Plant
2023; 11(1): 27-32
http://www.sciencepublishinggroup.com/j/plant
doi: 10.11648/j.plant.20231101.14
ISSN: 2331-0669 (Print); ISSN: 2331-0677 (Online)

Leaf Vegetable Cultivation in Cameroon: An Overview of the Situation in Njombe and Surrounding Areas

Enome Akame Guy[1, 2, *], Emade Ngoudjede Raissa[1, 2], Kwa Moise[1, 3]

[1]Multipurpose Station of Njombe, Institute of Agricultural Research for Development, Njombe, Cameroon

[2]Faculty of Sciences Department of Biochemistry, University of Douala, Douala, Cameroon

[3]Research Unit on Production Systems, African Centre for Banana and Plantain Research, Bonanjo, Cameroon

Email address:

enomeguy@gmail.com (Enome Akame Guy), raissaemade@gmail.com (Emade Ngoudjede Raissa), moisedekwa@gmail.com (Kwa Moise)

[*]Corresponding author

To cite this article:

Enome Akame Guy, Emade Ngoudjede Raissa, Kwa Moise. Leaf Vegetable Cultivation in Cameroon: An Overview of the Situation in Njombe and Surrounding Areas. *Plant*. Vol. 11, No. 1, 2023, pp. 27-32. doi: 10.11648/j.plant.20231101.14

Received: February 9, 2023; **Accepted**: March 13, 2023; **Published**: March 28, 2023

Abstract: Over the past ten years, it has been noted that the demand for leafy vegetables in the coastal area of Cameroon is increasing, particularly in the district of Njombe-Penja. Despite this growth in production volumes, there are also more or less severe shortages at certain times of the year. The main causes behind the variations in vegetable production in the Littoral zone are not well known and/or not recorded. In order to sort out the different factors (vegetable varieties, planting period, use of fertilisers and pesticides, soil, etc.) that interact on the production of leafy vegetables in the Littoral zone, it became necessary to conduct a study reviewing the state of leafy vegetable production and marketing activities in the locality of Njombé and its surroundings. This study also aims to better identify the main distribution chains and their vitality related to the markets supplied by vegetable production in the Njombe area. The methodological approach involved random sampling to constitute a population of 100 individuals (farmers, traders, etc.). A survey questionnaire was developed and administered to the target sample. The main results show that 96% of the individuals practising vegetable cropping are uneducated women, aged between 20 and 64 years. The individual areas cultivated are mostly very small to medium (between 64m^2 and 870 m^2). The vast majority of the cultivated land is rented (80%). The most cultivated leafy vegetable varieties are, in order of importance: “Black nightshade” (100%), “African Eggplant” (84%), “green amaranth” (80%), “bush okra” (80%), “Hibiscus” (40%), and “Water leaf” (32%). The seeds used come mainly from local markets (60%). The use of fertilisers and pesticides (doses and application frequencies) is not mastered by the farmers. The major constraints to production are: the difficulty of obtaining good quality seeds (86%), fungal diseases (80%), and attacks by various pests. This study also highlighted the economic potential of this vegetable activity in the locality.

Keywords: Leafy Vegetables, Varieties, Production Systems

1. Introduction

Vegetables in general and especially leafy vegetables are important in the diet of Cameroonian populations; they contribute to food security through their composition and are also an important source of employment and income [1]. Leafy vegetables are rich in mineral elements such as phosphorus (601-9256mg/100g), calcium (430-3495mg/100g) for *Solanum scarbrum* [20]*;* Potassium (7887-12861mg/100g), Magnesium (727-1947mg/100g) for *Amaranthus hybridus* [2]. *Solanum scarbrum* is also an important source of protein, whose content varies from 25.63 to 72.64% in Cameroon [20]. *Amaranthus hybridus, Solanum scarbrum, Corchorus olitorius* are leafy vegetables that are good sources of carbohydrates (total and reducing sugars) [2]. In Cameroon, leafy vegetables play an economic role in the food security strategies of urban and peri-urban populations [3]. In the Littoral region of Cameroon, particularly in the Moungo department, leafy vegetables are regularly grown in different production systems. As a result, considerable quantities of vegetables are produced and sent mainly to the markets in the regional capital. In recent years,

