

# Organic agriculture and its implications to food security: The case of the Likove farmers simplified cooperative society, Sasse, Cameroon

Jicenta N. Foncha\* • Estelle F. Assonwa • Daniel E. Mokenge

Department of Development Studies, Pan African Institute for Development-West Africa (PAID-WA) Buea, P.O. Box 133 Buea, South West Region, Cameroon.

\*Corresponding author. E-mail: jacinta\_foncha@yahoo.com. Tel: +237675201496.

Accepted 6<sup>th</sup> June, 2020.

**Abstract.** In Sub-Sahara Africa, small-scale farmers produce mostly food crops that contribute immensely to their livelihoods. These farmers face challenges like: lack of well adapted agricultural technology, infertile soil and fragile ecosystems. Consequently, they experience low agricultural output resulting from crop failure. This study is focused on agriculture adoption strategies and implication to food security in Cameroon: the case of Likove Farmers' Simplified Cooperative Society, Sasse - Buea. Farm wastes were recycled using low cost and locally available technology to obtain organic manure. The study specifically: a.) identified farm waste, b) analyzed different agricultural enterprises and their outputs, c) assessed the benefits alongside potential up takes by the farmers. Selected PRA tools and questionnaires were used in collecting data from farmers; data were analyzed using descriptive and dependent "t" test. The results indicated that farm wastes used include: Plant residues, livestock and poultry waste. Different agricultural enterprises included: Market gardening, poultry farming, horticulture, beekeeping and staple food crops. Organic Agriculture increased farm produce and improved food security, favors agricultural diversification, improved market access, generated employment, and increased income of farmers. The dependent t-test revealed a significant difference ( $t = -4.37$ ,  $p = 0.006$ ) of farmers production before and after introducing Organic Agriculture. Engaging in Organic Agriculture has enabled 8.5% of farmers to improve on agricultural productivity and livelihoods. It is recommended that, the government should encourage and invest in organic agriculture as it contributes to food security, livelihoods and the local economy.

**Keywords:** Farm waste, organic agriculture, food security, livelihood diversification, increased income.

## INTRODUCTION

Agriculture is the mainstay of most developing countries, as it plays a major role in food security, employment, poverty reduction and rural development. Though about 70 per cent of the world's population is involved in agricultural activities, 858 million people in the world still suffer from chronic hunger, and 820 million of these people live in developing countries, 25 million in transition countries and 9 million in developed countries (United States Department of Agriculture - USDA, 2016). Food

production is one major challenge to many countries around the world. In developing countries, food production is predominantly practiced by small scale rural farmers with farm sizes of less than 2 ha, (Foncha and Asongwe, 2018). Most of these farmers can barely feed their families; despite the rapid increase in the world's population which has resulted in an unprecedented increase in food demand. The inability of these farmers to meet up with the demand for food is associated with

challenges like: lack of access to finance to buy agricultural inputs, unsustainable agricultural practices that ultimately degrades the environment, discriminatory land tenure regulations, and the negative impact of climate change. Faced with these challenges, farmers have often resorted to organic agriculture. Organic Agriculture (OA) has its roots in traditional agricultural practices which are based on indigenous knowledge and culture. Initially, this farming system was limited to the decomposition of litter and post-harvest residues in both home gardens and farms. In some cases, animal graze on post-harvest residues and drop their dung which provides manure for food crop. With the availability of land (in relation to the population), rotational agriculture was also practiced; in this case, lands were left to fallow and regain their fertility. Similarly, pest management was also carried out using multiple cropping methods. Using their indigenous knowledge most farmers opted for food crops like pumpkin, melon, and sweet potatoes partly in a bid to prevent soil erosion and maintain soil moisture (Foncha *et al.*, 2019). As noted by Foncha and Asongwe (2018), it falls in line with the primary production strategy of organic farming which is to maintain traditional plants and animals that may yield less in the short – run, but will be more resilient and capable of surviving in the long–run (Food and Agriculture Organization - FAO, 2007), has documented that Organic Agriculture stresses diversification and adaptive management, which significantly decreases pests, diseases and weather vulnerability. A diversified organic multi cropping farming system increases farm production by 20 to 60 per cent compared to traditional mono-cropping systems. Diversified organic multi-cropping also improves stability by improving soil and water quality as well as help ecological services that supports agriculture (The Organic Organization - HDRA, 2008). This type of farming system, thus, can help local farmers survive a harsh environment, meet their family food needs, and improve their financial status through the sale of excesses, while simultaneously conserving the natural environment.

Most small scale farmers, faced with poverty and out of desperation stemming from land scarcity and lack of economic opportunities, became agents of their own destruction through the overexploitation of the natural environment which often leads to a fragile and unproductive ecosystem, implying low agricultural yields. These unsustainable agricultural practices usually precipitate the vicious cycle of poverty and land degradation. The burgeoning population pressure on the demand for food crops is what has often forced many countries (farmers) to use chemicals and fertilizers to increase farm productivity so as to meet the ever increasing demand for food.

