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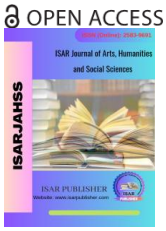

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Market Gardening Challenges and Livelihood Sustainability in Upper Wabane of the Bamboutos Mountain of Cameroon

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Abstract: Market gardening is one of the agricultural sector that is fast employing people especially in sub-Saharan Africa. Unlike the inland valleys and flood plains, market gardening in upper Wabane of the Bamboutos Mountain is peculiar as it is practiced on the slopes. It appears to face several challenges particularly for this mountain ecosystem. This study set out to a) analyse the drivers of market gardening b) examine the challenges of market gardening farmers in upper Wabane and c) livelihood management implications. Anchored on the sustainable livelihood framework, the methodology made use of questionnaires (n=130) administered in 7 villages in upper Wabane complemented by key informant interviews (n=5). Results reveal that there exists a strong positive relationship between natural drivers and market gardening and these drivers are the climate, soils and topography. It was equally noticed that market gardening challenges are significantly human factors; Lack of access to credit (66%), lack of technical know-how, poor farm to market roads and value chain difficulties (65.3%), scarcity of water (67.2%), limited land for cultivation (57%) and poor prices (52.4%). Faced with these challenges, farmer's strategies were: use of sprinklers to water crop (46.6%) improve soil quality using fertilizer (80.4%), improve credit acquisition by creating micro-finances (63.8%), formation of farmers' cooperatives, better water management, construction of farm to market roads, provision of assistance to farmers by the government(50%), adjusting of planting season according to the rains. Thus market gardening significantly contributes to livelihood diversification. The study therefore recommends the need to improve and modernize agriculture through the provision of subsidies and capacity building to the farming population and government intervention in price stabilization.

Keywords: market gardening, drivers, challenges, livelihood strategies, mountain ecosystem, Wabane.

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1. Introduction

Market gardening is commercial production of high-value crops such as vegetables, fruits, flower and other plants on a large scale than a home garden (Bechamann, 2009). All over the world, market gardening has grown to be a major agricultural production hub. This enterprise gives farmers the potential to increase their livelihoods option and income (Ellis, 2000, Barrett et al., 2001, Kalidou et al., 2024) the main goal, as with all farm enterprises to run the operation as profitable business entity. Market gardening is oriented towards local markets although production for shipping to more distant market gardening is possible and increasing with time (Pritchard et al., 2019). Market garden production contribute to more than 10% of the total world's output thus contribution to socio-economic transformation and general growth (Montpellier, 2013). Viable home gardens can improve the ability of smallholders and their communities to meet interrelated concerns of food security, nutrition, health, and economic security (FAO, 2024)

Market gardening production in Sub-Saharan Africa (SSA) has been on a stagnant trend owing to unreliable power supplies, unavailability of formal credit, high interest rates, limited infrastructure, lack of market information, poor transportation, poor storage facilities, limited use of certified seeds and water shortage (Ndimbo et al., 2023, the Montpellier panel, 2013). Largely in Sub Saharan Africa, rural development and farming in particular is constrained by unreliable, unusable and untimely information. Thus effective decision making becomes difficult due to dispersed and outdated information or data (Emkambo, 2018). This is the situation in Tanzania (Ndimbo et al.,2023), in southern Burkina Faso (Sanfo and Baibaca, 2017), in Zimbabwe (Tanyanyiwa, and Bakasa, 2018) and in Cameroon (Njukeng and Ngulefack, 2021) Major market gardening crops grown in Africa are cabbage, onion, pepper, tomatoes, garlic, and carrot (Bachmann, 2009) Most of the farm produce is wasted between farm and consumers due to bad roads, fuzzy land tenure, traditional rights and spillage degradation due to limited or no storage facilities (Bachmann, 2009). In DRC, Ivory Coast, Ghana, Nigeria, Rwanda, Senegal and Tanzania, challenges faced by market garden farmers are similar with fuzzy and often temporary tenure, evictions, in a nut shell, farmers lack security due to illegal sale of land (F.A.O, 2012). The death of the Agro processing capacity in Sub Saharan Africa, in both urban and rural areas is blamed for post-harvest fruits and vegetables losses that are estimated to be half of the total production (Emkambo, 2018). Farmers prefer to sell raw fresh products as they do not have capacity to process them. This is due to the need for more income which is determined by marketing chain. Nigeria farmers keep the marketing short by selling directly to the public at the “farm gate” many in Dar es Salam-Tanzania do so from roadside-stalls (Ndimbo, 2023) and in Lusaka-Zambia farmers transport their products to market by public transport, transport is not reliable in most African's countries hence it is often down when farmers take their produce to the market (World Bank, 2013). They sometimes, get stranded as their crops get withers and rot, middle men known in Zimbabwe as "ecomos" make profit than the farmers (Tanyanyiwa and Bakasa, 2018).. This is the case in Cameroon with “Bayam sellams” (Njukeng and Ngulefack, 2021). One of the major reason why market garden products are not easily exported is poor packaging by farmers (Mohammed, 2018). In Nigeria, markets are badly located, insanitary, heartily congested and lacking the physical facilities to handle large volume of produce and low returns to growers (Emkambo, 2016).

Market gardening is carried out on all year round basis. It entails the collection of highly perishables which are consumed and or transformed within a relatively short period of time. In Cameroon, market garden is practiced on the slopes of Mount Cameroon, the Mungo corridor, Benue depression, the Foumbot plains, Bamenda Highland including Santa, the Mount Bamboutos including the Southern part that covers upper Wabane. The main crops cultivated here includes Green beans, carrot, lettuce, cabbages, spices, vegetables, Irish potatoes under ample precipitation conditions (Jalo, 2008). If Cameroon maintains its position as the “Bread basket” of Central African sub region today, one of the area to be credited is the slope of Mount Bamboutos especially for its market gardening crops which are not only consumed in other parts of Cameroon but far on to other countries in the CEMAC region (Alangeh, 2013). The Wabane area of the Bamboutos mountain presents a good epistemological setting to study market gardening challenges and livelihood sustainability. This study set out to a)analyse the drivers of market gardening b) examine the challenges of market gardening farmers in upper Wabane and c) livelihood management strategies.

2. Analytical framework

2.1 The sustainable livelihood framework

DFID (2000) considers livelihood as capabilities, assets and activities required for a means of living. Livelihoods are again considered as activities, assets and the access that jointly determine the living gained by an individual or household (Ellis, 2010). The sustainable livelihood framework is use to study assets and livelihoods through market gardening in the Upper Wabane area of the Bamboutos mountains. Regarding sustainability, livelihoods are thought out sustainable when it can cope with and recover from stress and shocks and maintaining or enhance its capabilities and assets, both now and in the future without undermining the natural resource base (Ashley and Carney, 2010). Farmers use five capital assets presented in the sustainable livelihood framework; physical capital (water, sanitation, energy, transport, communication, housing and the means and equipment of production), financial capital (regular remittances, savings, supplies of credit), human capital (Health, Knowledge, skills, information, ability to labour), social capital (relationships of trust, membership of groups, networks, access to wider institutions), and natural capital (land, forest, water, wildlife, biodiversity, environmental resources).

In the Wabane landscape, natural, physical, social and human capital are highlighted within the context of market gardening production.

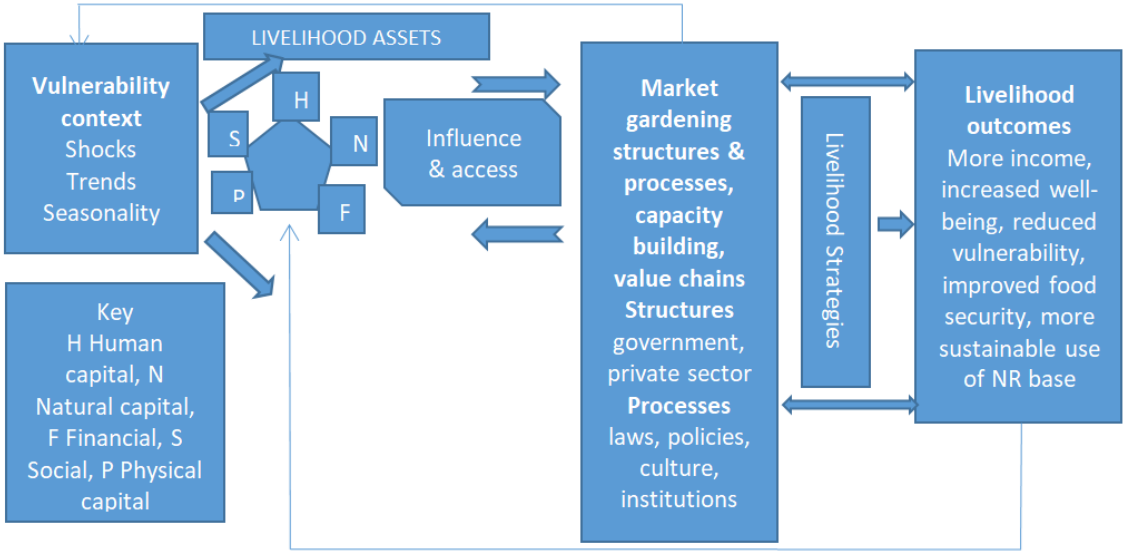

Figure 1: Sustainable Livelihoods Framework

Source: DFID, 2000

The cold fresh mountain climate and fertile mountain soils constitutes the wealth of natural capital for livelihood in the Wabane area as huge drivers of the system. Physical capital remains very little and challenging for agriculture. Social capital is one of the key assets of the area upon which few Common Initiative Groups CIGs and agricultural cooperatives are base with trust relationships with people grouping together in groups and accessing partners involved in. Thrift and loan groups are evidences of these relationships that have spurred the creation and easy adhesion of members to build on social resources. Financial resources have been limited in the past with poverty and reliance on sales of farm products and savings in thrift and loan groups. Livelihood improvement is largely related to market gardening despite the difficulties in this mountain landscape. The context that households operate in is the most import part of the framework and this context includes exposure to different sources of vulnerability such as seasonality and shocks, such as weather and output price variability (Barrett et al., 2001; Ellis, 2000; Nielsen et al., 2013; Scoones, 1998). Capital endowments are related to farmers choices and sustainable aspects looks at how households use their capital to overcome moments of vulnerability due to health, climatic, and market shocks.

