

Vegetable growers perception of pesticide use practices, cost, and health effects in the tropical region of Cameroon

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Abstract

Surveys of vegetable producers in Cameroon's primary vegetable production zones in the humid tropics looked at their usage of pesticides. The purpose of the surveys was to clarify farmers' crop calendar, pesticide spray schedule, and frequency. Farmers' understanding of insect objectives, amounts and key active substances utilized, and vegetable production training was assessed. Weekly pesticide spraying was shown to be the most popular method; 28% of farmers applied fungicides and 40% sprayed insecticides. Nevertheless, 45% and 59%, respectively, were unable to identify the illnesses and insect pests they were trying to manage. Depending on the size of the farm, farmers used 0.5–9 liters of pesticide, 10–49 kilograms, and 10–49 packets of chemicals annually. Pesticide costs range from 300 to 12000 F each package, 6000 to 8500 FCFA per kilogram of fungicide, and 5000 to 13000 FCFA per liter of insecticide. Twenty percent of farmers reported that pesticides had an adverse effect on their health, and ninety percent of farmers utilized a backpack sprayer. Chemicals are kept at home by around 25% of farmers. Seventy-five percent have never gotten any instruction on the use of pesticides and their impact on health, and they learn about agricultural productivity from other farmers. The risk of pesticide abuse and the expense of growing vegetables are increased when farmers are not trained. If Cameroonian vegetable farmers are to utilize less costly pest control solutions that are less dangerous to the environment and human health, they must be made aware of the risks associated with improper handling of pesticides.

Keywords: Pest and diseases, pest management, chemical spray.

Introduction

Many Cameroonian farmers use a variety of pesticides to manage vegetable pests and illnesses, but few are sufficiently aware of the risks connected to the substances (Ngowi, 2003). Farmers employ pesticides without fully comprehending how they affect the environment and human health (Mathews G.A., 2008).

Additionally, they don't know enough about how to use and handle pesticides safely (Ngowi et al., 2007). When applying pesticides, weeding, harvesting, gathering firewood or vegetables, or using pesticides in their homes to eradicate flies, cockroaches, and mosquitoes, humans are exposed to pesticides. Pesticide storage can result in exposure and negative health effects. Pesticide residues in food and water may contribute to indirect exposure, even if inhalation, contact, and oral modes of exposure are the more frequent. The ecosystem is also harmed by pesticide misuse.

Chemical reactions destroy both helpful and dangerous species and produce compounds that pollute the environment, causing biodegradation, pest resistance, and climate change (Ajayi, 2005). Since families typically provide agricultural labor in underdeveloped nations, pesticide-related illnesses among household members may have an impact on the farm family's overall performance and output. Some studies conducted in other countries have assessed the health costs associated with pesticide usage (Ajayi, 2000; Ntow, 2006; Mathews G.A., 2008). Studies on crop pesticide spraying, the primary pesticides used, and the equipment used by small-scale farmers have been carried out in Cameroon (Matthews et al., 2003). It is necessary to ascertain how vegetable growers see pesticide use and how much they know about the negative impacts on the environment and human health. This will aid in the creation of more effective pest management strategies as well as suitable instruments and regulations for Cameroon's pesticide usage control.

Methodology

The surveyed sites were selected based on important vegetable production zones in the southern half of Cameroon, using a multi-location random sampling. The sample size was determined based on the percentage of total vegetable production in major vegetable production regions (Table 1).

Table 1: Vegetable production zones in Cameroon and sample size ($n=198$).