women have become increasingly involved in the production of leafy vegetables. The scientific works recorded were mainly interested in the production, distribution and conservation of seeds [21, 23], as well as in the evaluation of the effect of the environment on the nutritional quality of vegetable leaves [22]. However, few studies have been done on consumption and flows to regional markets. Also, the technical itineraries used are generally not supervised, which raises serious problems regarding the quality of the vegetables produced (health status, presence/absence of pesticide residues, etc.). Moreover, little is known about the origin and quality of the seeds used in the locality. The same applies to the species of vegetables grown and the reasons for their choice. A real lack of knowledge that questions research on the bottlenecks of this vegetable production of capital importance for the household economy and national food security. In a general context of use of fertilisers and phytosanitary products, given the presence of industrial agricultural companies in the study area, a characterisation of vegetable production is urgently needed. It is therefore more than necessary to define the cropping systems practised, the technical itineraries developed and their relevance, as well as the potential risks associated with the consumption of vegetables produced in this highly agricultural area. Therefore, the objective of this study is to clearly define the contours of vegetable production in one of the most important production basins, located in Njombe-Penja, and to measure its impact on the environment.

2. Materiel and Methods

2.1. Study Area

The present work was carried out in Cameroon in the district of Njombe-Penja, Moungo Department, Littoral Region. Njombe-Penja is located approximately between 4°35 and 4°40 North longitude, and 9°39 and 9°41 East latitude. It is a locality in the coastal region with monomodal rainfall. It is a forested area characterised by variable rainfall between 1900 and 3200 mm/year. The landscape is dotted with hills, including volcanic cones and valleys. The soil consists partly of pozzolans, rock structures (from bombs and lapillis), but also in some places of advanced ferralitic soils, etc. The latter are generally clayey or rather sandy-clay along the coast. Cocoa, coffee, cassava, plantain, oil palm and maize, etc. are mainly cultivated [4].

2.2. Data Collection

A pre-established, tested and validated semi-structured questionnaire was administered to the targets (farmers and traders). The people to be surveyed were individuals growing leafy vegetables in the locality, regardless of age or gender. They were selected randomly in the field according to their availability. The study took place between March and June 2021 (4 months). The questionnaire was mainly about *the individual profile (age, gender, level of education and farming experience* (see Table 1)*, the profile of the land exploited* (areas, mode of acquisition of land and cropping system), *the technical itineraries used and the management of diseases*. The survey was carried out on a population of 100 individuals (Table 1). All questions relating to the farmers' profile were asked directly to them. Questions on varieties, their origins and production constraints were in some cases answered by direct observations of the variety species in the field. For others, the answers were obtained from discussions with the farm manager.

2.3. Data Analysis

The data collected was entered into Microsoft Excel, processed and analysed in descriptive statistics using SPSS software. Means and frequencies were calculated and used to construct distribution histograms for each of the production factors analysed.

3. Results

3.1. Respondent's Profile

Of the 100 people surveyed, 96% were women and 4% were men. The overall age range was between 22 and 64 years. More than half of the study population was at least 40 years old.

In terms of education, 64% of the sample have primary education, 28% have lower secondary education and 8% have upper secondary education. A large majority of women are engaged exclusively in subsistence farming (60%), while the others engage in parallel activities such as animal husbandry, small-scale trade and others (sewing, hairdressing, etc.); moreover, 96% of the people surveyed stated that they had inherited knowledge of leafy vegetable cultivation, hence their lack of agricultural training in vegetable cultivation. Only 12% of them belong to an agricultural association such as a GIC, COOP and other farmers' organisations (Table 1).

Table 1. *Characteristics of respondents.*

Variables	Modalities	Rate (%)
Gender	Man	4
	Women	96
Ages	20-25 years	8
	26-40 years	48
	> 40 years	44
School level	Primary school	64
	Secondary school (1st Cycle)	28
	Secondary school (2nd Cycle and more)	8
Nature of agricultural training	Without agricultural training	96
	With Agricultural training	4
Other activities	None	60
	Husbandry	8
	Small-scale trade	12
	Dressmaker	16
	hairdressing, etc.	4
Working group membership	None	84
	Agricultural association (GIC, COOP and other PO)	12
	Non Agricultural Association	4

3.2. Parcel Profile

In Njombe area, the surface of parcels dedicated to leafy vegetables varies between 64 and 870 m^2 with an average of 265.84 m^2. 80% of the exploited land is obtained by renting; the other 20% by inheritance or gifts.