3. Methodology

3.1 Study site

Wabane Sub Division was created in 1992. The Sub Division is lodged in the heart of the tropical rainforest and the upper part in the Sahel forest. It is located between latitude 5°36'0"N -5°53'0"N of the equator and longitude 9°60"24 -10°70"90 E of the green which meridian. Wabane shares boundaries to the North with Batibo Sub Division of the Momo Division (North West Region), to the South by Upper Bayang Sub Divsion of the Manyu Division (South West Region), to the east by Mbouda – Bamboutos (West Region) and to the West by Alou Sub Division of Lebialem Division and Koni Sub Division in the Menoua Division of the West Region. Wabane sub division is made up of 21 villages. It has an estimated population of over 63,818people (C.P.O, 2016). Wabane sub division covers a surface area of 1,800Km^2. The landform is undulating and characterized by elevated prominent mountainous terrain, with altitude ranging from lowland Nkong (72m) Bechati and Besali (57m) through Alonkong (1470m) to M'mouck Leteh (2200m). At the Bamumbu Fondom, hill slopes are steep, narrow boulder strewn, crests and deeply incised valleys. The area of M'mouck Leteh to Asuala is equally undulating but with broad hill tops and gentle slopes suitable for intensive market gardening farming. The area experiences two season the dry season that begins in November and ends in March and the rainy season that commences in April and stretches up to October. It has three zones owing to differences in topography and vegetation. The lower belt called lower Mundani with temperatures typical of a tropical forest zone. The middle belt where the council is located has a higher altitude and the temperature is mild. The upper belt (North West is tropical Savanna with an altitude of up to 2200m) here, the temperature can go below 18^{0}C in the months of December and January. The difference in altitude and vegetation types give rise to different soil types (NCDDP, 2013); soils of lower belt to parts of the middle belt are Sandy – loam to the redish alluvia that is ferrosol. The soils of the lower belt are highly exploited for plantation agriculture and to a lesser extent, subsistence crops. The upper belt has rich alluvial and salty clay soils. These soils serve for high commercial agriculture suitable for the cultivation of Irish potato cabbage, carrots and leaks

The study covered 7 villages that are engaged in the practice of market gardening. These villages are found in upper Wabane southern slopes of the Bamboutos maintains. The villages are Asuala, Agong, Fonenge, Fomeji, Mogha, Mouck Leteh and Maleta. Figure 2 presents the geographical location of Wabane and it villages in the South West Region of Cameroon.

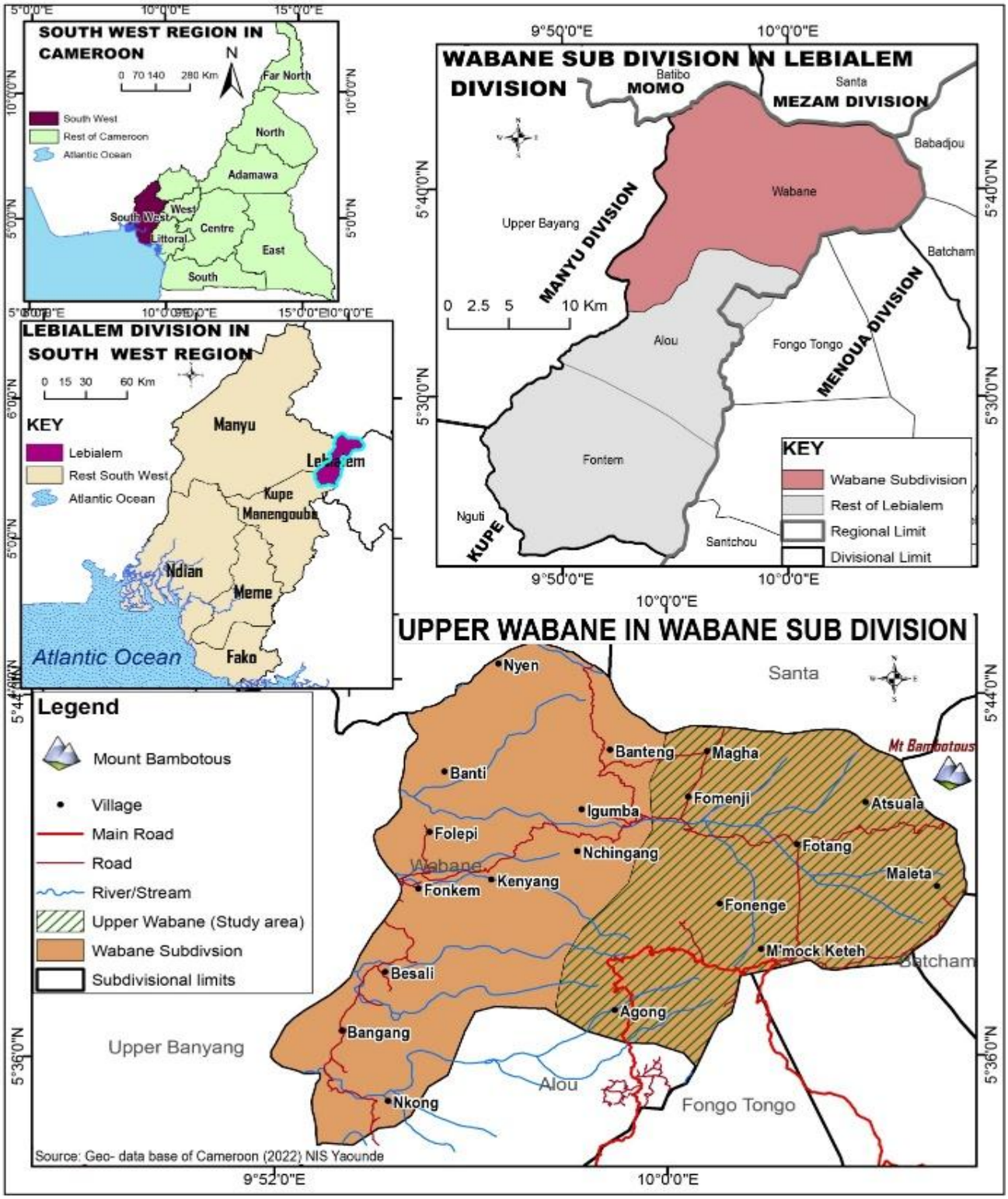

Figure 2: Location of study area

3.2 Methods

The study employed the exploratory, analytical and descriptive designs. Data was collected through quantitative and qualitative methods. The target population of this study included farmers involved in market gardening, people involve in on-farm and off-farm activities that are related to this study, village association leaders, thrift and loan or "njangi groups", agricultural experts and those involve in market gardening value chain. A sample of 130 respondents was derived for the study from the farmer population gotten from the subdivision delegation of the ministry of Agriculture, livestock, fisheries and animal husbandry (MINAGRI) and distributed to the different villages of Fonenge ,magha, Atsuala, maleta, M'mouck leteh, Agong. The questionnaires administered consist of open and closed ended questions with focus on drivers of gardening, challenges and livelihood related issues. We use the convenience sampling technique to be able to get these villages that are not easily accessible. Table (1) shows the sample size and questionnaire distribution per village.