Regions	Agro-ecological zones	Total vegetable production (tons)	% of total production	Sample size
Northwest	Western highland	10280	2	21
West	Western highland	320235	57	50
Southwest	Coastal forest	33699	6	34
Centre	Humid forest	134808	24	38
Littoral	Coastal forest	25975	5	22
South	Humid forest	17505	3	18
East	Humid forest	16132	3	15
Total		558634	100	198

The sample size was determined based on the percentage of total vegetable production in major vegetable production regions

Source: AVRDC (Cameroon Vegetable Country Report)

Government agricultural personnel, including village extension workers, agricultural delegates, and national agricultural research staff, assisted in identifying the places of vegetable production in each area. The capacity of enumerators to give a semi-structured questionnaire with 38 items intended to demonstrate the comprehension of ordinary farmers was pre-tested. Depending on the region or farmer, the questionnaire was delivered in local languages in addition to English and French. An attempt was made to guaranty that the chosen vegetable growers represented various settlement zones, age groups, sexes, family statuses, and economic levels, even though the sampling was random. Three settlement zones were identified: (1) peri-urban zones (a transition or interaction zone where urban and rural activities are juxtaposed and landscape features are subject to rapid modifications, induced by human activities); (2) urban zones (higher population density and vast human features in comparison to areas surrounding it, and may be cities or towns); and (3) rural zones (low population density, with a large portion of the land devoted to agriculture and possibly less air and water pollution). Four kinds of questions comprised the survey, which focused on farmer management experience, understanding of insect pests and illnesses, pest management techniques, and information requirements of vegetable farmers. It was acknowledged that due to variations in sex, age, labor division, and literacy level, data obtained from interviews with individual farmers might be inconsistent. Therefore, it was essential to make sure that enumerators could assist the responder in giving the proper response. While quantitative information was also Interviewers were able to get accurate information from the respondents based on information gathered during individual interviews. Amaranthus spp. (Amaranth), Brassica oleracea var. capitata L. (Cabbage), and Capsicum spp. were the ten crops of the AVRDC vegetable breeding and seed system employed in this study. Allium cepa L. (onion), Corchorus olitorius L. (jute mallow), Solanum scabrum Miller (African nightshade or huckle berry), S. melongena var. esculentum Nees (eggplant), Lycopersicon esculentum L. (tomato), and Abelmoschus spp. (okra). Each response was given a number between 1 and 6 in a codification manual; the code 9 was used for missing data. The farmers' replies were entered into CPro (Census and Survey Data Processing technique) using this coding technique, and

then they were imported into SPSS (Statistical Package for Social Sciences) for editing and analysis. The data was analyzed using descriptive statistics to determine the response frequencies. The figures and key quantitative data calculations were done using Excel.

Results

Settlement zone of vegetable farmers

During the course of this research, a significant number of respondents were either proprietors of vegetable farms or regular employees engaged to manage vegetable farms. According to the findings of the research, there were much more farmers of vegetables in rural regions (60%) than there were in peri-urban areas (31%), and urban areas (7%).

Furthermore, all of the vegetable crops that were investigated in the study were grown in rural areas. The most significant crops in the peri-urban settlements were African nightshades, jute mallow, amaranth, and okra. On the other hand, the most important crops in the urban regions were jute mallow and amaranth. There was a significant disparity in the significance of the vegetable crops that were grown across the areas.

All of the locations of the nation that are classified as warm and humid were used to cultivate the majority of the vegetables that were included in this study. Following closely after the tomato as the most significant and frequently farmed crop is the huckleberry, followed by the hot pepper, and then the okra.

In the humid savanna of the Mbam Ekim division, that is located in the Center areas, the only crops that are listed are tomatoes, okra, and hot peppers. In the Littoral region of Yabassi, the only crops that were planted were huckleberries, okra, and hot peppers.

Apart from the priority vegetable crop of the study, other vegetables included water leaf *Talinum triangulare* Willd, Basil *Ocimum basilicum*, leeks *Allium porrum* L., cucumber *Cucumis sativus* L., leafy eggplant or Gboma eggplant *Solanum macrocarpon* L., celery *Apium graveolens* L., carrot *Daucus carota* L., parsley *Petroselinum crispum* (Mill.) Fuss, beet *Beta vulgaris* L., green bean *Phaseolus vulgaris* L., and water melon *Citrullus lanatus* (Thunberg) Matsum. & Nakai.

