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Research Article

Vegetable Production Systems of Swamp Zone in Urban Environment in West Cameroon: Case of Dschang City

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Abstract:

The purpose of this study was to characterize the vegetable production system for swamps zone in urban area. Investigations were made in 18 zones in Dschang city, for 295 producers. It revealed that, producers are in majority men (56%), youth (22%), married (80.8%), and are teenagers (52.9%). Almost all use pesticides, organic and mineral fertilizers. Untreated polluted river waters constitute the principal source for watering the vegetables. The most produced vegetables are: huckle berry, tomatoes, celery, green pepper, basil, parsley, african aubergine, cabbage, lettuce, green-beans, leeks and carrot. They have an income ranging from 30,000 FCFA (60 \$US) to more than 500,000 FCFA per cropping cycle. The gross margin per hectare varies between 2,600,000 FCFA and 6,500,000 FCFA, depending on the type of crop. The vegetable production in swamps in Dschang is a considerable source of income for many families. However new farms are created by destruction of the raffia palms and trees, thereby increasing the farms with time. Also, access to farm land, high prices of the inputs (fertilizers, pesticides, and seeds), fluctuation of vegetables prices in the market, and the bad quality of water for watering constituted the principal constraints to the activity.

Keywords: Vegetable production system; urban agriculture; swamp zone; activity for unemployed; central Africa middle size cities.

1.0 Introduction:

Dschang is the head quarter of Menoua Division, created in 1903; it was only an extended village. There after Dschang became the provincial capital of the Bamiléké region. It then witnessed a rapid population growth and, passed from its village statute to that of town. In 1965, the provincial capital of the Bamiléké region was transferred to Bafoussam, and the growth of this town slowed until the creation of a complete university options in 1993. The town then had a rapid demography and the population passed from 49,147 inhabitants in 1992, to 109,576 in 2006 (INS, 2007). This rapid demography was accompanied by the problems of unemployment, pushed most of the inhabitants took up vegetable cultivation in the swamps to satisfy or up mend their daily needs. In fact, vegetables are species with rapid growths, are able to generate revenue that is more than civil servants' minimum monthly salary on small area within a short period compared to the

other crops (Gockowski *et al.*, 2003). Also, the vegetables have a high nutritive value (Bailey, 2003), and the urban populations due to new ways of life and cultural practices, introduce more vegetables into their food.

In Dschang, the demand for vegetables is high and causing scarcity in the market. The cultivated swamps are increasing in size at the same rate as the urban perimeter increases. In fact, the urban perimeter passed from 537 hectares in 1984 to 1,300 hectares in 2006 (INS, 2007). This significant increase in the vegetable production is not only to satisfy the demand or consumption, but it has also solved the problem of unemployment and underemployment. Unfortunately, no study on the vegetable system in Dschang is available, whereas the production in swamps covers a considerable area in Dschang town (Fomecha, 2004), and supplies several markets in the Cameroon (Ntangmo Tsafack *et al.*, 2009). Also, the urban

market gardening is recognized today like as a major stake in terms of provisioning of the cities and employment for many families which generally live under conditions of poverty or extreme poverty (Lynch *et al.*, 2001). The objective of this study was to portray the importance of urban vegetable gardening, and the constraints related to this activity in Dschang.

2.0 Materials and Methods:

2.1 Location of the Study Area:

Located in the West Region of Cameroon, Dschang city is the head quarter of the Dschang Subdivision which covers Foto and Foréké-Dschang villages and also the capital of the Menoua Division. Geographically, Dschang is located between latitudes 5°10' and 5°38' north and between longitudes 9°50' and 10°20' east and has a mean altitude of 1,400 m above sea level. This town is located on the South–Western slope of Mount Bambouto, and dominated by low plateaus, highly dissected by small valleys which are sometimes marshy. The climate is characterized by one dry season that goes from mid-November to mid-March and a rainy season going from mid-March to mid-November. Figure a presents the location of the Dschang municipality.

