

Farmers challenges of agro-chemical usage in vegetable production in Buea municipality (South West Region, Cameroon)

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Abstract

Global agricultural production has kept pace with population growth over the past 50 years mainly due to intensification associated with the 'green revolution' and expansion into previously uncultivated areas. However, the repercussions of some of the practices such as the application of agro-chemicals are increasing evident. This study seeks to investigate the Agrochemicals used in vegetable Production and its challenges in the Buea Municipality. The study was an experimental and investigatory one in which a multi-stage sampling technique involving the stratified and purposive random sampling techniques were employed to sample 262 small farm holders. Questionnaires were administered to various stakeholders; primary and secondary data were obtained through interviews and documentary research respectively). Soil samples were carefully collected and tested in the laboratory. Quantitative and qualitative data collected during field survey were assigned codes and inputted on excel version 20 and exported to SPSS Version 21 where they were analyzed using the inferential and descriptive statistical techniques, respectively. Findings show that the dominant agrochemicals used by market gardeners is fertilizer (65%) and insecticides (35 %). The results on methods of application of agrochemicals show that 68% of respondents used sprayer and granular application which is expensive while 32% of respondents used manual granular method which is very time consuming. These methods generated a lot of challenges such as Intoxicating resulting from malpractice, and high cost of equipment and maintenance. The study recommends that the government and agrochemical dealers should ensure farmer access to training services such as seminars and onsite training on agrochemicals protective measure and usage.

Keywords: Market gardening production, Agrochemicals, impact, Buea Municipality

Résumé

La production agricole mondiale a suivi le rythme de la croissance démographique au cours des 50 dernières années, principalement en raison de l'intensification associée à la « révolution verte » et de l'expansion dans des zones auparavant non cultivées. Cependant, les répercussions de certaines pratiques telles que l'application de produits agrochimiques sont de plus en plus évidentes. Cette étude vise à étudier les produits agrochimiques utilisés dans la production maraîchère et leurs défis dans la municipalité de Buea. Il s'agit d'une étude expérimentale et d'investigation dans le cadre de laquelle la technique d'échantillonnage en plusieurs étapes impliquant des techniques d'échantillonnage aléatoire stratifié et téléologique a été utilisée pour échantillonner 262 petits exploitants agricoles. Des questionnaires ont été administrés à divers intervenants ; les données primaires et secondaires ont été obtenues par le biais d'entrevues et de recherches documentaires. Des échantillons de sol ont été soigneusement prélevés et testés en laboratoire. Les données quantitatives et qualitatives recueillies au cours de l'enquête sur le terrain ont été codées et saisies sur Excel version 20 et exportées vers SPSS version 21 où elles ont été analysées à l'aide des techniques statistiques inférentielles et descriptives. Les résultats montrent que les principaux produits agrochimiques utilisés par les maraîchers sont les engrais (65 %) et les insecticides (35 %). Les résultats sur les méthodes d'application des produits agrochimiques montrent que 68 % des personnes interrogées ont utilisé un pulvérisateur et une application granulaire, ce qui est coûteux, tandis que 32 % des personnes interrogées ont utilisé une méthode granulaire manuelle, ce qui prend beaucoup de temps. Ces méthodes ont généré de nombreux défis tels que l'intoxication résultant d'une mauvaise manipulation et le coût élevé de l'équipement et de l'entretien. L'étude recommande que le gouvernement et les distributeurs de produits agrochimiques veillent à ce que les agriculteurs aient accès à des services de formation tels que des séminaires et des formations sur place sur les mesures de protection et l'utilisation des produits agrochimiques.

Mots-clés : Production maraîchère, Agrochimie, impact, Municipalité de Buea

Introduction

Royal Society 2009, established on a global note that agricultural production has kept pace with population growth over the past 5 decades due to intensification associated with the green revolution; Green *et al.*, 2005; Ramankutty *et al.*, 2008 equally added that this is accompanied by expansion into the previously uncultivated areas. Despite global gains in production, access to food remains unevenly distributed. As a result, 870 million people remain food insecure, with many more sufferings from 'hidden hunger' caused by micronutrient or protein deficiencies (Graham *et al.*, 2007; Keatinge *et al.*, 2011; FAO, 2011; Khush *et al.*, 2012).

Agro-chemical therefore, is any chemical used in agriculture to improve productivity, control pests, and treat or control diseases. It encompasses fertilizers and agricultural pesticides: insecticides, fungicides, rodenticides, acaricides, molluscides, and herbicides; and plant regulators (Tekwa *et al.*, 2010). Agriculture serves as a valuable source of income, contributing to poverty reduction. This is as a result of the employment that it offers. Seventy-five per cent of people live in rural areas of developing countries, especially sub-Saharan Africa and southern Asia (United Nations, 2011; IFAD 2011). Agriculture depends on the environment for land, water, sunlight, and even biological agents. The increasing world population has been the driving force to promote intensive land use, agrochemical use, irrigation and disease and pest-resistant varieties to boost agricultural production.

Also, some types of agro-chemicals known as organochlorines are persistent. They tend to stay longer in the environment and accumulate in aquatic food chains and cause effects on the health of top predators (Pearce, 1998). For example, dichlorodiphenyltrichloroethane (DDT) in avian bodies interferes with calcium metabolism and makes it impossible for birds to produce eggs with sufficiently thick shells to withstand incubation (Baird, 1999; Pollock, 2001; Tanabe, 2002).

Long-term exposure to pesticides can increase the risk of developmental and reproductive disorders, immune-system disruption, endocrine disruption, impaired nervous-system function, and development of certain cancers (Parthasarathy *et al.*, 2008).

Most countries in Sub-Saharan Africa, Cameroon for instance, heavily depend on agriculture that is dominated by subsistence smallholder farmers (World Bank, 2000). Farming is a major source of income for many people in developing countries. It also contributes to economic growth and employs over 30% of the labor force. However, the performance of the African agricultural sector has been disappointing over many decades (Wayo, *et al.*, 2011). Sub-Saharan Africa such as Cameroon is also reported as the only region in which per capita agricultural value added has not seen a substantial increase, rather a declining trend on average over the last three decades since 1961 with considerable variation over time and across countries (FAO, 2008). This declining per capita food production has resulted in increasing rural poverty, rising food prices, widespread famines and increasing food imports.