Table 2: Number of farmers who cultivate each crop in each region and number that considers the crop important.

Region	Tomato		Hot pepper		Sweet pepper		Onion		Cabbage		Amaranth		Okra		Huckle berry (African nightshade)		Eggplant		Jute mallow		Others	
	Very Imp	<i>n</i>	Very Imp	<i>n</i>	Very Imp	<i>n</i>	Very Imp	<i>n</i>	Very Imp	<i>n</i>	Very Imp	<i>n</i>	Very Imp	<i>n</i>	Very Imp	<i>n</i>	Very Imp	<i>n</i>	Very Imp	<i>n</i>	Very Imp	<i>n</i>
Center	14	18	4	14	2	10	1	8	15	19	3	6	16	26	16	23	2	11	6	12	13	15
East	11	11	7	10	5	8	0	3	2	5	1	4	5	9	6	11	0	2	0	2	6	8
Littoral	2	8	13	19		8		5	3	7		6	9	14	13	14		8		6	8	12
North-west	11	12	13	13	4	8	1	3	11	11	19	19	4	6	6	10	11	11	9	10	11	11
South	15	17	6	14	4	9		4	2	8	1	7	3	11	4	11	1	5		3	1	2
South-west	20	22	20	23	7	10	1	3	22	23	12	14	12	18	10	12	14	17	7	11	14	17
West	43	44	9	17	22	25	21	22	3	6	24	27	14	17	22	25	5	6		1	22	22
Total	116	132	72	109	44	78	24	48	59	81	59	81	63	101	77	106	33	60	22	45	75	87

Imp: Important, *n*: Sample size

Table 3: Crop calendar and pesticide spray schedule (%).

Regions	<i>n</i>	Cropping season			Spraying season		
		Dry	Rainy	Both	Dry	Rainy	Both
Center	38	25	8	67	25	6	64
East	15	31	0	70	31	6	56
Littoral	22	57	10	33	43	14	5
North West	21	10	5	86	14	5	81
South	18	12	0	88	12	0	88
South West	34	9	0	90	3	0	85
West	50	26	6	68	26	4	70

Pesticide spray calendar

Eighty-three percent of vegetable growers did not employ planting dates, growing season selection, or timeliness of activities as pest management techniques. Vegetable cultivation in Yabassi's littoral zone was limited to the dry season and the Nkam River. This is due to the fact that cultivation is feasible during the dry season, when there are no floods, but the land is submerged during the rainy season. The flood plains are damp and ideal for gardening during the dry season. In general, more farmers produced vegetables over both seasons, which explains why those who farmed during both seasons showed higher levels of spraying. However, the off-season is favored over rain-fed vegetable production among farmers who only grow vegetables during one season (Table 3). Merely 11% of farmers thought that insect issues could not be as severe during the dry season as they were during the wet season. Other reasons for choosing the growing season included: (1) preferring the rainy season because water is available and insect pests are reduced (5%); (2) preferring the dry season because diseases are not as serious (11%); and (3) the cost of vegetable production is lower in the dry season (1%). However, a very high percentage (83%) stated that there is no relationship between planting date and pests and disease problems. Weekly pesticide spraying was the most usual, with 40% of farmers spraying insecticides and 28% spraying fungicides, according to farmers' memories of pesticide kind and application frequency. A large percentage of vegetable growers (19% for insecticides and 41% for fungicides) failed to record how frequently they used pesticides on their crops.