The Green Revolution concept in the 1970s, a worldwide strategy to eliminate starvation, poverty and guarantee food security also promoted the extensive use of chemicals, high yielding seed varieties, and extensive

irrigation for improved food productivity (International Food Policy Research Institute - IFPRI, 2002). Unfortunately, this witnessed enormous setbacks, as most small scale farmers, who were poorly equipped, and had very low or no income were unable to gain access to the new production means (Stockdale *et al.*, 2001; USDA, 2016; Foncha and Asongwe, 2018). With farmers and consumers recognizing the enormous setback of using chemicals in both crop and animal production a return to organic agriculture was exigent. Many scholars have come up with different definition of organic agriculture. According to Chan *et al.* (2008), organic agriculture is an ecologically and socially friendly farming system, where farmers have as main goal, increased crop and animal production, while at the same time protecting the environment. Organic Agriculture as documented by International Federation of Organic Agriculture Movement - IFOAM (2006) is an effective and cost efficient measure to reach sustainability objectives in agricultural policy; it is not only a holistic approach to sustainable food production but a strategy to increase carbon sequestration in the soil. Organic agriculture as noted by El-Haggar *et al.* (2001) is a form of agriculture that relies on sustainable techniques aimed at enhancing the natural fertility of the soil (farm), through crop rotation, and biological pest control such as mixed cropping; fostering natural insect predators; and using natural sourced fertilizers such as: compost, green manure, and bone meals. Using the Indian experience, Yadav *et al.* (2013) described organic farming as one of the several approaches to meet the objectives of sustainable agriculture. They further classified products from organic agriculture under edible products like: basmati rice, honey, oil seeds, fruits and cereals among others; and non-edible products included: cotton, body care products. Organic agriculture aims at providing high quality food without adversely affecting the environment as is the case with contemporary agriculture practices where the use of chemical fertilizers is predominant. Organic agriculture is capable of sustaining higher crop productivity and improving soil quality and productivity by manipulating the soil properties on a long term basis. Emphasizing on the long term benefit, Subba (1999) documented that, the organic and low input farming practices after four years lead to an increase in organic content, soluble phosphorus, exchangeable potassium, pH, and the reverse pool of stored nutrients and relative stable electrical conductivity levels. This was reiterated by Surekha (2007) in a work carried out in India, in which it was argued that, the productivity of crops during the initial years in organically managed fields is low, but increases subsequently as soil fertility levels increase and as organic materials are added in the management systems.

Organic farming methods include: (i) Composting, which is cost effective to rural farmers, long lasting as it improves soil structure and fertility as compared to

chemical fertilizers that provide nutrients to plant but do not improve soil structure but rather only improves yields in the season in which it is applied (USDA, 2015). (ii) Mulching, which helps plants adapt to climatic conditions as it decreases water loss due to evaporation, reduces weed growth by reducing the amount of light reaching the soil, prevents erosion, increases the number of microorganisms in the top soils, adds organic matter and nutrients to the soil, and improves soil structure (USDA, 2016; Chan *et al.*, 2018). (iii) Natural pest and disease control, which involves the timely planting of crops to avoid the period when pests do not damage crops. It equally involves choosing crops with natural resistance to specific pests and diseases (prone in the environment) (Chan *et al.*, 2018). Local varieties have proven to be better at resisting local pests and diseases than introduced varieties, (iv) Green manure, which is the planting of cover crops to improve soil structure, organic matter and nutrient content of the soil (IFOAM, 2006). (v) Weed control, which is characterized by crop rotation, hoeing, and mulching which covers the soil and stops weeds (Guidelines for farmers, 1997).

Organic farming does not operate in isolation, since emphasis is placed on local resources and ecological knowledge shared with the farmer in communities; they come together and pool resources (in order to maintain the integrity of the environment, they depend on their neighbors farming practices) (Field notes on organic farming, 1994). Consequently, they develop a synergy that sets up a network which aims at sharing what they know; facilitates the pooling of resources; and makes them establish an organized force as they provide quality products. About two thirds of the population in the Buea Municipality gets their food and income by farming small plots of land of about one hectare or less. Most of these, small scale farmers struggle with unproductive land (marginal or wetlands) as most of the fertile and productive lands are used by the Cameroon Development Corporation that practices plantation agriculture. The increase in population due to urbanization has led to the conversion of farming lands for other land use purposes. Faced with discriminatory land tenure regulations, lack of access to finances to buy agricultural inputs, unsustainable agricultural practices and climate change challenges as documented (FAO, 2007); and coupled with government policies that rarely serve their interests (as government pays more attention to large scale farmers and cash crops that contribute to the nation's Gross Domestic and Gross National products – GDP and GNP, respectively), unreliable markets for their products and inconsistent information about pricing, most farmers have synergized in the practice of organic agriculture aimed at pooling their resources in a bid to increase food crop production, sell more crops, reduce poverty, and hunger (improve on food security), create employment, improve access to market and livelihoods, as documented by Field notes on Organic Farming

(1994). When farmers grow more food, sell and earn more income, they are better able to feed their families, pay for the education of their children, and ensure health care for the family. This makes their communities economically stronger and more stable.

However, the growing concern of climate change, its impact on food security and environmental degradation, has got the Government of Cameroon (GoC), involved through the Ministry of Agriculture and Rural Development, in having access to reliable data (which was non-existence) to inform their decision making processes and options. Data collection facilitates research, policy analysis which helps identify gaps and ease the evaluation of the impact of organic farming on out-put as well as the marketing systems at both national and international levels. Besides the government availing grants to ensure that farmers benefit from farming systems, the price guarantee policy was instituted (buffer stock), where the government buys the excess products from farmer and sells to the market in order to secure market failure for farmers. Special agro-pastoral shows to show-case and promote the activities of organic farmers. The activities carried out by these farmers have also been organized in different towns and regions in collaboration with the GoC, justifies the basic ideas and rules documented by Guidelines for Farmers (1997), such as health, ecology, fairness and care as the guiding principles of organic agriculture.