It is noted that the Green Revolution, which has saved many lives in Asia and South America, has by passed Africa and hunger still prevails on the continent despite the past research and development efforts. Some of the factors hindering agricultural development in Africa include inadequate investment in agriculture, limited access to credit by smallholder farmers, high cost and unavailability of inputs such as fertilizers and improved seeds, inadequate use of modern technologies, inefficient agricultural input markets, and the absence of a conducive policy environment. In Cameroon, agro-chemicals are extensively utilized in oil palm, cocoa, cola nut, coffee and cotton farms, vegetable (such as tomato, eggplant, onion, pepper, okra, cabbage, lettuce and carrot) and fruit production (including papaya, citrus, avocado, mango, cashew and pineapple) (Fianko *et al.*, 2011). It is also widely used in mixed-crop farming systems involving cereals (e.g. maize, millet, sorghum and rice), tuber crops (e.g. yam, cassava, cocoyam and sweet potato) and legumes (e.g. cowpea, bambara nut, groundnut and soybean) (Essumang, Togoh & Chokky, 2009).

Cameroon thus, has known a continuous growth of agro-chemical usage, both in number of chemicals and quantities because of the expansion of area under cultivation for food, vegetables and cash crops (Ministry of Food and Agriculture (MOFA), 2007). Agro-chemical application in Buea Municipality is more concentrated in cocoa, oil palm, cereals, vegetables and fruits sector. Agriculture is the largest consumer (around 85% of world production) of pesticides to chemically control various pests. Moreover, pesticides are also used

in public health activities to control vector-borne diseases (e.g., malaria and dengue) and unwanted plants (e.g., grass and weeds) in ornamental landscaping, parks, and gardens. They are also useful in suppressing or avoiding the proliferation of insects, pests, bacteria, fungi, and algae in electrical equipment, refrigerators, paint, carpets, paper, cardboard, and food packaging materials (Gilden *et al.*, 2010).

Unintended exposure to pesticides can be extremely hazardous to human health and other living organisms as they are designed to be poisonous (Sarwar, 2015). They may also be harmful to the environment and to people who are exposed to pesticides through occupational (or home) use, eating foods or liquids containing pesticide residue, or inhalation (or contact) of pesticide-contaminated air (Pimentel *et al.*, 2013). Even very low levels of exposure may have adverse health effects at early development (Damalas and Eleftherohorinos, 2011). Pesticide exposure is linked with various diseases including cancer, hormone disruption, asthma, allergies, and hypersensitivity (Van Maele-Fabry *et al.*, 2010).

Buea Municipality is located between latitude 4°12'' and 4°31'' north of the Equator and longitude 9°9'' and 9°12'' east of the Greenwich meridian. It is found in the Fako Division of the south West region of Cameroon. It is bounded to the north by the tropical rainforest on the slopes of mount Cameroon (4095m above sea level). It shares boundaries to the south with Limbe Subdivision; by Tiko Subdivision to the Southeast; Muyuka Subdivision to the East and Idenau to the West.

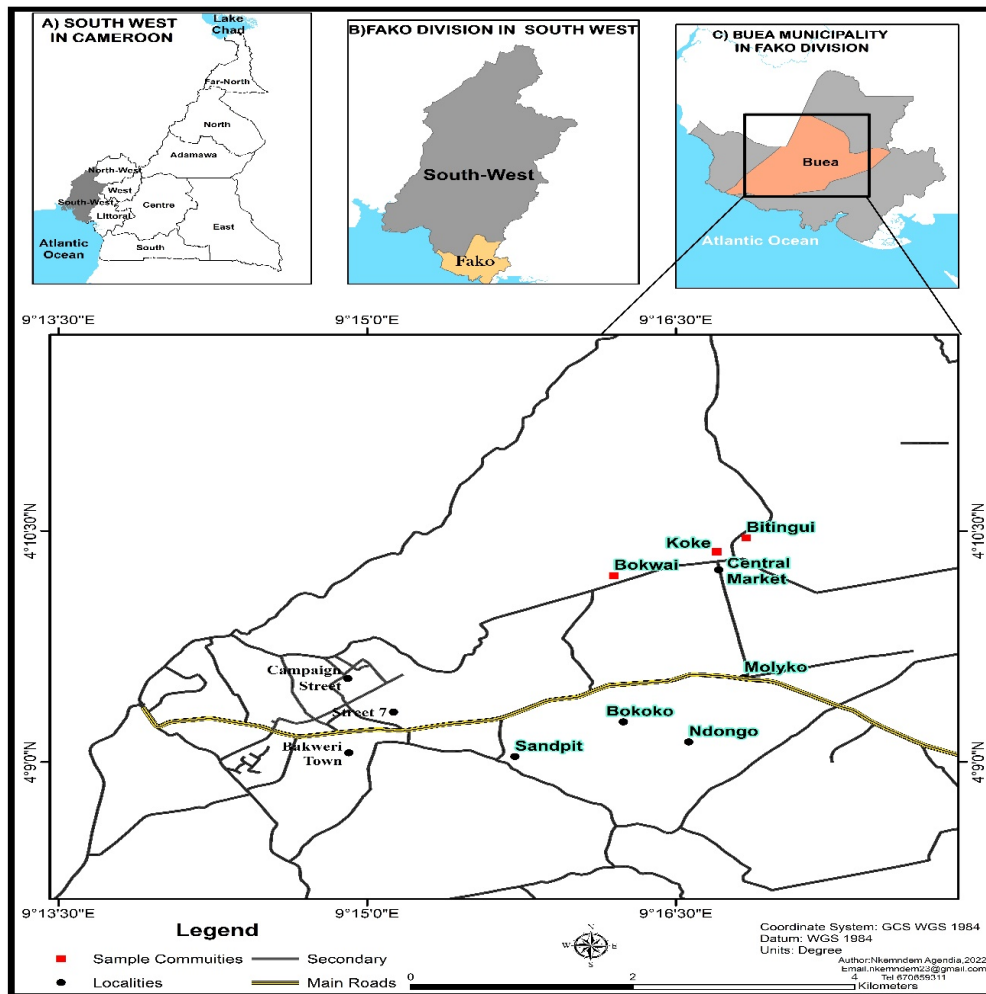


Figure 1. Location of the study area

I. Materials and methods

This section explained the process that was used to collect data based on the agrochemical used in market gardening production and its challenges in Buea Municipality. For this research, both primary and secondary sources of data were utilized. A multi-stage sampling procedure was used. Firstly, there was a stratified random sampling where farmlands involving market gardening were delineated within the Buea Municipality. These sample sites were Bokwango, Muea, Upper farms and the University of Buea Open fields. After,

these farming zones were delineated, through a simple random sampling technique, farmers were selected in order to provide the information needed for the study. The observation was conducted to provide background information about the environment of the study. Therefore, an extensive personal observation was undertaken to support the primary data that was gathered and be able to gain a richer understanding of the phenomena in a natural setting and qualify the nature of the problem. The merit of this approach is that the investigator gets an inside picture of the study. It can also reveal information people are not directly aware of (Emerton,

