	Abamectin	EC	II	Avermectin
2.	Abroch 5 %	Fenpyroximate	SC	III	Carbamate
3.	Aceta 20%	Acetamprid	SP	II	Neonicotinoid
4.	Actara 25 %	Thiamethoxam	WG	U	Neonicotinoid
5.	Actellic 50%	Pirimiphos methyl	EC	III	Organophosphorus
6.	Admiral 10%	Pyriproxyfen	EW	U	Neonicotinoid
7.	Amazon 5.7%	Emamectin benzoate	SG	II	Benzimidazole
8.	Aphox 50%	Pirimicarb	DG	II	Carbamate
9.	Applaud 25%	Buprofezin	EC	U	Thiadiazin
10.	Avaunt 15%	Indoxacarb	EC	II	Pyrethroid
11.	Avenue 70%	Imidacloprid	WG	II	Neonicotinoids
12.	Axon 5%	LambdaCyhalothrin	EC	II	Pyrethroid
13.	Blanch 48%	Thiacloprid	SC	II	Neonicotinoide
14.	Capitol 24%	Chlorfenapyr	SC	II	Neonicotinoide
15.	Challenger Super	Chlorfenabyr	SC	II	Neonicotinoid
16.	Chlorzane 48%	Chlorpyrifos	EC	II	Organophosphorus
17.	Chlorzed 48%	Chlorpyrifos	EC	II	Organochlorine
18.	Cord 72%	Profenofos	EC	II	Organophosphorus
19.	Diazomax 60%	Diazinon	EC	II	Organophosphorus
20.	Dimetox 40%	Dimthoate	EC	II	Organophosphorus
21.	Dolf X 5%	Lambda cyhalothrin	EC	II	Pyrethroid
22.	DursbanH 48%	Chloropyrifos	EC	II	Organophosphorus
23.	Excellent 1.9%	Emamectin benzoate	EC	III	Avermectin
24.	Hostathion H	Triazofos	EC	IB	Organophosphorous
25.	Imidamex 70%	Imidacloprid	WG	II	Neonicotinoid
26.	Kuik 90%	Methomyl	Sp	IB	Carbamate
27.	KZ oil 95%	Mineral oil	EC	U	Mineral oil
28.	Lambdaphos 50%	Lambdacyhalothrin +	EC	II	Pyrethroid +
29.	Lamdathrin 5%	LambdaCyhalothrin	EC	II	Organophosphorus
30.	Lannat 90%	Methomyl	SP	Ib	Carbamate
31.	Malason/Extra	Malathion	EC	III	Organophosphorus
32.	Malathin 57%	Malthion	EC	III	Organophosphorus
33.	Malatox 1%	Malthion	DP	III	Organophosphorus
34.	Micronite 80%	Sulfur	WP	U	Inorganic
35.	Mospilan 20%	Acetamprid	SP	II	Neonicotinoid
36.	Neomyl 90%	Methomyl	SP	IB	Carbamate
37.	Nomolt 15%	Teflubenzuron	SC	U	benzoylurea
38.	Ortus 5%	Fenpyroximate	SC	III	Oxim Carbamate
39.	Oshin 20%	Dinotefuran	SG	U	Neonicotinoid
40.	Pasha 1.9%	Emamectinbenzoate	EC	III	Imidazolinone
41.	Pestiban 48%	Chlorpyrifos	EC	II	Pyrethroid
42.	Prince 10 %	Hexythiazox	EC	U	Oxim Carbamate
43.	Protecto 9.4%	Bacillus thringiensis	WP	U	Triazine
44.	Selecron 72 %	Profenofos	EC	II	Neonicotinoid
45.	Spiro 24%	Spirodiclofin	SC	U	Ketoenol
46.	Spirotex 24%	Spirodiclofin	SC	U	Ketoenol
47.	Tafaban 48%	Chlorpyrifos	EC	II	Organophosphorus
48.	Tamaron 600	Methamidophos	SL	IB	Benzoylurea
49.	Tedo 50%	Pymetrozine	WG	U	Pyrethroid
50.	Vermex 1.8%	Abamectin	EC	II	Dithiocarbamate
51.	Vertimec 1.8%	Abamectin	EC	II	Neonicotinoid
52.	Zincphosphide	Zinc phosphide	DP	IB	Inorganic pesticide

