

**EVALUATING POST HARVEST OPPORTUNITIES AND CONSTRAINTS  
TO UTILIZATION AND MARKETING OF  
AFRICAN LEAFY VEGETABLES IN CAMEROON**

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## ABSTRACT

A rapid production and market appraisal was undertaken to target important markets, commodities, producers and traders of vegetables (exotic and indigenous) in three regions of Cameroon. For each vegetable, post harvest losses were estimated and gross marketing margins were calculated and then used to estimate daily earnings. The main actors were women of between 17 and 50 years old with an average daily earning of less than 1 000 FCFA (US\$1 = 495 FCFA). The typical market woman sold 2.5 different products with a mean daily earning of 525 FCFA per product and a total daily earning of 893 FCFA. By groups, sellers of exotic vegetables, such as tomato and cabbage, earned significantly ( $p < 0.001$ ) more than those of indigenous vegetables. Although earnings from huckleberry were comparable with those from exotic vegetables, its production was still traditional, based on indigenous knowledge or on knowledge borrowed from other staple crops and used little or no external inputs. There were no commercial indigenous vegetable seed producers. The diffusion and effectiveness of the indigenous vegetable seed system depended largely on the quality of the variety to be diffused, kinship relationships, and the existence of a culture for agricultural experimentation. Post harvest systems for all vegetables were rudimentary leading to heavy losses (11% and higher) as most vegetables were sold fresh. No storage facilities were available but opportunities exist in drying vegetables using available low cost solar technology thereby offering a chance to increase the value of the seasonal surplus and earning extra income. Complex and stable trading networks existed for selling vegetables, especially for more commercial crops such as huckleberry. The study indicated that indigenous vegetables can be a viable source of income for rural women and can contribute to poverty alleviation, but post harvest procedures need to be established for the handling and marketing of leafy vegetables.

**Key words:** indigenous, vegetables, marketing, processing, women

## INTRODUCTION

Traditional societies have always exploited edible wild plants to provide an adequate level of nutrition [1, 2]. Studies on agro-pastoral societies in Africa indicate that these plant resources play a significant role in nutrition, food security and income generation [3].

The total number of species of subsistence crops forming the base of agricultural development and cultivation in developing countries is large [4] and the majority of this is vegetable, which plays an important role in African agricultural and nutritional systems. Other studies list several species of leafy as well as root and fruit vegetables in Cameroon [5, 6]. These include indigenous vegetables (IVs) such as huckleberry (*Solanum scabrum*), pumpkin leaves (*Cucurbita moschata*), cocoyam leaves (*Xanthosoma sagittifolium*), garden eggs (*Solanum melongena*) and exotic vegetables such as okra (*Abelmoscus esculentus*), tomato (*Lycopersicon esculentum*), carrots (*Daucus carota*) and sweet peper (*Capsicum annuum*). A wide diversity of these vegetables is more remarkable in the central and southern parts of the country where rainfall is relatively high. Due to lack of documentation on their yields and sales, indigenous vegetables have been regarded as minor crops and have been given low priority in most agronomic research and development programmes. However, leafy indigenous vegetables are assuming an increasingly important commercial role especially for farming households living near urban centres [7]. Moreover, they remain one of the mainstays of rural diets in most of the country.

The production of fruits and vegetables in Africa increased from 112 million tonnes in 1970 to 203 million tonnes in 1994 [8]. However, this increase in production has not necessarily met the requirements of the population for several reasons. Fruits and vegetables are perishable commodities, which are usually harvested at high moisture content. When harvested, a large portion is lost because of poor handling and marketing conditions. Moreover, few post harvest technologies exist for the vegetables, and when they do, they are too complex or unaffordable by the rural farmer [9].

