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Misuse Of Pesticides By Vegetable Farmers In Palestinian Territories And Recommendations For Their Proper Use

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Abstract: survey was carried out to study the misuse of pesticides in Nablus, Tulkarm and Jenin districts. The results have revealed that up to 50% of farmers usually do not read the directions on the labels of pesticide containers. Some of them (20-36%) also dispose off the empty pesticide containers by throwing them in fields or leaving them in corners or near the field hedges. They burn empty fiber and paper containers of pesticides including those of herbicide and they may often not keep enough safe distance from the smoke. Some of the farmers (2-21%) recklessly open containers or pour into the spraying apparatus, as well as spray the pesticides in windy days. Also, 51% of the pesticides available in the Palestinian markets have Hebrew illustration. Furthermore up to 61% of the farmers ignore the official recommendations of the agricultural extension service.

The results showed that most farmers (87-91%) ignore the necessity of wearing the appropriate protective clothing. Furthermore, 80-85% of them do not accurately measure the application rate of pesticides using the proper equipment.

Other form of misuse of pesticides is that many farmers (31-41%) expose themselves to the pesticides, sometimes using their mouths to blow out clogged lines and nozzles. Also, 80% of the farmers whose fields are located beside water canals spray herbicides to control the wild vegetation around them.

Above all, most farmers (up to 95%) never precisely observe the safety periods specified between the applications of the pesticides and the harvesting period or reentry time.

Key words: Misuse, Pesticides, Palestine

سوء استخدام مبيدات الآفات من قبل مزارعي الخضروات في الأراضي الفلسطينية: تقديم نصائح حول الاستخدام الأمثل لها

ملخص: أجريت دراسة في محافظات نابلس وطولكرم وجنين لتحديد الأخطاء اليومية التي يمارسها المزارعون الفلسطينيون في استخدام المبيدات الزراعية. لقد تبين من هذه الدراسة عدم اكتراث المزارعين لقراءة الإرشادات على عبوات المبيدات بنسبة تصل إلى 50%. كذلك، يقوم بعض المزارعين (20-36%) بالتخلص من عبوات المبيدات الفارغة والتالفة عن طريق رميها في

أطراف الحقول الزراعية. كما يقوم بعضهم بحرق العبوات القابلة للاشتعال في جوانب الحقل دون الاكتراث بضرورة الابتعاد عن الغازات المتصاعدة من الاحتراق لمسافة كافية. أيضا اعتاد بعض المزارعين (2-21%) في منطقة الدراسة على التعامل مع المبيدات ورشها حتى في الأيام التي تسود فيها الرياح.

بينت الدراسة أيضا إن 51% من المبيدات المعروضة في الأسواق الفلسطينية تستخدم اللغة العبرية لعرض تعليماتها. وكذلك فان كثيرا من المزارعين (41-61%) لا يلتزم بالإرشادات العلمية المقدمة من الجهات الرسمية. ومن ناحية أخرى يتجاهل معظم المزارعين في منطقة الدراسة (87-91%) ضرورة ارتداء الملابس الواقية المناسبة. وعلاوة على ذلك، فان نسبة عالية من المزارعين تصل إلى 80% لا تقوم بإجراء قياس دقيق لكمية المبيدات المطلوبة وذلك بسبب استخدامهم لأدوات بدائية قليلة الدقة والكفاءة.

هناك شكل آخر من أشكال سوء استخدام المبيدات من قبل المزارعين وهو قيام كثير منهم (31-41%) بتعريض أنفسهم للمبيدات وذلك باستخدام أفواههم أحيانا في فتح خطوط وفوهات معدات الرش المغلقة بسبب الأوساخ والشوائب. بالإضافة لما سبق، تبين من الدراسة إن 80% من المزارعين الذين يزرعون مزارع محاذية لقنوات المياه الطبيعية يقومون برش مبيدات الأعشاب على جوانب القنوات بهدف التخلص من الأعشاب البرية وتقليل من احتمالية غزوها لحقولهم.