Table 1. Cont. frequently used Herbicides in Sohag Governorate

No	Trade name	Common name	Type of formulation	WHO classification	chemical group
54.	Action 15 %	Clodinafop-propargyl	WP	U	Thiadiazole
55.	Agrisate 48%	Glyphosate	SL	U	Glyphosate-diammonium
56.	Amex 48 %	Butralin	EC	U	Dinitroaniline
57.	Atlantis 1.25%	Iodosulfuron-methyl-sodium-	OD	U	Sulfonylurea
58.	Atrazine 50%	Atrazine	SC	U	Atrazine
59.	Axial 4.5 %	Pinoxadin	EC	U	Sulfonylurea
60.	Ballas 4.5 %	Pyroxsulam	OD	U	Carbamate
61.	Basagran 48 %	Bentazone	AS	III	Benzothiadiazinone
62.	Brominal W	Bromoxynil octanoate	EC	III	Hydroxybenzonitrile
63.	Brond 25 %	Rimsulfuron	EC	U	Sulfonylurea
64.	Bround X 48	Glyphosate	SL	III	Glyphosate-diammonium
65.	Cash cool 75%	Tribenuron-methyl	WG	U	Sulfonylurea
66.	Columbus15%	Clodinafop-propargyl	WP	III	Thiadiazole
67.	Derby 17.5 %	Flumetsulam+Florasulam	SC	U	Triazolopyrimidines
68.	Doxar 12 %	Oxadiazon	EC	U	Oxadiazole
69.	Fusilade Forte	Fluazifop-p-butyl	EC	U	Aryloxyphenoxypropionate
70.	Glypho Elnasr	Glyphosate	SL	U	Glyphosate-diammonium
71.	Glyphon 24 %	Glyphosate	WSC	U	Glyphosate-diammonium
72.	Glyphoup 48	Glyphosate	SL	U	Glyphosate-diammonium
73.	Glysate 48 %	Glyphosate	SL	U	Glyphosate-diammonium
74.	Goal 4F 48 %	Oxyfluorfen	SC	U	Diphenylether
75.	Ground Up 48	Glyphosate	SL	U	Glyphosate-diammonium
76.	Granestar 75%	Tribenuron-methyl	DF	U	Sulfonylurea
77.	Harness 84%	Acetochlor	EC	III	Chloroacetamide
78.	Herbeno 24%	Coldinafop-propargyl	EC	U	Thiadiazle
79.	Herbazed 48%	Glyphosate	SL	U	Glyphosate-diammonium
80.	Gesaprim80 %	chlortriazine	WP	U	Atrazine
81.	Londax	Bensulfuron	WG	U	Sulfonylurea
82.	Maxtop15%	Clodinafop-propargyl	WP	U	Thiadiazle
83.	Ownstar 75 %	tribenuron-methyl	DF	U	Sulfonylurea
84.	Pantera 4%	Quizalofop-P-teffuryl	EC	III	Axyloxyphenoxypropionate
85.	Round up 48%	Glyphosate	SC	U	Glyphosate-diammonium
86.	Round up Max	Glyphosate mono-ammonium	SG	U	Glyphosate-diammonium
87.	Ronstar 25%	Oxadizon	EC	U	Glyphosate-diammonium
88.	Satup 48%	Glyphosate	SL	U	Glyphosate-diammonium
89.	Saturn 50%	Thiobencarb	EC	III	Thiocarbamate
90.	Starane 20%	Fluroxpyr	EC	U	Pyridinecarboxylic acids
91.	Select supper	Clethodim	EC	U	Cyclohexanedione
92.	Select Ultra	Clethodim	EC	U	Cyclohexanedione
93.	Sencor 60%	Metribuzin	SC	II	Triazinone
94.	Sino Super	Clethodium	EC	U	Cyclohexanedione
95.	Sino Up 48%	Glyphosate	SL	U	Glyphosate-diammonium
96.	Stolin 50%	pendimethalin	EC	U	Dinitroaniline
97.	Stomp Extra	pendimethalin	CS	III	Dinitroaniline
98.	Sun Up 48%	Glyphosate	SL	U	Glyphosate-diammonium
99.	Topik 15%	Clodinafop-propargyl	WP	U	Thiadiazole
100.	Touchdown	Glyphosate monopotassium	SC	U	Glyphosate-diammonium
101.	Whip-super	Fenoxaprop-p-ethyl	EW	U	Axyloxyphenoxypropionate

