

Pesticide Use and Occupational Hazards among Farmers Working in Small Scale Tomatoes Farms in West Region of Cameroon, Sub-Saharan Africa

Ayuk Bertrand Tambe^{1*}, Baleba Moise Roger¹, Medoua Nama Gabriel¹ and Dapi Leonie Nzefa^{2,3}

¹Institute of Medical Research and Medicinal Plant Studies (IMPM)-MINRESI, P.O. Box 13033, Yaoundé-Cameroon

²Faculty of Medicine and Biomedical Sciences, Department of Public Health Yaoundé University, Cameroon

³Faculty of Social Science, Linnaeus University, Sweden

*Corresponding author: Ayuk Bertrand Tambe, Institute of Medical Research and Medicinal Plant Studies (IMPM)-MINRESI, P.O. Box 13033, Yaoundé-Cameroon, Tel: +237674615608, E-mail: ayuk.bertrand@yahoo.com

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Abstract

Background: Agriculture is undoubtedly the back-bone of Cameroonian economy and other economic activities thrive only if production in this sector is assured. It has been estimated that about 25 million agricultural workers worldwide experience unintentional pesticide poisoning yearly. Unfortunately, limited information exists about the health and safety of the farmers. The aim of this study was to describe the OHS conditions of farmers working on small scale tomato farms in Western Region of Cameroon.

Materials and Methods: A quantitative descriptive cross-sectional research method was used to collect data from tomato farmers in May 2017 using a questionnaire by the research team. The data was analysed using Epi Info version 7.

Results: A total of 104 tomato farmers from small-scale farms participated in the study. The analysis revealed that the occupation is male dominated. The training and use of Personal Protective Equipment's (PPE) among farmers was rare and farmers were mostly exposed to chemical hazards. The farmers reported the following work-related health problems: skin irritation, backache, impairment of Central Nervous System (CNS), visual problems and respiratory difficulties.

Conclusions: Findings confirmed that working in small-scale tomatoes farming is unsafe, and the occupational health and safety conditions are poor thus predisposing farmers to the risk of work-related health problems. Exposure to occupational hazards can be significantly reduced if the required PPE are efficiently used.

Keywords: Tomatoes; Pesticides; Occupational health and safety; Cameroon

Abbreviations: CNS: Central Nervous System; FAO: Food and Agricultural Organisation; GDP: Gross Domestic Product; MINADR: Ministry of Agriculture and Rural Development; OHS: Occupational Health and Safety; PPE: Personal Protective Equipment; WHO: World Health Organisation

Introduction

Agriculture is a very vital economic sector in the Cameroon since an estimated 45% of Cameroon's gross domestic product (GDP) depends on it [1]. The traditional food crop is part of an integrated household-farming system [2]. Therefore, crop destruction would paralyze many household so farmers rely on pesticide use for pest control due to its apparent lower cost. However, according to World Health Organization standards [3], only pesticides that are safe to farmers and farm-workers, other non-target species and the consumers should be used in crop production especially tomatoes. Pesticide use has increased over the past 20 years, highest in low-income countries starting from a low base like Cameroon, Ethiopia and Burkina Faso with an 8 to 50 fold increase [4]. In middle-income countries like

China, Argentina, Brazil and Thailand, pesticide use increased from 3 to 8 fold while it has been stable or even decreasing in high-income countries like in United States of America, Germany, Japan and Denmark [4]. Even though, there has been rise in pesticide use in developing countries, very limited information exists about the health and safety of the farmers.