ومن ناحية أخرى بينت الدراسة إن 95% من المزارعين يهملون فترة الأمان للمبيدات ولا يتخذون أي قيد يحدد دخول الحقل بعد إجراء الرش أو حتى قطف المحصول وبيعه قبل زوال آثار المبيدات منه.

الكلمات المفتاحية: سوء استخدام، مبيدات زراعية، فلسطين

Introduction

There are few aspects of agriculture that have advanced so rapidly and generated so much controversy, similarly to the use of pesticides for crop protection. Pesticide use raises a number of concerns. Pesticide misuse that endanger human health or even cause death get the most attention from law enforcement, yet pesticide poisonings are still a common problem, particularly with agricultural workers. In its early days, the subject of pesticides involved little more than an enumeration of the toxic compounds used in agriculture with lists of their chemical properties and practical uses {1}.

Although pesticides have benefits, they are accompanied by a number of problems. For one thing, pesticides affect numerous species in addition to the target pests, creating imbalances in the ecosystem {2}. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target

species, including non-target species, air, water and soil {3}. Pesticide drift occurs when pesticides suspended in the air as particles are carried by wind to other areas, potentially contaminating them. Pesticides are one of the causes of water pollution, and some pesticides are persistent organic pollutants and contribute to soil contamination {4}.

Environment is not only harmed by pesticides. Exposure to pesticides can also damage human health. Pesticide poisoning caused by short-term exposure to high levels of pesticides can result in harm to organs and even death, whereas long-term exposure to lower levels of pesticide can cause cancer {2}.

In Palestine, pesticides including DDT, lindane, a-benzene hexachloride, organochlorine, and organophosphate are used extensively to maintain and increase crop yields. The total annual tonnage of pesticides utilized in Gaza Strip ranges from 500 to 700 tons, which lead to an annual average of 38.4 kg/hectare of pesticide used in the target areas {5}. The intensive use of such pesticides leads too many speculations as to increased cancer and other serious diseases {(6, 7}. Despite the high risk and frequency of exposure, farmers did not follow the safety procedure while working with pesticides. Furthermore, the Ministry of agriculture and the private organizations are concentrating their efforts to controls the use of pesticides and to encourage farmers to use the organic farming. Also, they always warn against the misuse of pesticides on human life and demand legal actions to prevent the introduction of toxic and illegal pesticides into the agricultural areas

Therefore, the current research aims at studying the misuse of pesticides practiced by Palestinian farmers in different regions that may adversely affect humans and the environment. Also, the research aims at providing recommendations on the proper use of pesticides for farmers and farm workers.

Methodology

The survey was carried out during 2009 starting from January until October. Different farms were visited in three main districts including Tulkarm (Noor Shams and Zeimer Valley), Jenin (Sanoor and Al-Zababdeih) and Nablus (Al-Far'a and Wadi Al-Badan). These regions were selected because they have extensive crop cultivation and intensive use of pesticides. Also, they are suitable to follow practices commonly adopted by farmers to raise crops and control pests. The information was obtained by two ways. The first was by questioning the farmers and/or the farm workers using a questionnaire (Appendix 1). The second was by personal observation of behavior of using

pesticides by the farmers and/or the pesticide technicians. Also, the pesticides in use and the empty pesticide canes and bottles dumped in the farms were inspected.

Results

One hundred questionnaires were filled by farmers and/or farm workers from the studies regions. The results showed that about 24%, 17% and 50% of farmers do not read and are not aware of the instructions available on the label of each pesticide container in Nablus, Tulkarm and Jenin districts respectively. Also, about 36% of the farmers in Nablus do not safely dispose pesticide containers compared with 24% and 20% in Tulkarm and Jenin respectively. In regard to pesticide application in windy days, the results showed that about 21% of Tulkarm farmers spray their pesticides in windy days compared with 10% and 2% in Nablus and Jenin respectively. Furthermore, the results proved that 95%, 87%, and 79% of the farmers from the regions of Jenin, Tulkarm and Nablus respectively do not give the safety period of the pesticides the attention and importance it needs (Fig 1).