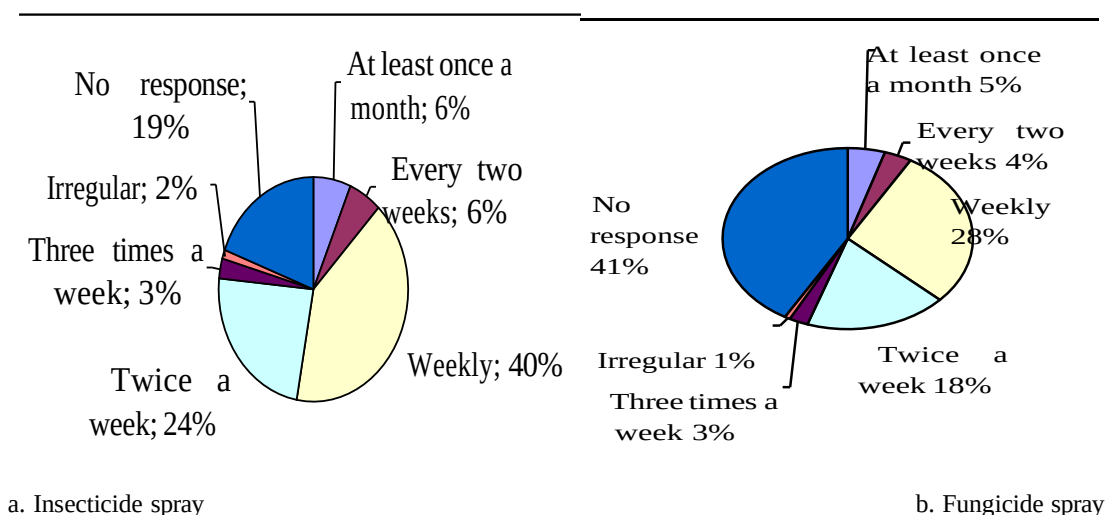


Figure 1a, b: Frequency of pesticide applications.

The period of pesticide spraying varied with crops growth stages (Figure 2). But 39% could not say what time of plant growth was most effective for controlling pests

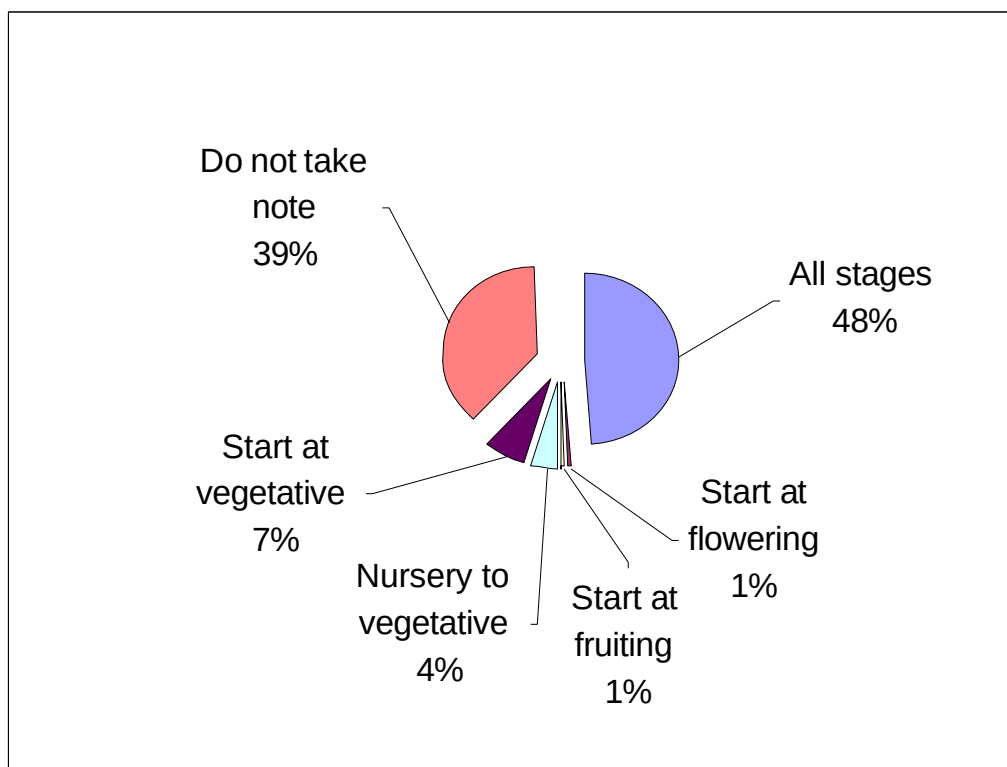


Figure 2: Pesticide application periods.