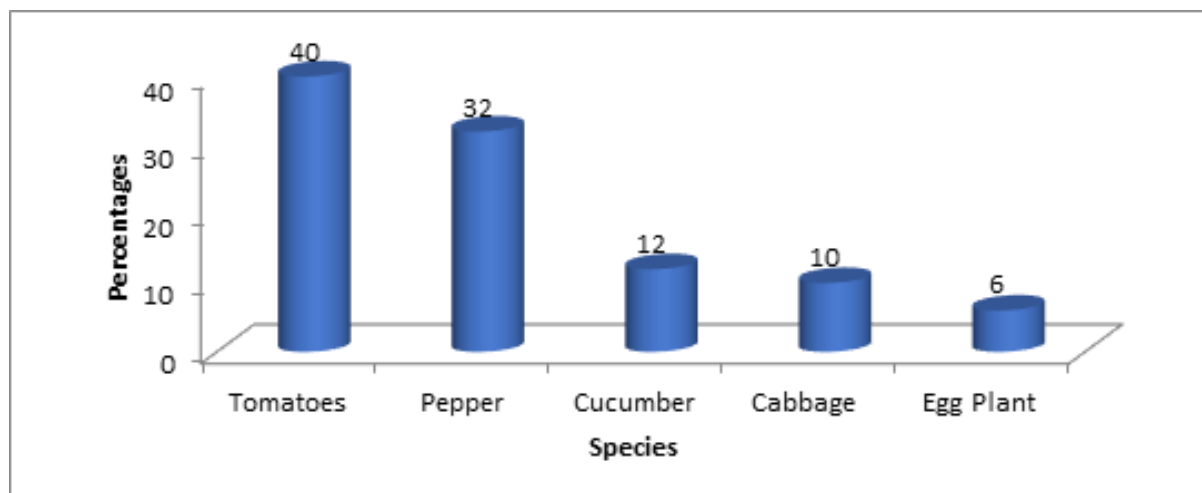
2014). Questionnaires were administered to these groups of respondents to get their views and perceptions on investigating the effects of agrochemical use on market gardening production in Buea municipality. The questionnaire method was chosen because it is easy to administer and provide stimulus to all the subjects (Casley and Kumar, 2015). The chi-square and the Mactor software were used to analyze primary and secondary data.

II. Results

1. Crop Species of market gardening in Buea

Various species of market gardening crops are practiced by farmers in the Buea Municipality, as indicated on Figure 2.

Figure 2: Species of market gardening



Source: Field data (2023)

As presented on Figure 2, it was observed that the most market gardening crops cultivated were; tomatoes as represented by 40% of the respondents, 32% of the farmers are those cultivating pepper while 12% are practicing cucumber cultivation. Furthermore, 10% are in cabbage cultivation while the least (6%) are in Egg Plant cultivation. A majority of the population is into tomatoes and pepper cultivation because they have a fast turn-over and they are easy to carter by the experts involve. Cucumber is also widely cultivated because it is a kind of fruit needed by the population.

Plate 1 shows samples of market gardening products practice in Muea, upper farms, and Bokwango.



Plate 1. Samples of market gardening products cultivated in the Buea Municipality

Source: Fieldwork (2023)

In line with the information presented on plate A depicts samples of cabbage species, B is sample of tomatoes, and C is pepper while plate D is eggplant.

2. Farm size

The sizes of farmlands where market gardening activities are being done vary across the various localities. The variation is due to land tenure systems and the financial capability of the farmer to acquire a piece of land. More evidences on this are presented on Table 1.

Table 1: Farm Size

Average	Frequency	Percentages (%)
Less than ½	89	33.9
½ - 1 Acre	51	19.5
1.1- 2 acre	70	26.7
2.1 – 3 Acre	42	16
Over three acre	10	3.8
Total	262	100

Source: Field data (2023)

Based on farm size presented on Table (1), most market gardeners have farm sizes less than ½ hectare, 26.7% of them has 1.1-2 acres while 19.5% 1/2-1 acres of land. More so, 16% of the respondents said that they have farm sizes 2.1-3 acres and the least (3.8%) said that they have farm sizes which cover over 3 acres. Agrochemicals using spraying can make the process very fast and more effective for soluble agrochemicals while the insoluble chemical are applied using manual granular method which is very time consuming.

3. Agro-chemicals used in vegetable production

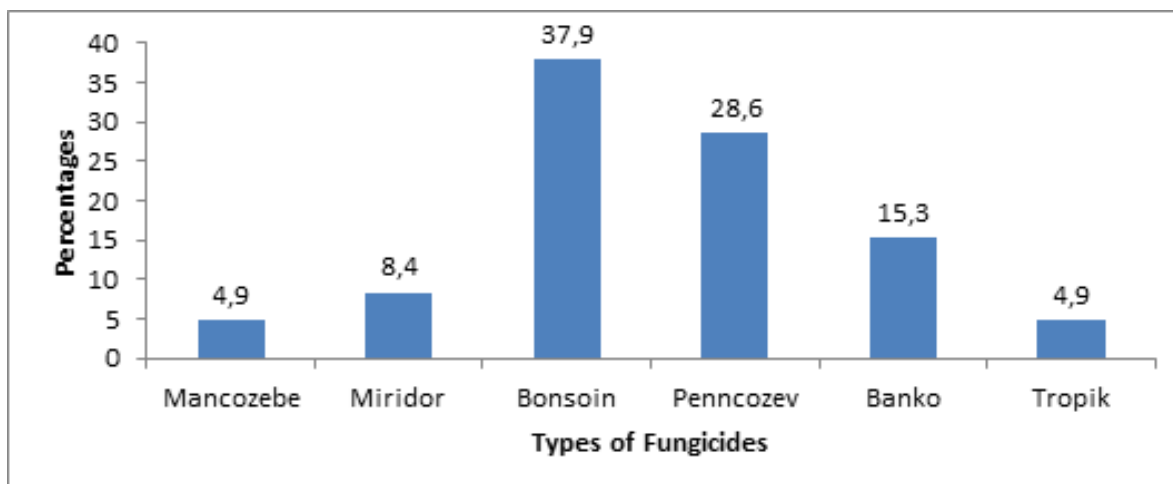
There are many different agro-chemicals use by farmers in market garden farms. However, these chemicals vary across farmlands depending on the soils and the types of market garden species practiced. During the course of the field study, the different and common agro-chemicals identified were fertilizers, herbicides, insecticides and fungicides. They had different periods of application at different stages of growth of the plant. The researcher sought to establish the percentage in terms of usage the different agrochemicals. These agro-chemicals