Although IVs are an important source of minerals and vitamins, not all households in most developing countries are privileged to have as much of this category of food as desired, due to either scarcity or high costs in producing or purchasing [10]. Exotic vegetables require high input of fertilisers, pesticides and laour for their production. Conversely, IVs require less costs of production owing to the fact that their growth requirements are highly met locally. However, the quantity and quality of these IVs are still far from satisfying the needs of the growing population. A lot of efforts are still required to improve on the production of IVs so as to solve the acute nutritive problems of the low-income households in developing countries [10].

The main objectives of the study were to establish the socio-economic importance of indigenous vegetables compared to exotic ones, to estimate the post harvest losses and identify ways of reducing them so as to use these vegetables as an income source for resource poor rural communities.

## MATERIALS AND METHODS

A survey was carried out in five markets in the Western Highlands of Cameroon and in Yaoundé during the production months of June to September, 2003 using semi-structured interviews. The markets surveyed were Foubot, Bafoussam and Dschang in the West Region, Bamenda in the Northwest Region and Yaoundé in the Centre Region. All except Foubot were urban markets. Foubot, located in a high agricultural production area was mainly a supply market to neighbouring towns.

Enumerators were selected and trained in rapid appraisal techniques [11]. The design and implementation of data collection activities were similar to those described by other studies [12]. A total of 120 farmers and 100 traders (both retailers and wholesalers) were interviewed. Interviews were conducted in the mornings because by noon many of the traders who were also producers had begun leaving.

On getting to the markets, the enumerators moved through identifying and counting sellers of vegetables, distinguishing between female and male sellers. The interviews were then conducted, selecting sellers at random. Points of entry and/or exits were located where key actors in these areas were interviewed. Market masters, who were usually employees of the local councils and controlled the placement of produce in the markets, were also interviewed. These in general had a lot of authority over the traders and were well informed on market activities. Truck loaders also appeared to have a good amount of information as to the numbers of trucks and approximate quantities of produce leaving the market.

Samples of each group of vegetables were purchased, and weighed to estimate their retail weights. Physical losses resulting from either mechanical or microbial damage were evaluated by visual inspection and expressed as a percentage of the total. Gross market margins for the vegetables were also calculated and then used to estimate weekly earnings. The data collected were analysed using descriptive statistics and regression in the data analyses add-in of EXCEL 2007.