Farmers buy pesticides in packages, kilos, or liters (Table 5). A greater proportion of farmers (32%) use up to nine liters of insecticide annually. Depending on the size of the farm, a higher percentage (18%) used 10 to 49 kg of pesticides, while around 9% used 10 to 49 packets of chemicals. Chemical prices differ depending on how close a site is to the market. Depending on the chemical grade and package size, the majority of pesticides were supplied to farmers at costs between 5,000 and 13,000 FCFA per liter, 6,000 and 8,500 FCFA per kilogram, and 300 and 12,000 FCFA each packet. This suggests that if we take into account the 32% who purchase pesticides in liters, the 18% who purchase them in kilograms, and the 9% who purchase them in packets, a farmer may spend between 50,000 and 600,000 FCFA on pesticides annually. Only a small percentage of farmers (4%) had vegetable fields that were around 4 hectares in size, but the majority of farmers (35%) had fields with a surface area between 0.5 and 1 hectare. As a result, they could annually spray around 58 kg of pesticides per acre.

Table 5: Quantities of chemical inputs used during the cropping season and percentage of farmers buying different types

Quantities (L, Kg orLitters (L) of chemicals Packets)	% of farmers who used (L) of chemicals	% of farmers who used kg of chemicals	% of farmers who used bags of chemicals	% of farmers who used packets of chemicals
0.5 to 4	24	4	1	2
5 to 9	32	6	1	4
10 to 49	4	18	1	9
50 to 99	1	7	0	2
>100	1	3	0	4

Pesticide use and handling

Synthetic insecticides are used by almost 90% of farms surveyed. The 10% who did not use pesticides cited expensive costs, particularly for small-scale farmers who did not grow a lot of vegetables. All of the crops under study are treated with pesticides, although tomatoes are the most heavily treated (Table 6).

Table 6: Number of farmers using pesticides to control pests of vegetable crops

Region	Tomato	Hot Pepper	Sweet pepper	Onion	Cabbage	Amaranth	Okra	Night-shade	Egg plant	Jute mallow	Others
Centre	13	9	1	2	5	15	20	14	3	6	7
East	12	7	7	1		4	4	10	1		3
Littoral	5	11	2			1	5	6			4
North-west	14	12	5	1	15	11	3	5	10	9	10
South	17	14	6	1		5	8	6	3	1	2
South-west	19	17	5		10	18	11	6	12	5	10
West	39	10	21	18	27	0	12	23	2		13
Total	119	80	47	23	57	54	63	70	31	21	49

The effects of farmers' use of pesticides are summarized in Figure 3. The list of chemicals used by farmers in each location is shown in Table 7. The most popular active ingredients were Gramoxone against weeds, Maneb, Metalaxyl, Manizan, and Mancozeb against fungus, and Dimethoate and Cypermethrine against insects. Cameroon's tropical regions employ a variety of pesticides. The active elements are less varied in the western highlands and coastal forests. No farmer in the Yabassi region acknowledged the use of chemical spray (Table 7).