Pesticides use in tomato farms are classified according to their target organisms, chemical class, and toxicity. According to their target organism, they are divided into insecticides, fungicides, herbicides, rodenticides and bactericides. Previous studies have revealed that the most used pesticides in low-income countries like Cameroon are insecticides contrary to herbicides which are the mostly used at the global level, given that weeding is done manually in Cameroon [5-8]. According to their chemical classes, the most common pesticides used are organophosphates, organ chlorides, carbonates, pyrethroids and dipyridils. World Health Organisation (WHO) has divided pesticides into the toxicity classes Ia, Ib, II, III, U with falling toxicity and O being the sign for obsolete pesticides. Obsolete pesticides are defined as those pesticides that can no longer be used for their intended purpose or wanted to be used and therefore must be disposed of. They include among others banned, outdated and deteriorated pesticides according to Food and Agricultural Organisation (FAO) [9]. Although a great

number of toxic pesticides fall under the WHO class Ia and Ib, and some pesticides belonging to class II and class O have been restricted for use in several countries, but they are still extensively used in middle- and low-income countries due to their efficacy in killing pests of a broad spectrum and relatively cheaper and simpler to produce and use [6]. The intensive use of pesticides in tomato farms seems to provide nice and best quality of produce at sight for the markets and makes good deals for both the farmers and vendors [10].

Work-related pesticide poisoning has increased worldwide especially in less developed countries [11]. It has been estimated that about 25 million agricultural workers worldwide experience unintentional pesticide poisoning yearly [12]. The main obstacle to the control and prevention of work-related pesticide poisoning is that the scope and magnitude of this issue often remains uncharacterized, especially in an underserved population such as farmers [13]. In Cameroon, pesticide poisoning data are often reported as incidence data from hospitals. Contrary to workers in large agricultural companies who may receive safety training on the use of pesticides to reduce exposure, the majority of tomatoes farmers in Cameroon work independently with small plots of farmland. They may apply pesticides using simple backpack style applicators without adequate knowledge of the basic safety measures.

The aim of this study was to describe the OHS conditions in the use of pesticides among farmers working on small scale tomato farms on Western Region of Cameroon. The specific objectives of the research were to; assess the demographic profile of the farmers; evaluate the training and use of PPE; and report work-related complaints among small scale tomatoes farmers.

Methodology

Survey participants

A quantitative descriptive cross-sectional survey was conducted to collect data from one hundred and six small scale tomatoes farmers related on their demographic profile, farmers' OHS knowledge and practice on the use of pesticides, and the occupational health complaints. The farmers were interviewed in their various farms in order to conduct an on the spot inspection on the use of pesticides.

Study area

West Region is a major tomato growing region in Cameroon and the overuse of pesticides to manage pests and diseases have been observed. Although, these chemicals increase crop yields, they can also cause health and environmental hazards when used improperly.

Data collection

The data collection was done in May 2017 by the research team. The farmers were interviewed at farms in French. Data were collected through a well-structured interviewer-led questionnaire and on site observations to complement responses got from the use of questionnaire. The questionnaire consisted of three sections namely: the demographic profile, farmers' OHS knowledge and practice on the use of pesticides, and the occupational health complaints. The farmers were interviewed in their various farms in order to conduct an on the spot inspection on the use of pesticides. The questionnaire was pre-tested on five farmers to ensure the language used was appropriate and

could be understood by all farmers and the feedbacks got were incorporated into the final questionnaire used in this study.

Data analysis

The data collected was coded, entered, cleaned and analysed using Epi Info version 7. Means and 95% confidence intervals (95% CI) were calculated for continuous data, and frequencies were established for categorical data. The accepted level of significance for determinants of practice of OHS was set 0.05.

Results

A total of 106 tomatoes farmers were initially surveyed and interviewed. Two (02) questionnaires were rejected because the participant did not provide complete information required. The results reported below are based on the data collected from 104 tomatoes farmers.

Demographic Details

The current study analysis indicated that the average age of all participants was 38.0 ± 10.3 years. The 31-40 year age group was the most frequent age group (30.8%) and majority of farmers were males (86.5%). Most of the respondents were married (81.7%) with at least secondary education (62.5%). The average work experience of the farmers was 4.8 ± 1.2 years with majority of participants working for 4-6 years (83.7%, Table 1).