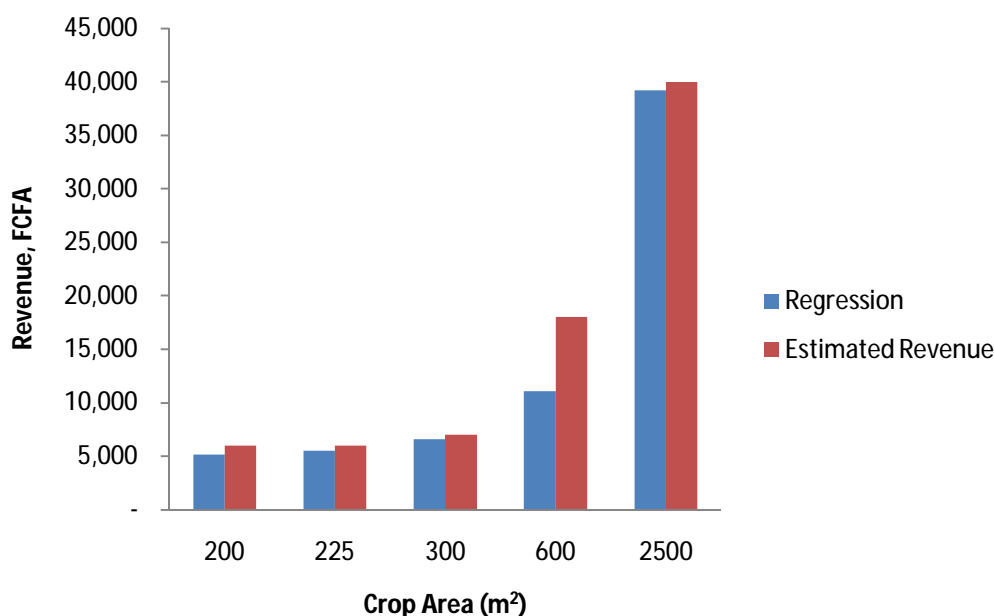
## RESULTS

### Socioeconomic importance of indigenous vegetables

Dschang and Bafoussam markets followed a cultural eight-day week, while the Bamenda and Foubot markets were on Saturdays and Sundays, respectively. More than 80% of the traders arrived at the market before 7.00 am and left before 6p.m. Women constituted 90% of all vegetable traders in the Foubot market and 100% of all traders of IVs. Thirty six percent of traders in these markets were "Buyam sellams"; these were traders who bought from farmers and re-sold in the same market or transported to urban markets; the rest were farmers who brought in their produce from their farms or bought extra supplies in their villages for the market. The traders ranged from 17 to 50 years old although during the holidays, children could be found helping out.

Production of indigenous vegetables was on a subsistence basis with revenue from huckleberry (*Solanum scabrum*) being substantial when mono-cropped (Fig. 1). The other indigenous vegetables were often inter-cropped in home gardens and rarely occupied a significant portion of the farm. Income from them was rarely significant and only complemented that from huckleberry. Some of the land used for the vegetable production was owned but more than 50% of the farmers interviewed rented their land. The amount paid for rents varied with location and with the landowner but in most cases it was only a token, although producers of high value crops could pay up to 20 FCFA (US\$0.04) per m<sup>2</sup> per season.

Vegetable production was mainly rain fed. In the dry season, producers adopted risk-avoidance strategies to meet vegetable needs. These strategies included producing in inland valleys and along river banks and using supplementary watering. The principal method of supplying water to the farms was by surface canals, although water was also supplied using pumps by farmers who had larger surfaces (>0.25ha). This option was both for exotics and huckleberry.



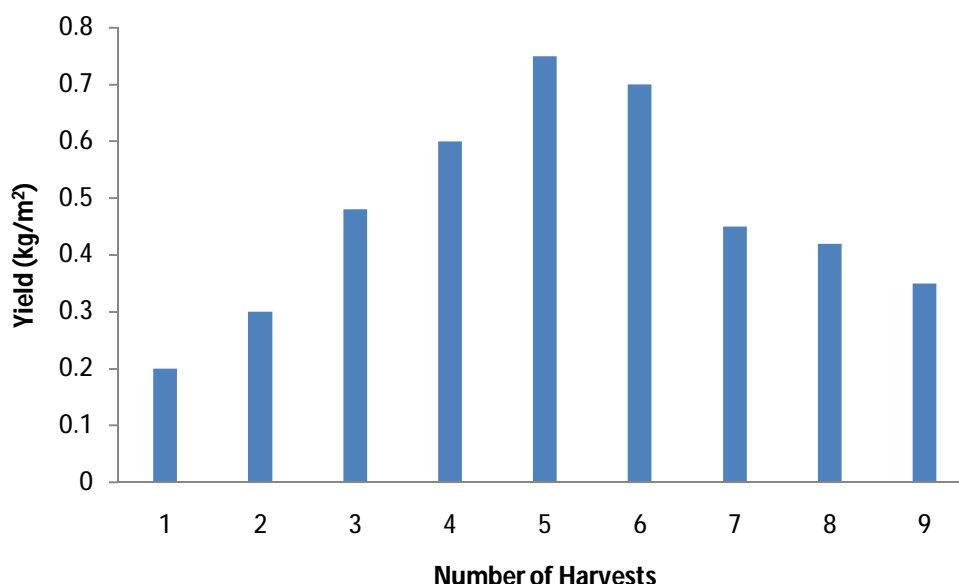
**Figure 1: Monthly income from huckleberry as a function of cultivated area in Foubot**

Management practices were basically traditional and crops were cultivated in beds. This was as much a water management as a land preparation technique, since most of the valleys were swamps in the rainy season. Each bed measured about 1m across and in some cases as high as 0.80m. Where inter-cropping was practised, spices

and/or exotic vegetables were grown on the top of the bed and the African leafy vegetable especially huckleberry, was grown on the slopes. The reasons for this cropping pattern varied according to the farmers. While some farmers did so to separate the crops in case some had to be sprayed with pesticides, others did so to protect the exotics from damage during the harvesting of IVs, which was frequent. Moreover, crops grown higher on the beds were less tolerant to excess water that ran on the irrigation furrows.