The Likove Farmers' Cooperative Society was created in 1995 and is made up of mostly small scale food crop farmers. Their main objective was to improve agricultural production so as to enhance livelihoods and sustainability. Unfortunately, due to poverty (inability to buy agricultural inputs), and land tenure challenges they found it difficult to meet their objectives. Thus, they continued with unsustainable agricultural practices. By 2015, the initiative of Organic Agriculture (OA) (sustainable agricultural practices) was introduced to improve output while maintaining an ecologically-friendly environment. At the time of data collection for this study, the cooperative had 500 farmers. This study focuses on agriculture adoption strategies and implication for food security in Cameroon: the case of Likove Farmers' Simplified Cooperative Society, Sasse. In Buea, farm waste is recycled using low cost and available local technology to obtain organic manure. The study specifically set out to: a) identify farm waste (sources of waste, for animals, the number they generate, the weight/volume of waste generated and frequency); b) analyze different agricultural activities and their outputs before and after the practice of organic agriculture (harvest period, farming method, outputs in 4 successive years); and to c) assess the benefits alongside potential up takes by the farmers (income level before and after the practice of OA, diversification of livelihoods after OA was practiced). The involvement of about 70 per cent of women in OA had a major impact in the society as it

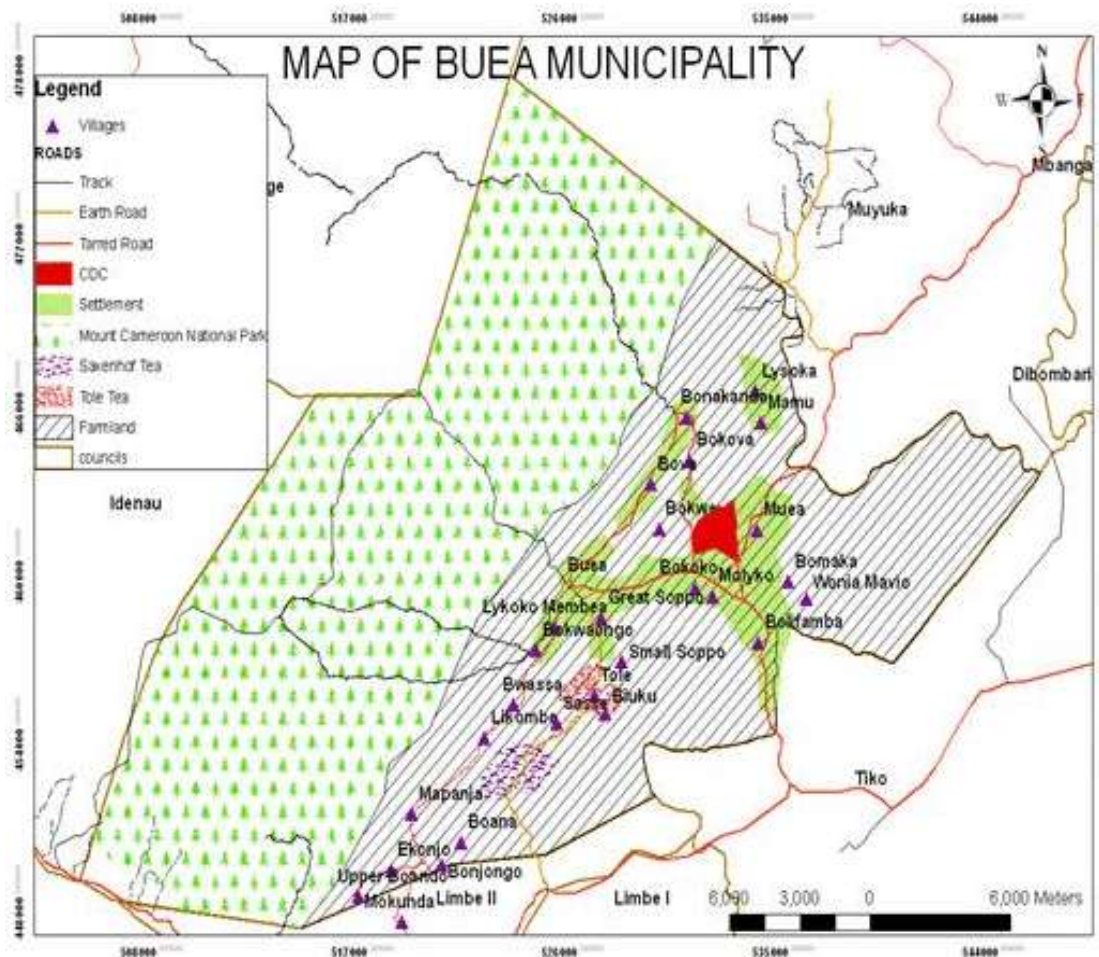


Figure 1. Map of the Buea Municipality. Source: Buea Municipal Council (2010).

removed social barriers and reduced domestic gender-based violence; these women were able to contribute immensely to the up-keep of most family needs.

## MATERIALS AND METHODS

The Buea Municipality is located on the eastern slopes of Mount Cameroon and lies on longitude 4°10'0 N and latitude 9°14'0. It has a surface area of 870 km<sup>2</sup> and constitutes 67 villages (Figure 1). It has an equatorial climate with two seasons. The dry season spans from mid-October to mid-March, with temperatures ranging from 20 to 28°C. The rainy season spans from mid-March to October, with annual rainfall ranging between 2000 and 5000 mm. Buea has an undulating topography (high and lowlands). Although soils are rich in basalts which occurred in the cretaceous system, it features rocks and stones as a result of the frequent volcanic eruptions. Buea is the regional Capital of the South West Region of Cameroon, though it has little to show in terms of urban activities. Besides its administrative and educational

facilities which over shadow agriculture, tourism and small scale businesses are also carried out in the municipality (Foncha and Asongwe, 2008).