Variables	Frequency	Percentage
	N=104	%
Sex		
Male	90	86.5
Female	14	13.5
Total	104	100
Marital status		
Single	19	18.3
Married	85	81.7
Total	104	100
Age		
21-30	31	29.8
31-40	32	30.8
41-50	28	26.9
51-57	13	12.5
Total	104	100
Level of education		
No formal	3	2.9
Primary level	25	24
Secondary level	65	62.5

Vocational training	9	8.7
Tertiary	2	1.9
Total	104	100
Work experience		
01-Mar	17	16.3
04-Jun	87	83.7
Total	104	100

Table 1: Socio-demographic characteristics of employees (N=104).

Participants' farm sizes and description of products cultivated

The tomato farms were generally small, varying from 0.3 to 4.0 ha with an average size of 1.1 Ha. Majority (79.8%) of these farmers owned farms less than 1 hectare as compared to 20.2% who owned more than 1 hectare of the tomatoes farm. The main restraining factors for farmers to cultivate large surface areas were labour and capital. Although tomato fruits were the main product, most of these farmers also cultivated other crops such as: pepper, green paper, water melon, beans, green beans, green spices, carrot, maize, groundnut, potatoes, cocoa, banana and cucumber alongside tomatoes.

Pesticides use in tomatoes farming

The analysis revealed that eighteen (18) pesticides were used on tomatoes by farmers in West Region of Cameroon with most (15) of the pesticides enlisted in the homologated list of pesticides published by the Cameroon Ministry of Agriculture and Rural Development (MINADER) while 3 pesticides were not. Out of the 15 pesticides enlisted in the Cameroon homologated list, 11 are obsolete as compared to 4 pesticides not obsolete. The main factor in the build-up of unused stocks is apparently unplanned purchasing policy. In several instances, too many chemical were bought by the government and then distributed to bases which have not yet finished their previous year supply. This has led to an increase in the stock piles of pesticides at provincial bases. The study analysis indicated that the most used fungicides in the study sites were Maneb, Mancozeb, metalaxyl, carbendazim, Thiophanate-methyl while the most used insecticides are Cypermethrine, Imidachlopride, lambdacyhalothrine, chlorpyrifos-ethyl, Endosulfan and Dimethoate. In addition, the frequently used herbicides are Glyphosate Paraquat and Pendimethalin. All of the pesticides used are classified under the WHO chemical active ingredients hazards category class II (moderately hazardous) and class III (unlikely to cause hazards) as demonstrated in Table 2 below. The choice of pesticide used varied by season, area and individual farmer.

Pesticides	Commercial name	Active ingredients	Chemical group	WHO chemical
		(AI)		AI hazard classification
Fungicide	PLANTINEB 80 WP	Maneb 80%	Carbamate	II

	DITHANE M 45*, IVORY 80*	Mancozeb 640, 800 g/kg	Carbamate	II
	CLEARY'S 3336†	Carbendazim	Benzimidazole	II
	TOPSIN M†	Thiophanate-methyl	Benzimidazole	II
		AKITO 25 EC, CIGOGNE 12 EC*, CYPALM 50 EC*, CYPERCAL 50 EC, CYPLANDIM 260 EC*	Cypermethrine 12, 20, 50, 100 g/l	Pyrethiod
PARASTAR 40EC	Insecticides	Imidachlopride 20 g/l + lambdacyhalothrine 20 g/l	Pyrethiod	II
PYRIFORCE*		chlorpyrifos-ethyl 600 g/l	Organophosphorus	II
THONEX 35R EC*		Endosulfan 350 g/l	Organochlorine	II
DIMEX 400EC*		Dimethoate 400 g/l	Organophosphorus	II
Herbicide	Gramoxone *	Paraquat 200 g/l	Bipyridylum	II
	ROUND UP 360*	Glyphosate 360 g/l	Glycine derivative	III
	Corral G†	Pendimethalin 500 g/L	Dinitroaline	III

Table 2: The main pesticides used by tomato farmers in the West region of Cameroon.

The use and storage of pesticide by tomatoes farmers

The duration between the spraying of pesticides and harvesting of the tomatoes fruits for consumption ranged from 1 to 30 days depending on the farmer and the type of pesticide used with the mean duration of 9.0 days. Regarding the storage of pesticides, 69.2% stored their pesticides in their farms, 26.9% stored in their homes while 26.9% stored in their warehouse/stored (Figure 1).