Indigenous vegetable seeds were obtained from the previous season's crop. A specialised trend had developed to ensure a steady seed supply, with the farmer producing, processing and storing the seed. There were no institutions involved in commercial IVs seeds. The diffusion and effectiveness of the seed system depended largely on the quality of the variety to be diffused, kinship relationships, the existence of a culture for agricultural experimentation and the economic stability of the farming enterprise.

Huckleberry was harvested by hand or with the help of a knife once a week and on the eve, or early in the morning of, the market day. The field could be divided into plots and a plot harvested every other week in a rotation to give the crops time to regenerate. Ten harvests were possible where water was not limiting and fertilizers (mainly urea) were applied often. Evaluations carried out during the survey showed that yields started low and peaked at about the fifth harvest, and dropped considerably after the 7<sup>th</sup> harvest (Fig. 2).

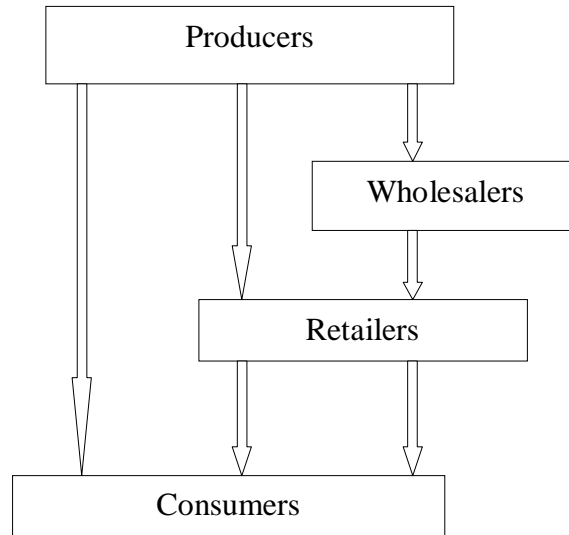


**Figure 2: Huckleberry yield variation with harvest in Foubot**

Fresh shoots were cut at about 10 cm above the soil surface to allow branching, which increased biomass yield per plant. Other studies also showed that leaf yields were higher when harvested fortnightly and tended to decrease when harvested at heights greater than 15 cm [13].

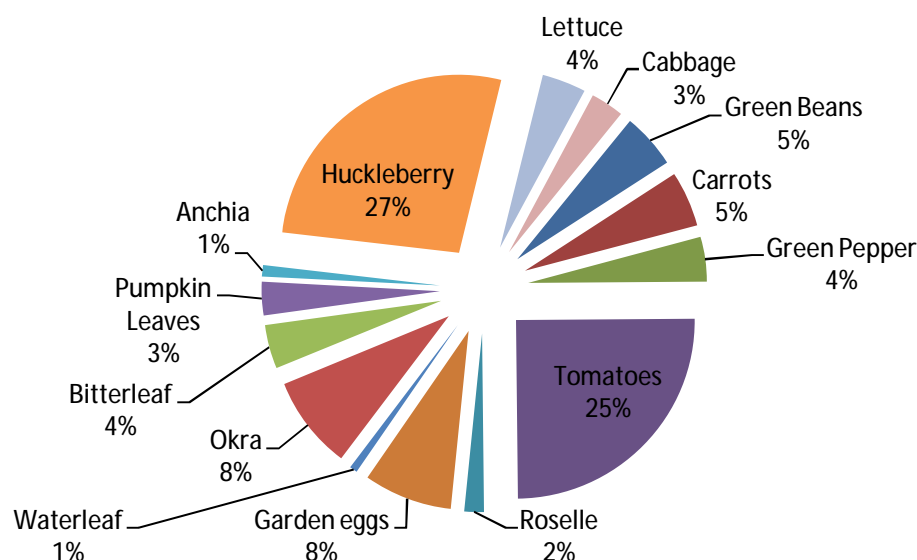
### Marketing Channels

Marketing channels for indigenous vegetables included complex family networks. The producer harvested, packaged (tied into bundles and bales) and transferred the