were analyzed respectively as presented in the subsequent paragraphs below.

3.1. Fungicides

During the course of the field survey, investigations were done regards to the types of fungicides use by farmers. According to the WHO (2005), Fungicides are used to prevent the prevalence of fungal diseases in market gardening and to improve the yields of market gardening. Details of the investigations are presented on Figure 3.

Figure 3: Types of Fungicides used by market garden farmers



Source: Field data (2023)

As presented on Figure 3 a majority (37.9%) of the respondents pointed out that they mostly use bonsoin type of Fungicides, 28.6% revealed that they use penncozev, 15.3% said banko while 8.4% attributed to the use of miridor. The least (4.9%) were those who pointed at mancozebe and tropic. All these fungicides are applied at different market gardening production sites and in different seasons. Figure 3 shows sample of some of the fungicides used by market gardeners.

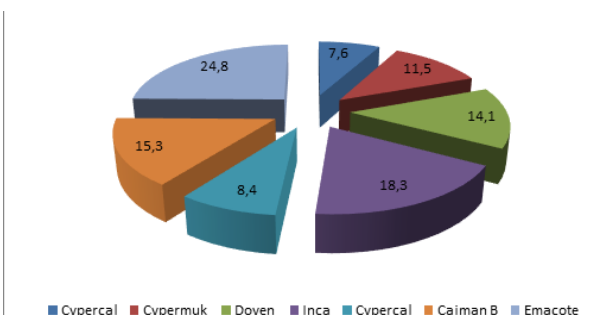
3.2. Insecticides

Insecticides as agrochemicals are used in market gardening to protect crops from insect pests that can damage or destroy them, leading to reduced yields and economic losses. The following paragraphs explain the investigations on insecticides and herbicides.

The findings on the types of insecticides were succinct by investigations on the various insecticides use by the farmers. Details of this are

presented on Figure 4.

Figure 4: Types of insecticides used by respondents



Source: Field data (2023)

In line with the information on Figure 4, 24.8% of the respondents said that their use mostly emacote, 15.3% said that they mostly apply caiman, 18.3% claimed of always applying Inca while 14.1% pointed at doyen. Furthermore, 11.5% and 8.4% pointed at cypermuk and cypercal, respectively. Plate 2 shows a sample of insecticides apply by farmers in their market gardening farms in the Buea Municipality.



Plate 2: Doyen insecticide

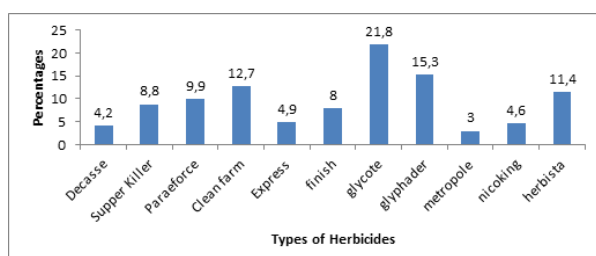
Source: Field data (2023)

Plate 2 shows the Doyen insecticides use by farmers in the Buea Municipality. This is mostly applied in tomato farmlands in order to limits the spread of plant of diseases.

3.3. Herbicides

Findings were also done on the types of herbicides apply by farmers. Herbicides are chemicals used to control or eliminate unwanted plants, commonly referred to as weed. They are used in market gardening to control weeds from competing with crops for nutrients, water, and sunlight, which can significantly reduce crop yields. Details of these are presented on Figure 5.

Figure 5: Types of Herbicides used by respondents



Source: Field data (2023)

Different types of herbicides were used by local farmers engaged in market gardening crops. The study results showed that 21.8% of the herbicides are glycote. 15.3% is glyphader, 12.7% clean farm while 11.4% is herbista. Furthermore, 9.9% is paraeforce, 8.8% supper killer while 8% is finish. Also, 4.9% and 4.6% is express and nicoking, respectively while 4.2% is decasses and 3% is metropole. Figure 5 depicts some of the herbicides apply in market gardening units by farmers.

Plate 3: Samples of Herbicides used by farmers in the Buea Municipality



Source: Field data (2023)

Figure 3 shows some of the herbicide products used by farmers to spray their farmlands in the Buea Municipality. They are: Glycot, Clean farm and Express herbicides.

3.4. Organic Farming

Majority of the respondent resort to know of organic farming using organic manure in the early stage of cultivation but said it can not a sure the output they desire as it is not easy to get in large quantities and is very expensive and using only it will exposed their farms to pest attack.

4. Challenges faced by market gardening farmers

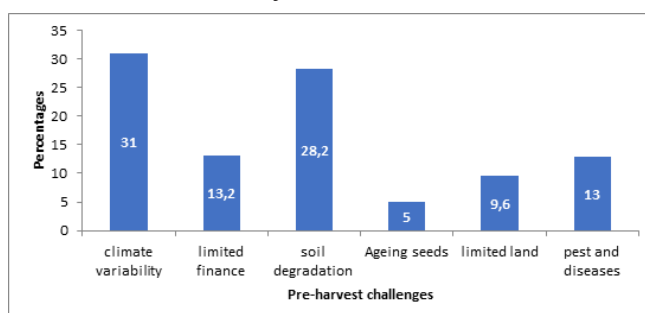
4.1. General challenges faced in carrying out market gardening activities

During the course of the field survey, investigations were done through focus group discussions, interviews and questionnaires. The focus was to investigate the challenges that market gardeners actually face in the course of carrying out their market gardening activities. The challenges are group into pre-harvest and post-harvest. Details on this are presented in the subsequent paragraphs.