Among the practitioners of leafy vegetables, 84% combine several varieties of leafy vegetables with other crops such as groundnuts, plantain, cassava, macabo; 4% practice pure cultivation of vegetables and 12% both (pure cultivation and combination). Figure 1 shows the diversity of leafy vegetable species found in the locality of Njombé-Penja; it shows 6 main leafy vegetable species in all sites, namely: "green amaranth or folong" (*Amaranthus hybridus*), "Black nightshade or zoom" (*Solanum americanum),* "bush okra or kéleng kéleng" (*Corchorus olitorius)*, "Hibiscus or foléré" (*Hibiscus sabdariffa*), leaf of "African Eggplant or nkéya" (*Solanum aethiopicum*) and "épinards or waterleaf" (*Talinum triangulare*). African nightshade is the leafy vegetable most cultivated by farmers (100%) and waterleaf concerns only 32% of farmers (Figure 1).

3.3. Technical Itinerary

The technical itineraries according to the respondents are almost the same and can be summarised in 4 phases: germination of seeds, transplanting of plants, field maintenance and harvesting of leaves.

Seed germination consists of planting the seeds widespread or in rows (about 15 cm between rows) on beds 80 to 120 cm wide and of variable length, prepared according to their needs (ploughing, burying of organic matter if possible and levelling). After two weeks, the seedlings are ready to be transplanted into the field. Transplanting in the field is done in bulk or in rows on previously prepared beds, respecting a density of about 45 plants/m^2, which means a spacing of 15 cm x 15 cm. Field monitoring consists of manual weeding, cover fertilisation and treatments with molluscicide or insecticide. Fertilisation takes place two weeks after transplanting, with an average of 3.2 g of fertiliser per plant. Phytosanitary treatment is carried out every two weeks with an average dose of 0.061g of pesticides per plant (Table 2). The leaves are harvested one month after transplanting and cut every two weeks. After each cut, maintenance operations such as manual weeding, cover fertilisation and phytosanitary treatments are applied.

Table 2. *Application of fertilizers and pesticides.*

Variables	Min Value	Max Value	Mean
Land area (m^2)	64	870	265.84
Density/m^2	45	45	45
Total density	2880	39150	11962.8
Amount of fertilizer (g)/pass	140	480000	24068.33
Dose per plant (g)	0	71.11	3.21
Quantity of pesticide (g)	0	6000	595.77
Dose per plant (g)	0	0.69	0.062

The seeds used for the nursery come from individual production (12%), local markets (60%) and structures in charge of seed production and extension such as IRAD and MINADER (28%). The constraints to obtaining seeds are high cost (56%), poor quality (32%) and low availability (12%). Table 3 shows that fertilisation and the use of plant protection products are essential: ammonium sulphate is the most widely used fertiliser (80%), while chicken droppings are the least used (12%). Pyriforce (Chlorpyriphos-ethyl) is used extensively for insecticide control (28%) and metaldehyde 50g/kg against molluscs (36%). It should also be noted that 56% of the producers monitored do not control the pesticides they use. The peak production season for leafy vegetables in Njombe is from March to October. Leaf harvesting starts 1 month after transplanting and continues every two weeks for 3 months. This process is repeated once until the end of the season. The vegetables harvested are generally destined for the local market (64%), the markets in the mainland (Douala) (28%) and for self-consumption (8%).