**Figure 3: Marketing channels for indigenous vegetables in the high plateau area of Cameroon**

vegetables to the buying point nearest the farm, usually by a roadside. Generally the producers supplied their produce directly to consumers or to wholesalers and retailers (Fig. 3). Traders from urban centres bought and transported vegetables to strategic wholesale regional and urban markets where they sold them to their counterparts who then moved the vegetables to retail points. At each vegetable exchange point, a profit of well over 50% was possible. A wholesaler could purchase a bundle of huckleberry for 50 FCFA (US\$0.10), split the bundle into two and each was again sold at 50 FCFA to the retailer. The retailer repeated the same procedure before selling to the consumers.



**Figure 4: Distribution of vegetable sellers in Foubot over three market days**

The majority of vegetable sellers were between 17 and 50 years old. The typical market woman sold 2.5 different products (Tables 1 and 2, Fig. 4) with a mean daily earning of 525 FCFA per product, and a total daily earning estimated at 803 FCFA (\$1.53 at the current US\$ exchange rate) for an average 12 hour day's work (Table 3). The vegetables were sold fresh; hence, proximity to a local market place was a major advantage for producers because it allowed the supply of quality products at reasonable prices. Pre-bundled, fresh succulent vegetables represented a market advantage due to quality and presentation. Some vegetables such as bitter leaf (*Vernonia sp.*) and cowpea (*Vigna unguiculata*) could be washed, sliced, steamed and sun dried prior to marketing. Sun dried huckleberry did not have an attractive appearance and, therefore, did not compare favourably with the fresh one, which, generally is in abundance. Some traders in the Bamenda market dried their vegetables such as huckleberry (*Solanum scabrum*), bitterleaf (*Vernonia sp.*), and eru (*Gnetum spp.*), using electrical box driers [14]. These vegetables were then packaged in polyethylene bags of various sizes for sale to people travelling abroad.

### Post Harvest Losses and Processing

No facilities were available in the markets for storing fresh produce. Consequently, losses were high (Table 4), and traders tended to purchase small quantities on the morning of the market day to add to the leftovers from the previous day. Vegetable losses were on the average higher in Yaoundé markets than in the other two market centres with Bamenda experiencing the lowest (9.47%) rate (Table 4). The high losses



in the Yaoundé market were probably due to higher competition among traders in Yaoundé with the result that many of them held their produce longer, leading to high losses from respiration as well as from mechanical damage [8, 15]. It could also have been due to the long distance from production areas (> 350 km) and poor handling facilities.

## DISCUSSION

The transport of vegetables to markets was by light truck, mini bus or pushcart, depending on the road infrastructure. Because appropriate packaging was not available, transportation and handling caused physical damage that later resulted in losses. Trading was generally through networks and along well-established patterns similar to marketing patterns in other African countries [16]. Some of the trading networks were rather complex and stable, suggesting that it might be difficult for new comers to enter into relationships with existing networks. This was certainly the case in seasons of low supply when family networks gave preference in selling to traders in the family.