2.2 Data-gathering:

To have an idea of market gardening in Dschang, in order to prepare the investigations, series of trips in the study area were carried out. After this preliminary phase, a questionnaire was elaborated and applied to 18 zones in the urban area (Fialah-Foréké, Haoussa, Fiancop1, Fiancop2, Canne à sucre, Nylon, Minghong, Keleng, Vallée, Quartier Administratif, Ngui, Madagascar, Mingmeto, Tsenfem, Tchoualé, Tapalé, Tsinkop, Fiala-Foto). The target population of our study consisted of the gardeners who have truck farms in swamps (much snuffed medium). No data was available on the number of producers who were exploiting swamps in Dschang town, but 295 market-gardeners were questioned (at home and on farm) randomly in the 18 chosen zones. The questionnaire comprised four shutters. The first made it possible to identify the gardeners; the second was devoted to the cultivation methods, the third for the economic aspects and the fourth for the constraints. The production cost and gross production were obtained from farmers before converting by land unit (ha). The gross margin was calculate by reducing the production cost to the gross production per ha.

2.3 Data Analyses:

After the investigations and the control of the data obtained, the data were analyzed by the descriptive statistics and the software Excel and SPSS version 12.0 were used.

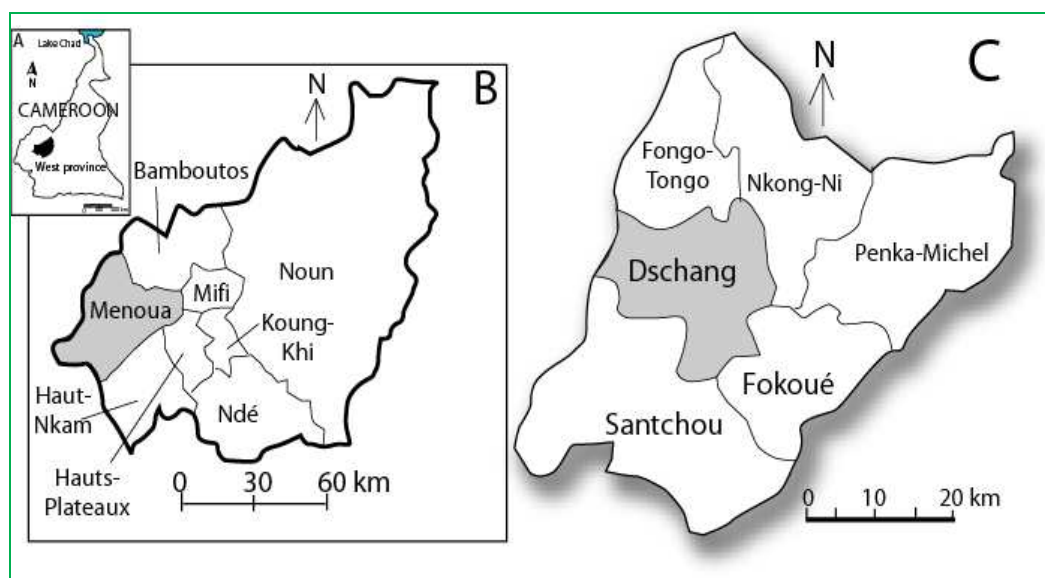


Figure a: Location of the Dschang town in the Menoua Division (C), West Region (B), in Cameroun (A).

