

Original Research Article

Farmers' perceptions of pesticide and chemical fertilizer use in market gardening in the Comoé river watershed in Burkina Faso

ABSTRACT

Aims: Analyzing farmers' perceptions of the use of synthetic pesticides and chemical fertilizers in market gardening in the Comoé Province of Burkina Faso.

Place and Duration of Study: The present study was carried out in the watershed of the Comoé River located in Burkina Faso in the western part of Africa. The study covered the period from March 12th to May 25th, 2019.

Methodology: An individual survey of a sample of 204 market gardeners using synthetic chemicals was conducted. It was supplemented by field observations. A survey form was designed and the questionnaire was integrated into an application (mWater) for data collection. The data collected was summarized by descriptive statistics.

Results: Study showed that vegetable producers almost unanimously say it is necessary to use fertilizers and pesticides on their production sites. Some of the producers (18.87%) well appreciate the use of fertilizers and synthetic pesticides on the sites. Nearly 94% also believe that the use of fertilizers improves soil fertility and helps to increase crop yields.

As for the precautions taken by the gardeners/producers while using synthetic in the use of pesticides, results of it emerges from the interviews showed with them that 96.57% of them do not use any protective equipment when applying pesticides. In general, after treating their farms with synthetic pesticides, vegetable growers wash themselves at water points and clean their equipment in the field. Of all the producers interviewed, nearly 58% wash themselves at water points while 41% do so in the field. Furthermore, almost all the market gardeners (96%) refer to the nearest medical centre in case of symptoms related to the use of synthetic pesticides.

Conclusion: with a view to the rational use of phytosanitary products and the safeguarding of the ecosystem, it is important to initiate and implement awareness-raising actions aimed campaigns among the gardeners, producers must be implemented.

Keywords: Synthetic pesticides, Farmer's perceptions, Environmental risk, Burkina Faso

1. INTRODUCTION

The abusive and irrational use of agricultural chemical inputs can have adverse effects on the environment and on human health according to annual statistical data published in developing countries. According to the [1] WHO (1991), nearly 1.5 million cases of pesticide poisoning, causing the death of several thousands of farm workers in sub-Saharan countries are reported.

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Pest pressure was identified as ~~being the~~ major constraint ~~and on accounts~~ ~~efor~~ crop losses in market gardening [2,3]. As a result, in order to improve yields and meet the ever-increasing market demand, ~~gardenersproducers~~ use synthetic pesticides almost systematically ([3]?). But yet, their harmful effects on humans and the environment ~~have beenwere~~ demonstrated [4,5,6]. It is observed that market gardeners use ~~inappropriate~~ insecticides ~~indiscriminately~~ and also ~~violate the protocolthat the methods~~ of usage, the lack of appropriate protective equipment ~~byfer~~ users and ~~the proper~~ storage conditions constitute aggravating risk factors for farmers and consumers [7]). ~~Synthetic p~~Pesticides, ~~whenby used to protecting~~ market garden crops, ~~helpsmake it possible~~ to reduce losses of agricultural product~~sion~~, ~~however, but~~ their use ~~posespresents~~ serious ~~health~~ risks ~~tofer both~~ humans and ~~pollute~~ the environment [8].

The Comoé River Watershed (BVC) is an agrosystem where vegetables, sugarcane, cereal and cotton crops are expanding rapidly due to increased activities in the area. This raises a reflection on the management of fertilizers and ~~synthetic pesticide use that willto better~~ promote a sustainable ~~development that would permit use and the~~ long term management and exploitation of the environment, ~~while maintaining and even improving the natural resourees~~. Hence, the interest in conducting such an investigation in order to better understand farmers' perceptions ~~onf~~ the use of ~~synthetic~~ pesticides and fertilizers in market gardening. The present study is aimed at analyzing farmers' perceptions of the use of pesticides and fertilizers in market gardening in the Comoé Province of Burkina Faso.

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2. MATERIAL AND METHODS

2.1. Study area

The Comoé River basin is in the western part of Africa between longitudes 2°45' and 5°58' West and latitudes 5°10' and 10°29' North. It is drained by a 1160 km - long river that rises in the region of Banfora at an altitude of 420 m in Burkina Faso. It covers an area of about 78,000 km² and extends over the south-western region of Burkina Faso, the south-eastern parts of Mali and eastern part of Ghana, the northern, central and southern regions of Côte d'Ivoire.

The Burkina Faso portion of the Comoé River Basin has an area of 17,590 km², covering all or a part of the Comoé, Léraba, KénéDougou, Houet and Poni provinces. It is framed by latitudes 9°35' N and 11° 05' N and longitudes 3°30' W and 5°30' W. It comprises five (05) main sub-basins: the Comoé, the Léraba, the Kodoun, the Baoué and the Iroungou.