Revenue from indigenous vegetables, especially huckleberry, was related to the area cultivated ( $r^2=0.99$ ) indicating that it is possible for the producer to make a living from growing African indigenous vegetables, especially huckleberry. This revenue became profitable when the area cultivated was greater than 0.25ha mono-cropped. The revenue was generally higher for exotic vegetables although this trend was reversed for huckleberry in the Bamenda and Bafoussam markets. The fact that exotics were available in supper markets and were used as ingredients in many dishes in commercial restaurants favoured these vegetables against IVs. Besides, consumers of these could afford the higher prices. Indigenous vegetables still played a typically traditional role or were eaten mainly by the low income earners, but this trend is changing as there is a re-awakening of interest. The revenue from huckleberry in Yaoundé was low while that for amaranth was high, suggesting that African leafy vegetables had a cultural significance, as huckleberry tends to be eaten mainly with foods from the grasslands.

By groups, sellers of exotic vegetables earned significantly ( $p<0.001$ ) more than sellers of indigenous vegetables. The estimated daily revenues per product were 645 FCFA and a total earning of 1028 FCFA for sellers of exotic versus 429 FCFA and a total daily earning of 817 FCFA for indigenous vegetable sellers (Table 3). There are several explanations for this disparity in earnings. Sellers of indigenous vegetables cited a lower percent marketing loss than those of exotics (12.8% against 16.1%,  $p<0.01$ ). In general one would expect sellers of risky commodities to demand a risk premium. The financial risk of selling exotic vegetables was also higher. A mean of 2851 FCFA was spent per transaction on purchasing products by retailers in the indigenous vegetable market as compared to 4 927 FCFA for exotic vegetables. The average weekly expenditures by retailers for resale were also significantly ( $p<0.05$ ) higher for exotic vegetables (13 038 FCFA against 10 878 FCFA).

The low capital requirements for getting into the IVs market and the relative lack of barriers means that this was a fairly competitive market consequently earnings were generally low. This market offers poor unemployed women one of the few opportunities for earning a living. Based on a rapid reconnaissance of 14 satellite markets in Yaoundé, it was estimated that roughly 1 000 women were engaged regularly in selling IVs. This number was even higher in rural markets. For these women and their families the meagre revenues earned were of the utmost importance.

The main form of processing was sun drying, which could take from three days in the dry season to well over six days in the rainy season because of unreliable sunshine. The sun-dried vegetables were not appealing to consumers because the appearance was unattractive due to re-wetting during drying and possible contamination by flying objects and domestic livestock. Other studies have shown that solar drying can cut down drying time by about 60% [9]. The final product after solar drying was also more appealing to the consumer and tasted better.

Simple and low cost solar units that could be sized to the traders' needs were available [15, 17]. These coupled with attractive packaging could provide an income opportunity for small producers during off-season. Experiences elsewhere have shown that there were circumstances where it was feasible to establish solar drying operations as viable micro enterprises in rural areas [18]. However, market channels also needed to be developed, product quality to be controlled and technical assistance given to the producers and traders in these commodities.

## CONCLUSION

Although exotic vegetables were on the whole more profitable, indigenous vegetables both had subsistence and income value. The number of traders of indigenous vegetables had increased over time and women played an important role in their producing, processing and marketing. The low capital requirements for getting into this market and the relative lack of barriers also meant that this was a competitive market, and earnings were thus, generally low.

No post-harvest packaging and conditioning of fresh vegetables were available. As a result, losses were high, averaging over 11% in all the markets surveyed. However, marketing chains were well established, especially for more commercial crops such as huckleberry.

Drying vegetables offer the chance to increase the value of the surplus seasonal produce and thus an opportunity to earn extra income. The expansion of vegetable farms and the development of urban and export markets may open new perspectives for improving traditional drying methods and expanding the potential for processing.

Producing and marketing indigenous vegetables in Cameroon hold great promise to provide a livelihood to the rural and peri-urban poor families through providing employment, and can contribute significantly towards poverty alleviation and food

security. However, appropriate production and post harvest systems need to be developed for an increased indigenous vegetable production.