Table 1: Questionnaire distribution

Villages	Estimated Population	Number of questionnaires
Agong	1750	16
Asuala	1200	10
Fonennge	2400	22
M'mock leteh	4500	42
Magha	2300	21
Fomeji	1374	12
Maleta	1200	8
Total	139000	130

Source: MINAGRI Wabane, (2018)

The data obtained was entered and cleaned with the Statistical Package for Social Sciences (SPSS) version 20. Inferential statistical techniques methods were exploited. Descriptive data gotten from the field was represented with the use of graphs, diagrams, tables, pie charts, bar graphs complimented by photos. The Pearson's Product-Moment Correlation Coefficient was used to test the relationship between two random variables. It provides a measure of strength and direction of the correlation varying from -1 to +1. Positive values indicate that the two variables are positively correlated, meaning the two variables vary in the same direction. Negative values indicate that the two variables are negatively correlated, meaning the two variables vary in the contrary direction. Values close to +1 or -1 reveal the two variables are highly related, whereas values that are close to zero are weakly correlated and when the correlation coefficient is zero, there exist no correlation between the variables. In our study, this technique has been used to test the association between the independent variables and the dependent variable. To do so we used the statistical package for social science (SPSS) version 20 in order to automatically obtain the various values of our correlation coefficients. Mathematically, Pearson's Coefficient of correlation, r, is given by:

$$r = \frac{n\sum x_{1y_1} - \sum x_1 \sum y_1}{\sqrt{[n\sum x_1^2 - (\sum x_1)^2] \times [n\sum y_1^2 - (\sum y_1)]^2}}$$

Where

r = product moment correlation coefficient

n = number of data sets considered

x = independent variable

y = dependent variable

Data from questionnaire was complemented by 10 key informant interviews. An interview guide consisting of questions related to market gardening drivers, challenges of production and marketing, livelihood sustainability issues was used. Interviews provided information in enhancing the progress of the research. Key informants included the Chief of agriculture, Nkongle and Magha, quater heads and key farmers of some communities in Fonenge, Magha , Atsuala and Agong. These group of persons provided vital information on land management, planting season, problems faced and livelihoods. Each interview lasted between 30minutes to 50minutes. Information from interviews was recorded using tape recorders, retrieved and extracts summarized in tables. It was treated using thematic content analysis and narratives for reporting.

Table 2: Information from key informant interviews

Villages	Key respondents	Key terms discussed
Fonenge	Chief	Access to land, human and natural drivers, water management challenges, value chain and livelihood land management, value chain management
Magna	Four youths	Engagement in market gardening, livelihood, problems encountered, farm level practices, land management and market chain value problems
M'mock Leteh	MINAGRI delegate	Drivers, market gardening production techniques and inputs, their role in production, related problems, improvement measures, agricultural calendars.
Agong	Chief and three farmers	Type of market gardening crops they produce and why, water management, access to credits challenges and livelihood sustainability issues
Atsuala	Traders "Buyam sellams"	Value chain issues, pricing, transportation, marketing

4. Results

4.1Market gardening drivers

There are both natural and human drivers that propel market gardening in the Upper Wabane area. The natural drivers are; topography, climate and soils while the human drivers are proximity to the market, laws and institutions

4.1.1 Physical drivers

4.1.1.1Conducive climate

The study revealed that climate is one of the natural drivers of market gardening in upper Wabane sub division. The table below shows the people's perception about the climate of upper Wabane

Table 3: Conducive of climate

	Frequency	Percent
Good	75	58.9
Very good	36	28.6
Bad	17	12.5
Total	130	100.0

The climate of the area is conducive and good (58.9%) for cultivation of market garden crops. Upper Wabane sub division is a tropical Savanna with an altitude of up to 2100m. Temperatures range between 15°C to 26°C and even below 15°C in the month of

December to January. This climate has greatly favoured the cultivation of carrots, cabbage, Irish potato, and leeks. About 28.6% of the population are of the view that climate is very good while only 12.5% see limitations in the climate. Looking at the above statistics, one can deduce that, the climate of upper Wabane sub division is good for market gardening and that is the reason why market gardening is the main farming activity carried out here.

4.1.1.2. Area of crop cultivation.

This shows that even though they are in a mountainous area, there are area where it favours market gardening. This area has valleys, gentle slopes, plateaux. Farmers therefore have particular areas where they choice to cultivate in (figure 3). Example,in Fonenge and Agong, farmers prefer cultivating on plateau submits because because they are on a lower altitude while in the villages of Magha, Asuala and Fomenji, farmers prefer gentle slopes

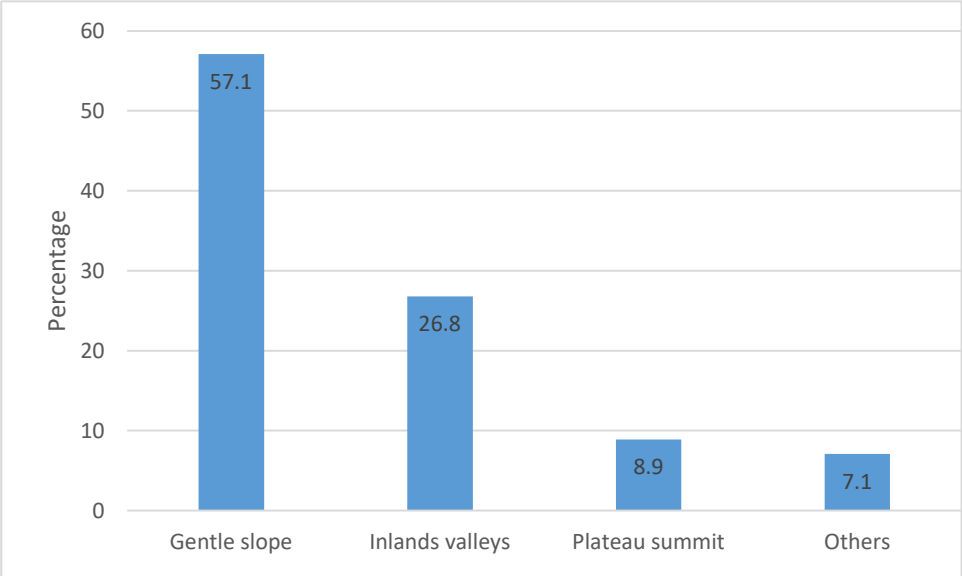

Figure 3: Area of plant cultivation preference for crops

A greater part (57.1%) of the population prefer cultivating on gentle slopes. This is because gentle slopes are well drain and hold water averagely, the rate of erosion is equally minimal as compared to steep slopes. Over 26.8% of the farmers prefer cultivating in inland valleys. This is because there is less erosion in the valleys and alluvial soils from deposition from slopes. Also there is enough water in the valleys. However, a small proportion of farmers (8.9%) prefer cultivating on plateau submits because plateau submits have gentle flat undulating topography. Some (7.1%) cultivate where they find land due to limited land for farming so, any place they find land, they do cultivate there. It is noted that majority of the farmers prefer gentle slopes since there is less erosion and no floods.

4.1.1.3. Fertile nature of the soils.

The study revealed that the soil of this area are fertile.This is because mount Bamboutos falls along the Cameroon volcanic line with fertile volcanic soils. The figure below illustrates the respondent's perception about the state of the soil.

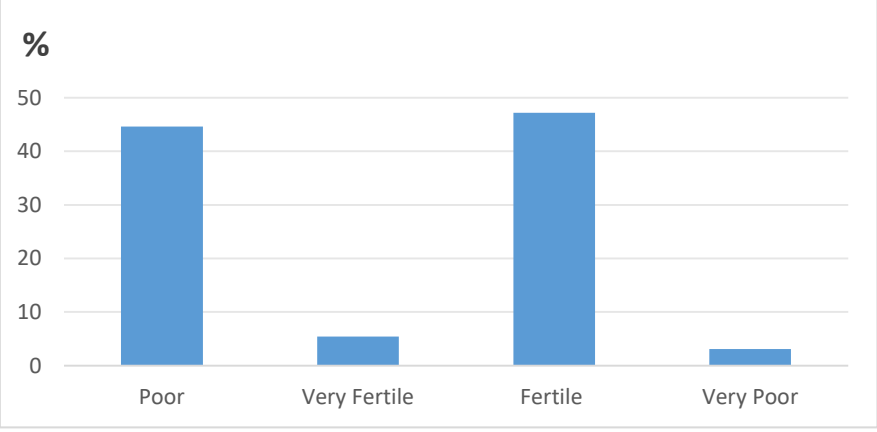

Figure 4: Farmer Perception on soil fertility

Table 4: Farmer perception on State of soil fertility

Village/variable	fertile	V fertile	poor	Very poor	Total
Agong	4	4	8	2	16
Assuala	5		9		15
Fomenji	11	1	7	2	21
Fonenenge	7		11		18
M'mouck leteh	9	3	5		17
Maleta	6		10		21
Magha	11		6		18
Total	7(47.2%)	7(5.4%)	58(44.6%)	4(3.1%)	130

From figure 4, 47.2% of the population perceive soil to be fertile. The soils of upper Wabane sub division has rich alluvial and silty loam. These soils serve for very high commercial market gardening crops like leeks, garlic, potatoes and carrots, even though after have being cultivated over a long while, it gradually losses it fertility. A good proportion of the population (44.6%) note that soils are poor loosing fertility due to long periods of cultivation and leaching but when fertilizers are added, yields are good. However some (3.1%) farmers feel the soils are very poor in some places. We can therefore deduce that the soils in upper Wabane sub division are fertile.

4.2.2. Human drivers of market gardening

Human drivers here include; laws governing market gardening, reason why people are involved in the activity.

4.2.2.1. Perception on institutions and laws governing market gardening

The study revealed different perceptions of the people of upper Wabane on institutions and laws governing market gardening (table 5).