3.0 Results and Discussion:

3.1 Principal Zones of Market Gardening of Dschang Town:

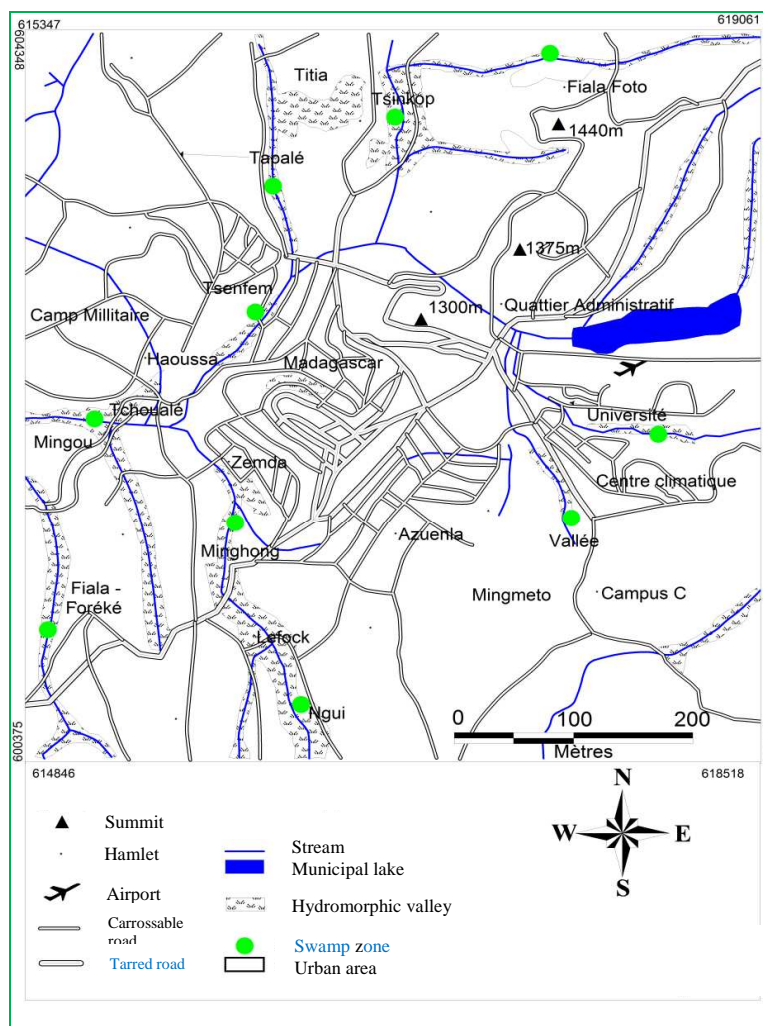


Figure b: Zone of market gardening in Dschang town

In the Dschang, 10 principal zones of market gardening were identified: Tsenfem, Tchoualé, Tapalé, Tsinkop, Minghong, Ngui, Valley, Administrative, Fiala-Foréké and Fiala-Foto. As the figure b shows that, the farms are located in the hydromorphic valleys, along the river crossing the town.

3.2 Characteristics of Market-gardeners:

The results show the heterogeneity of the producers in their socio-characteristics. Those interviewed all belong to the active age groups ranging between 15 to 65 years (figure c) and 90.4% of the sampled population was located between 15 and 50 years. The highest percentage was the age group of 31-40 years which were mostly men (56%). In the urban centre we observed the predominance of women (56.85%)

and towards to the periphery of the urban area, men predominated (81.6%).

The educational level of the gardeners was relatively low, with 42% primary education; 56% secondary education (with the “BEPC” certificate holders being the highest) and only 2% with higher education. A majority of the gardeners are married (80.8 %), and have an average of 8 persons per household (of which, 53.8 % had 5 and 8, 35.6 % 1 and 4 and 9.6 % 9 and 12, per household respectively). The vegetable production in Dschang is carried out mainly by gardeners who do not have a salary or regular employment. The majority (71.2 %) of the interviewed gardeners had as principal source of income market gardening; 28.8% take vegetable production like an auxiliary activity, of which 12.5 % are employees and 15.4 % are traders. This activity is more than 20 years old

in Dschang and the farmers began this activity very young and their duration vary; 47.1 % have carried out the activity for 5-10 years, 44.2 % for 10-20 years, 5.8 % for 1-5 years and 1.9 % for more than 20 years. The activity is for subsistence 57.7 %, 34.6 % due to unemployment, 3% for pleasure; and 4.8% declared that they did not choose to be farmer but inherited the farms from their parents and had to continue with the farming.