Table 3. *Seed origins, fertilisation and pesticide treatments.*

Variables	Modalities	Rate (%)
Origin of seeds	Personal production	12
	Local producers	60
	Both (personal and local)	28
Constraints on seed procurement	Low availability	12
	High cost	56
	Poor quality	32
Use of fertilizers	Ammonium sulphate	80
	Urea	68
	Chicken droppings	12
Use of pesticides	Pyriforce (insecticide)	28
	Cap fort (insecticide)	20
	Mamira (insecticide)	4
	Methylparafen (insecticide)	8
	Métaldéhyde 50/kg (molluscid)	36
	Other	56

3.4. Production Constraints

The most frequent constraints are parasitic attacks (Insect larvae) and pests (Caterpillars, snails and insects). The high pest pressure reported by the majority of respondents restricts vegetable production. The pests are 80% insects and 30% molluscs. Insects cause a lot of damage to vegetables, especially on the leaves. They include caterpillars, locusts, whiteflies, ants, termites, aphids, hoppers, cicadas, bugs, ladybirds and thrips. This pest pressure limits the number of harvests and lowers the quality of the vegetables, thus compromising yields and income. Important diseases frequently mentioned are: leaf wilt, leaf yellowing, black spots, rot and perforated leaves (Figure 2). To fight against diseases and pests, 72% of farmers use chemical control, 16% use cultural techniques, 4% use biological control, 8% use both chemical control and cultural techniques.

4. Discussion

The results of this study showed that the majority of the respondents were female and aged between 22 and 64 years. This is explained by the fact that in Cameroon, it is the woman who is responsible for selling leafy vegetables in the

markets. Income generated from the sale of field products contributes to household food security, access to family health care and allows women to achieve a degree of financial independence in the family budget [5, 6]. Knowledge of vegetable cultivation is passed on from ancestors who are trained on the job and experience is gained over time in practice. Surveys carried out in Njombe identified six of the most widely grown leafy vegetables. This diversity is lower than that found by Nchoutnji et al. [7] in the northern part of Cameroon. Of this diversity, African nightshade (*Solanum scarbum*) is the most cultivated leafy vegetable in rural and peri-urban areas, and the most requested in urban areas of Cameroon [6]. It occupies an important place thanks to its nutritional qualities which contribute to the well-being of the human organism; the daily consumption of quality vegetables in sufficient quantity would ensure good health and prevent various chronic diseases.