Table 5: Views on institutions and laws influencing market gardening

Variable	Frequency	Percent
Institutions influencing market gardening		
Yes	30	23.1
No	100	76.9
Total	130	100.0
Laws governing market gardening		
Yes	15	14.5
No	115	85.5
Total	130	100.0

From table 5, some farmers (23.1 %) highlight that there are institutions that influences market gardening in upper Wabane. They mentioned njangi groups within farmers themselves, NGOs such as AIVDP and the Wabane council that do organizes mini agricultural shows and sometime construct farms to market roads. Nevertheless, a significant part (76.9%) of the population hint there are no institutions that influence market gardening in upper Wabane. On the other hand 14.5% of farmers acknowledge laws governing market gardening while a significant part (85.5%) think there are no government laws governing market gardening in upper Wabane. It is noted that institutions such as government has less influence over market gardening in upper Wabane

4.1.2.3 Proximity to market rural-urban linkage

One of the human drivers that has encourage market gardening in this area is proximity to the market.The demand from urban centres in Cameroon is pushing middle men traders (Buyam-Sellams) from Bafoussam, Douala,Yaounde and others from outside Cameroon such as Gabon, Equatorial Guinea and Chad. This high demand has encourage people to engage in market gardening production.

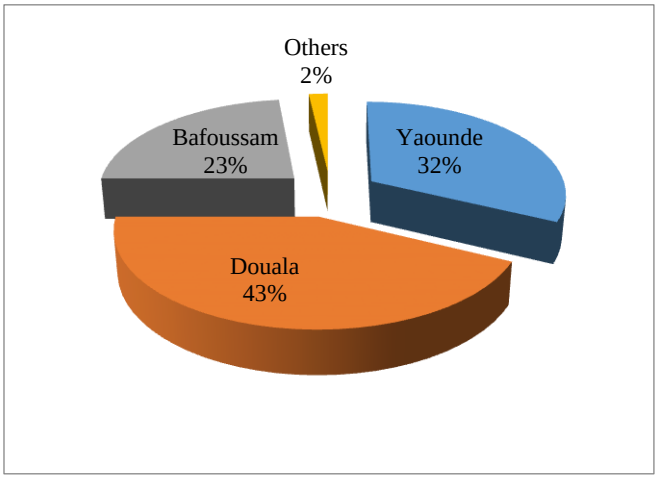

Figure 5: Main towns of sales where major products are taken to

Market gardening produce from Upper Wabane are sold in Bafoussam (23%), Douala 45% and Yaounde (32%) while 2% of the farmers have buyers from other places such as Gabon and Equatorial Guinea. We can therefore deduce that, proximity of major towns in Cameroon has encourage market gardening in upper Wabane sub division.

4.1.3 Livelihood Assets and Sustainability Challenges in Market Gardening in Upper Wabane

Through the cultivation of different market gardening crops, households have engaged their forms of capital (assets) and valorise their resources for their well being despite the challenges. These challenges cut across different capital assets with limitation on the part of farmers (table 6).

Table 6: Sustainable livelihoods on assets in upper Wabane

Livelihood assets or capital	Challenges
-physical assets	Lack of machines, lack of equipment, inventory, roads, motor pumps
Human assets (skills, knowledge, creativity, problem solving	Limited health, education, knowledge to use the use of new seedlings, new cultivation techniques
Financial assets	Lack of savings, credit and low income, access to loans and farm inputs
Natural capital (soils, good climate, wet inland valleys)	Rapid lost in soil fertility, climate variability, water problem during dry season
Social Capita (njangi groups, farmer's meetings)	Lack of common initiative groups, lack of farmer's cooperatives

While these challenges are highlighted, a good number of measures are used by farmers to adapt, improve their skills and get better opportunities. The different domains related to market gardening improvement gathered from farmers views and summarized according to FAO livelihood grow in gardens.

Table 7: Options for better skills

Improving small- scale farmers' skills in:	**Lead to better opportunities**
Production technologies	More efficient and sustainable use of resources. Increased livelihood diversity, for example green spices to food crops like Irish potatoes.
Processing and storage	Profit from surplus. Reduced losses after harvest and during transport to market. Added product value. Increased marketing options.
Marketing	Regular and loyal buyers. Higher prices through better supply timing and quality. Integration of production and marketing enterprises
Money management	Access to and profitable use of credit and remittances. Better household budgeting.
Urban-rural linkages	Understanding of sophisticated markets and distribution chains. Access to technical information and production inputs. Exposure to town-based technologies.
Organization, leadership and communication	Collective marketing to retain profits, increase bargaining position, access larger markets and increase transport efficiency. Social empowerment - better access to services and participation in government. Enhancement of social status of disadvantaged groups.

Source: Derived based on FAO, Livelihoods grow in gardens

5.1 Human challenges

5.1.1 Farm to market roads

Looking at Wabane area as a whole, there is no tarred road. The only outlets from the area meet tarred only in the West region in Dchang and Mbouda. The study revealed that farmers surfer post-harvest losses due to difficulties to transport their produce to the market. Views gathered from the field depict different aspects about the state of farm to market roads. About 12.3% of farmers say there are enough earth roads in upper wabane, while a significant 65.3% are of the view that there are very poor roads in upper wabane. They cited few earth roads like the Nkongle- Dschang road, the Magha–Nkombou road which are the two main roads leading to the area and these are only seasonal very bad and difficult to ply during the raining season. Within the area, most farmers use foot paths with bikes to ferry their product out. About 22.4% of the population say there are not enough roads when they are compared to other places. Foot paths that exist becomes extremely hard to manoeuvre in the rainy season. This poor nature of the roads makes difficult for farm's inputs such as fertilizers to reach this area and when the few successfully reach; they are very expensive. It is equally very difficult to evacuate farm produce to the market. Given that market garden crops require fast evacuation after harvest in real time to avoid spoilage, the poor nature of roads becomes a huge limitation at times leading to huge losses. Looking at the above statistics, it is evident that there are very poor roads in upper Wabane as captured in photo 1 to 4.

Photo 1 and 2: Poor state of roads in the rainy season in upper wabane

Photo 3 and 4 Effect of landslides on roads in upper Wabane, mud from slides making movement difficult

5.1.2 Lack of storage facilities

Storage facilities here involves ware houses, refrigerator and refrigerate cars. Field evidence point to the fact that storage facilities are generally lacking and it becomes difficult to store and stabilize prices. Some say, during harvest if the price is not good, they delay harvesting if risk of spoilage is minimal. In the case of Irish potatoes and garlic, they harvest and keep in their houses and ware houses. Some account prize instability in that once crops are mature, you need to harvest and prepare the land for another farming season. About 90% of the farmers highlight there are no storage facilities because of the perishable nature of this crops and the lack of suitable ware houses. Except for few ware houses for crops like Irish potatoes that can be kept for a while, there are no storage facilities due to perishability as farmers strive to ferry out farm produce to markets immediately after harvest. Fresh vegetables and green spices immediately harvested are taken to the markets.

5.1.2 Transportation means

The study revealed that farmers in Upper Wabane uses four different transportation means to transport their produce to the market. Figure 6 shows the different transportation means

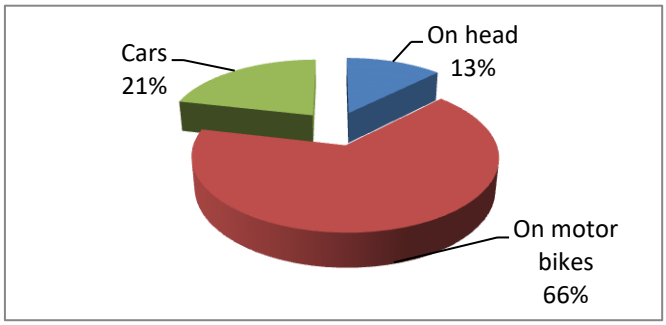

Figure 6: Transportation means for produce

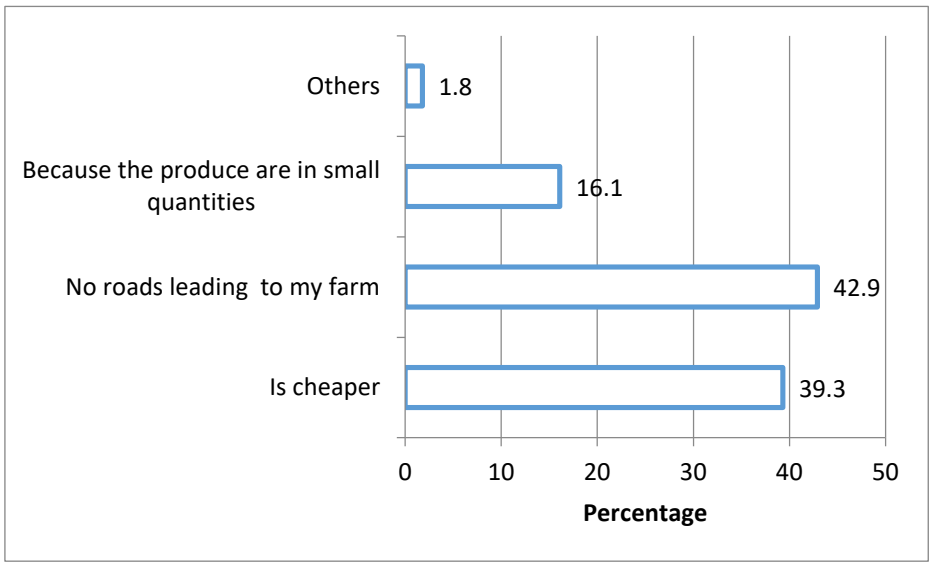

Figure 7: Reasons for choosing the various means

Source: Field Work

About 13% of farmers transport their farm produce through head loads to homes or markets and in some cases to the road where a bike or a car is able to reach. This is mostly in cases where there are no roads leading to the farms and when the produce is in small quantities. About 66% use motor bikes to transport their farm produce to the market or to assemble them. This is because bikes can easily access farms when the produce are in small quantity and where a car cannot be hired for and because there are no motorable roads reaching the farms. Above 21% farmers reveal that they use vehicles to transport their produce to the market. They prefer this means because they usually harvest in large quantities and in some cases in areas where the roads are good. Also bikes do at time assembles it for a vehicle to only carry. It is evident that the people of upper Wabane mostly use bikes to assemble farm produce to accessible grounds before transportation using cars to the market in towns like Douala. This common means of transport in upper Wabane is presented in plate 5.