3.3 Farming Systems:

The farming systems are identical in all farms. As regards the system of ploughing, 88.5% make ridges, 1.9 % no ridges and 8.7 % make both. They found that with the ridges, management (weeding, watering, treatment....) of the farms is easily done without damaging the crops. The size of the ridges

varies according to the farmer and in order to make maximum use of the cultivated area and to maximize the profit, on the same ridge they generally plant several types of vegetables and sometimes intercropping with corn and taro. Crops with short cycles, like green spices and the huckle berry, are produced several times in the swamps (November to May). For the crops with longer cycles like tomato and green pepper, the first harvest is done in February and the next goes from February to May. From June, most farms are flooded. Production is dominated respectively as show the figure c by the huckle berry, tomatoes, celery, green pepper, basil, parsley, African aubergine, cabbage, lettuce, green beans. Production of most of these vegetables in Dschang the last years is on the increase (table 1).

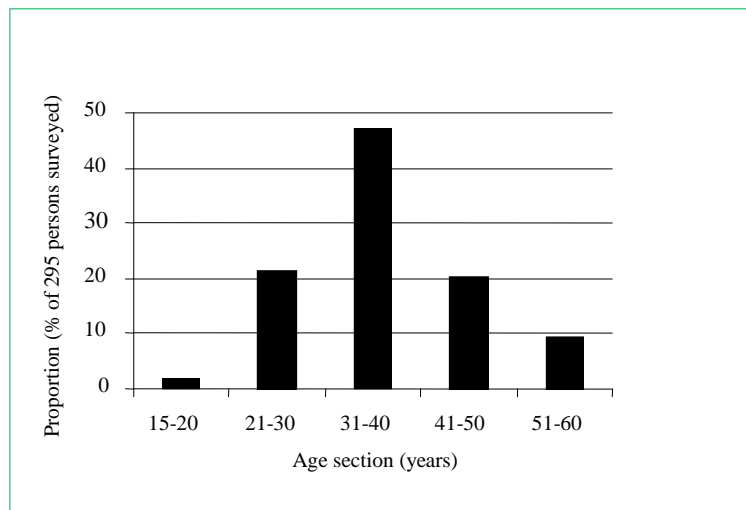


Figure c: Proportion of the producers according to age

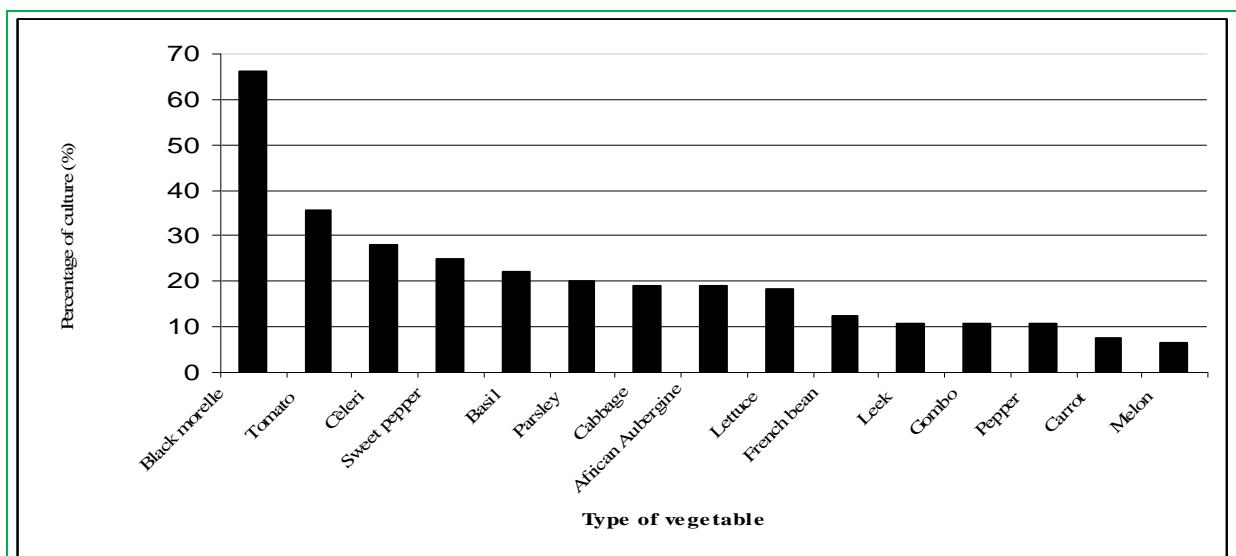


Figure d: Frequency of culture of vegetables in swamp zone in Dschang city

Huckle berry is the most cultivated vegetable. This plant develops quickly and its harvest can extend for more than six months. It is easy to maintained, eaten by the farmers and the urban population, consequently has good commercial value. Tomatoes, despite its high demand, occupy the second position and also appreciated by the producers for its commercial value. When the demand is high, the price of a 20 liters basket goes up to 13,000 FCFA. The African aubergine occupies the seventh position and is cultivated generally in associated with other crops. Its demand is low but appreciated by the farmers because its production can extend for more than one year. In the rain season, when the farms are abandoned, harvest continues, although the fruits are drowned in mud or polluted water. This is an advantage to the market-gardener, but the consumers run the risks of contamination due to the flooded polluted waters. With modernism, the populations spice their meals more and more, and the tomatoes as well as condiments (green spices) do not trail any more in the market.

Table1: Production of some vegetables (in tons) in dries season in the city of Dschang during 2008-2010 period

Vegetable	2008	2009	2010
Tomatoes	7650	4200	1950
Huckle berry	42.50	52.30	135
Cabbages	50	32	55
Pepper	30	31.20	55
Okra	18.20	21	23.20
Green pepper	2.80	3.75	7.50
Carrot	2.87	7.50	15
Onion	3.75	5.10	9
Leek	0.35	0.40	1.13

Source: Divisional delegation of the Agriculture and the Rural Development of Menoua

