Knowledge, attitudes and practices of market gardeners toward pesticide use in Bamako, Mali

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Abstract. Introduction: Pesticides are used in market gardening to meet growing consumer demand and achieve economically viable production levels. These products inevitably leave residues that could harm human health and the environment if misused. The aim of this study was to assess the knowledge, attitudes and practices of market gardeners toward pesticide use in Bamako. Methods: This was a prospective study conducted among 120 market gardeners randomly sampled in the district of Bamako. Results: According to the results, 56.7% of market gardeners did not have a diploma and 84% said they never read the instructions for safe use. The personal protective equipment used were: masks (58%), gloves (18%), boots (8%), safety glasses (3%) and coveralls (1%). Empty pesticide packaging, in general, is discarded in the environment (35%). Headache and flu-like symptoms (fever, runny nose, tired) were the most cited symptoms after crop treatment (29% and 27%, respectively). After suspected poisoning, market gardeners took milk in 17% of cases. Conclusion: Pesticides can cause health and environmental risks. To stem this, the use of these products must be done in accordance with good agricultural practices in order to protect the health of market gardeners and ensure the protection of the environment.

Keywords: Pesticides; Market gardeners; Bamako; Mali

Introduction

Pesticides are all chemicals or biologicals intended to destroy living elements considered harmful (microbes, animals or plants) or intended to oppose their development [1].

In order to meet growing demand and achieve economically viable production levels, market gardeners use pesticides against phytophagy's, parasite attacks and fungal diseases. While the use of these products is often necessary for the producers to achieve their production goals. It remains important to remember that pesticides are toxic and their use can only be accepted or encouraged on condition of perfectly controlling the modes of use as well as the risks to human health and the natural environments likely to be affected through these residues [2].

Many authorized pesticides are known to be very dangerous for health, possible carcinogens, disruptors of the hormonal system, reprotoxic ..., by the official health agencies of the European Union and the United States [3].

From 1990 to 2010, there was an increase of over 261% of pesticide imports into Africa [4]. This situation also concerns Mali, because more than 5,400 tons of pesticides are used per year, or a market value of 17 billion CFA Francs. Agriculture's share amounts to 90% of all pesticides used in Mali [5].

Nowadays, we are witnessing the use of pesticides without any regulatory measures of good use practices. The use of pesticides must be done in accordance with good agricultural and sales practices in order to protect the health of users [6].

In Mali, pesticides are sometimes left in the open or kept in unsuitable stores. The population is poisoned by the use of old containers for domestic work (water tank, kitchen utensils, etc.) and / or by the consumption of poorly processed food. Pesticides are the third leading cause of death by poisoning in Mali [7]. Users become intoxicated through bad practices: no-use of personal protective equipment and good practices for the use of these products (deconditioning, storage, etc.).

Faced with this problem, we initiated the present study which aims to assess the knowledge, attitudes and practices of market gardeners toward rational use of pesticides in the district of Bamako.

Methods

This was a prospective cross-sectional study on the assessment of knowledge, attitudes and practices (KAP) of market gardeners toward rational use of pesticides in the market gardening zone of Bamako.

The sample consisted of 20 market gardeners per municipality, i.e. 120 market gardeners. We chose a random sample by inclusion of all the market gardeners meeting the study criteria. In order to collect the data, we interviewed the market gardeners using a questionnaire that took into account the following elements:

- Social-demographic characteristics;
- Pesticides used in treatment;
- Knowledge, attitudes and practices of market gardeners toward rational use of pesticides.

Informed consent of respondents was requested for their inclusion in the study. The value of the study was explained to all participants, so their participation was free and voluntary. The information collected was treated with anonymity and confidentiality.

Data were collected on a tablet using Microsoft Excel software then transferred to Epi Info version 7 software for statistical analysis.

Results

Table I. Socio-demographic characteristics of market gardeners

Characteristics		Number of cases (%)
Gender	Male	120 (100.0)
Age group	[20-30[	24 (20.0)
	[30-40[	36 (30.0)
	[40-50[	29 (24.2)
	[50-60[	18 (15.0)
	≥ 60 years	9 (7.5)
	Non-respondents	4 (3.3)
Education level	None	68 (56.7)
	Primary	34 (28.3)
	Secondary	15 (12.5)
	Superior	3 (2.5)
Professional experience	Under 3 years	6 (5.0)
	[3-10[	54 (45.0)
	[10-25[	35 (29.2)
	≥ 25 years	25 (20.8)

The age group [30-40 years[predominated with 30% and that 56.7% of market gardeners surveyed had no education level against.

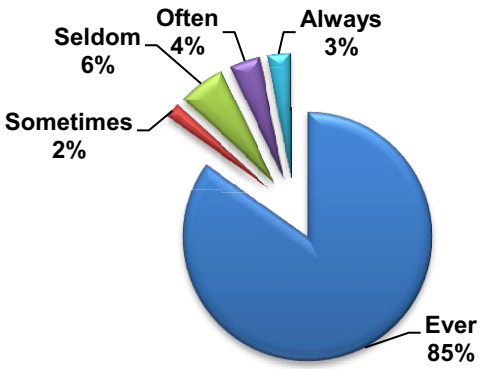

Fig. 1. Reading labels before using any pesticide

In this study, 84% said they did not read the instructions for use of the product compared to 3% who always took information on the rational use of pesticides.