Photo 5$6: Use of bikes to transfer produce in difficult terrains in upper Wabane

5.1.3. Access to credit

Access to credit and credit facilities in Upper Wabane remain a significant challenge faced by market gardening farmers. This system of agriculture requires intensive methods, close attention, good inputs and labour and fast transportation to the market. All these require huge financial resources that most farmers don't have. Nevertheless, farmers tend to use the small facilities and social capital and financial assets at their disposal (table 8) mostly thrift and loan groups (njangi groups), credit unions and few from banks.

Table 8: Farmer's Access to credit

Variables	Frequency	Percentage
Njangi	56	44
Bank	14	10
Credit union	23	17.7
Others	37	28.3
Total	130	100.0

From table 8, over 44% of the population who accepted they have access to credit obtain their credit from Njangi groups because its less expensive. About 10% of the farmers have access to credits from banks. Around 17.7% of the population borrow from the M'mockbine and M'mouck lateh cooperative credit unions in the area. The population complain that taking credit from the credit union is very expensive since the interest rate is very high, they equally say they lack collateral to deposit before obtaining credit and some don't belong to any credit union. Over 28.3% of the population prefer individual money lenders, borrowing from friends and family members where they shall refund with much interest. Also, farmers have a risk and fear factor as market gardening farming is a type of farming in which one can never predict as crop failure can lead to difficulty. Generally, farmers have limited access to credit as they lack assets to use as collateral to obtain loans, limited information and however resort to thrift and loan groups, credit unions and other means to facilitate their production process.

5.1.4 Problem of accessing farm inputs

Results reveal that farmers have limited access to farm inputs. Only about 5% have access to farm inputs. These are those who are members of M'mouck cooperative society and Magha farmer's cooperative society. The farmers highlight that prices for farm inputs for the past few years have been increasing at alarming rate. For example, a bag of chemical fertilizers (20.10.10) use to be 16000 frs (32$) but today, it is 37000frs (74$). The price of insecticides like Emacot and Dusban has increased in recent years not living out pesticides. Other farm tools like sprayers, pipe to irrigate water are very expensive. So, it is very difficult to have a good harvest without the application of chemical fertilizers and manure. Further, for it to reach them it becomes more expensive since there are no good roads leading to this area. At times they have money but have difficulties to fertilizers. This causes delay in input application leading to crop failure and even spoilage in the farm. Farm inputs are a very big problem in this area. Some farmers complain that they buy costly inputs and after the harvest but due to delays and other associated factors, the output cannot compensate the amount invested in the farm and this has caused many people to start leaving the activity.

5.1.5 Small farm sizes and difficulties of land accessibility

Field visits reveal that the average farm size is about half an hectare that is 50m squared. Even though market gardening is an activity carried out on relatively small piece of land, those here are not only small but not available in many cases. Field distribution shows that over 11% are on 1ha, 5% on above 1ha, 33% on 1/2ha and over 52% on 1/4ha. The spatial distribution according to villages in the area is presented in table 9

Table 9: Average Farm sizes of the population

Villages/Farm sizes	½ hec	1/4hec	1hec	others		
Agong	4	9	/	3	16	
Assuala	5	8	1	2	15	
Fomenji	3	12	3	/	21	
Fonenge	2	11	/	/	18	
M'mock leteh	10	6	2	6	24	
Magha	7	7	/	/	21	
Maleta	4	10	1	5	18	
TOTAL	32(32%)	68(52%)	7(5%)	15(11%)	130	

From the figure above, 52% of respondents say their farm size is only 1/4hectar and even less than. They say this is due to the fast growing population of this area and that even when one need a farm to rent, he or she will not find it. The little they manage on may be a piece of land shared by a family head to his children. Also, the fast growing population needs land to construct on hence limiting farming land. More so, people here are highly attached to their land and have the notion that they don't sell land inherited. Even people who own land but cannot cultivate, prefer to leave it inactive than to rent or sell it. Even though these farmers lack money to purchase or rent. A little over 2% of the population note their farm sizes are up to 1hectar even though not in a particular spot, they have it in pieces and it is very difficult for them carry work on it since it is not at a particular spot. Over 32% of the population agreed their farms are up to ½ hectare. These groups of people highlight they inherited the land from their parents and some have bought from some villagers. We can therefore conclude that access to land is a challenge to farmers practicing market gardening in this area due to increasing land scarcity as a result of rapid population growth.

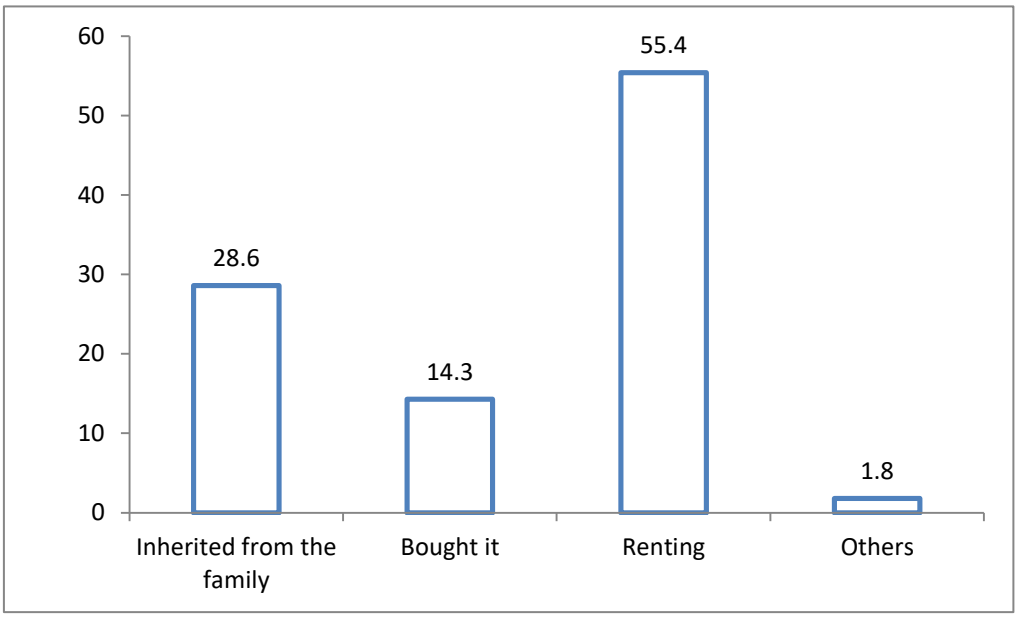

Figure 8: Means of land acquisition

Source: Field Work

Results reveal that there is limited available land for farmers to carry out their activities as 55.6% of the population strongly disagreed that there is available land for farmers, 33.2% of the population disagree that there is enough land for farmers to carry their activities and only 7.1% of the population strongly agreed that there is enough land for farmers to cultivate on it and, 3.1% of the population agreed that there is enough land for farmers in upper Wabane to carry out their activities on. It is deduced that, there is not enough land for farmers in this area to carry out their farming activities especially with rapid population growth.

5.1.6. Market channels for farmers.

The market chain here involves selling in the village market, “buyam-sellams” and selling to outsiders.This has led to inconsistencies in market price. Field data analysis reveals that 62.7% of the farmers sell their produce to “buyam-sellams”. These “buyam-sellams” buy at very cheap prices from farmers and in turn sell in markets in towns making much profit than the farmers. About 22.3% sell their produce in the village market and 15.4% of the respondents say they sell their produce to outsiders. These outsiders are traders who leave Dschang, Bafoussam Nkoubu to these villages to buy Cabbages, carrots, Irish potatoes and garlic to urban areas in Cameroon like Douala, Yaounde and equally to some CEMAC zone countries such as Gabon and Equatorial Guinea. we can therefore deduce that, farmers sell their produce largely to" buyam-sellams" and this has helped to redynamise livelihoods.