In addition, 51% of the pesticide container instructions currently available in the market are written in Hebrew compared with 49% using Arabic translations (Fig 2). Also, the farmers do not seek for recommendations and advices from the agricultural extension services by about 61% and 41% before and after crop infection respectively (Fig 3).

On the other hand, the results showed that the majority (87-91%) of farmers in the studied regions do not use protective outfit when spray pesticides. Also, 80-85% of the farmers do not use proper equipment to measure the application rate of pesticides. 31-41% of the farmers used to use their mouths to blow out the clogged lines and nozzles. In addition, 50-53% of the farmers usually buy pesticides in retail (Fig 4).

Furthermore, 80% of the farmers spray herbicides extensively (3-4 times/month) to kill weeds on field edges adjacent to the natural canals of Wadi Al-Badan in Nablus district. Also, 59% and 23% of the farmers apply intermediate (2 times/month) and mild (1 time/month) spray of herbicides respectively (Fig 5).

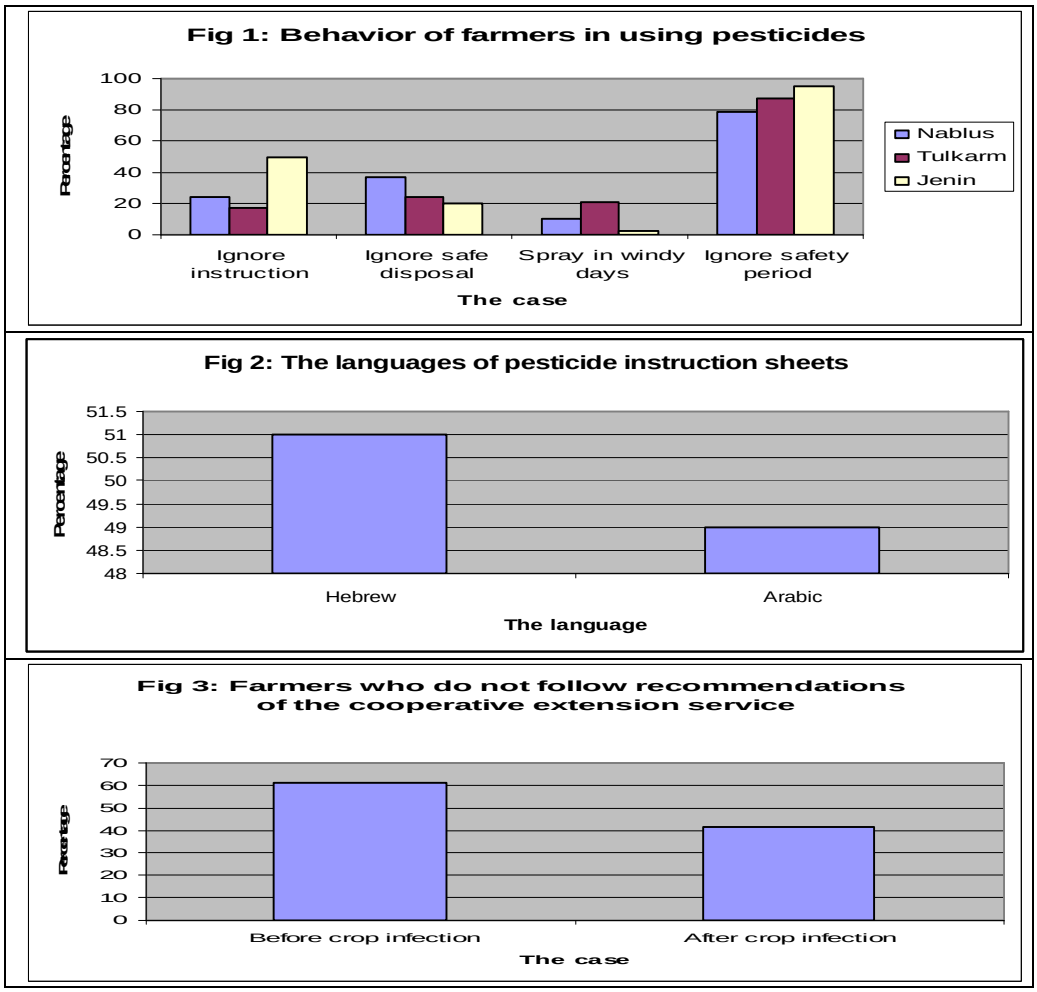
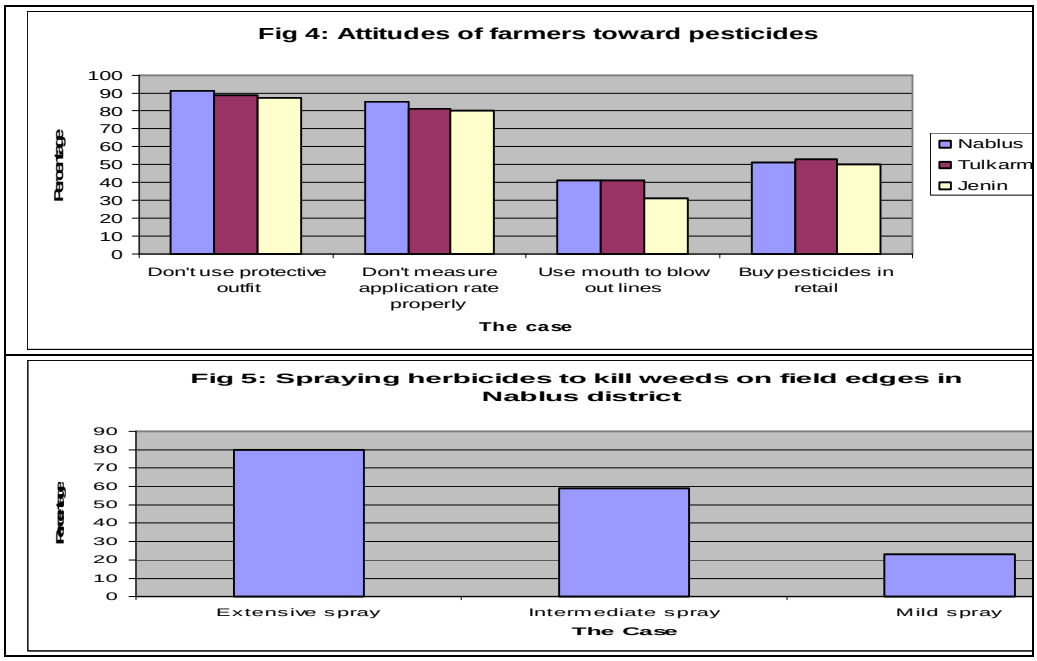