## Sampling techniques

A reconnaissance study was carried out to obtain background knowledge of the study area. This was followed by a transect walk with the aid of two field assistants who were familiar with the area. Stakeholders (farmers, agricultural-extension workers, official of the Regional delegation of Agriculture and Rural Development for the South West region of Cameroon) were duly identified. During the transect walk, major crops cultivated were identified, the farming systems were assessed (multiple cropping, mulching, use of traditional pesticides used), and the waste management unit (Composting site) was also visited. Using purposive sampling techniques, 100 farms were chosen based on the sizes of the farms, (ranging from 500 square meters to 1 ha). The identification of farm waste was based on

**Table 1.** Daily generation of waste and values and ranking.

S/N	Sources of waste	Average number	Daily weight (kg)	Weekly weight (kg)	Bi-weekly weight (kg)	Ranking
1	Goats	50	10	60	123	4
2	Pigs	80	50	300	750	1
3	Poultry	200	150	-	130	3
4	Biodegradable waste from houses/ households	*Sampled persons	20	155	250	2
5	Wood ash	*Sampled persons	10	30	51	6
6	Farm residue /straw	*Sampled persons	15	30	89	5
7	Leaves from trees in farms	*Sampled persons	5	7	11	8
8	Remains from animal fodder	50	20	22	29	7

Key: \* sampled persons are the respondents. Source: Field work (2017).

the different crops produced and farm enterprises carried out. To guide this study, secondary data included, review from documents like project proposals, field reports, and workshop proceedings on agricultural waste management. The participatory Rural Appraisal (PRA) tools, like unstructured interviews, semi structured interview (SSI), group discussions and key informant interviews were used to collect data on: identification on source waste; output of agricultural enterprises before and after the practice of Organic Agriculture; impact of Organic Agriculture on crop output and farmers' incomes; benefits enjoyed by farmers' after the practice of Organic agriculture.

### Data analysis

Besides the modified Institutional analysis and developmental framework, the data were subjected to statistical analyses using descriptive statistics and inferential statistics of dependent t-tests was used to assess the benefits enjoyed by farmers after the practice of Organic Agriculture.

## RESULTS AND DISCUSSION

### Identification of sources of waste

The major sources of wastes recycled where pig weighed 750 kg, biodegradable waste from houses 250 kg, poultry 130 kg, goats 123 kg, farm residue/straw 89 kg, wood ash 51 kg, remains from animal residue 29 kg, and leaves from trees in farms 7 kg as presented in Table 1.

Pig waste comprises feed mixed with drinking water, urine and excreta making it wet and heavy. The waste is easily collected on a daily basis as the animals are confined. Biodegradable waste from homes was ranked second. The study communities are mostly rural were most of the waste produced are biodegradable. This result agrees with that of (United Nations Environment

Programs, 2007), which states that waste composition is influenced by the income level and culture of the communities. The wastes are mostly putrescible, characterized by high volume of water. Given the average size of the family which is seven, the volume of waste generated is usually very high. Poultry waste is ranked third, the initial weight of the waste was 150 kg but reduces to 130 progressively in two weeks to 130 kg; this is because, the sawdust spread in the poultry is wet and as time goes on it becomes dry and reduces in weight. Although the sawdust is mixed with fowl droppings the volume is usually very little. Goat wastes is ranked fourth, goats are usually not confined like pigs, they are tied out of their stable where there is pasture (grass) their excretory waste is scattered; secondly, very little fodder is put in their stalls as goats regurgitate thus the waste is not voluminous. Farm residue/straw is ranked fifth, crop harvesting is seasonal and the weight of the waste depends on the type of crop harvested. Corn (maize) wastes weighs more than vegetable waste. The daily waste is usually high because it is fresh and as it stays longer in the farms it gets dry and weight reduces. Wood ash is ranked sixth, the major sources of domestic energy in these communities are firewood (fuelwood), charcoal, sawdust, kerosene stove. The regression in the quantity of wood ash generated is as a result of the alternate use of sawdust and kerosene stove. Sawdust is gotten from carpentry workshops in the town, while charcoal is easily retailed (based on the quantity needed). The absence of forest makes firewood relatively expensive as it comes from the neighboring villages with forests. Leaves from trees in farms (at the time of this study some farmers had mostly tree crops more of orchards, (the researcher decided to separate farm residue from leaves from orchards). Leaves are from pruning or fall off when they are dry. The practice of agro forestry is at its initial stage (tree crops having young leaves), this justifies the weight from the trees in the farm.