5.1.7 Poor market price and price variability

Farmers in upper Wabane are not satisfied with the price variability and the prices they sell their produce. Over 52.4% of the farmers are not at all happy with the price they sell their produce. This is because the buyers buy at a very low price."Buyam –sellams" or middle men traders most often agree before coming to buy. They will have a fixed price where no buyer buys above the said price. This makes it very difficult for farmers to resist selling since they do not have any means to store these crops because of it perishable nature. Over 27.6% of the population highlight that sometimes, they are satisfied with the price they sell their produce. This is mostly in the dry season where the roads are good and buyers can reach the village and equally with the fact that some particular crops sell high during particular periods of the year. Close to 20% of the population are satisfied with the price they sell their produce. These respondents said they make sure their harvest is done during the dry season where buyers from far (that is Gabon, and Equatorial Guinea) come to buy at good prices. Looking at the above statistics, we can deduce farmers in upper Wabane are not satisfied with the price they sell their produce since they invest much in the farm..

5.1.8 Use of crude tools and lack of mechanization

Farmers in upper Wabane lack tractors to work in their farms. This is because they lack money to purchase them. Also, the terrain do not favour the use of tractors to help till the soil. Small farm sizes do not permit them to hire the services of a tractor. Even in areas accessible to tractors, farmers are not able to raise money which can hire a tractor for even an hour. Because of these challenges, farmers here prefer to carry out work in their farms with crude tools with the help of their family members and some farmers organize meetings and carry out work in their farmers. Only few wealthy farmers pay work to be done in their farms. Many say to hire workers to work in your farm, you need much since 6hours work causes 3000-4000frs per a worker.

5.1.10 Lack of assistance to farmers

The study revealed that farmers receive little or no assistance from the government. Farmers inputs are getting expensive every day and the government is doing little to regularize the price worsen by poor roads leading to upper Wabane. Some of the respondents note that the council is limited to address the challenges faced by farmers in this area. NGOs are few and their activities are limited in the area. When NGOs comes for assistance, their coverage is limited. One must be a member of a cooperative before he or she is eligible to benefit from them.

5.1.11 Lack of farmer's cooperative societies

Limited number of farmers in upper Wabane belong to farmer cooperatives. Only about 27.2% of farmers in upper Wabane are members of a farmer's cooperative society and this is because there are having cooperative societies in their respective villages. These are Magha farmer's cooperative societies and M'mouck Leteh potato seeds producing cooperative society. Over 72.8% of the respondents do not belong to farmer's cooperative. These farmers say they are not aware about the existing of farmer's cooperative. Some don't know the modalities to become a member and others say they don't know the advantages of cooperative societies we can therefore conclude that lack of farmer's cooperatives and sensitization is necessary.

5.2 Physical challenges to practicing market gardening in upper Wabane

These physical challenges are water scarcity, limited land and diseases attack.

5.2.1 Diseases that affect market gardening crops in upper Wabane

There are different types of diseases that affect crops and this include pest, Bacteria leaf spot, early and late blight and wilting. Figure 5:4 shows diseases that affect market gardening crops.

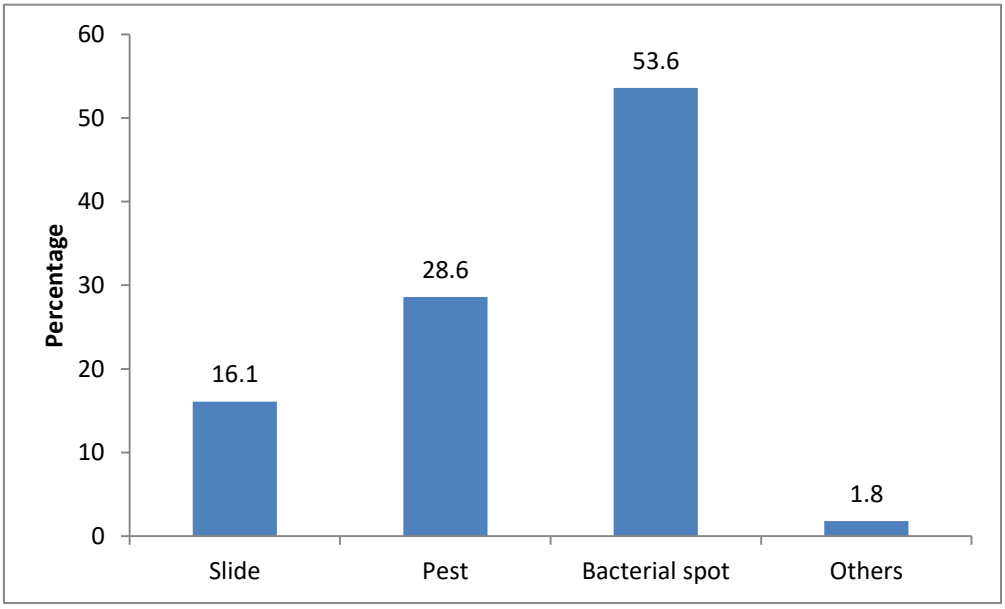

Figure 9: Diseases attack on crops

From figure 9, 28.6% of farmers highlighted that disease pest affect market gardening crops. Bacteria leaf spot is a disease that significantly (53.2%) affects market gardening crops in upper Wabane while slide is present but least significant. Others cited wilting as the main constraints that affect crops in this area resulting from climate variability and unprecedented droughts that occur. Others cited some insects that cause serious thread to crops in this area.

5.5.2 Water scarcity as a challenge to market gardening in upper Wabane

The research revealed that one of the major problem faced by market gardening farmers in upper Wabane is water scarcity. A significant par (67.1%) of the population hinted there is not actually enough water for them to carry out market gardening activities. This is mostly in the dry season exacerbated by climate variability with early abortive start of rainfall. The few streams and rivers that exist, are facing a lot of competition as many farmers depends on it to irrigate their farms (Plate 1). Even in areas where water is available only people around river banks do benefit from it. The hilly nature do not permit people who are up the hills to be able to channel water to their farms. Only 17.9% of the farmers accept there is enough water mostly those permanent farmers beside the river banks that they cultivate during the dry season. Those afar advance their reason base on the fact that these are far off places that there is enough water for farming but people are not willing to cultivate far because of transportation problem, the fact that to irrigate your farm, you need to be in the farm in the morning and afternoon to position the sprinklers discourages people from cultivating far from home. Water scarcity is therefore a major challenge to market gardening in upper Wabane.

Photo 7: Searching for water in the dry season Photo 8: Dry farm because of less water

5.2.2 Soil quality and topography

The soils in the area are getting old and impoverished due to cultivation over a long period in a mountain region with phenomenal erosion losses. The topography is hilly and some areas face landslides and mud flow causing local disruptions in circulation. Unlike inland valleys and foothills or plains with gentle or flat surfaces, the cultivation of steep slopes of Wabane in the Bamboutos mountains provide first years of success and declining fertility with time. The soil in upper Wabane are loosing fertility over time. Some farmers (5.4%), note that the soils were fertile but as a result of constant farming it is losing its fertility. Over 44.6% of the population confirm that the soils are poor in terms of fertility but note that chemical fertilizers and manure are used to improve fertility. A significant majority (47.2%) of the respondents hint that the soils are fertile especially when farmers practice rotational farming and shifting cultivation.

The trend matrix shows there exists a significant relationship between natural drivers and market gardening in upper Wabane sub division than human driver.

Table 4.5 Trend matrix between natural drivers of market gardening

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.269	3	.323	1.559	.137
Within Groups	32.309	129	.140		
Total	33.578	130			

The interactive effects between the natural drivers and market gardening is 1.559 with 3 and 129 degree of freedom in which p value is 0.137. Since p value is 0.137 and is greater 0.05 we accept the alternative hypothesis which states that there exists a significant relationship between human drivers and market gardening in upper Wabane sub division than human driver.

6. Strategies put in place to curb market gardening challenges in upper Wabane.

There are different strategies put in place to curb the challenges market gardening farmers face in upper Wabane sub division.

6.1 On-farm strategies

6.1.1 Strategies to improve productivity

This research revealed the following ways in which farmers in upper Wabane embrace to improve productivity. These methods include new techniques of farming, improved seed, better land management, managing weeds, increase use of organic and in organic fertilizers and use of pesticides. These strategies are seen in the figure 10.