Fig 1: Behavior of farmers in using pesticides
100
80
60
40
20
0
Percentage
Ignore instruction
Ignore safe disposal
Spray in windy days
Ignore safety period
The case
Nablus
Tulkarm
Jenin
Fig 2: The languages of pesticide instruction sheets
51.5
51
50.5
50
49.5
49
48.5
48
Percentage
Hebrew
Arabic
The language
Fig 3: Farmers who do not follow recommendations of the cooperative extension service
70
60
50
40
30
20
10
0
Percentage
Before crop infection
After crop infection
The case



In addition, the above mentioned results were illustrated in Fig 6.

	
Empty pesticide bottles dumped in a field corner	An empty pesticide container dumped in a field between plant rows

Misuse of pesticides by vegetable farmers in Palestinian

Burning empty plastic pesticide containers in a field corner

Mixing pesticides using a soft drink bottle without wearing gloves

Using mouth to blow out the clogged pesticides lines and nozzles

Spraying herbicides in field edges without wearing appropriate protective clothing

Fig 6: Pictures showing the misuse of pesticides by farmers in the studied regions

Discussion

The results have shown that farmers in the studied domain make reckless mistakes and sometimes tend to misuse pesticides. For example, many farmers ignored the constancy of the agronomists and the extension departments of the ministry of agriculture in the nearby regions. Such situation may cause wrong selection of the pesticide and therefore causing extensive damage to crops and the environment.