4.1.1. Pre-harvest challenges

Pre-harvest challenges are: climate variable, ageing seeds, limited finance, pest and diseases, limited land, and soil degradation as shown on Figure 6

Figure 6: Pre-harvest challenges faced by farmers



Source: Fieldwork (2023)

As presented on figure 6, many (31%) of the farmers complained that they are faced with climate variability which is the perpetual changes in the weather conditions that affects the available soil

moisture for plant growth. Furthermore, climate variability leads to increasing temperatures and increasing rainfall that results into flood and consequently soil erosion. Climate variability also disrupts the planting as well as the harvesting season thus, disrupting the supply of market gardening products.

28.2% of the farmers also said that rapid soil erosion is one of the major problems there are facing. This comes about due to increasing environmental degradation which is due to increasing rainfall; prolong dry season and the poor application of agrochemicals. Increasing soil erosion affects the farmers are they are bound to spend much money on agrochemicals to enrich the soil. It also affects their income in that, they have to invest into much land into to extend the area under cultivation and to diversify the risks of crop failure.

Furthermore, 13.2% said that they are facing limited finances and 13% also said that they are faced with agricultural pest and diseases. The problem of limited finance leads to the inability to acquire land, seeds, and agrochemicals as well as the compensation of the labour employed within the various farmlands and the cause of the falling income of the farmers is due to falling prices of the market garden products. However, agricultural diseases like weevils, stock borrowers and fungi and parasites come in as a result of climate variability. These usually dealt with many of the market gardening products such as cabbage, tomatoes and pepper. Because of this, farmers spent much money on insecticides and pesticides so as to prevent the occurrence of these diseases and pest and therefore spike their harvest. Farmers have burdens and huge sums of money to return as loans taken from credit unions

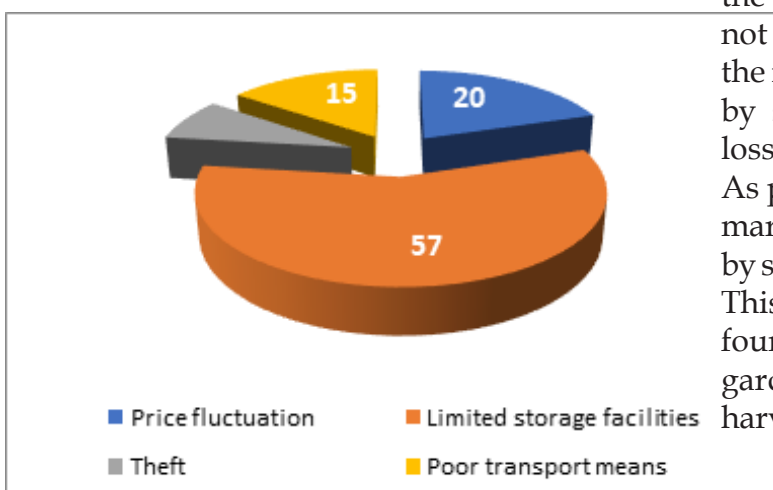
and *njangi* houses due to the prevalence of pest and diseases in their various farmlands.

In addition, 9.6% of the farmers said that they are faced with limited land while 5% said that they are faced with the issue of ageing seeds. Limited cultivation land comes as results of pressure from the population involved in other socio-economic activities, that is, urban sprawl which affects farmers' extent of cultivation. More so, most of the market gardening seeds are becoming unproductive and farmers have to go in for more improved ones in order to improve their harvest.

4.2. Post harvest challenges

These are issues which market garden farmers face after they have harvested their products or when their products are ready in the various farmlands. Figure 7 shows some of the post-harvest challenges face by market garden farmers.

Figure 7: Post-harvest challenges faced by farmers



Source: Fieldwork (2023)

In line with the information

presented on Figure 7, 57% of the farmers said that they are faced with limited or poor storage facilities. This is a major issue because after all the efforts to enhance productivity, farmers waste most of the products either in the farm or in the market when they are not bought in time. At some point, there can be a lot of tomatoes and cabbage and just in few days, everything will be finish. This is a very big problem and that which must be address to help the farmers. Farmers make a lot of losses which come as results of poor storage facilities. 20% of the farmers also pointed at price fluctuation which reduces in their level of income. At times, the price for a bucket of tomatoes goes down to 1500 FRS especially during seasons of massive harvest, while at times price goes up to 5000 FRS. The sharp contrast in price affects farmers especially those who took agrochemicals on hire purchase or on borrow. 15% of the farmers also pointed at poor transportation means. Since market garden deals with perishable products, transportation means could have been more effective to help transport these products home or to the various commercial centers. This is not the case in the Buea Municipality as the roads are seasonal and mostly affected by seasonality which results into many losses in the course of the transportation. As point by 5% of the farmers, most of the market garden products are often stolen by some careless people in the community. This is especially with farms which are found in the interior. Thefts of market garden products reduce the quantity of harvest and leads to a reduction in price.

4.3. Challenges farmers faced in the application of agrochemical Substances

The results on methods of application of agrochemicals showed that 68% of respondents used sprayer and granular application which were the most commonly used methods of applying agrochemicals on their farm. They argued that, using spraying made the process very fast and more effective for soluble agrochemicals while 42% of respondents said that the insoluble chemical are applied using manual granular method which is very time consuming. All these methods generate a lot challenges.