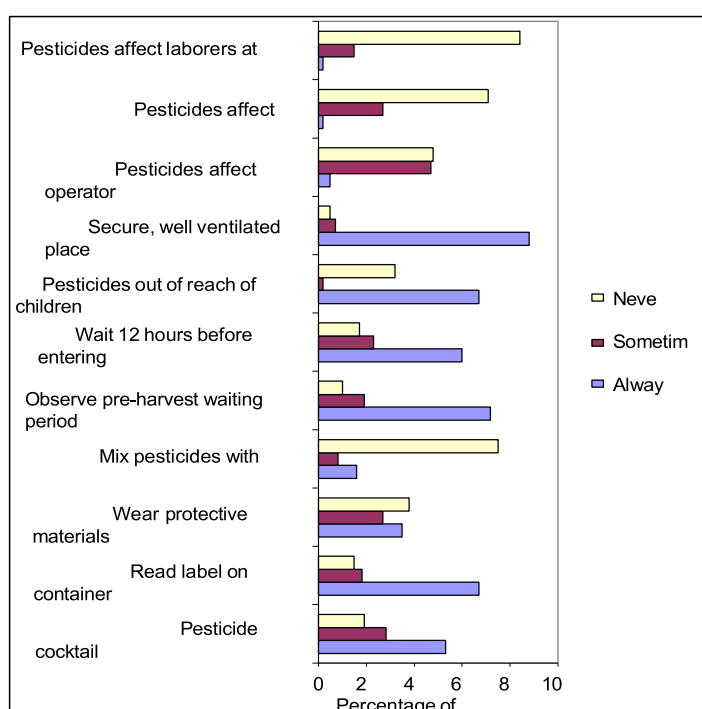


Figure 3: Farmer's knowledge of pesticide handling and storage

Table: 7. List of pesticides use by farmers from each Location

Center region			East region	South region	Littoral region		South-West region			North-West Region		West region		
Bafia	Obala	Yaounde	Bertoua	Ebolowa	Douala	Njombe	Buea	Ekona	Muyuka	Ndop	Santa	Foumbot	Dschang	Bangangte
Insecticides														
Callidim	Callidim	Callidim	Callidim	Callidim	Callidim			Callidim		Callidim	Callidim	Callidim	Callidim	Callidim
Karate												Karate		
	Cypercal	Cypercal	Cypercal	Cypercal		Cypercal	Cypercal	Cypercal	Cypercal	Cypercal	Cypercal	Cypercal	Cypercal	Cypercal
	Lambdacal	Lambdacal	Lambdacal	Lambdacal			Lambdacal							
	Planthoate	Planthoate	Planthoate	Planthoate						Orthene				Planthoate
	Cyperdim	Cyperdim	Cyperdim	Cyperdim		Cyperdim	Cyperdim	Cyperdim			Cyperdim	Cyperdim	Cyperdim	Cyperdim
	Cigogne	Cigogne	Cigogne	Cigogne			Cigogne					Cigogne	Cigogne	Cigogne
	Decis	Decis	Decis	Decis		Decis						Decis		
	Dimex	Dimex	Dimex		Dimex	Dimex		Dimex					Dimex	
	Camindacal	Camindacal	Camindacal						Gamaline					
	Parastar	Parastar	Parastar						Gramoxone					
		Carbofuran	Bastion				Callisulfan	Callisulfan						
			Dursban	Dursban		Dursban		Dursban					Dursban	
			Actellic										Malathane	
				Furaplant										
				Pyriforce Thiodan	Thioplant	Pyriforce Kunter	Pyriforce Pacha	Pacha					Pacha	
				Cyplandim				Bravo				Cyplandim		
				Cyperplant									Cyperplant Regent	Cyperplant
Fungicides														
	Plantineb	Plantineb	Plantineb	Plantineb		Plantineb	Plantineb	Plantineb		Plantineb	Plantineb	Plantineb	Plantineb	Plantineb
	Plantizeb	Plantizeb	Plantizeb	Plantizeb	Plantizeb		Plantizeb		Plantizeb		Plantizeb	Plantizeb	Plantizeb	Plantizeb
	Penncozeb	Penncozeb					Kocide				Penncozeb		Penncozeb	
	Trimangol	Trimangol	Trimangol	Trimangol			Trimangol			Trimangol			Trimangol	
	Ridomil	Ridomil		Ridomil			Ridomil	Ridomil		Ridomil	Ridomil	Ridomil	Ridomil	
	Beauchamp	Beauchamp		Beauchamp			Pylory			Beauchamp				
	Ivory	Ivory			Ivory		Calthio DS	Ivory		Agrizeb		Ivory	Ivory	