Furthermore, the studies have revealed that farmers (up to 50%) ignore the directions on the labels of pesticide cans and disregard the current official state recommendations of the agricultural extension service. What aggravated the situation is that many of those farmers are poorly educated or completely illiterate. Those farmers select their pesticides depending on their personal experience rather than scientific evidence and they determine the application rate of pesticides using rough estimates and traditional tools. Such situation may lead to application of wrong doses of pesticides and so bad effect on pests, crops and environment may be expected. The situation may become even worse if the pesticide containers currently available in the market are written in Hebrew, a language most farmers are unqualified to read and unable to understand

The studies revealed that most farmers ignored the necessity of wearing the appropriate protective clothing and using the proper equipment specified on the label. Furthermore, many of them sometimes recklessly open containers or pour into the spray apparatus, as well as spray the pesticides on windy days, thus resulting in the splashing of the toxic materials or the disruption of the pesticides because of the wind. The most serious case is when they use their mouths to blow out clogged lines and nozzles. Such direct exposure to pesticides may cause direct acute and delayed health effects in those who are exposed {8}. Pesticide exposure can cause a variety of adverse health effects. These effects can range from simple irritation of the skin and eyes to more severe effects such as affecting the nervous system, mimicking hormones causing reproductive problems, and also causing cancer {9}.

The fact that some farmers used to dispose the empty pesticide containers by throwing them in the fields or leaving them in the corners or near the field hedges is very critical. Also, when they burn empty fiber and paper containers of pesticides including those of herbicides they may often not keep enough safe distance from the smoke. Such situation of pesticide misuse can endanger wildlife and other environmental resources. According to Environmental Protection Agency, it was reported that throwing pesticides on the ground or pouring them down the drain can pollute lakes, streams and underground water {10}. Miller reported in 2004 that the majority of sprayed pesticides do not reach the targets, but they pollute water and air and potentially contribute to soil contamination {3}. Another serious problem associated with pesticides is that

they do not stay where they are applied, but tend to move through the soil, water and air, sometimes long distance {2}.

Avery crucial point requiring immediate attention is the fact that many farmers whose farms have been established adjacent to the water canals. They spray the wild vegetation growing densely along the canal banks with herbicides for the purpose of destroying the weed and pest sources and to avoid weed-crop competition along the farm sides. By doing so, farmers participate in the direct pollution of the water and add significant amounts of toxic materials to the environment. In this regard, Rittmann and McCarty reported that chlorinated pesticides are taken up by aquatic organisms and concentrated within them. They are further concentrated in the fatty tissue of fish that eat such aquatic organisms, and then further concentrated within birds and other carnivores such as humans. This tendency to bio-accumulate magnifies their negative impacts on higher organisms {11}. In addition, Campbell and Reece reported that chemicals released into the environment may be converted to more toxic products by reaction with other substances or by metabolism of microorganisms{12}.

An example on such a case can be noticed in Wadi Al-Badan where the farmers use intensive spray to kill the wild flora along the water sites. The major canals of such region flow down towards the Jordan Valley, and sometimes evolve to form the vast canals, which flow, throughout the valleys. As a result, farm animals may use the water in the valleys as drinking water. Furthermore, the smooth flow of water in the warm region (The Jordan Valley) may attract herds of wild animals and birds to inhabit the region beside the canals and depending on them as a major water source to exist.

The most serious form of pesticide misuse is regarding the safety period. Results showed that the majority of the farmers in the studied regions did not give the safety period of the pesticides the attention and importance it needs. Such a case may cause a chronic effect on humans which occurs when they are exposed separately to small, non-lethal doses of pesticides. Some well-known chronic responses to various irritants include silicosis, lung cancer, brain damage, and necrosis of the liver and kidneys {1}. Furthermore, many studies of farm workers and others who are exposed to low levels of pesticides over many years show an association between serious diseases as cancer and long-term exposure to pesticides {2}.