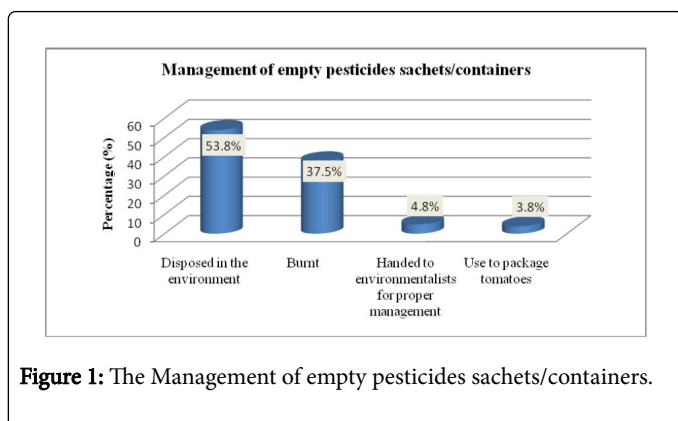


Figure 1: The Management of empty pesticides sachets/containers.

Training and safe practice of OHS among tomatoes farmers

Table 3 shows that 35.6% of the participants were trained on the use of PPE while 64.4% did not received any form of training. Thirteen participants (12.5%) used safety boots during the spraying of pesticides as compared to 87.5% who did not. The use of safety glasses was also assessed, 31.7% used safety glasses when required while 68.3% did not. Regarding the use of gloves, the analysis revealed that 49.0% used glove during work as compared 51.0% who did not. Only 35.6% of the participants put on raincoats during the spraying of pesticides while 64.4% did not wear. Majority (99.0%) of the workers did not clean up their body immediately after the use of pesticides.

Variables	Yes	No	Total
	n (%)	n (%)	n (%)
Received training on the use of pesticides	37 (35.6)	67 (64.4)	104 (100)
Use of safety boots	13 (12.5)	91 (87.5)	104 (100)
Use of safety glasses	33 (31.7)	71 (68.3)	104 (100)
Use of gloves	51 (49.0)	53 (51.0)	104 (100)
Use of nose mask	69 (66.3)	35 (33.7)	104 (100)
Use of raincoats	37 (35.6)	67 (64.4)	104 (100)
Clean up the body immediately after the use of pesticides	1 (1.0)	103 (99.0)	104 (100)

Table 3: Participants’ practice relating to the training and use of PPE (N=104).

Participants’ work-related health complaints

Regarding participants’ work-related health problems/complaints, 24% complained of skin irritation after spraying of pesticides, 10.6% complained of backache, 9.6% nervous system injury such as headache and dizziness, 16.3% reported visual problems and 4.8% complained of respiratory difficulties as shown in the Table 4 below.

Health complaints	Yes	No	Total
	n (%)	n (%)	n (%)
Skin irritation	25 (24)	79 (76.0)	104 (100)

Backache	11 (10.6)	93 (89.4)	104 (100)
Nervous system injury	10 (9.6)	94 (90.4)	104 (100)
Visual problems	17 (16.3)	87 (83.7)	104 (100)
Respiratory difficulty	5 (4.8)	99 (95.2)	104 (100)

Table 4: Work-related health complaints as reported by participants (N=104).

Discussion

This study was aimed at investigating the OHS conditions on the use of pesticides among farmers working on small scale tomato farms on Western Region of Cameroon. Majority of the farmers were males in their active age. This implies that the workforce in the small-scale tomato farming in the study sites is mostly male-dominated. This might be due to the hard and laborious work required which might naturally limit the involvement of females and elderly people. These results confirmed the findings of Tarla et al. [14] who reported that majority of small scale tomato farmers in the Western Region of Cameroon were males. Women assisted their husbands in activities that did not require a lot of energy such as transplanting and harvesting of tomato fruits. Similarly, another study conducted by Tandi et al. [15] to evaluate the

Regarding the level of education, the study revealed that secondary school was the highest level of education attained by majority of tomato farmers in the study area. It has been argued that being educated increases access to information, training and communication materials, enables a better awareness of various workplace hazards and ensures an understanding of safe work procedures and a better propensity to develop a positive attitude towards OHS at work. The findings confirm results a study by Tandi et al. [15] that made known that most tomatoes farmers in Cameroon are had no formal education. This study corroborates with results of Kenko et al. [16] that revealed that majority of local farmers in the South West region of Cameroon attained only secondary education.