2.2 ~~Sampling of producers~~Sample collection

In the absence of a sampling frame of vegetable growers operating in the Comoé Basin, an empirical sampling method was used, namely the quota sampling. Nevertheless, random sampling techniques were combined with the quota method. The sample size was determined using the proportion of growers using ~~synthetic pesticideschemical inputs~~ in market gardening in the study area. This information was obtained from the officers of ~~the~~ ZAT ~~inof~~ Banfora. According to them, nearly 85% of market gardeners in the area use ~~synthetic pesticideschemical inputs~~. The sample size was ~~therefore~~ determined using ~~the~~

formula [9]: $n = \frac{z^2 p(1-p)}{e^2}$ where n=sample size; Z=margin rate deduced from the desired confidence level $z=1.96$; $P(1-P)$ the variance of the variable; e margin of error ($e=5\%=0.05$). This formula determines the number of people n to be interviewed according to the margin of error e that can be tolerated on a proportion of responses p.

This gives a size of 196 market gardeners. Assuming that the response rate in these types of surveys is 95% in the place, then the size was adjusted to 206 market gardeners. In total 204 market gardeners were surveyed, giving a response rate of 99%.

2.3. Data collection and analysis

Data collection was based on the following tools:

An individual interview was conducted using a questionnaire [forte](#) the [sampling](#) of gardeners. The questionnaire was integrated into an application (mWater) that not only allows the survey to be conducted without paper but also allows [forte](#) [geo-location](#) [of](#) the respondents.

A questionnaire [sheet](#) was designed to provide information on the identity of the respondent, the origins of fertilizers and [synthetic](#) pesticides, and [their](#) [impacts of fertilizers and pesticides](#) on the natural environment. It also provides information on agricultural production, [on the](#) health of the population and [on](#) market gardeners' behaviour in [the use of](#) water resources [use](#), as well as on [synthetic](#) pesticides and fertilizer [usage](#).

An interview guide enabled us to discuss with the people in charge of the technical services and the training [of](#) personnel in the locality.

These were supplemented by direct field observations in the various vegetable growing sites in the study area.

The [whole](#) data collected was processed and summarized through descriptive statistics.

3. RESULTS

3.1. Knowledge on good phytosanitary practices

The knowledge level of market gardeners on good phytosanitary practices is presented in Table 1. It indicates that 44.66% of the market gardeners interviewed have already received training on appropriate practices [regarding](#) pesticide use. This is about the choice of the appropriate formulation, the use of personal protective equipment, the treatment period, the instructions, exploitation, etc.

Table 1. Distribution of market gardeners according to whether they have received training or not.

Variable	No		Yes	
	Number	%	Number	%
Organisation				
State			33	16,02
MCA			25	12,13
PAFASP			3	1,45
SAPHYTO			12	5,83
SOFITEX			19	9,23
Total (n=206)	112	55,34	92	44,66

[Key :](#)

3.2. Impact of chemical fertilizers and pesticides on crops

The results of the impact of chemical inputs on crops are presented in Table 2. Vegetable producers almost unanimously say it is necessary to use fertilizers and pesticides on their production sites. [Some](#) producers (18.87%) well appreciate the use of fertilisers and pesticides on the sites. Nearly 94% also believe that the use of fertilisers improves soil fertility and helps to increase crop yields.

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Table 2. Distribution of market gardeners according to their apprehensions about the effect of chemical inputs on the soil and on market garden crops

Response		Nbr	%
Question			
What do you think about the use of pesticides and fertilisers on your site?	Good	178	87,25
	Bad	26	12,75
Do fertilisers improve soil fertility?	Yes	191	93,63
	No	12	6,37

3.3. Knowledge of pesticide hazards and precautions

The results are shown in Table 3. The figure shows that vegetable producers are less aware of the dangers of pesticide use on nature, the consumer and other living beings. According to the producers, only the applicator can be at risk when using pesticides. In fact, 79.41% of the producers interviewed were aware of the dangers of pesticide use for the applicator. This situation reflects the lack of knowledge of the real dangers of chemical products used in agriculture on other actors, particularly the consumer, the rest of the biocenosis and the environment in general.

As for the precautions taken by producers in the use of pesticides, it emerges from the interviews with them that 96.57% of them do not use any protective equipment when applying pesticides.

Table 3. Market gardeners' perceptions of the target impacted by phytosanitary treatments and precautions.

Response		Nbr	%
Question			
Which target do you think the use of pesticides is dangerous for?	Applicator	162	79,41
	Nature	3	1,50
	Consumer	11	5,4
	Others	28	17,72
Do you take any special precautions before carrying out your plant protection treatments?	Yes	7	3,43
	No	197	96,57

Market gardeners do not take any precautions during [synthetic](#) pesticide application despite the fact that most of them are relatively aware of the dangers [of pesticides](#) on the [usersapplicator](#) (Picture 1).



Picture 1. Pesticide application ion or user ~~or~~ without protective equipment

3.4. Post-treatment precautions and knowledge of the easement area

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Analysis of the data in Table 4 shows that, in general, after treating their farms with pesticides, vegetable growers wash themselves at water points and clean their equipment in the field. Of all the gardenersproducers interviewed, nearly 58% wash themselves at water points while 41% do so in the field. On the other hand, 88% wash their equipment in the field after application of pesticides.

Furthermore, the results of our field interviews indicate that 76% of respondents were unaware of the existence of the easement area.