Table II. Market gardener behavior after pesticide use

Behaviors	Number of cases (%)

Action after handling pesticides	Wash hands	118 (98.33)
	Bathe	36 (30.00)
	Washing of clothes	22 (18.33)
Management of rinsing water for spraying containers	Near field	100 (83.33)
	In field	13 (10.83)
	Near well	5 (4.16)
Management of packaging after use	Thrown to Field	42 (35.00)
	Burned	38 (31.66)
	Dumped in landfill	30 (25.00)
	Cut then discarded	6 (5.00)
	Buried in field	4 (3.33)
	Buried in landfill	3 (2.50)
	Gasoline canister	1 (0.83)
	Store	1 (0.83)
	Seed reserve	1 (0.83)
	Store in field	1 (0.83)

In this study, 98.33% of market gardeners washed their hands after treating the crops, 83.33% poured the rinsing water near the field and 35% threw the empty packaging into the field.

The results of this study showed that 29% of market gardeners felt headaches after crop treatment and 27% had flu-like symptoms (fever and/or chills, runny nose, fatigue).

We found a diversity of families of pesticides used by market gardeners see table below.

Table III. Pesticide active ingredients suspected to be the cause of health problems in market gardeners

Active ingredients	Families	Classes	Number of cases (%)	Approval
Glyphosate acid	Phosphonoglycin	Herbicide	18 (38)	Yes
Lambda-Cyhalothrin + Dimethoate	Pyrethrinoid + Organophosphorus	Insecticide	7 (15)	No
D salt Dimethylamin	Alkylchlorophenoxy	Herbicide	6 (13)	Yes
Acetamiprid + Lambda-cyhalothrin	Neonicotinoid + Pyrethrinoid	Insecticide	5 (10)	Yes
Bensulfuron-methyl	Sulfonylurea	Herbicide	4 (8)	Yes
Propanil + 2.4 D isobutyrate	Anilide	Herbicide	3 (6)	Yes
Pretilachlor + pyribenzoxim	Organochlorine	Herbicide	2 (4)	No
Methomyl	Carbamate	Insecticide	1 (2)	No
Cypermethrin + Imidacloprid	Pyréthrinoid + Neonicotinoid	Insecticide	1 (2)	Yes
Carbofuran	Carbamate	Insecticide	1 (2)	No

Thus, in 40% of cases, the pesticides used were not approved by the Sahelian Pesticide Committee (SPC).

Discussion

In this study, all the market gardeners were male. This result is similar to that found by two other studies, which found 93.47% and 98.3%, respectively [8, 9]. This high proportion of men could be explained by the fact that market gardening is an activity purely dedicated to men. Indeed, the phytosanitary treatment is tedious, because the fact of acquiring the product, preparing the solution and applying it by means of a sprayer is often complicated.

The most represented age group of market gardeners was that of [30-40 years[(30%). This result is identical to that of Toe and *al.* (2010) who found 34.5% for the same age group [9]. It was found as a result of the survey

that 56.7% have no educational level. This result is similar to those of Toe and al. (2010), Wade (2003) and Fayom (1998) who found 55%, 60.5% and 70%, respectively [9-11]. This could be explained by the fact that people with a low level of education have difficulty finding a job in the formal sector, which would partly justify their high representativeness in market gardening where the activity does not require specific skills.

35% of market gardeners threw the empty packaging into the field, while 31.7% practiced burning. These results are similar to those of Tchamadeu and *al*. (2017) where 37.9% of market gardeners threw the empty packaging in the field and 37% burned them [12]. According to Congo (2013), this practice contributes to the pollution of the ecosystem through the emanation of fumes and the dispersion of toxic ashes [13]. In our study, the burying of empty packaging was practiced by 2.5% of respondents. This would present a risk of groundwater contamination [13].

The results of the survey showed that 61% of market gardeners surveyed claimed to be aware of the dangerousness of pesticides for human health and 47% believed so for the environment. Similar results have been reported by Fayomi and al. (1998) where farmers asserted that there are risks associated with the use of pesticides [11].

In the event of discomfort felt after using pesticides, 17% of market gardeners drank milk, only 1% went to a health center. These results are similar to that of Kanda and al. (2019) where 6% of market gardeners have consulted a health center [2]. In our study, the most frequent active ingredients in the pesticides used were Glyphosate and Lambda-Cyhalothrin, thus the family of Phosphonoglycines and Pyrethroids were the most used. This could explain the use of herbicides mainly in this activity.

The pesticides used in this study (40%) by market gardeners were not approved, which would explain the fraudulent importation of pesticides into our country.

Conclusion

At the end of this study, it appears that pesticides were used relatively by young market gardeners who had professional experience of at least 10 years.

Lack of education was observed in more than half of the market gardeners. Thus, we recorded these behaviors among the respondents:

- before using pesticides, market gardeners did not acquire the information necessary for good use practice;
- after use, market gardeners threw away or burned empty pesticide packaging in the field;
- in the event of discomfort, consumption of milk was the most frequent practice among these market gardeners;
- Many of the pesticides used were not registered.

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