The analysis revealed that fungicides, insecticides and herbicides were the pesticides used on tomatoes in the area of study. In addition, insecticides were the most used while herbicides were the least used pesticides. This implies that fungi, insects and herbs are the major hindrance to production of tomatoes in the study area. This study findings corroborates with a study by Tandi et al. [15] conducted in the South West region of Cameroon that found out that insecticides, fungicides and herbicides are the frequently used pesticides by tomatoes cultivators to control pest with insecticides being the most used. Also, the least used pesticides according to Tandi et al. [15] was herbicide, this was probably due to the fact that most farmers did manual weeding of their farms with their family members or friends using hands, cutlasses and hoes on the smaller farms [17].

Majority of tomatoes farmers disposed empty pesticide containers within the fields or burnt. The indiscriminate disposal of these containers in the field could cause This practice of indiscriminate disposal pesticides containers in the fields have been reported by Lekei, Ngowi, and London [18] and Khan, Shabbir, Majid, Naqvi, and Khan [19] in Arumeru-Tanzania and Pakistan respectively.

The current findings showed that majority of the tomatoes farmers in the study area have poor practices of OHS as a result of inadequate OHS training and use of PPE. Good practices in OHS generally require

respondents to comply with OHS practices during the execution of their duties and leads to more positive health and safety culture among the workers and can significantly reduce both injury rates and costs at the workplace [20]. Comparable preceding studies conducted in Cameroon and Philippine revealed that the use of PPE was rare among participants [21,22]. Asongwe et al., [21] revealed that 95% of farmers in Bamenda Municipality of Cameroon do not protect themselves during pesticide applications. In addition, Palis et al., [22] make known those Filipino farmers believe in immunity, meaning that the youths were not susceptible to the adverse health effects of pesticides. Consequently, personal protection equipments were not important for them [22].

Regarding the work-related problems sustained by farmers, current findings showed that most common work-related problems were skin irritation, backache, nervous system injury such as headache and dizziness, visual problems and respiratory difficulties after spraying of pesticides. Generally, farmers believe that pesticides poisoning symptoms are ordinary so they get used to them [22]. Comparable studies carried out in Ivory coast [23] and Tanzania [24] reported that pesticide applicators likely to accept a certain level of illness as an expected and normal part of the work of farming and, never reported the symptoms in health centres for prescribed medical assistance.

Conclusion

Findings confirmed that working in small-scale tomatoes farming is unsafe, and the occupational health and safety conditions are poor thus predisposing farmers to the risk of work-related health problems. Exposure to occupational hazards can be significantly reduced if the required Personal Protective Equipment are put on. Increasing of farmers' awareness on good practices for pesticide application and strengthening of foods safety control services for pesticide control as measures to prevent and protect public health against pesticides is recommended.

Ethics Approval and Consent To Participate

Before the interview, the research goals, objectives and the nature of the study were clearly explained to participants and their questions appropriately answered before the administration of the questionnaire. All farmers signed informed consent, confirming that they were willing to participate in the interview. The study complies with the Helsinki Declaration.

Consent for Publication

Not applicable

Availability of Data and Material

All data generated or analysed during this study are included in this published article [and its supplementary information files].

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Conflict of Interest

The authors declare that they do not have any conflicts of interest concerning this article.

Authors' Contributions

All authors took part in the conception, data collection, analysis, discussion, writing and the editing of the final paper.

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Availability of Data and Materials

No additional data available.

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