Table 2: Challenges farmers faced in the application of agrochemicals

Option		Frequency	Percent	Mean
Application without personal protective equipment	Agree	127	48.5	0.99794
	Strongly Agree	84	32.1	
	Disagree	21	8.0	
	Strongly disagree	30	11.5	
	Total	262	100.0	
Incorrect measurement and different mixtures	Agree	86	32.8	1.09522
	Strongly Agree	89	34.0	
	Disagree	37	14.1	
	Strongly disagree	50	19.1	
	Total	262	100.0	
Inadequate knowledge of the farmers	Agree	114	43.5	0.77746
	Strongly Agree	115	43.9	
	Disagree	23	8.8	
	Strongly disagree	10	3.8	
	Total	262	100.0	
High cost of equipment and maintenance	Agree	202	77.1	0.50236
	Strongly Agree	54	20.6	
	Disagree	5	1.9	
	Strongly disagree	1	.4	
	Total	262	100.0	
Repackaging or no labelling/ or labelling in different language.	Agree	142	54.2	0.64167
	Strongly Agree	113	43.1	//
	Disagree	7	2.7	//
	Strongly disagree	262	100.0	//
	Total	142	54.2	//
Intoxicating resulting from malpractice	Agree	134	51.1	1.05134
	Strongly Agree	64	24.4	//
	Disagree	32	12.2	//
	Strongly disagree	32	12.2	//
	Total	262	100.0	//

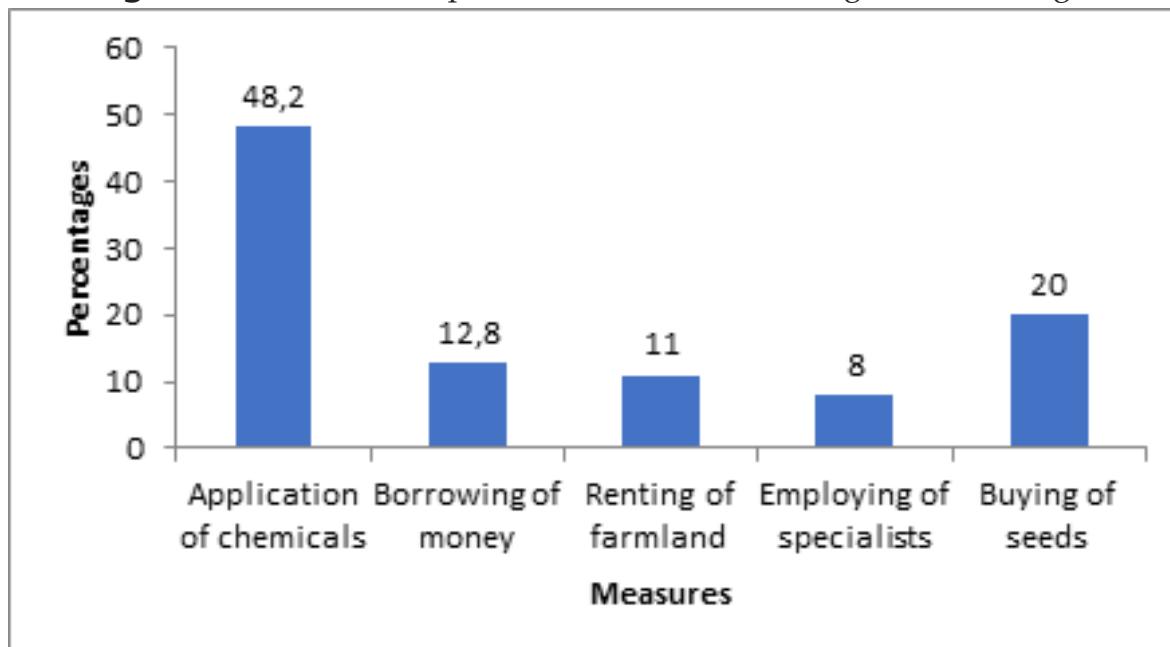
Source: Field data (2023)

5. Farmers adaptation measures to market gardening challenges

Since a greater proportion of the populations in the Buea Municipality depends on market gardening production as their main livelihood activities; added to the fact that the population depends on the products as their sources of food, no

As presented on Figure 7, 48.2% of the farmers said that they adapt especially to the changing environmental conditions and soil degradation by applying agrochemical fertilizers, 12.8% said that they usually borrow money to get some of the farm requirements such as working tools and to avoid their transportation means, 20% revealed that because of the ageing seeds which have become unproductive, they usually replace

Figure 8: Farmers adaptation measures to market garden challenges



Source: Fieldwork (2023)

matter the level of challenges, farmers or actors involved in the activity always do their best to maintain the supply of these products to the entire community and also to make out their living (Ejuande E.W & Nkumbesone 2020). Figure 8 explains some the adaptation measures adopted by market garden farmers to improve their productivity and do away with some of the challenges.

them by buying the improved ones. Furthermore, 11% said that they usually rent more land in the case of land scarcity to increase their scale of cultivation while 8% said that they usually employed a farm specialist or an extension worker to help educate and coordinates their various market garden activities.

6. Discussion

The different fertilizers commonly used by farmers were plantonus, grovert, codafol, agrovert. The results showed that agrovert 98(37.4%) were most common, also followed by supper growth as indicated by the respondents 64 (24.4%) Farmers indicated different methods of disposal of agrochemical waste containers (Table 2). The results showed that most famers indicated waste bottled of agrochemicals were disposed in farms. Sonchieu J et al., (2018) noted over dependence and inappropriate applications of synthetic insecticides has led to harmful effects on the environment and human health. These effects are numerous such as disruption of the normal functioning of soil organisms, toxicity for a wide range of non-target organisms including humans and a high tendency to reduce agricultural land productivity. The study showed that 127 (48.5%) of the respondent agreed to that opinion that applications without personal protective equipment was done during cultivation. The National Institute for Occupational Safety and Health (NIOSH) recommends protective equipment for local farmers and their families to reduce risks of take-home exposure and about ways in which they can minimize pesticides risks (Richard, 2005).

Participant No 5 Report health problem rashes, eye and skin irritation, hormone disorder, after exposure and contact with agrochemicals digestive disorder after consuming vegetables and other market gardening crops.

Participant number 4 said Market gardening production in Buea is a livelyhood activity this is seen as it is

mostly cultivated for sale in and home consumption the sale generates income for the gardener and his house hold this income is used for the wellbeing of the family also market gardening serve as a source of employment creating job by employing labourer during the cultivation this jobs range from day labourer, transportation agents during spraying and sales agent thereby employing youths of all category and reducing the rate of unemployment in Buea . Furthermore, market gardening production has led to diversification in crops production here different market gardening crops are being cultivated this has increased the variety of crops available in the market this also has reduced vitamin deficiencies in the urban areas of Buea by increasing variety and scale of production increase availability of nutrients for consumption all these impact the livelihood of market gardening in Buea.