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**Table 1: Some popular indigenous vegetables available in the western highlands of Cameroon**

Common/Local name	Name	Availability
Huckleberry (large and small leaf cultivars)	<i>Solanum scabrum</i>	A <sup>1</sup>
Pumpkin	<i>Cucurbita moschata</i>	A
Roselle	<i>Hibiscus sabdariffa</i>	D
Garden eggs (rounded and oblong fruit cultivars)	<i>Solanum melongena</i>	LD
Melon	<i>Cucumis melo</i>	A
Water leaf	<i>Talinum triangulare</i>	LD
Bitter leaf (large and small leaf cultivars)	<i>Vernonia amygdalina</i>	A
Cocoyam	<i>Xanthosoma sagittifolium</i>	A
Amaranth	<i>Amaranthus sp</i>	A
Fluted gourd	<i>Telfairia occidentalis</i>	A
Cowpea	<i>Vigna unguiculata</i>	A

<sup>1</sup> A-All Year round, D-Dry Season, LD-Less in Dry Season

**Table 2: Some exotic vegetables available all year round in the western highlands of Cameroon**

Common name	Name
Okra	<i>Abelmoschus spp.</i>
Tomato	<i>Lycopersicon esculentum</i>
Leeks	<i>Allium ampeloprasum</i>
Celery	<i>Apium graveolens</i>
Carrots	<i>Daucus carota</i>
Cabbage	<i>Brassica oleracea</i>
Parsley	<i>Petroselinum crispum</i>
Basil	<i>Ocimum basilicum</i>
Snap beans	<i>Phaseolus vulgaris</i>
Water melon	<i>Citrullus lanatus</i>
Sweet pepper	<i>Capsicum annum</i>
Onions	<i>Allium cepa</i>

**Table 3: Average weekly earnings in Francs CFA for traders of vegetables in three urban centres of Cameroon**

Vegetable		Bafoussam	Bamenda	Yaoundé	Mean
<i>Amaranthus spp.</i>	Amaranthus	*	4 536	16 870	10 703
<i>Vernonia amygdalina</i>	Bitterleaf	18 720	10 350	14 715	14 595
<i>Brassica oleracea</i>	Cabbage	28 971	20 925	26 880	25 592
<i>Phaseolus vulgaris</i>	Green Beans	20 475	2 700	*	11 588
<i>Capsicum annum</i>	Sweet Pepper	10 494	18 252	*	14 373
<i>Solanum Scabrum</i>	Huckleberry	29 547	34 425	6 630	23 534
<i>Corchorus olerorius</i>	Kelen Kelen	*	11 700	11 216	11 458
<i>Abelmoschus spp.</i>	Okra	*	25 155	16 073	20 614
<i>Lycopersicon esculentum</i>	Tomatoes	22 680	24 480	18 420	21 860
<i>Talinum triangulare</i>	Water Leaf	12 600	14 400	*	13 500
	Average	20 498	16 692	15 829	16 782

\* Data not available

**Table 4: Estimated average post harvest losses (%) encountered by sellers of vegetables in three urban centres of Cameroon**

Vegetable		Bafoussam	Bamenda	Yaoundé	Mean
<i>Amaranthus spp.</i>	Amaranthus	8.50	6.50	14.00	9.67
<i>Vernonia amygdalina</i>	Bitterleaf	9.29	5.00	14.60	9.63
<i>Brassica oleracea</i>	Cabbage	10.56	5.83	16.30	10.90
<i>Phaseolus vulgaris</i>	Green Beans	9.40	12.00	*	10.70
<i>Capsicum annum</i>	Green Paper	12.22	11.40	*	11.81
<i>Solanum scabrum</i>	Huckleberry	13.13	12.45	10.00	11.86
<i>Corchorus olerorius</i>	Kelen Kelen	*	11.50	12.00	11.75
<i>Abelmoschus spp.</i>	Okra	*	10.50	16.30	13.40
<i>Lycopersicon esculentum</i>	Tomatoes	10.56	10.38	16.70	12.55
<i>Talinum triangulare</i>	Water Leaf	15.00	9.14	*	12.07
	Average Loss	11.08	9.47	14.27	11.43

\* Data not available

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