About 25% of farmers stored their pesticides at home, while the majority kept them at commodities stores. Pesticides were maintained at home by farmers who lacked commodities stores. Farmers occasionally just purchased what they needed right away. 50% of them kept chemicals out of children's reach because they were aware of their toxicity, and 10% believed that having easy access to chemicals may lead to suicide. On the farm, 70% either burnt or discarded the pesticide containers. Some people placed the containers in toilets or buried them in the ground. Some others cleaned the containers and utilized them at home for storage. The proportion of vegetable farmers who maintained records of crop farm operations and pesticide information, as well as whether the operator adhered to pesticide handling and application practices, are shown in the table below. Vegetables were regularly sprayed by nearly half of the vegetable producers surveyed. Fewer people sprayed their crops based on field scouting and monitoring, and very few talked to others before doing so. Only 75% of people own a backpack sprayer, despite the fact that 90% utilize them. Less than half were aware of the product trade name, application location, and application date. Thirty-eight percent of farmers were able to cite some adverse or detrimental impacts of employing pesticides, including toxicity to crops due to excessive doses (22%) and toxicity to humans (12%). Twenty percent reported that pesticides had an impact on their health. Fifteen percent were aware of helpful insects, and around one-third were aware of alternative pest management techniques.

Table 8: Percentage of farmers who kept pesticide and spray equipment record (n = 198)

Questions	Yes	No
Do you keep records of application location?	45	55
Do you keep records of date of application?	45	55
Do you keep records of pesticide product trade name?	43	57
Do you keep records of operator / worker name?	32	68
Do you use a knapsack sprayer?	90	10
If you use a knapsack sprayer, do you own it?	73	27
Do you rent the knapsack sprayer?	21	79
Do you borrow the knapsack sprayer?	40	60
Do you have negative or harmful effects of using pesticide?	38	62
Do you have knowledge about some beneficial insects?	15	85
Do you have knowledge about other methods of pest control?	30	70

Information needs

Information about integrated pest management, pesticide usage and safety, insect and disease identification, and quality elements of their vegetable crops was unavailable to over 75% of farmers (Table 9). Half of them gathered data on their overall sales, spraying costs, and output.

Tables 9: Percentage of farmers who received training on selected aspects of vegetable farming (n=198)

Training on topics	Yes	No
IPM	14	86
Pesticide usage	25	75
Pesticide safety	24	76
Insect identification	16	84
Disease identification	16	84
Quality management aspects of vegetables	14	86

The majority of the information about managing crop pests and diseases came from conversations with other farmers and neighbors. According to the findings, 75% of vegetable producers rely on other farmers' expertise for guidance on how to control pests and illnesses in their farms.