Most of the farmers involved are small scale farmers specialized in food crop and animal rearing. The cooperative members assemble the waste and carry out

large scale composting, since most farmers do not have the skill to recycle the waste. However, the distribution of manure is based on the quantity of waste that each farmer brings to the composting unit. Agricultural waste is rich in organic matter derived from the soil and the soil needs it back in order to ensure the production of healthy crops (IFOAM, 2006); this organic matter is easily gotten through the recycling of waste using composting (technique) which produces manure in response to farmers' needs. Composting is one of the best known recycling processes for organic matter to close the natural gap and it involve, the aerobic decomposition of organic material by micro-organisms under controlled conditions (USDA, 2015, 2016). Successful composting in the study area involved local and accessible materials to poor farmers and was accelerated by natural factors like water and soil. Decomposition of organic matter by microorganisms is facilitated by oxygen, moisture, and temperature which result from microbial activities (FAO, 2007). Other major components are nutrient (carbon and nitrogen) from waste, PH, time, and the physical characteristics (porosity, structure, texture, and particle size) of the raw material (Surehka, 2007). Because composting usually contains some biologically resistant compounds, a complete stabilization of the compost may not be achieved as wood ash and soil will accelerate the process, maintain stabilization, get rid of odor and attract insects for aeration, (Mostafa *et al.*, 1999) .The quality and decomposition rate depend on the selection and mixing of these raw materials (IFAD, 2005). Aeration is required to recharge the oxygen supply for microorganisms, producing good organic matter (manure) which when added to the soil, improve fertility (Foncha and Asongwe, 2018). The materials used for composting were carefully selected method of mixing did meet the scientific standards as it was done with the supervision of workers in the Ministry of Agriculture and Rural Development; on the other hand, local technology was in the mixing of the compost, for example spades and sticks where used instead of tractors or tumblers.

#### **Analysis of agricultural enterprise and output before and after the practice of Organic Agriculture**

Before the practice of organic agriculture farmers relied solely on natural climatic factors (rain- feeding), involving the plough back of crop residues as manure to enrich soil fertility. As a result, some farmers were able to afford chemical fertilizers but not yearly: This inconsistency led to low outputs. With the introduction of organic agriculture farmers' output increased tremendously as seen in Table 2, where tomatoes had an increase of 46 baskets, green beans 74 baskets, cabbage 72 bags, green pepper 73 baskets, beans 75 bags, Brooklyn/cauli flower 71 baskets, groundnuts 19 bags, assorted spices 4 baskets, soya beans 18 bags, corn 1 bag, yams 32 bags, pumpkin 7 baskets and sweet potatoes 4 bags.

The crops planted are High Valued Vegetables (HVV) and staple food crops commonly cultivated in the communities (on their farms) of the municipality. The results however shows that the yields of corn within those years reduced by one bucket. This may be because, it is widely cultivated by almost all farmers on a large scale and for commercial purpose or on a small scale gardens for home consumption. Although it is widely consumed by human beings, it is equally sold to poultry feed markers. Corn takes a longer time to mature and this reduces the profits of small scale farmers. The table further reveals that, the initial output/ yields of crops in the first year of OA did not increase much as farmers needed to infuse heavy organic content in to the soil and carry out other practices like mulching, planting of crop variety, and crop rotation in order to neutralize the impact of chemical fertilizer, as well as control weed and pest. In subsequent years, after the soil had stabilized there was a tremendous increase in crop yields. The result is in agreement with the findings of several authors who include: (Sharma and Mitra, 1990; Shubba 1999; Surekha, 2007). The HVV experienced a tremendous increase to between 71 to 75 baskets/bags. Besides the different farming methods that favored increase in yields, access to markets was equally facilitated by new technologies, like the mobile phone which the farmers used to communicate directly with buyers thus, by- passing the middlemen who usually exploit them. A large quantity (about 80 per cent ) of HVV – green beans, cabbage, green pepper, Brooklyn/cauli-flower are sold in supermarkets in the neighboring towns like Douala, while about 20 per cent is taken to local markets. Tomatoes witnessed an increase of 46 basket, in the group discussion, the farmers explained that tomatoes are planted all over the country and thus to avoid surplus in the market, little attention is paid to its cultivation. Beans experienced an increase by 19 buckets. It is a staple food in Cameroon which is consumed not only in homes but in almost all restaurants. Coupled with its nutrition value (protein) it is transformed and prepared in various forms; this partly explains why most farmers are engaged in its cultivation. Yams are considered an elitist food, and through the practice of OA there was an increased by 32 buckets. For about two decades, the nutrition department of the Ministry of Public Health in Cameroon, has carried out widespread advertisements on the consumption of soya beans given its nutritive value especially for children. Other products with similar nutritive values are milk and meat. Given its rich nutritive value and popularity soya beans production increased by 19 buckets through the practice of OA. On their part, pumpkin and sweet potatoes increased by 7 and 4 buckets respectively. Initially, these crops were planted as cover crops to protect the soil, and to feed animals (leaves of potatoes for rabbits, pumpkins for pigs) but most families now consume large quantities of it. The farmers acknowledged that pumpkins (classified as a HVV) are in high demand in super markets. Tending spices is labor intensive with very little income from its

**Table 2.** Output of farm enterprises from 2011 to 2018.

S/N	Crops	Farm produce before the practice of organic agriculture						Farm produce after the practice of organic agriculture						Change in quantity (kg)
		2011	2012	2013	2014	Total (basket/bag)	Total (kg)	2015	2016	2017	2018	Total (basket/bag)	Total (kg)	
1	Tomatoes	15	13	15	12	55	550	15	24	29	33	101	1010	-460
2	Green beans	5	8	6	10	29	290	15	23	30	35	103	1030	-740
3	Cabbage	4	4	4	5	17	170	10	15	24	40	89	890	-720
4	Green pepper	8	6	6	5	25	250	15	18	26	39	98	980	-730
5	Beans	7	5	5	4	21	210	12	19	30	35	96	960	-750
6	Brooklyn/Cauli flower	8	4	5	8	25	250	9	24	30	33	96	960	-710
7	Groundnuts	2	2	3	2	9	90	3	5	8	12	28	280	-190
8	Assorted Spices	6	7	8	7	28	280	5	8	8	11	32	320	-40
9	Soya Beans	1	-	1	-	2	20	3	3	7	7	20	200	-180
10	Corn/Maize	8	9	10	13	40	400	5	8	11	15	39	390	10
11	Yam	1	1	1	1	4	40	3	7	11	15	36	360	-320
12	Pumpkin	2	1	2	1	6	60	3	3	3	4	13	130	-70
13	Sweet Potatoes	1	1	1	2	5	50	2	1	3	3	9	90	-40