Fertilizer constitutes one of the principal factors of production. In the studied zones, the gardeners use the poultry manure (96.2%), household manure (40.4%), piggery manure (45.2%), compost (6.7%) and mineral fertilizers (96.2%), (especially the NPK 20-10-10 and the urea). The compost is manure less used and is not really known by the producers, with 86.8 % of the interviewed farmers showing some enthusiasm to learn how to make compost. From the interviewed farmers, 85.2 % are willing to buy compost if produced in a specialized site. Like fertilizers, pesticides are used by these farmers without training. From the interviewed farmers, 87.5% use insecticides, followed by fungicides (81.7%) and finally the

herbicides (41.1%). As regards the treatment techniques, 48.1% use knapsack sprayer, 35.6% watering buckets or container (locally made) and 1.9% watering-cans. The applications of treatment is done uniquely by the adults (54%), or by the children (8%) or both (31%).

3.4 Source of Water:

Untreated river water, is the main sources of water (90%) while 10% of the farmers use water from wells dug in their farms. Watering by sprinkling is the main mode of watering (93.3%) and the polluted water is directly in contact with the vegetables of which some are eaten raw, and is very dangerous to farmers who handle without any precautions, and to the vegetable consumers after at harvest. In fact, these rivers are polluted by sewage from latrines and septic tanks, and receive all sort of wastewater from the urban center. The gardeners do not have any idea on the quality and the risks of using this polluted water. The vegetable producers of Dschang are even abandoned by the technical services concerned and do not have any formation on the risks they incur. They have acquired farming experiences from their parents, input retailers and the neighbors. Delicate farm inputs like the pesticides, fertilizers and as well as the polluted water are used without protection equipment, like empty packages and plastics are thrown all over in disorder.

3.5 Economic Aspect:

Crops are either sold in the market or in the farms. The prices are not fixed in advance, and vary according to the demand, especially by whole sellers who buy from the farms to resell to retailers in Dschang, Douala and Yaoundé. Sometimes the market-gardeners carry their products to the markets in Douala and Yaoundé or are in permanent contact with the market-retailers in other markets. At times when there is a significant difference in prices between the markets in Dschang and other markets, the farmers carry their products there themselves. So if these products are not of good sanitary quality, the danger is not only for the population of Dschang, but also for the populations of Yaoundé and Douala.