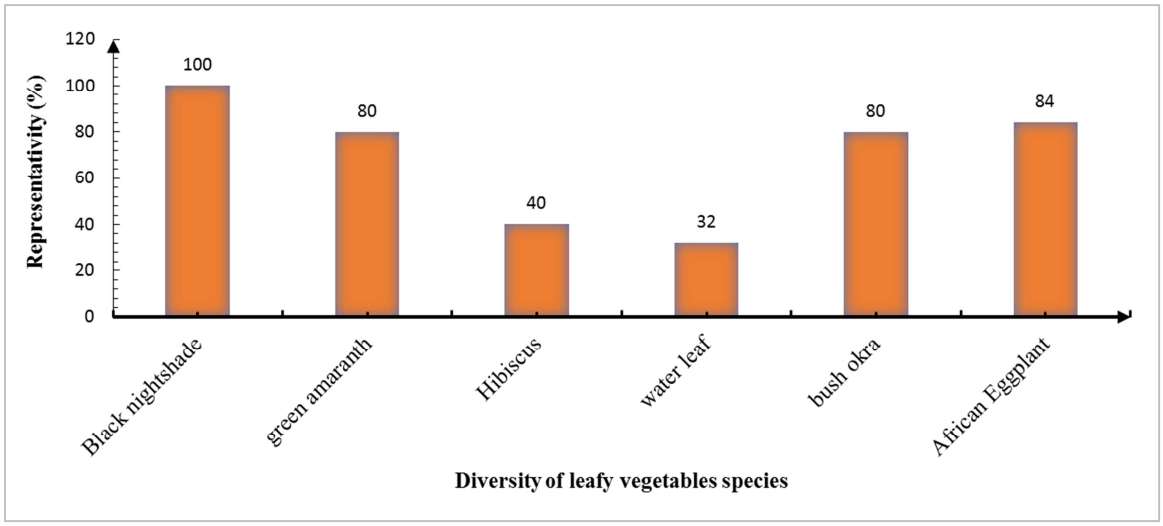

Figure 1. *Diversity of leafy vegetabels in Njombe.*

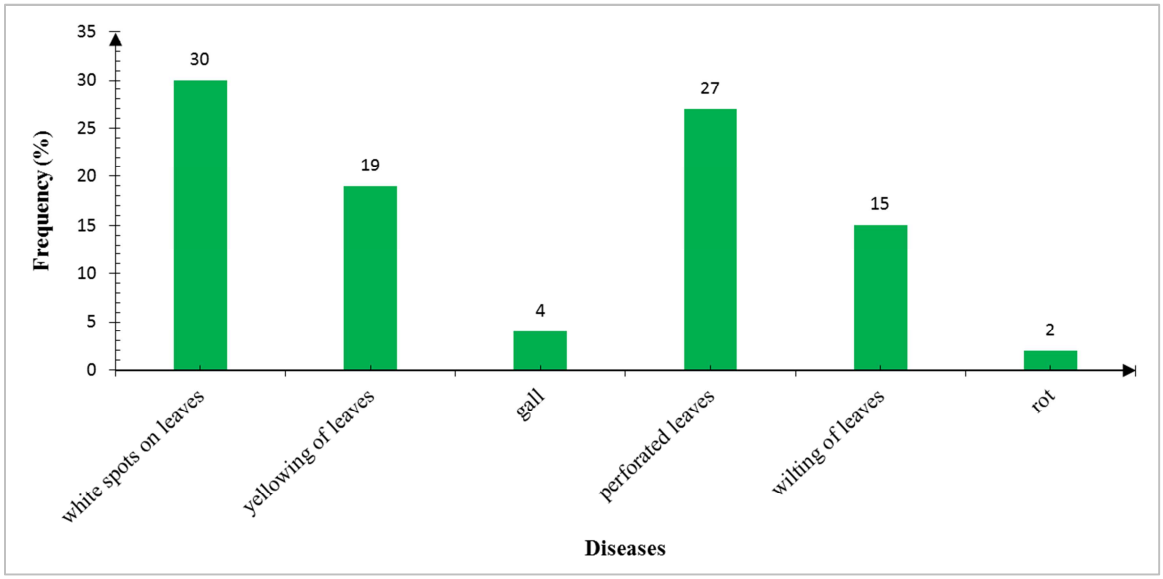

Figure 2. *Different types of Diseases of leafy vegetables in Njombe.*

Their richness in trace elements, vitamins and phytocompounds [8, 9]. It also provides interesting revenues to the actors [10]. According to the experience of *Asian Vegetable Research Development Center* (AVRDC), Production systems, seed selection and cultivation techniques are crucial for vegetable cultivation [11].

The technical itinerary for the production of leafy vegetables begins with the establishment and monitoring of a nursery; one month after planting in the nursery, seedlings of between 10 and 15 cm are taken and then transplanted onto previously prepared beds (clearing, ploughing and bed formation). After transplanting, the most important operations that follow are manual weeding, fertilisation and phytosanitary treatments (insecticide, fungicide, molluscicide). These operations have an impact on the production yield of leafy vegetables [20]. As indicated by *Asian Vegetable Research and Development Center* devenu *World Vegetable Centre »* (AVRDC) The application rate of

chemical fertilisers is 250kg/ha, corresponding to 25g/m^2; the average rate of fertilisers used by producers is 90g/m^2, this rate is three times (3.6 times) higher than the one recommended by this organisation. Over-fertilisation with nitrogen can lead to a high accumulation of nitrates in leaves, especially those used as spinach and lettuce [12, 13]. Some of the ingested nitrate can be converted into nitrite, which is responsible for respiratory disorders, especially in young children, resulting in methemoglobinemia [14]. Some studies have proven conclusively that nitrates combine with amines to form carcinogenic compounds called nitrosamines [15]. Phytosanitary problems are one of the constraints that limit the production of leafy vegetables in Njombe.