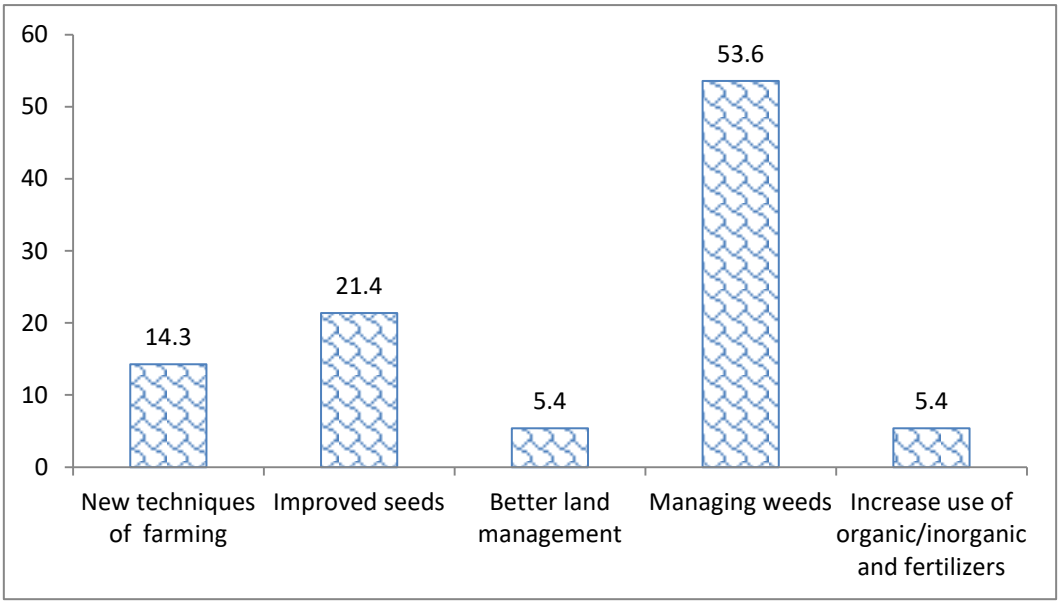

Figure 10: Innovations to improve productivity

A significant (53.6%) part of the population improve productivity by managing weeds. This involved the use of pesticides to eliminate weeds. Land management is a good innovation that is improving productivity. Over 5.4% of the population highlight that, in order to improve productivity, they increase the use of organic and inorganic fertilizers such as chemical fertilizers and organic manure. New farming techniques such as horizontal cultivation (14.3%), reduce or small size of beds are better ways to improve productivity while improve seeds (21.4%) from the institute of agricultural research (IRAD) has improved productivity in market gardening in this area.

6.1.2 Strategies to curb the problem of water scarcity

Results reveal that farmers in upper Wabane do face problem of water shortage especially when the rains early stop. Figure 11 illustrate the various methods farmers use to fight water scarcity

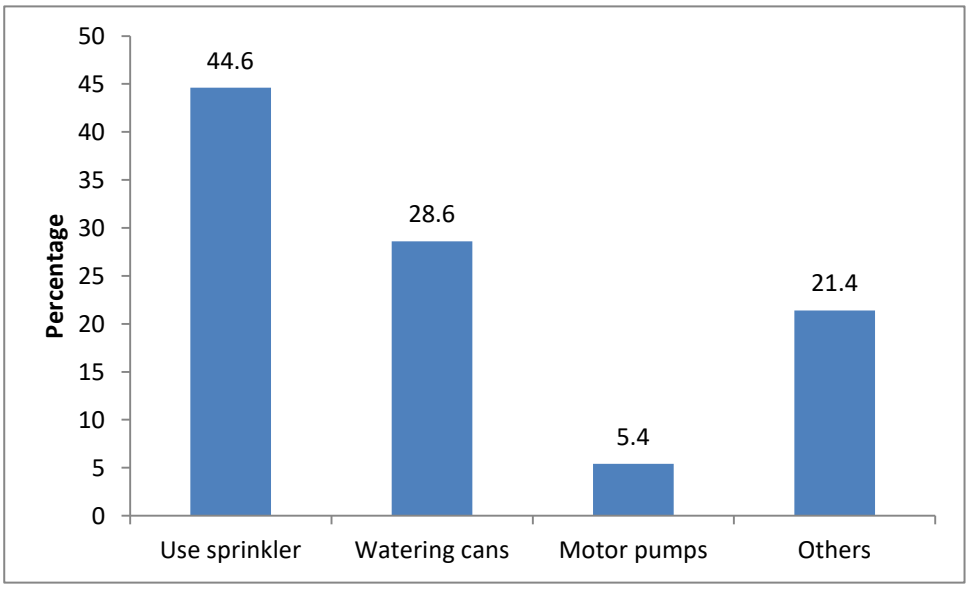

Figure 11 : Ways to water crops in dry season

A significant part of the population (44.6%) of upper Wabane carryout irrigation and use sprinklers to water their crops while others use motor pumps (5.4%) to supply water in their farmers during the dry season, over 28.6% use watering cans to apply water into their crops during scarcity of water and 21.4% use other methods such as cultivating in the marshy lands during the dry season while some stop cultivation and only wait for the rains.

6.1.3 Adjusting planting dates and adaptation to climate variability

Due to recent changes especially with early abortive start in rainfall at the beginning of the rainy season, farmers adjust planting dates and follow information from the Ministry of Agriculture and rural development (MINGRI). It was noted that 19.1% of the respondents cultivate their crops using information from the Agricultural post and new disease and drought resistant species,

while 67.7% curb the problem by adjusting planting calendars according to the first rains. Farmers note that the climatic condition of this areas have greatly change. At first, they first rain falls in late February and early march but today, at times it falls earlier than this or very late. So, they only wait till when the first rain at depth before they go for planting. They prefer to start planting in the late March to April when they are very sure of the rains while others said they do the planting and support with irrigated water until the rains are constant.

6.1.4 Strategies to improve soil fertility.

The study revealed the following ways in which farmers are improving on the quality of the soil in order to have a good harvest. These methods are seen in the figure 12.

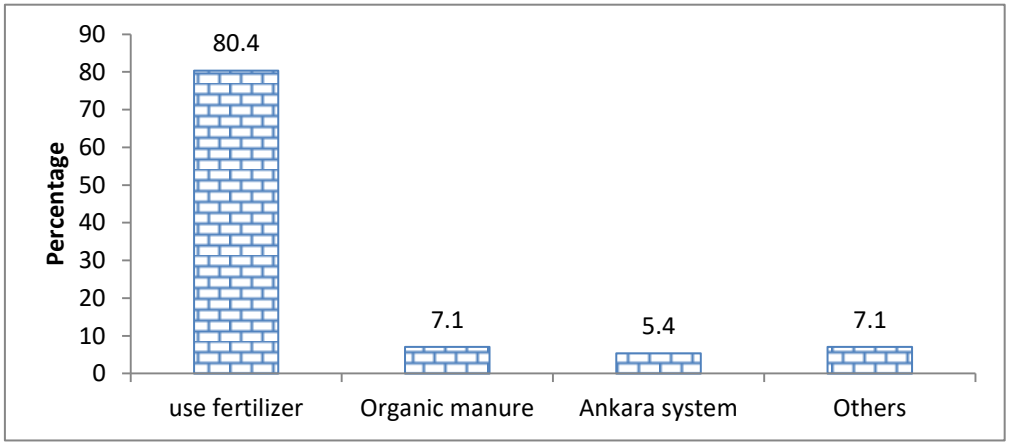

Figure 12: Ways to boost soil fertility

Source: Field Work

Boosting soil fertility is not easy but a greater part of farmers (80.4%) use chemical fertilizers and organic manure (7.1%) to improve the fertility of the soil while only 5.4% practice the "ankara" system (burying dry after harvest hay in furrows and burning) to improve soil fertility and that this system is fast dying because after practicing it, the soils becomes less fertile and 7.1% practice rotational farming.

6.2 Off-farm strategies

6.2.1 Formation of farmer'cooperatives

The study reveals that farmers in upper Wabane are not having enough access to credit. Farmers cry out government should come to their help by creating a bank which is uniquely for farmers and which will grant loans or credit to the farmers at a very low interest rate. Over 63.2% population decry the interest rates of micro finance institutions but however note that their availability is a big relief. During the research it was discover that there are only two cooperative credit unions in the villages of M'mouck Leteh and Magha. They are Magha farmer's cooperative union which is in the village of Magha and M'mock potato producers and seeds multipliers cooperative society L.M.T (MPPSM COOP) These cooperative societies benefits the farmers in that it gives their members seeds, fertilizers and some farm tools at affordable prices. Farmers should group themselves and form cooperative as 76% of the farmers highlighted, if they belong to a cooperative body, they can jointly buy their items in bulk where it can be sold at a cheaper price, they can equally gather their produce and call a buyer to come and buy by doing so, they will reduce the numerous channel in which their produce go through before reaching the market. They could also delve into common initiative groups group under a cooperative. This can facilitate negotiation for assistance from NGOS and capacity building. Only few farmers have benefitted from cooperatives and NGOs and this needs to be replicated and expanded upon the whole area to improve production.

6.2.2 Marketing and price stabilizaiton

Farmers are resorting to the creation of more ware houses to permit a time lag to search for better prices and negotiate their value chains, only fresh vegetables are directly ferried out. Some farmers are creating retail shops for farm inputs as well as some cooperatives.

6.2.3 Contribution of market gardening to livelihood and diversification

The study revealed market gardening activity has a significant contribution to livelihood improvement in upper Wabane. So many jobs are generated both on-farm (farm preparation, tilling, application of inputs, weeding, harvesting and gathering"and off-farm (transportation, loading, related input and sale shops, warehousing, weaving of packaging baskets). Data analysis reveal that 56.2% of the farmers highlight that market gardening to them serves as a major source of income as against 35.4% of farmers where market gardening to them is a source of employment and 8.5% whom market gardening serve as source of food. Market gardening serve as a major source of income to the people of upper Wabane.