Table 1. Cont. Frequently used Fungicides in Sohag Governorate

No.	Trade name	Common name	Type of formulation	WHO classification	Chemical group
102.	Acrobat copper	Copper oxychloride	WP	U	Inorganic group
103.	Ridomil Gold	Metalaxyl M -	MZ	II	acylamino acid fungicides
104.	Bellis 38%	Pyraclostrobin-	EG	U	Carboxamide
105.	Cabritol 80%	Sulfur	WG	III	Sulfur
106.	Cabrio Top	Pyraclostrobn-	WG	U	Methoxycarbamate
107.	Dithane M-45-	Mancozeb	WP	U	Dithiocarbamate
108.	Z sulfur 80%	Sulfur	WP	III	Sulfur
109.	Amistar	Azoxystrobin	SC	III	methoxyacrylate strobilurin
110.	Amistar 25%	Azoxystrobin	SC	U	Strobilurea
111.	Index	Copper hydroxide		III	Inorganic compounds
112.	Teliozed 25%	Propiconazole	EC	U	conazole fungicides
113.	Captan Ultra	Captan	WP	U	Dithiocarbamate
114.	Manco El Nasr	Mancozeb	WP	U	Dithiocarbamate
115.	Tilt 25%	Propiconazole	EC	U	conazole fungicides
116.	Teldor 50%	Fenhexamid	SC	U	anilide fungicides
117.	Capido 80%	Sulfur	WG	III	Sulfur
118.	Mancopan	Manczeb	WP	U	Dithiocarbamate
119.	Restart 56 %	Hymexazol-		U	Imidazoles
120.	Score 25%	Difenoconazole	EC	U	Triazoles
121.	Topas (100)	Penconazole	EC	U	Triazoles
122.	Option 40%	Flusilazole	EC	II	Triazoles
123.	Caprosate Gold	Mancozib-Cymoxanil	WP	II	Dithiocarbamate
124.	Mydragon 25%	Myclobutanil	EC	U	Triazoles
125.	Blue copper	Copper oxychloride	WP	II	Inorganic compounds
126.	Mycosam 25%	Propiconazole	EC	U	Triazoles

*WHO (2009) classification: IB = highly hazardous; II = moderately hazardous; III = slightly hazardous; U = Unlikely to pose an acute hazard in normal use. **% = Percent of pesticide most frequently used by the subject.

Table 2: Workers knowledge and understanding the pesticide labels

Question	Answer	No.	%
Do you follow an agriculture rotation?	Yes No	370 (Farmers)	65.0 35.0
Do you read pesticide label?	Yes No	550	74.1 25.9
When do you read pesticide label?*	Before buying Before application Before storage	550	38.9 41.0 20.0
Do you know the indication of pesticide labels colour?	Yes No	550	58.0 42.0
Do you use pesticides according to the recommended rate?	Yes No Sometimes	550	68.0 20.0 12.0
Do you check the expiry date?	Yes No	550	41.9 58.9
Are you bought expired pesticides?	Yes No Sometimes Don't know	550	24.0 38.0 14.0 24.0

3. Safety practices, protective clothes, and precautions against pesticide exposure

Pesticide labels serve as the primary point of interaction between the manufacturer and the product's end-user, which is conveying vital safety information and using guidelines (FAO and WHO, 2015). Results of the assessment of workers knowledge on pesticide labels indicated that, the majority of them read the pesticide labels (74.1 %), while (25.9 %) did not read it (Table 2), because they may be incapable to read and comprehend meanings of the label, the long list of instructions and guidelines were unclear and the font sizes on the labels were hard to read as they were tiny.