The stakeholders surveyed reported pest attacks (mites, caterpillars, nematodes) and diseases (rot) on leafy vegetables. Chemical control is the main method used by local producers. Pesticide use practices are most dangerous. Indeed, vegetable growers most often spray vegetables with a variety of insecticides and fungicides at inappropriate doses. These results are the same as those of [16] who worked on cultivation practices and levels of anti-nutritional elements (nitrates and pesticides) in *Solanum macrocarpum* in southern Benin. In addition, most producers do not observe any protective measures during phytosanitary treatments of crops. The excessive use of fertilisers and phytosanitary products by producers causes numerous problems, the most important of which are: contamination of crops by pesticide residues; pollution of the water table; and the perishability of produce, which leads to numerous post-harvest losses (rotting); as a result, the nutritional and sanitary quality of these vegetables is becoming worrying. The presence of pesticide residues on the leaves of vegetables can lead to food poisoning in the long run. Pesticide use practices are identical in the Njombe locality; these results have also been observed by other authors in some African countries [17-19].

5. Conclusion

This study enabled us to know and identify the different types of leafy vegetables grown in Cameroon, in this case *Amaranthus hybridus*, *Solanum americanum*, *Corchorus olitorius*, *Hibiscus sabdariffa*, *Solanum aethiopicum* and ***T****alinum triangulare* which are the main ones represented. It allowed us to understand the cultivation practices related to leafy vegetables in the locality of Njombe and surrounding area. The results show that women aged at least 40 are the main actors in this field of activity. The technical itineraries used have similarities, starting with the setting up of the nursery, transplanting to the field, through phytosanitary treatments and fertilisation, to harvesting. Furthermore, the use of fertilisers is not controlled, as they are often applied in inappropriate doses. Moreover, the use of fertilisers is not controlled, as they are often applied in inappropriate doses, and the application of phytosanitary products is hazardous, without any agronomic reference point. This reduces their effectiveness, as recurrent attacks by leaf pests and parasites have been observed despite preventive treatments, with the immediate consequence of reduced harvests and depreciation of vegetable quality. Therefore, an optimisation of the complete technical itinerary of leafy vegetable cultivation is recommended, as well as a reinforcement of the technical capacities of the actors of the leafy vegetable sector of Njombe-Penja and its surrounding areas, through training and recycling sessions.

Acknowledgements

The authors thank the Institute of Agricultural Research for Development (IRAD) Njombe-Cameroon for the facilities made available to us for the realization of this work.

References

[1] Adorgloh R. (2006). Guide pour le développement de l'entreprise de production et de commercialisation de légumes de qualité dans les régions urbaines et périurbaines du Sud Benin. Rapport de consultation, IITA Bénin, 86p.

[2] Ocho-anin Atchibri A L., Soro LC., Kouame C., Agbo E A., Kouadio K K A. (2012). Valeur nutritionnelle des légumes feuilles consommés en Côte d'Ivoire. Int. J. Biol. Chem. Sci., 6 (1): 128-135. DOI: http://dx.doi.org/10.4314/ijbcs.v6i1.12.

[3] Kahane R., Temple L., Brat P., Bon H D E. (2005). Les légumes feuilles des pays tropicaux: diversité, richesse économique et valeur santé dans un contexte très fragile. In Les légumes : un patrimoine à transmettre et à valoriser. Thème III : Utilisation et perception. P. 9.

[4] Delvaux B., Lassoudière A. (1984). Etude Agropédologique de la zone bananière Camerounaise. Enquête Diagnostic. IRA, Ekona, Cameroun, 240p.

[5] International Institute of Tropical Agriculture. (2003). Pass the leafy veggies please. In E. W. Sci. In Afr. Mag. Iss. n°. 31.

[6] Batchep R. (2009). Analyse des filières légumes feuilles (amarante, morelle, corète potagère) dans la ville de Yaoundé. Mémoire de fin d'études. FASA. Université de Dschang, 109 p.

[7] Nchoutnji I., Fofiri Nzossié EJ., Olina Bassala JP., Temple L., Kameni A. (2009). Systèmes maraîchers en milieux urbain et périurbain des zones soudanosahélienne et soudano-guinéenne du Cameroun : Cas de Garoua et Ngaoundéré. Tropicultura, 27 (2) 98-104.

[8] Konan Y., Mamidou W K., Kagoyire K. (2015). Contribution des Légumes Feuilles à la Nutrition des Populations en Zones Urbaines de la Côte D'ivoire. European Journal of Scientific Research. ISSN 1450-216X / 1450-202X Vol. 130 No 4 March, 2015, pp. 338-351 http://www.europeanjournalofscientificresearch.com

[9] Sanclemente T., Marques-Lopes I., Fajó-Pascual M., Cofán M, Jarauta E., Ros E., Puzo J., GarcíaOtín AL. (2011). Naturally-occurring phytosterols in the usual diet influence cholesterol metabolism in healthy subjects. Nutr Metab Cardiovasc Dis. 22 (10): 849-55.