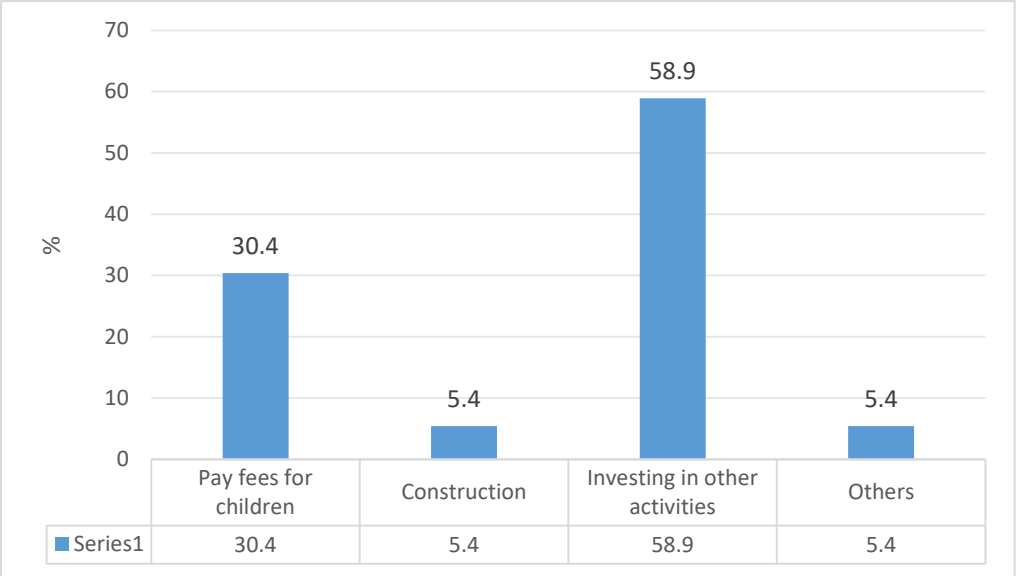

Figure 13: Benefits of market gardening to the people

Income generated from market gardening has helped them pay school fees of their children in primary, secondary and high schools they have equally been able to use money generated from it to sponsor children to learn a trade. Money generated from market gardening is used for investment in other activities (58.9%) such as the rearing of animals that they raise and sell which serve as social capital and safety nets. To this, is added the purchasing power of inputs, small working equipment and for the support of workers back in the farm. The population also note market gardening has help them, in that money generated from the activity is use for the construction and improvement of houses where they live with their families and also money generated from market gardening is used for other things such as taking care of hospital bills, in addition, this practice allows producers to meet secondary needs such as family clothing, purchase of animal feed and debt repayment. Finally, according to the population these activity have greatly contributed to social cohesion between producers and their families.

Nevertheless, some negative aspects are noted such as pollution resulting from the application of fertilizers polluting water bodies. Due to the growth in the market gardening activity, conflicts are increasing over land and water management. For instance, a key informant notes that

"*the population of Asuala village decry that in 2018, the Divisional Officer of Babadjou stopped them from cultivating during the dry season since they used to channel much of the water sources to their farms leaving little to flow down to town of Babadjou for a stream that use to be the main source of water for communities downstream*". Conflicts over water are high during the dry season. Deforestation to create farms is another issue that is increasing over the days especially rapid population growth both indigenous and migrant to take advantage of the opportunities of market gardening.

The Pearson's Product Movement Correlation test on states that there exist more on-farm improvement strategies in market gardening than non-farm adaptation/improvement strategies. To arrive at this, a contingency table was used with a Correlation matrix

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.578a	4	.001
Likelihood Ratio	20.215	4	.000
Linear-by-Linear Association	1.023	1	.129
N of Valid Cases	129		

Computed using SPSS version 20, test values shows statistic is 18.578 with a p value of 0.001, since p value is closer to zero or less than 0.05 we say there that, there exist more on-farm improvement strategies in market gardening than non-farm adaptation/improvement strategies, there by meaning that there is no relationship, we therefore reject the alternative

7. Discussion

Anchored on the sustainable livelihood framework, this study set out to a) examine the challenges of market gardening farmers in upper Wabane of the Bamboutos mountains of Cameroon b) analyse the drivers of market gardening and c) livelihood management strategies. Our findings are pertinent and show the happenings in a mountain ecosystem. Major market gardening drivers in upper Wabane are dominantly physical and include the fertile nature of the soils (47%), conduciveness of climate (68.9%), the gentle and undulating nature of area (57.1%) and human drivers such as market demand especially rural-urban linkage (97%) with most of the crop cultivated sold in the major towns of Douala, Yaounde and Bafoussam. Crops cultivated are mostly vegetables like carrots, cabbages and tubers like potatoes. While market gardening production is sustaining livelihood with on-farm and off-farm activities, it is challenged by poor road network (65%), water crisis during the dry season (67.9), diseases such as bacteria spot (57.6%), poor Soil quality (47.2%), lack of access to credit (67.8%), poor assistance assistance to farmers (72.1%), lack of farm inputs and lack of farmer's cooperatives (72.8%). This corroborates the findings of Tanyanyiwa and Bakasa (2018) in the Chihota area of Zimbabwe that noted that market gardening in Chihota is challenged by poor transport network, inputs shortages, uncompetitive market prices and limited access to extension service just like elsewhere in Africa but is improving peoples livelihoods.

These results are similar to the findings of Ndze and Fombe (2015) in the Nkom highlands of Cameroon that establish that slope gradient naturally controls the pattern of agricultural productivity in developing regions through it role in determining the type of agricultural yields and methods of cultivation that is practiced in an area. It also links up with the postulations of Gebremedhin (2007) cited by Mohammed (2018) that Ethiopian vegetable and fruit commercial growers export volume and sales lack consistency and constrained different challenges and these less experienced growers are highly affected by export problems, management commitment problem, lack of accessible transport system, low awareness of stakeholders, shortage of storage facilities and technical advancement. All these were identified as problems of market gardening post-harvest problems are in line with Feldman (1998) in Zimbabwe who affirms that major horticulture production constrains include pest, sought, shortage of fertilizer and price of fuel for pumping irrigation water. In addition to the work of Jone (2015) in Burkina faso, there are different ways to boost crop production in Africa that involve boasting irrigation, increase use of fertilizer, improve market areas. On the other hand, it is significantly different from the work of Ekombe (2009) who establish that mountain soils are not good for market gardening cultivation because they lack water and infertility nature of the soils due to constant erosion of the top soils. While environments vary and present different challenges, those of mountain ecosystems for market gardening are unique and more challenging like the case of the Upper Wabane in the Bamboutos mountains of Cameroon.

Nevertheless, the strides made by farmers in valorizing their assets for livelihood sustains a unique gardening system in this mountain environment that falls along the mount Cameroon volcanic line with Wabane above 2000m and therefore farmer's adaptation is key and requires stakeholders and development support.

While the market gardening system seems to be experiencing challenging problems like elsewhere in Africa, the contribution to livelihoods and livelihood diversification are significant. The population affirms that money generated from market gardening is used for investment in other activities (58.9%) such as the rearing of animals that they raise and sell which serve as social capital and safety nets. Moreover, farmers purchasing power increases to acquire inputs, small working equipment and for the support of workers back in the farm. Finances generated from market gardening activity has helped in construction and improvement of houses for families, hospital bills, education, in addition, this practice allows producers to meet secondary needs such as family clothing, purchase of animal feed and debt repayment. Finally, according to the population these activity have greatly contributed to social cohesion between producers and their families. Khalidou et al.,(2024) establish that market gardening significantly enhances farmers's income and household food security. They went ahead to note that in Niger it is a crucial tool for securing agro-pastoral systems and rural livelihoods amid interwoven challenges such as climate change, conflicts and insecurity, demographic pressure, and poverty. Ellis, 2000 and Barrett et al., (2001) establish that non-agricultural credit and agricultural credit had a positive effect on livelihood diversity and could be explained that access to credit may provide options to establish non-farm businesses. These difficulties are key in Upper Wabane with farmers struggling more with thrift and loan groups but with positive outcomes.This outcome emphasizes the value of land as a key capital resource that provides opportunities for households to diversify (Ellis, 2000; Nielsen et al.,2013; Scoones, 1998). Despite the challenges of market gardening, its contribution to livelihood diversification and sustainability is well established in this landscape

8. Conclusion

Market gardening takes place in upper Wabane in the Bamboutos mountains of Cameroon under very peculiar conditions. Largely driven by physical elements and some human factors, it faces a lot of challenges for a successful farming system. These include difficult access to credit, limited technical know-how, poor farm to market roads and water scarcity during the dry season, limited land for cultivation and poor prices. Faced with these challenges, farmers use sprinklers to water crops, improve soil quality using fertilizers, improve access to credits by creating micro-finances, formation of farmers' cooperatives, and better water management and capacity building with NGOs. Market gardening thus contributes significantly to livelihood improvement through job creation (on-farm and off-farm), better incomes through value chains that are used in education, health and investment in other sectors. It also helps in livelihood diversification that help face vulnerability shocks. More research is needed on livelihood diversification in upper Wabane.

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N.M.M.; supervision, H.W.M. All authors have read and agreed to the published version of the manuscript.

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