During the field study, in Table 3, it was found that (55 and 68 %) of farmers and retailers workers smoke and eat during work, while (80 %) of pesticide applicators did not eat and smoke during work. Also, it was noticed that in Table (4) the major of farmers and pesticide applicators were aware of protective equipment that should be used while dealing with pesticides or during agriculture operations after pesticide applications. 44 % of farmers were wearing overall and special boots (25 %), while, 25 % of applicators were wearing overall, special boots (26 %), masks (18%), and glasses (10 %), as well, (8 and 13 %) of the farmers and the pesticide applicators did not follow any safety precautions during work or spraying pesticides. In this study, (91% and 72 %) of the farmers and the pesticide applicators reported using sticks for mixing pesticides, while (9%) and (28 %) of them use their bare hands for mixing, respectively. At the same respect, most of the pesticide shops contain water supply and had good ventilation (80 %), (12 %) of shops had a fire extinguisher, (16 %) of pesticide retailers had gloves and (4 %) had face masks and glasses, while (12 %) of pesticide shops and retailers did not follow safety precautions. On the question of the reason for not using protective equipment during pesticide application, the majority of them answered that, the high cost of protective wear is the main factor. Also, about (20 %) of the respondents were reluctant to use protective wear due to feeling discomfort especially with increase temperature degrees. In another study was conducted in Egypt by (Tchounwou, et al., 2002) displayed that more than 95% of farm workers do not practice safety precautions during pesticide formulation and application in Menia El-Kamh, Egypt. Also, a try to explore knowledge, attitudes and practices towards safety issues related to dealing with pesticides between tobacco farmers in the rural area of Beret, in northern Greece. All farmers (99%) believed that pesticides could have serious harmful effects on user health. Despite awareness of potential health risks by treating pesticides, a large percentage of farmers (46 %) have been informed of not using any protective equipment, especially when spraying pesticides. Of those who have been informed that they use protective equipment, most of them mentioned that they usually use a hat (47%) and shoes (63%). Only a few farmers using the face mask (3%), gloves (8%), and fracture (7%) are on a regular basis (Damalas, et al., 2006). These results agree with (Yadav and Dutta, 2019), which, they confirmed that only (19.4%) of respondents use protection measure (mask, goggles and gloves) to protect themselves from direct exposure to the pesticide and (47%) of respondents were using the mask and the remaining 33.6% were not taking any safety measure. In the same respect, another study was conducted in northern Cote d'Ivoire to assess farmers' understanding of pesticide safety designations, pesticide processing practices and spraying that may expose them to chemical risks. The results showed that 50% of farmers have an accurate understanding of their pesticide safety designations, by 17% partially understood but 33 % misunderstand stickers. (53 %), he did not wear protective clothes while spraying (Ajayi and Akinnifesi, 2007). Also, (Adjrah, et al., 2013) reported that Sphinx Plus has been applied for statistical treatment on the survey forms and showed vegetable farmers have an acceptable educational level (36% have more than 7 years of formal education) to instructions exploitation about pesticide use, but more than 97% do not use recommended tools. Only 21% of them received training for pesticide use. Moreover, 84% of them did not usually wear gloves, and less than 30% used masks.

Table 3: Workers Practices on storage of pesticides and disposal of expired compounds and empty containers.

Question	Answer	No.	%
Where do you store your pesticides?	In the field In store room Inside house	370	20.17 72.36 7.27
Did you eat or smoke during work? Farmers Pesticide retailers applicators	 Yes Yes No	 370 120 60	 55 68 80
Do you buy pesticides in none original containers?	Yes No Sometimes	370	19 48 33
Do you know pre-harvest intervals (PHI)?	Yes No	550	60.4 39.6
Where do you disposal of empty containers?	Leave it in the fields Re-use it Bury on-farm Throw it in the canals and drains Sold it	490	62.0 20.0 5.0 8.0 10.0