Table 2 presents the trends of the prices in FCFA of vegetables per kg during the year 2010. The highest prices are observed in dry season and it is perhaps what justifies market-gardeners in the swamps. The market-gardeners generally do not have a keep farm records and spend money

according to family needs. It is estimated that, 30% of their profit is spend for production which generally is for at most four months. Among them, 50% have an income ranging between 30,000 and 200,000 FCFA, 25% between 201,000 and 500,000 FCFA and 25% more than 1,000,000 FCFA per cycle of culture. The gross margin per hectare varies between 2,600,000 FCFA/ha and 6,500,000

FCFA/ha (Table 3). In Dschang, the most produced vegetable are not those having the lowest production costs. Also, the vegetables having the highest gross margins are not generally those having the low production costs. Tomato for example is the most produced vegetable but having the highest gross margin and production cost.

Table 2: Trends of the prices (FCFA) of vegetables per kg during the year 2010.

	January	Febr.	March	April	May	June	July	Aug.	Sept.	Octo.	Nove.	Dece.
Tomato	250	250	310	650	345	300	650	350	350	375	350	700
Fresh pepper	1500	1500	1500	1500	1000	1000	1200	1500	1500	1500	1100	1500
Onion	600	600	600	600	700	700	700	900	1000	1500	1500	1000
Carrot	500	550	500	500	400	400	400	500	500	400	400	400
Akra	600	700	600	600	700	700	700	700	700	600	600	600
Huchle berry	200	250	200	200	200	100	100	150	150	150	150	150
Green pepper	450	500	600	600	500	600	700	700	700	500	500	700
Cabbage	250	300	125	200	200	175	150	150	150	100	100	100

Source: Divisional delegation of the Agriculture and the Rural Development of Menoua

Table 3: Gross margins due to the market gardening (from field survey)

Speculations	Production cost (FCFA/ha)	Gross production (FCFA/ha)	Gross margin (FCFA/ha)
Cabbages	1,223,500	4,621,500	3,400,000
Lettuce	1,027,500	4,690,000	3,662,500
African aubergine	858,000	5,181,000	4,223,000
Carrot	1,225,000	3,878,000	2,653,000
Huckle berry	978,000	5,662,500	4,319,500
Sweet pepper	1,840,000	5,205,000	3,365,000
Tomato	4,211,500	7,605,000	6,531,000
Celery	635,000	3,890,000	3,265,000
Parsley	769,500	4,536,000	3,766,500
Green bean	550,000	3,450,000	2,900,000
Leek	452,400	4,347,200	3,627,000
Basil	650,000	4,100,000	3,450,000

3.6 Constraints Related to the Activity:

Market gardeners in Dschang face many constraints such as the health, land, climatic, market and agricultural inputs constraints. Agricultural inputs present in general spectacular rise of prices and constitutes the principal problems of market-gardeners in Dschang. The prices of mineral fertilizers for example went up from 2,500 FCFA/bag of 50kg in 1984 to 13,000 FCFA in 2006, 15,000 FCFA in 2007 and 25,000 FCFA in 2008 and, seeds and pesticides followed the same trends. The price of the latter also had a gradual increase; it went up from 450 FCFA/sachet of 3 grams in 1999 to 600 FCFA in 2009. In 2009, fertilizers prices dropped, but the price of the bag remains high (18,000FCFA). Contrary to fertilizers, the prices of phytosanitary products did not

witness of significant drop in prices. The prices of the products fluctuate and depend on the demand and to solve this problem, they generally practice the mixed cropping. According to these producers, when one has several products, the fall in price of some products can be compensated by others, and on the other hand it results sometimes in the additional incomes which make it possible to cover certain production expenditures.

The availability of the farm land constitutes also one of the principal constraints related to market gardening in general. The size of the farms of 53% of the surveyed population is lower than 500 m². The market-gardeners either are farm land owners (29.9 %), renters (52.9 %), or have obtained their farm lands following any form of arrangements

(17.2 %). The numbers of market-gardener increases with time and swamps are very appreciated for off season cropping. The demand of swamps is very high, resulting to high prices of renting swamps as compared to farms located on hills and the cost of hiring of a piece of land varies according to the owner. It varies between 35,000 FCFA and 220,000 FCFA/ha/year. In response to the high demand for land, new farms are created by the destruction of raffia and trees in swamps and this is mostly observed in Fiala-Foto zones. The most important health risks are actually ignored by producers. They handle dangerous chemicals and polluted water, which are applied on the crops without any precautions.