Source: Field work (2017). In 20 liters of baskets/bags.

sales. There is high competition with ground spices sold in many shops as they last longer than the fresh ones. However the spices are mostly bought by restaurant owners. It also serves as tisane to some people; overall, fresh spices increased by 4 buckets. It is widely cultivated by almost all farmers on a large scale and for commercial purpose or on a small scale gardens for home consumption. Although it is widely consumed by human beings, it is equally sold to poultry feed markers. Corn takes a longer time to mature and this reduces the profits of small scale farmers.

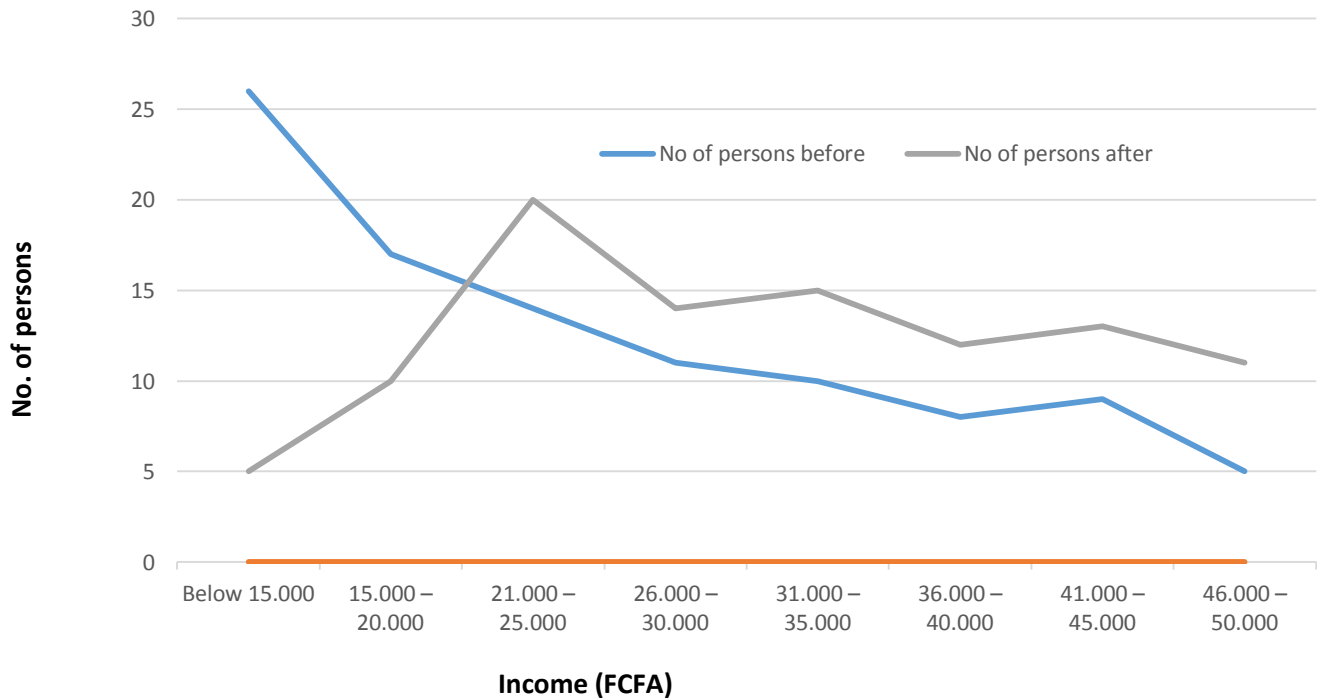
Organic agriculture helps foster biological activities such as careful mechanical intervention, and nitrogen fixation (most crops planted improve the nutrient status of the soil, as they possess high levels of nitrogen, phosphorus, potassium

with residue/ compost material which help soil – making and planting possible all year round). Compost was the major component used by the farmers of the cooperative under study, as it is cost effective, feeds soil life and improves soil structure with long- lasting benefits, unlike the case with artificial fertilizers which provide only short term nutrient supplies to crops. These fertilizers neither feed soil life nor add organic matter to the soil. They also do not help build good soil structure nor improve the soil holding capacity or drainage (chemical fertilizers provides nutrients for plants but does not improves soil structure), but only improves yields in the season when it is applied (Zheng *et al.*, 2016; The Organic Organization-HDRA, 2008). Composting was complemented by mulching, weed control, crop rotation, crop variety and the application of

green manure.