Table 4: Safety practices for workers during pesticides application

Question	Answer (Variable)	No.	%
Safety practices for farmers: 1. Wear protective clothes or equipment:	Wear overall Special boots Glasses Mask Gloves Nothing	370	44.0 25.0 37.0 14.0 18.0 8.0
2. How to mix pesticides?	Bare hands Using stick	370	9.0 91.0
Safety practices for pesticide applicators: 1. Wear protective clothes or equipment: 2. How to mix pesticides?	Wear overall Special boots Mask Glasses Gloves Nothing	120	25.0 26.0 18.0 10.0 8.0 13.0
	Bare hands Using stick	120	28.0 72.0
Safety practices inside pesticide shops: 1. Safety practices in pesticide shops:	Water Good ventilation Gloves Fire extinguisher Mask Glasses Nothing	60	80.0 80.0 16.0 12.0 4.0 4.0 12.0
Why didn't you wear PPE?	High cost Discomfortable Unsuitable	550	70.0 20.0 10.0

The most common way to get rid of empty pesticide containers between farmers (62 %) by throwing or emptying them away from the field. 7% of farmers follow the burning process to get rid of the empty container of pesticides. It was also revealed during the discussion that some farmers (13%) re-use empty pesticide containers.

Most of farmers (87%) get pesticides from local merchants; this is because the majority of farmers are unable to distinguish between the various pathogens and appropriate pesticides, whether insecticides or fungicides dependence on the information and advice provided by merchants. However, from discussing farmers and spraying workers, they established that some pesticides were effective on some vegetables and crops (75 %), and therefore, we find that some farmers depend on the advice that merchants provide to resist pests. During the field study, it was found that a few of farmers about 35% do not follow to pre-harvest interval (PHI). It was found that many of the farmers were smoking and chewing tobacco while spraying pesticides. Obtained data revealed also, 87 % of farmers get their pesticides from local agricultural input dealers and depend on the information and advice provided by local agricultural input dealers to make decisions. This is consistent with the results described in (Afari-Sefa, *et al.*, 2015), who found that the Majority of the farmers (90.8%) obtain their pesticides from local agrochemical input dealers.

Results shown in Fig. (3) show that the majority of farmers (72.4%) store pesticides in a safe store after purchases and use, but a number of them (7%, 21%) store them at home and in the field respectively, thus exposing them to the risk of toxicity through direct inhalation of insecticides, As the storage of pesticides in open places can be accessed, it may lead to an acute and/or chronic toxicity, with harmful health consequences. These results agree with the findings of (Afari-Sefa, *et al.* 2015 and Ngowi, *et al.*, 2007), which found that a lot of farmers store pesticides after buying or harvest in closed places far away from anyone also, storing pesticides in open accessible places such as bedrooms may lead to acute and/or chronic exposures, with adverse health consequences and Some deaths resulted in the poor storage of pesticides, which leaked to food stocks (NPAS).

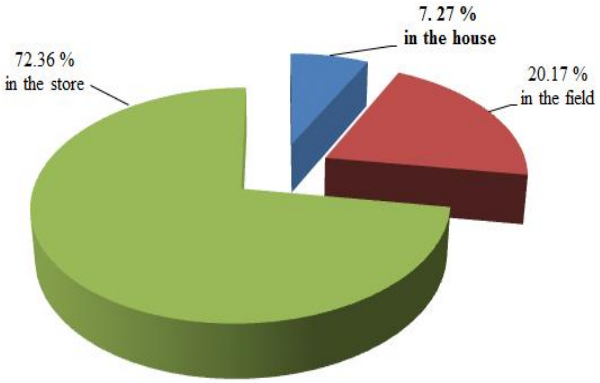

Fig. (3): Where do you store your pesticides?

Generally, depending on the limited participants' number (150 workers), we can't assume that the results are representative of overall Egypt's pesticide occupational workers. To conduct larger-scale interviews around the country was not feasible at the current circumstance, we aimed to highlight relevant occupational health and pesticide safety issues for the studied participants. Besides, the previous researches and findings that reported the adverse effects of pesticides on workers carried out in Egypt made this study in demand (Mahammed, *et al.*, 2018; Gaber and Abdel-Latif, 2012; Shalaby, *et al.*, 2012; Nassar, *et al.*, 2016). Farmers, pesticide retailers, and applicators were all found to be using un-safe pesticide handling practices.