Some strategies used by farmers include: Selective chemical weeding ,crop rotation , host plant resistance, physical, chemical and biological control agents have been included but farmer are not willing to follow this strategies because according them they are slow and less effective (Okolle JN 2020).

7. Conclusion

The Buea Municipality is one of the towns in Cameroon with a rapid increasing population growth. However, the livelihoods of these increasing populations to a greater extent depend on agricultural activities and market gardening forms a greater proportion of the agricultural sector in the Buea Municipality. Over the years, with the volcanic soils in Buea, farmers have produced million tons of market gardening produce without engaging in the application of agrochemicals. However, the development of agrochemical was aimed to improve and increase the yields of farmers. The issues attached to the application of agrochemical are of the fact that most of the farmers do not have the knowledge as well as the skills needed in the application of these agrochemicals. For instance, areas with rich fertile soils do not need any agrochemicals unless or otherwise in a situation of agricultural pest and disease prevalence. On the contrary, in the Buea Municipality, the application of chemical fertilizer remains one of the preliminary factors exercised by farmers to spike their productivity. These have however affected the suitability of the land as most of the soils are rather becoming unproductive. In many areas, issues related to the application of agrochemicals are increasing evident with unstable soil pH, Irons, electrical conductivity, and amongst others. In a nutshell, population growth will keep increasing at a pace in the Buea Municipality and the practice of market gardening can be a remedy to some of the merging issues as well as augmenting the living conditions of the actors through the income and foodstuffs they earn from it. Therefore, objective soil

evaluation, agrochemical assessment as well as plant species examination must be effectively carried out in the Buea Municipality in order to maintain a balance between the types of agrochemicals, soil fertility, market garden species and food security. More developed and effective information dissemination channels to ensure that farmers have adequate sources of technical information available on the safe use of agrochemicals with regard to their recommended usage, health and the environment. The government and agrochemical dealers should ensure farmer access to services such as seminars and onsite training on agrochemicals protective measures, usage as indicated in the recommendation below.

Recommendation

The general perception amongst the neighborhood studies is, the government should put in place specific measures which can help the farmers in their activities. These measures are suggested in the paragraphs below according to the different challenges indicated in figure 8. The inadequate knowledge of the farmers can be prevented through the organization and training programs, and workshops to educate farmers on best agricultural practices in the selected sample site in particular, and in general in the South West Region of Cameroon. In addition, the challenges of high cost of equipment and maintenance can be solved on agricultural farms through the maintenance activities. For instance, they are maintenance and repair of machines, equipment and vehicles, maintenance of farmyards and buildings, just to name these few. The government should take measures to favor farm maintenance or

agricultural maintenance in such a way that the process of proactively plan and perform for equipment maintenance, maintenance tasks to reduce repair costs, maximize equipment lifespan, and ensure the equipment operates efficiently should be put in place. Therefore, repackaging or no labelling/ or labelling in different language constitute an important issue. In fact, labelling provides critical information about the agrochemical used on the farms such as manufacturing date, expiration date, and usage instruction, among others. Thus, it is important to promote agrochemical labels in the language that the farmers can understand.

The application of agrochemical without personal protective equipment is not good for farmer's health; thus, the government must identify the basic tools for spraying agrochemical on the farms, those tools are for instance: respirators, chemically impervious gloves and footwear, washable coveralls and hats, goggles or face shields, In order to permit to each peasant to have his personal face shield to protect his face and mouth, respirator to protect the lungs and use goggles to better protect the eyes. Also, about incorrect measurement and different mixtures, farmers can be trained on the preventives measures which avoid use of agrochemical for instance crop rotation which is the growing of different crops in succession on a piece of land to avoid exhausting the soil and to control weeds, pest, and diseases. In fact, measurements and mixture errors affect the yields, inputs, and productivity variables. Farmers must be trained on the general principles for measure and mixing pesticides. Mixing pesticides that are not compatible can negatively affect spray quality, product uptake, and plant surface retention of

the agrochemical application, thus, the farmers must mix only two pesticides for instance whenever possible and be certain of compatibility. Finally, because of intoxicating resulting from malpractice, there is a greatest potential for poisoning via respiratory exposure through vapors and extremely fine particles of the spray solution. In order to prevent this, farmers must wear protective clothing as describe on the label. The government must store protective clothing away from living spaces. In addition, sensitize the farmers to never smoke, drink, or eat while handling pesticide, fungicide, and herbicide on the farms.

References

- Aguilar, J. and Ortiz, R. (1992). Metodología de capacidad de uso agrícola de los suelos. III Congreso Nacional de la Ciencia del Suelo. 281-286. Pamplona. Spain
- Alabi O. O., Lawal A. F., Coker A. A. & Awoyinka Y.A. (2007) (n.d.). Probit model analysis of smallholder farmers' decision to use agrochemical inputs in Gwagwalada and Kuje area councils of federal capital territory, Abuja, Nigeria. *International Journal of Food and Agricultural Economics*, Vol. 2 No. 1 pp. 85-93
- Ao D, A. k E, Asuming-Brempong, S. (2009). Insecticide use pattern on tomatoes produced at Yonso community in the Sekyere West District of Ashanti Region, Ghana. *Ghana Journal of Agricultural Scienc.*;42:55-63
- Bibby, J.S. and Mackney, D. (1969). Land Use Capability Classification. Soil Surv. Gt. Br. Tech. Mono. No. 1.
- Bie, S.W., Ulph, A. and Beckett, P.H.T.