### The impact of Organic Agriculture on crop output and farmers' income

There was a direct relationship between increase in crop output and an increase in income as shown in Figure 2. Before the practice of OA, the income level of most farmers was low as very few farmers were involved; but after the practice of OA income levels increased as the number of farmers also increase. Twenty six (26) farmers had a monthly income of 15.000 *Francs Communante Financiere Africane* (FCFA) before the practice of OA, and most of these farmers did not possess land. They either had to hire or land were given to them based on social relations, and as a result



**Figure 2.** Income level before and after the practice of OA. Source: Field work (2017).

most of the crops they chose to cultivate were those that could be harvested within a short span of time. This was because the farmers understood that at any time they could be asked to vacate the farmland. This situation led to constant mobility on the part of farmers from one farm to the other. After the practice of OA 5 out of those 26 farmers still earned 15,000 FCFA, while 21 of them witnessed an increase in their monthly income. In addition, land was owned by farmers who were also now interested in the introduction of the new technology to develop the land. They also became more sedentary, and land tenure, thus had an impact on crop output and income. Similarly, 5 farmers who witnessed an increase in income earned between 46,000 and 50,000 FCFA, before the practice of OA, while 11 farmers earned the same amount after the practice of OA. The increase in incomes and profits was attributed to improved communications through mobile phones (ability to buy) which put buyers and sellers (management of super markets) in touch, saved time and facilitated access between stakeholders. As a result of the increase in income levels a group of HVV farmers were able to come together and sell their products in markets either in neighboring towns or major super markets in these towns. This guaranteed monthly payments which helped stabilize their livelihoods as they could constantly afford their basic family needs. Meanwhile some farmers were able to double their incomes due to lower costs of organic input. The use of natural pest and disease control is often cheaper (most often at no cost) than chemical pesticides

which they have to buy. The price stabilization program/instrument carried out by the Ministry of Agriculture and Rural Development (GoC) through which they buy surplus products during flush seasons as well as the agro pastoral shows in which the Regional Delegations of Agriculture and Rural Development usually organized to show-case the organic products of farmers also helped boost farmers' sales and incomes. A major innovation that the increase in income had on society was the removal of social barriers and the reduction of gender based violence, as women (about 70 percent of the farmers) started contributing immensely to the up-keep of their homes.

### Benefits enjoyed by farmers after the practice of OA

The increase in agricultural production led to increase in sales, with small scale farmers realizing maximum profits; a phenomenon which creates multiple livelihood options that augment their living standards, this scenario was also documented by (IFAD, 2005). Table 3 details some of these options that emanate from an increase in farmers' incomes and profits. Of the 100 farmers that were sampled, 20 of them were involved in bee farming. The practice of OA attracted social insects which were often repelled when pesticides were used. During flowering of the plants, nectar is collected (pollination) and this has encouraged apiculture, not only is honey produced but honey wine, candles, cosmetics to mention



**Table 3.** Diversification of livelihoods before and after OA.

S/N	Occupation	Number of people before	Number of people after	Percentage change
1	Bee farming	0	20	100.00
2	Horticulture (flower planting)	0	8	100.00
3	Small scale animal rearing	10	26	61.54
4	Petite trading /provision store	15	19	21.05
5	Local brewery	7	8	12.50
6	Restaurants/ local confectioneries	6	13	53.85
7	Trainers of waste recycling/recovery	0	3	100.00
8	Micro credit workers (daily/weekly savings)	0	3	100.00
	Total	38	100	

Source: Field work (2017)

**Table 4.** Dependent sample t-test of the difference in agricultural product before and after introduction of organic agriculture.

Paired Samples Statistics		Mean	N	Std. Deviation	t-test
Pair 1	Before	20.4615	13	15.67703	-4.37
	After	58.4615	13	38.30930	

but these. The use of organic manure encouraged farmers to practice animal rearing (although on a small scale) as the animal waste is often used as raw material for compost. In total, 26 farmers are engaged in animal rearing. Because farming is not done on a daily basis some farmers carry out other activities like operating provision stores and 19 farmers in the sample were involved. The cultivation of food crops encouraged the sale of food, thus many new restaurants were set up to sell cooked food from the crops harvested from the farms. Meanwhile, local confectioneries like caramel (groundnut sweets), dried groundnut paste called 'kwilikwili', accra beans from beans, soya beans meat, mixed fried corn and groundnuts, and pastry from corn and groundnuts commonly called 'adakwa' among other. In all, 13 farmers were engaged in these activities. Horticulture and local brewery registered 8 farmers each. Abundant manure production encouraged the growing of flowers which are sold in neighboring towns like Douala (the largest market in Cameroon), limbe and Buea. Most of these flower sold in the local markets are used for decoration during functions like weddings, funerals and in homes. These flowers are bee loving plants that have also contributed to bee farming. The production of honey has also boosted the horticulture sector, given that before OA no farmer was involved in horticulture but after the practice of OA practice 8 farmers started planting flowers. Local brewery which depends almost extensively on corn harvested from the farms saw an increase by 1, thus, before OA corn planted was for home consumption and the brewing of local drink called 'Shah'. Meanwhile, before the practice of OA no farmer was engaged in the training of waste recovery, recycling projects, and micro

finance. The waste management project designed to improve agriculture led to capacity building and livelihood strategies as some of the farmers were empowered to train others to improve on agricultural practices and ultimately food security. Similarly, the emergence of micro credit workers resulted from an increase in income from the proceeds from OA (though the opening of a Saving Scheme); this is because these farmers 'engaged in daily, and weekly contributions and savings. These savings guaranteed access to credit for any farmer who is a member in the saving scheme. Thus, OA, increased farmers' financial potentials and improved farmers' standard of living through livelihood strategies like: bee farming, horticulture, trainers of waste recycling/recovery and micro credit workers all of which did not exist before the practice of OA.

The result in Table 4 revealed that there is a significant difference in farm produce after the introduction of organic agriculture ( $t = -4.37, P < 0.05$ ).