Despite its limitations, this research adds information about pesticides practice and knowledge of safety between pesticide occupational workers in Egypt and can contribute to policy recommendations and educational aims to avoid or minimize the risks related to pesticides. Consequently, to minimize the adverse effects of pesticides on occupational workers and environmental consequences, educational training programs must be provided regularly to the farmers, pesticide retailers, and applicators through strong policy intervention (Miyttah, *et al.*, 2020 and Shalaby, *et al.*, 2022).

CONCLUSION

Creating awareness of safe pesticide handling is remarkably vital and can be achieved through establishing and accessing special orientation programs. The awareness of occupational workers and authorities should be increased regarding the use of PPE and proper procedures for handling, storage, disposal of pesticides, and empty container disposal. Besides, promoting alternative pest control strategies, such as the use of environmentally friendly or "green" insecticides and integrated pest management (IPM), could be productive. Also, it is vital that pesticide retailers receive training to improve their knowledge of pesticide risk communication and safety. They should have at least one technical advisor who is knowledgeable about pesticide dangers and handling to adequately advise end-users. Also, a stricter application of monitoring and pesticide regulation policies should be established to reduce the threats that occupational workers' current practices pose to their environment and health.

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تقصى لممارسات وتصورات إستخدام المبيدات بمحافظة سوهاج، مصر: دراسة حالة

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الملخص العربى

تلعب مبيدات الآفات دورًا محوريًا في تلبية الزيادة في استهلاك الغذاء والألياف القطنية للزيادة في السكان والسيطرة على الأمراض التي تنتقل بواسطة الحشرات. ومع ذلك فإن معظم المبيدات الحشرية التطبيقية تنتشر في البيئة مما تؤثر على صحة العمال المهنيين غير المحميين للمبيدات الحشرية. لذلك تم تصميم هذه الدراسة لتقييم مستوى فهم البطاقة الإستدلالية للمبيدات ، ممارسات التطبيق الميداني ، مراقبة إجراءات السلامة بين المزارعين ومتقدمي مبيدات الآفات في محافظة سوهاج ، مصر. أجريت الدراسات الاستقصائية الميدانية المتعمقة مع 550 فرد وتكملها مناقشات مجموعة التركيز والمقابلات، الاستبيانات ، المراقبة الميدانية. أظهرت البيانات التي تم الحصول عليها أن (65٪) من المزارعين يتبعون الدورة الزراعية، بينما يقرأ غالبية المشاركين البطاقة الاستدلالية. كما أوضحت النتائج أيضًا أن المبيدات الحشرية كانت أعلى المبيدات استخداما بنسبة (41.7 ٪) تليها مبيدات الأعشاب (38.6 ٪) ثم المبيدات الفطرية (19.7 ٪). وقد تبين أن المبيدات الحشرية من مجموعة الفوسفور العضوية الأكثر استخدامًا تليها النيكوتينويد، البيروثرويد ثم الكاربامات. وطبقا لتصنيف سمية المبيدات حسب منظمة الصحة العالمية ، فإن المركبات الخطرة قليلا" والتي تنتمي إلى الفئة (U) كانت قليلة وأكثر استخداما في منطقة الدراسة تليها المركبات الخطرة المعتدلة (الفئة الثانية). كما أوضحت البيانات أن (49.8 ٪) من المجيبين وجود مخاطر صحية فورية بعد تطبيق المبيدات. كما أشار حوالي ثلث المشاركين إلى أنهم لم يرتدوا معدات الحماية الشخصية (PPE) لأن تكلفتها عالية. في حين أن (32 ٪) منهم ذكروا أنها مريحة. يجب زيادة وعي عمال المزارع والسلطات فيما يتعلق باستخدام معدات الحماية الشخصية (PPE) وإجراءات التخزين الصحيحة والتعامل مع المبيدات الحشرية والحاويات الفارغة.

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