The poultry manure, household manure and the piggery manure are the most used organic fertilizers. However these organic fertilizers may harbour pathogenic micro-organisms which may contaminate the vegetables and water, therefore putting the lives of the gardeners, market agents and consumers at risk, since they manipulate the contaminated inputs and outputs. These micro-organisms may contaminate the aerial parts of the crops by water splashes, since watering is done by sprinkling. A majority of the gardeners (80.8%) do not protect themselves during the manipulation of these contaminated products. From the 19% who claim to protect themselves during the handling of these fertilizers, none had all the necessary protection materials. They have either the boots, or the gloves, or the mask but not all. Most of them generally wear trousers and long sleeves shirts. They declared that, the wearing of these cloths was to protect themselves from the cold climate, not against dangerous products they manipulate and when the weather becomes hot, they get rid of these clothing. These farmers do not have any idea of the dangers incur from these contaminate products and said, "Handling without protection is an old practice which has been going on from generation to generation without any problem". However these market-gardeners suffer from several diseases. The paludism occupies the greatest proportion (96%), stomach trouble (68.3%), rheumatism (29.8%), typhoid fever (22.1%) and dermatoses are the least with 9.6%. Considerable, market-gardeners do not have the habit of going to the hospital for consultation, consequently it was difficult to know the origins of the diseases affecting them or to know whether the disease mostly occur at the periods of swamps exploitation. They treat the "symptoms" with herbs which they prepare, or with drugs that they buy from road sides.

3.7 Urban Vegetable Production: Activity Courted By Young and Nonemployee in Dschang:

The results of our investigations show that as a whole the market gardening in Dschang is an activity which is in full expansion and practiced by educated youths. This is carried out by young dynamic farmers who are jobless or those who have not found better jobs elsewhere. These youths tend more and more towards urban area to do vegetable gardening, whereas the older ones remain in their villages. Also, market gardening in urban zones is an activity which is done mostly in dry season and needs much energy especially for watering and this energy factor screens out older people (≥ 50 years of age) from carrying out this job. A majority of the market gardeners think that, approaching the town, activity is more profitable. For them, in the town the climate is hot and the growth of the plants is fast, supply of inputs is easy and the sale of the products is done easily, while others, feel that in the town one is not closer to agricultural extension workers for advise and the lack of land obliges many to have farms in the villages.

With the expansion of the urban area we estimated that, more than 10 hectares of swamps was used for the market gardening in the urban zone of Dschang whereas in 2004, Fometcha estimated at 5 ha all the farm lands cultivated (urban agriculture) in the town of Dschang. In this town, the gardeners have been interested in the market gardening for more than 30 years. This period corresponds to the period of the optimal point of the economic crisis which began in 1980, whose consequences are still felt in by the urban population. Towards to urban periphery, men gardeners' domination was observed. In fact, at the periphery of the town as well as in rural areas, the agricultural activity is almost the only source of revenue and men must go into it for the survival of their family (education of the children, health, construction, funeral...). Also, the swamps are difficult to plow and require consequently a lot of physical effort which discourages many women; swamp soils being wet, and difficult for the women to work with the small children as they do in the mountains. Vegetable production is also an activity which requires much time (follow up) and money so, the men who generally head the family, put in more financial means. In the urban centre on the other hand, there was a predominance of the women rather than men. That is due to the fact that, men have other occupations like civil servant, traders, motor bike taxi, etc....).