## CONCLUSION

Organic Agriculture is one of the fastest and most promising food production strategies as it provides quantity and quality food without adversely affecting man's health and the environment. The sources of wastes identified and ranked in weight where pigs > biodegradable from households > poultry > goats > farm residue/ straw .wood ash > leaves from farms > remains from animal residues. There is a significant difference in farm produce after the introduction of organic agriculture ( $t = -4.37, P < 0.05$ ), with major increase in the production

of HVV ranging from 46 to 76 baskets /bags. There was also a moderate increase in staple food crops (baskets/bags) like: yams, groundnuts, soya bean, pumpkin and sweet potatoes, assorted spices increased by 4 baskets. Two main staple food crops had contrasting increase in output; beans had an increase of 75 bags while corn increased by 1 bag. This led to the introduction of livelihood options like: bee farming, horticulture, micro finance workers which never existed before the introduction of OA; while other diversified activities like provision stores, local brewery that existed also increased. Generally, this farming type generates significant secondary impacts on the rural economy as it contributes to the local economies through net income and revenue, employment, easy repairs and maintenance of community-based projects and services which used to be delayed because of reliance on Municipal Authorities. However, in most developing countries, the non-existence of official statistics makes certification difficult thus, mitigating global assessment. Challenges like property rights in land distribution/acquisition (land tenure), and access to agricultural extension workers/trainers, if properly addressed, would encourage these farmers to invest and boost farmers' production capacities in Organic Agriculture.

## ACKNOWLEDGEMENTS

The authors acknowledge the assistance of Dr. Awantang F. CEO of Eco-farms, Mr Mokenge T. the initiator of Likove farms who facilitated access to the farm and the farmers who assisted in data collection and logistics. I equally thank Dr. Anyingang R. for analyzing the data, Mr. Chia J. for editing the work, Mr. Itoe E. for type setting.

## REFERENCES

- Chan KY, Dorahy C, Wells T (2008).** Use of Garden organic Compost in Vegetable Production under Contrasting Soils Status. *Austr. J. Agric. Res.* 59(4):374-382.
- El-Haggar SM, Ghribi M, Longo G (2001).** Agricultural waste as an Energy Source in Developing Countries: A case study in Egypt on utilization of agricultural waste through complexes. The American university in Cairo, Cairo-Egypt International Center for Science and High Technology, Trieste Italy pp. 1-10.
- Field notes on Organic Farming (1994).** Njonge, Kenya Institute of Organic Farmers.
- Foncha JN, Asongwe GA (2018).** Improving Agricultural Productivity and Energy Efficiency on Marginal Lands: The Agricultural Waste Recycling Approach in the Ndop Ecofarms; North West Region, Cameroon. *J. Adv. Biol. Biotechnol.* 20(2):1-8.
- Foncha JN, Asongwe GA, Che EF (2019).** Using Indigenous Knowledge in Agro-Forestry Practices: A Strategy for Livelihood Sustainability, in the Mount Oku Region of Cameroon. *J. Int. J. Food Sci. Agric.* 3(4):299-307.
- Guidelines for Farmers (1997).** Africa 2000 Network, United nations Development Program (UNDP) Kampala, Uganda.
- HDRA: The Organic Organization (2008).** What is Organic Farming? HDRA publishing – Ryton Organic Gardens, pp. 2-21.
- International Federation of Organic Agriculture Movement (IFOAM) (2006).** "The World of Organic Agriculture: more than 31 Million Hectares Worldwide". [http://www.ifoam.org/press/press/statistics\\_2006.html](http://www.ifoam.org/press/press/statistics_2006.html).
- International Food Policy Research Institute (IFPRI) (2002).** Green Revolution: Curse or Blessing? <Http://www.ifpri.org/pubs/ib/ib11.pdf>. May 2002.
- International Fund for Agricultural Development (2005).** Organic Agriculture and poverty reduction in Asia: China and India Focus, Rome IFAD.
- Mostafa M, El-Haggar SM, El-Mawla G (1999).** Matching of an Anaerobic Animal Waste digester with a Dual-Fuel Generator Unit. *Int. J. Environ. Pollut.* 12(1):97-103.
- Sharma AR, Mitra BN (1990).** Complementary effects of Organic Material in Rice-Wheat Crop Sequence. *The Indian J. Agric. Sci.* 60(3):163-168.
- Stockdale EA, Lampkin NH, Hove E (2001).** Agronomic and Environmental Implications of Organic farming Systems. *Adv. Agron.* 70:261-327.
- Subba RNS (1999).** Organic Matter Decomposition. In *Soil Microbiology*. Oxford and IBH publishing. New Delhi, India. pp. 255-270.
- Surehka K (2007).** Nitrogen Release Pattern from Organic Sources of Different C: N ratio and Lignin Content, and their Contribution to Irrigated rice, (*Oryza Savita*). *Indian J. Agron.* 52(3):220-224.
- The Food and Agriculture Organization of the United Nations (2007).** Waste management Opportunities for Rural Communities. Composting as an effective waste management Strategy for farm, households and others. Agricultural and Food Engineering Working Document, No. 6, Rome-Italy.
- United State Department of Agriculture (2015).** National Organic Farming Handbook, pp. 3-30, Washington D.C.
- United States Department of Agriculture (2016).** Introduction to Organic Practices. The national Organic Program/Agricultural Marketing service, Washington D.C pp. 1-2.
- Yadav SK, Subhash B, Yadav MK, Singh K, Yadav GS, Suresh P (2013).** A Review of Organic Farming for Sustainable Agriculture in Northern India. *Int. J. Agron.* Article ID, 718143:8-16.
- Zheng AL, Karam DS, Zawawi RM, Rajoo KS (2016).** Conventional vs. Organic farming, Poster. University Putra Malaysia.