Farmers sometimes tend to buy pesticides in retail, obtaining the chemicals in small bottles that do not have the pesticide label of instructions on it. The farmers have thus deprived themselves from being familiar with the pesticide instructions. Thus they become oblivious to the dangers of using the toxic chemicals without following the safety precautions. Moreover, the farmers may set these smaller bottles aside for a while, forgetting which bottle contains the right chemical when the time comes to use them again.

In typical work situations, skin absorption is the most common route of poisoning from pesticides. The hazard from skin absorption increases when workers are mixing pesticides because they are handling concentrated pesticides that contain a high percentage of active ingredients {13, 14, 15}. So, protective clothing should be worn when using pesticides or repairing contaminated equipment (Fig 7). Spraying during windy periods should be avoided. Also, the pesticide applicators should not re-enter a sprayed field without protective clothing until the re-entry time has elapsed.

The tissues of the eyes are particularly absorbent. Besides, there is a potential for chemical injury to the eye itself {16, 17}. Therefore, eye protection is needed when measuring or mixing concentrated or highly toxic pesticides. Also, protective face shields or goggles should be worn whenever there is a chance that pesticide sprays or dusts may come in contact with the eyes (Fig 7).

The most severe poisoning usually results when pesticides are taken in through the mouth {18, 19}. Pesticides can be ingested by accident, through carelessness, or intentionally. The most frequent cases of accidental oral exposure are those in which pesticides have been taken from their original labeled container and put into an unlabelled bottle. So, pesticides should not be put in an unlabelled bottle or food container. They should be kept in secure locked containers {20} (Fig 7). Applicators must never try to clear a spray line or nozzle by mouth blowing.

It is known that chronic toxicity is more frequent to occur more than the acute one due to potential exposure to pesticides on or in food products {1}. Therefore, the farmers and farm workers should read the instructions of each pesticide and follow the safety period for each chemical. In addition, cautions against entering sprayed fields should be used (Fig 7).

Pesticides are considered the major pollutant of the environment. They are particularly damaging when they are introduced into the bodies of water. In waterways, aquatic life is killed by pesticides each year, and other wild and

domestic animals also suffer the consequences of pesticide-contaminated water. So, spraying herbicides to kill weeds growing along the natural canal banks should be stopped. Also, the amount of pesticides should be measured accurately to avoid extra doses that may pollute the environment. Furthermore, dumping and burning empty pesticide containers in fields should be stopped. Instead, containers should be cleaned using pressure rinsing. The rinse water is added to the application equipment tank. After triple-rinsing, containers may then be buried in a sanitary landfill {21} (Fig 7).

Concerning the fact that some Palestinian farmers are illiterate or not cultured enough to read the pesticide instruction especially those written in Hebrew, those farmers should always consult the scientific sources especially the Ministry of agriculture.

Pesticide applicators wearing appropriate gloves and protective clothing with face shields or goggles.

Source: The US Environmental Protection Agency (US-EPA) {8}.

Accurate measuring of pesticides. Source: UK. Agriculture {20}	Pesticides kept in a secure locked container. Source: UK. Agriculture {20}
	
Caution against entering a sprayed field. Source: The US Environmental Protection Agency (US-EPA) {8}.	Pressure-rinsing an empty container. Source: University of Florida, IFAS Extension {21}
Fig 7: Examples on proper use of pesticides	

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Appendix 1: The questionnaire used in collecting information from farmers and/or farm workers

Question	Yes	No
Do you use pesticides?		
Do you follow pesticide instructions?		
Do you ask the agricultural cooperative extension services for a help **before** your crop becomes infected?		
Do you ask the agricultural cooperative extension services for a help **when** your crop becomes infected?		
Do you read the labels on pesticide containers?		
Do you consider the safety period of each pesticide?		
Do you use the appropriate protective clothing while using pesticide?		
Do you spray pesticide in windy days?		
Do you buy pesticide in retails?		
Do you follow the suitable methods for dumping the empty pesticide containers?		
Do you burn the flammable empty pesticide containers?		
Do you use accurate tools for measuring pesticide quantities before use?		
Do you use your mouth to blow out the clogged pesticide lines and nozzles?		