- (1973). Calculating the economic benefits of soil survey. *Journal of Soil Science*, 24: 429–435.
- Blandine TS, Jean S, Samelle EAE (2020). *Handling conditions and pesticide-related signs/symptoms among agrochemical sellers in Bafoussam municipality, West-Cameroon*. *Austin Environmental Sciences*;5(2):1048
- Boixadera, J. and Porta, J. 1991. Información de suelos y evaluación catastral. Método del Valor Índice. Ministerio de Economía y Hacienda. Madrid.
- Bouma, J. (1989). Using soil survey data for quantitative land evaluation. In: *Advances in Soil Science* (ed. B.A. Stewart). Springer, New York, pp. 177-213.
- Bourguet, D. and Guillemaud, T. (2016). The hidden and external costs of pesticide use. In *Sustainable Agriculture Reviews*, Vol. 19, ed. E Lichtfouse, pp. 35–120. Cham, Switz.: Springer
- Chakraborty P, Zhang G, Li J, Sivakumar A, Jones KC. (2015). Occurrence and sources of selected organochlorine pesticides in the soil of seven major Indian cities: assessment of air–soil exchange. *Environ. Pollut.* 204:74–80
- Chowański, S, Kudlewska, M, Marciniak, P, Rosiński, G. (2014). Synthetic insecticides – is there an alternative? *Polish Journal of Environmental Studies*;23(2):291-302
- Clark JFM. (2017). Pesticides, pollution and the UK's silent spring, 1963–1964: poison in the Garden of England. *Notes Rec.* 71:297–327
- Cohen H., Sheldon, L.S., Burke, J.M., McCurdy, T.R., Berry, M.R. and Rigas, M.L., (2000). Children's exposure assessment: a review of factors influencing children's exposure, and the data available to characterize and assess that exposure. *Environ Health Perspect* 108 :475–486.
- Curl, C.L., Fenske, R.A., Kissel, J.C., Shirai, J.H., Moate, T.F., Griffith, W., Coronado, G. and Thompson, B., (2002). Evaluation of takehome organophosphorus pesticide exposure among agricultural workers and their children. *Environ. Health Perspect.* 110, (12) pp. 787–792.
- Ejuande Emmanuel Wonomu & Nkumbesone M.E. (2020). Valorization of the cassava economy as a social livelihood between Bonaberi to Souza in the North-West of Douala-Cameroon. In D.T. Ndamsa, & B. Yamb, (Eds.), *Socio-Economic Issues in Cameroon Vol.3*, (pp.111-131), KSP Books: Istanbul
- Elcom (1995). TC/EC Ad Hoc Expert Meeting on Assessment of National Programmes on Nutrient Reduction, Helsinki ASNUTH.
- Ellis, E.C. (2021). Land use and ecological change: a 12,000-year history. *Annu. Rev. Environ. Resour.* 46:1–33
- FAO (U. N. Food Agric. Organ.). 2021. FAOSTAT Statistical Database. Food and Agriculture Organization of the United Nations. <https://www.fao.org/faostat/en/#data>
- Galloway JN, Bleeker A, Erisman JW. 2021. The human creation and use of reactive nitrogen: a global and regional perspective. *Annu. Rev. Environ. Resour.* 46:255–88
- Gollin, D., Morris, M. & Byerlee, D. (2005). Technology Adoption in Intensive Post-Green Revolution Systems. *American Journal of Agricultural Economics*, 87(5): 1310-1316.
- Graham, R.D., Welch, R.M., Saunders,

- D.A., Ortiz-Monasterio, I., Bouis, H.E., Bonierbale, M., de Haan, S., Burgos, G., Thiele, G., Liria, R., Meisner, C.A., Beebe, S.E., Potts, M.J., Kadian, M., Hobbs, P.R., Gupta, R.K. and Twomlow, S. (2007). Nutritious subsistence food systems. *Advances in Agronomy* 92: 1-74.
- Green, R.E., Cornell, S.J., Scharlemann, J.P.W. and Balmford, A. (2005). Farming and the fate of wild nature. *Science* 307: 550-555.
- Guha R. 2016. *Environmentalism: A Global History*. London: Penguin
- John DA, Babu GR. 2021. Lessons from the aftermaths of Green Revolution on food system and health. *Front. Sustain. Food Syst.* 5:644559
- Kenko BDN, Fai PAB, Ngameni TN, Mbida M. Environmental and human health assessment in relation to pesticide use by local farmers and the Cameroon Development Corporation (CDC), Fako Division, South-West Cameroon. *European Scientific Journal*. 2017;13(21):454-473. DOI: 10.19044/esj.2017.v13n21p454
- Kerle, E. A., Jenkins, J. J., and Vogue PA (2007). Understanding pesticide persistence and mobility for groundwater and surface water protection. Oregon State Univ Extension Service, EM8561-E.
- Kibiwott K., (2009). Kings of the jungle now have to fight for survival, *Daily Nation* 15th Oct, pp 39. Ed.No.15345, Nairobi, Kenya.
- Lu C., (2004): Chensheng Lu, Golan Kedan, Jennifer Fisker-Andersen, John C. Kissel and Richard A. Fenske. Multipath way organophosphorus pesticide exposures of preschool children living in agricultural and nonagricultural communities. *Environmental Research*, November 2004, Pages 283-289 Volume 96, Issue 3.
- Mayor Ekama Patrick, 2014 description of Buea municipality
- Meena RS, Kumar S, Datta R, Lal R, Vijayakumar V, et al. 2020. Impact of agrochemicals on soil microbiota and management: a review. *Land* 9(2):34
- Monosson E., *Agriculture, Food and Environmental health*, (2007): Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment.
- Munga D., (1985) DDT and Endosulfan residues in fish from Hola Irrigation Scheme, Tana River Kenya, (MSc thesis). Department of Chemistry University of Nairobi
- Ngowi, A. V. F. (2003). A study of farmers' knowledge, attitude and experience in the use of pesticides in coffee farming. *African Newsletter on Occupational Health and Safety*, 13, pp. 62-64.
- Nielsen UN, Wall DH, Six J. 2015. Soil biodiversity and the environment. *Annu. Rev. Environ. Resour.* 40:63-90
- Okolle JN, Ngosong C, Nanganoa LT, Dopgima LL. Alternatives to synthetic pesticides for the management of the banana borer weevil (*Cosmopolites sordidus*) (Coleoptera: Curculionidae). *CAB Reviews*. 2020;15(026)
- Orodho, A, J., and Kombo, D.K., (2002). *Research Methods*. Nairobi: Kenyatta University, Institute of Open Learning.
- Pearce, G. R. (1998). *Agrochemical Pollution Risks Associated with Irrigation in Developing Countries: A Guide*. Wallingford: HR.

Pollock, C. G. (2001). Silent Spring Revisited: A 21st-Century Look at the Effect of Pesticides on Wildlife. *Journal of Avian Medicine and Surgery*, 15(1), pp. 50-53.

World Health Organization (WHO). (1997). *Guidelines for drinking-water quality*. 2nd ed., Geneva.