[10] Gockowski J., Mbazo'o J., Mbah G., Moulende F T. (2003). African traditional leafy vegetables and the urban and peri-urban poor. Food Policy, 28 (3): 221-235. DOI: 10.1016/S0306-9192(03)00029-0.

[11] Tchientche KRKC., Atangana AR., Chagomoka TNR. (2013). Nutritional evaluation of five African indigenous vegetables. Journal of Horticultural Research, 2013.

[12] Dapoigny L., Fleury A., P Robin. (1997). Relation entre la vitesse relative de croissance et la teneur en azote dans la laitue (Lactuva sativa L.). Effets du rayonnement et de la température. Agronomie; 17: 35-41.

[13] Tittonell PA., De Grazia J., A Chiesa. (2003). Nitrate and dry matter concentration in a leafy lettuce (Lactuca sativa L.) cultivar as affected by fertilization and plant population. Agricultura Tropica; 36: 82-87.

[14] Mnzava NA. (1997). Comparing nutritional values of exotic and indigenous vegetables. In: African Indigenous Vegetables, IPGRI and NRI; 70-75.

[15] Tremblay N., Scharpf HC., Weier U., Laurence H., J Owen. (2001). Régie de l'azote chez les maraîchers. Guide pour une fertilisation raisonnée. In: Agriculture et Agroalimentaire, Canada.

[16] Assogba-Komlan F., Anihouvi P., Achigan E., Sikirou R., Boko A., Adje C., Vodouhè R., Assa A. (2007). Pratiques culturales et teneur en éléments anti nutritionnels (nitrates et pesticides) du *Solanum macrocarpum* au sud du Bénin. African Journal of Food Agriculture Nutrition and Development, 7 (4), 1–21.

[17] Cissé I., Badiane B., Ngom S., Diop Y M B., Séne M. (2008). Usage des pesticides et risques sanitaires sur la production horticole de la zone des Niayes au Sénégal,. *Rev. Sn. Res. Agric.,* Vol. 1 (3), 19–26.

[18] Ngom S., Cissé I., Traore S., Rousseau J., Anastasie M. (2009). Incidence des pesticides sur la qualité des ressources en eaux et des produits agricoles dans la zone des Niayes au Sénégal,. In 2ème Colloque francophone en environnement et santé, Université Badji Mokhtar de Annaba, Algérie.

[19] Diop A. (2013). Diagnostic des pratiques d'utilisation et quanti cation des pesticides dans la zone des Niayes de Dakar (Sénégal). In Thèse de doctorat Chimie analytique (p. 241).

[20] Emmanuelle Cadot., Valérie Borrell Estupin., Marine Rousseau., David Sebag. (2015). Impact environnemental de la diffusion de produits phytosanitaires par ruissellement. *Dynamiques environnementales*, 36 | 2015, 182-197.

[21] Maurice Njiandoh. M., Youmbi. E., Mala. WA., Manga. GA., Ngwa. FA., Medard. S., Badjel. B., Ngosong. C. (2019). Comparative evaluation of six different storage materials for long-term preservation of huckleberry (Solanum scabrum) seeds. International Journal of Sustainable Agricultural Research. ISSN(e): 2312-6477 ISSN(p): 2313-0393 Vol. 7, No. 1, pp. 30-38.

[22] Ngo Bogmis. MN., Ngwa, FA., Manga GA. (2018). Evaluation nutritionnelle de la morelle africaine au Cameroun. International Journal of Biological and Chemical Sciences. ISSN 1997-342X (Online), ISSN 1991-8631.

[23] Pousseu. L., Pegalepo. E., Kouamé. C., Bell. JM., Kamga. RT. (2014). Diagnosis of seeds supply of leafy vegetables in Yaoundé, Cameroon. African Journal of Food, Agriculture Nutrition and Development. Volume 14 No. 4.