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Table 4. Distribution of gardenersproducers according to risk behaviour for the ecosystem

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	Washing of equipment after		Bath after applying pesticides	
	Number	%	Number	%
Water point	19	9,31	118	57,84
In the field	180	88,23	84	41,17
Others	5	2,46	2	0,99
Total	204	100	204	100

3.5. Harmfulness of pesticides and prevention of pollution of watercourses Threat of synthetic pesticide runoff as sources of pollution to watercourses?

Almost all the market gardeners (96%) know that there are diseases related to the use of synthetic pesticides in the Comoé river watershed (Table 5). This information shows that the issue of diseases related to the use of fertilizers and pesticides is not unknown to market gardeners, though even if some of them are still unaware of it.

Furthermore, almost all the market gardeners (96%) refer to the nearest medical centre in case of symptoms related to the use of pesticides. Nevertheless, some of them continue to see traditional therapists to treat these diseases.

Table 5. Distribution of market gardeners according to appreciation of the danger of pesticides by market gardeners.

	Extremely dangerous	Quite dangerous	Not very dangerous	Not dangerous	Total
Number	171	12	13	8	204
%	83,82	5,88	6,37	3,93	100

As a means of preventing pollution of watercourses, the vegetable producers propose:

- Avoid bathing or washing equipment around or in watercourses after [synthetic](#) pesticide application,
- Avoid throwing pesticide packaging near or into water [pointsbodies](#),
- Avoid cultivating near watercourses,
- Avoid preparing pesticide slurries near watercourses.

4. Discussion

The investigations conducted during this study aimed [ate analyzing](#) farmers' perceptions [on](#) the use of [synthetic](#) pesticides and fertilizers in market gardening in [the study](#) area.

The survey indicates that 79% of the farmers were aware of the dangers of pesticide use on the [user applicator](#). Only 1.47% [are aware think](#) that the use of [synthetic](#) pesticides can have a negative impact on the environment. This situation reflects the lack of awareness of the dangers of chemical products used in agriculture [against the user on other actors](#), particularly the consumer, the rest of the biocenosis and the environment in general. This result contradicts that of [7] in Benin, [in](#) Togo [10] who showed that all farmers recognize that pesticides are likely to cause harm to humans and the environment.

Most farmers do not protect themselves sufficiently. There is little compliance with hygiene rules before, during and after a phytosanitary treatment as already observed by [10] in Togo, in Senegal [11], in Benin [7], in the Philippines [12] and [13] in Benin, Ethiopia, Ghana and Senegal. [14] showed that the non-use of personal protective equipment could be linked to lack of financial means and neglect by farmers.

After treatment, 37% wash only their hands, while 16% wash their whole body. However, it was shown that the lack of body protection equipment increases the risk of poisoning which, although minor at the beginning, can become serious through bioaccumulation [14,15,16]. A number of poisoning and [cases of](#) illness [cases](#) linked to pesticides in market gardens and cotton growing areas have been reported [17,18,19, 20]. The cases of discomfort often reported by market gardeners in the Comoé region may be due to non-compliance with hygiene rules during and after phytosanitary treatments, as shown by [21] in Ethiopia. Aware of the health risks involved, all of them take some precautions after the treatments: washing their hands, taking a bath, etc.

On the other hand, 13% of the farmers interviewed said that women also participated [d](#) in the treatment and [usually on their](#) [generally for their](#) farms which are small in size. However, a study conducted in the United States noted an increase in certain categories of congenital malformations, central nervous system anomalies and cleft lip and palate, related to parents' exposure to pesticides or to mother's residence near cultivated fields, without further details on the products used [22].

As for the type of treatment applied, 54% of the vegetable producers used calendar spraying and 40% used threshold spraying. The calendar treatment does not take into account the need for intervention but is automatically started [during periods of pest abundance](#). [when the](#)

day comes. This type of practice exposes the ~~users~~ applicator cyclically and continuously to chronic poisoning as they do not have adequate protective equipment. [23] and [24] considered that ~~the~~ long time exposure of cotton growers to treatments without adequate protective equipment constituted ~~as a the~~ major source of ~~risk of~~ poisoning.

The results of our field interviews showed ~~ed~~ that 75% of the market gardening population is unaware of the existence of the ~~leasement areas~~, which prevents pollution of the watercourse where animals and sometimes human's drink. The proximity of the market gardening sites to water points and the topographical situation can be a risk factor. The major risk related to this proximity to water points is contamination.

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5. CONCLUSION

Market gardening in the Comoé region remains the main activity of farmers ~~during in~~ the dry season, but it is faced with various difficulties. Despite the economic profitability of this activity, it must be recognized that there is a major issue relating to the farmers' perception of the use of pesticides and fertilizers in market gardening in the Comoé Province of Burkina Faso.

In order to preserve the farmers' health, and consequently public health and the environment, measures and actions must be taken. Proposals are made along the same lines ~~on around~~ strict control of the quality of fertilizers and pesticides that are used on the various market gardening areas and, more generally, the safe management of chemical inputs in agriculture; sensitization on the dangers of plant care products, which should focus on pollution problems, particularly water pollution and its consequences on human and environmental health.

It would therefore be wise to encourage and promote biological pest control in order to preserve human and animal health and the environment.

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