Discussion

About 60% of the vegetables produced in the study regions are produced by the rural population, 31% by the peri-urban population, and 7% by the urban population. Despite the fact that only 7% of farmers surveyed grow vegetables in urban areas, Hovorka (2005) noted that urban agriculture is a significant source of employment and food, and it helps keep cities clean by turning urban garbage into organic manure. Approximately 32% of the farmers dropped out of secondary school, and 48% of them had first school leaving certificates as their highest credential. This supported prior findings by Elizabeth S. and Zira D. (2009) that for people without access to formal work because of a lack of education, training, or other possibilities, farming is a viable alternative to wage labor. In the tropics, illnesses and pests are major obstacles to vegetable production. Seasons affect infestation. Our survey revealed that the majority of farmers sprayed during the dry season, most likely due to the fact that more people cultivate vegetables during this time than during the rainy season. Insect pests may be more dangerous during the dry season since farmers spray against insects more frequently than illnesses. According to Holmer et al. (2001), farmers find chemical pesticides to be more persuasive than cultural approaches and other pest management measures. Despite the fact that almost 90% of farmers surveyed use chemical pesticides, which supports the findings of Obopile et al. (2007), they lack proficiency in handling pesticides (Ngowi et al., 2007 and Mathews G.A., 2008). Since the majority of vegetable growers are rural and have lower levels of education, their ignorance of how to handle pesticides might become more harmful. Some farmers keep chemicals at home, and the fact that some of them discovered that pesticides had an adverse effect on their health is a clear indication of inadequate training and bad pesticide usage methods. The most popular fungicides are Maneb, Metalaxyl, Manizan, and Mancozeb, while the most popular insecticides are Dimethoate and Cypermethrine. The usage of these chemical classes was documented by Matthews et al. (2003). The variety of pesticides on the list may be a sign of significant pest issues and management challenges, leading farmers to experiment with different formulations; it may also be a sign that farmers are not applying the right pesticides. Target plant parts, timing, frequency, and dosages are examples of application techniques that might be inaccurate. Pest resistance to insecticides is another option. The fact that 75% of vegetable producers rely on other farmers' expertise for guidance on controlling pests and illnesses in their farms may support these arguments. According to the findings of Elizabeth and Zira (2009), farmers seek guidance from nearby farmers rather than interacting with the village extension workers (VEW). In addition to using pesticides, farmers employed a number of techniques to anticipate and avoid illnesses. However, the majority of vegetable producers (24%) claimed that the best indicator of pest and disease epidemics is a lack of funds to buy pesticides. In other words, the over-reliance on chemical pesticides to protect plants has led farmers to assume that low harvests due to illnesses and insect pests are caused by a lack of access to and financial resources for chemicals. Farmers are aware that there would be significant insect and disease issues throughout the cropping season since they are unable to purchase pesticides due to issues with pest breakouts, resistance, and resurgence. Guidelines for prevention and control should be closely adhered to at the beginning and tracked throughout development. The risk of needing pesticides and the expense of growing vegetables may both rise if farmers are not trained in sustainable pest management techniques. Pesticide usage degrades the environment by harming plants and biodiversity, which is an important weapon in the battle against climate change. Additionally, some greenhouse gas emissions are generated by compounds released from pesticides. Almost one-third of the world's greenhouse gas emissions are caused by agriculture, including forestry and land use change (WRI, 2008). If Cameroonian vegetable farmers are to utilize less costly pest control solutions that are less dangerous to the environment and human health, they must be made aware of the risks associated with improper handling of pesticides. To increase farmers' understanding of the use of pesticides and reinforce the role of extension services in pest management, it is necessary to develop the connections between researchers and extension as well as between extension and farmers.

Conclusions and Recommendations

This study offers important information about the pesticides used in Cameroonian vegetable production to manage pests and diseases, the degree of proficiency of vegetable farmers in using pesticides, and the impact on crop and farmer health. The results of this study clearly show that vegetable producers do not have the necessary understanding to handle and use pesticides safely. This is explained by the scarcity of training and extension services. Pest control training programs and extension services should be enhanced. To increase farmers' production, research should be done, particularly on the proper and safe application of pesticides. Although they are not well documented, there are compelling signs that the improper use of pesticides in Cameroonian horticulture cultivation is linked to serious health issues for people. The costs of pesticide use's negative impacts on human health and the environment have not been included into the overall cost of vegetable production,

and further research is necessary to produce relevant statistics that can be used to inform policy. Crop resilience, biological controls, and habitat management techniques are alternatives to chemical pest control that should be developed, spread, and strengthened via policy reform in Cameroon to reduce vegetable production costs for farmers and provide a better environment for everyone.

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