3.8 Vegetable Production in Swamp Zone Generates High Incomes in Dschang:

Vegetable production in swamp zone in Dschang is an activity which makes it possible for a considerable portion of the population to satisfy their daily needs. Several studies have shown good contribution of urban agriculture in satisfying the food demands of the urban population (Cissé, 1997; Moustier, 1998; Yappi Affou, 1999; Moustier and David, 2001; Endamana *et al.*, 2003; Nchoutnji *et al.*, 2009). In spite of the multiple constraints related to the activity, the market gardening in Dschang is a beneficial activity. The incomes generated by this activity are ranging between 30,000 and more than 1,000,000 FCFA per cycle of culture (4 months maximum). The minimum guarantee salary in Cameroon is around 24,000 FCFA per month. The gross margin per hectare, between 2,600,000 FCFA and 6,500,000 FCFA for cultures with short cycle, is superior to that obtained from the market-gardeners of several African cities. Indeed, in Garoua and Ngaoundéré (Northern CAMEROON) for example, the gross margins are between 1,632,500 FCFA/ha and 3,270,835 FCFA/ha (Nchoutnji *et al.*, 2009). In Ouagadougou (BURKINA FASO), market gardening produced a monthly income ranging from 22,500 and 50,000 FCFA; in MALI, it ranges from 2,500 to 88,121 FCFA; in Lomé (TOGO), this average monthly income is 185,000 FCFA in a country where the majority of population lives with less than one US\$ per day; this amount representing 3 times the poverty line, is not negligible (Zallé, 1999; Bagré *et al.*, 2002).

3.9 Urban Gardening: An Activity Confronted with Many Difficulties in Dschang:

The availability of the farm land, the fluctuation in prices of the products, the increase in the prices of agricultural inputs and the poor quality of watering water, are the main constraints to urban gardening in Dschang. In most developing countries, the majority of the farmers does not have the right of ownership on the wetlands, but rather have uncertain rights which expose them to the risks of expulsion (Barry, 2001; Cissé and Tanner, 2001). Urban agriculture in general is not integrated in town-planning in Cameroon, whereas for the United Nations Development Program (UNDP), the development of urban agriculture belongs to the policies of sustainable human development (Breuil, 2005). In Dschang, the average farm size is 500 m². The availability of land for urban gardening is an African problem. In Darès Salam, 10,000 farmers, exploit each an average area of

500 m² (Jacobi *et al.*, 2000); in Abidjan, the average farm size is 600 m² (Yappi Affou, 1999). In Dakar, the market-gardeners of "Niayes" exploit an area ranging between 1,000 m² and 1 ha (Mbaye and Moustier, 2000).

The market-gardeners have a preference for swamps not only for their fertility but also for the availability of water. The river water is the main source of water used for watering the crops. However the town does not have any collection or treatment system for the waste water and the river receive all the wastewater produced in the city (Temgoua, 2011). These zones are highly influenced by urban activities and, the riverside populations construct their latrines and directing the fecal material in the river. The rivers are also the sites of solid waste disposal. This habit is a call for concerns on its consequences (the health of farmers, market agents and of consumers) because this river water can content pathogenic micro-organisms and chemicals likely to cause serious of public health problems (Yappi Affou, 1999; Jacobi *et al.*, 2000; Bailey, 2003; Endamana *et al.*, 2003; Atkinson *et al.*, 2010; Ndiaye *et al.*, 2011). Although fertilizers constitute the main factor of production in the sampled zones, the high price of this input constitutes one of the principal constraints related to the activity. However the compost which can solve partly this problem is not known. According to Kessler (2004) and N'Diénor (2006), the market-gardeners in general are not very used to the "real" composts for many reasons which are inter related; the price, the time allocated for the manufacture, the distance separating the composting site and the fields.

4.0 Conclusion:

Urban gardening in swamp zone of Dschang city is an activity mostly carried out by educated youths. It is a new integrated option for the urban population in solving the difficulties of town live. Despite its numerous advantages, market gardening has considerable negative impacts on the population and its environment. These impacts are; pollution and its various factors which affects the public health. The polluted river water used for the watering the vegetables are without preliminary treatment. This river water which receives the entire urban waste (solid and liquid) is of a doubtful quality. The use of such water constitutes a danger to the farmers, market agents and the consumers. The pesticides and fertilizers, uses in urban swamp gardening are poorly applied. Despite the constraints related to the acquisition

of farms land, the high cost of agricultural inputs, the fluctuation of the prices of the vegetables in the markets and the poor quality of the watering water, market gardening in Dschang creates employment for many youths and nonemployees. Jobless and under employed youths are employed on well established farms, as farm laborers. Although this activity is not practiced for the whole year due to the floods, it has an impact on the supply of Dschang with cheap vegetable. The authorities concerned should recognize, tolerate, manage and promote this activity.

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