FTR

Opportunities and constraints in the subsistence production and marketing of indigenous vegetables in East and Central Africa.

A 0699

R6964 - 004

Edited by Rudy Schippers and Nicholas Fereday

June 1998

University of
Dschang
P.O.Box 388
Dschang
Cameroon

Institut de
Recherche Agricole
pour le Développement
IRAD Ekona
PMB 25 Buea
Cameroon

International Institute for
Tropical Agriculture -
Humid Forest Station
BP 2008 (Messa)
Yaoundé
Cameroon

Makerere University
P.O.Box 7062
Kampala
Uganda

Kawanda Agricultural
Research Institute
P.O.Box 7065
Kampala
Uganda

Natural Resources Institute
University of Greenwich
Central Avenue
Chatham Maritime
Kent ME4 4TB
United Kingdom

Contents

Abbreviations

DFID	Department for International Development
EV	Exotic vegetable
GDP	Gross Domestic Product
Ha	Hectare
IITA	International Institute of Tropical Agriculture
IRAD	Institut de Recherche Agricole pour le Développement
IV	Indigenous vegetable
NRI	Natural Resources Institute

Key to vernacular names

Indigenous vegetables refers to those crops which originated from Africa.
Exotic Vegetables such as carrot, cabbage and tomato are of non-African origin.
Although some exotic vegetables are often considered as traditional vegetables (because they were introduced to Africa many years ago), under the present context they are not considered indigenous.

Vernacular name	**Scientific name/English name**
Cameroon:	
Huckleberry, Zom	*Solanum nigrum/ scabrum,* Huckleberry
Folon	*Amaranthus cruentus*, Amaranth
Ndolé	*Vernonia* spp.*I,* Bitterleaf
Njakatu	*Solanum aethiopicum,* Gilo group - garden egg
Ekongobong	*Telfairia occidentalis*, Fluted gourd
Kelen kelen, Tege	*Corchorus olitorius*, Jute Mallow
Eru	*Gnetum africanum, G. buchholzianum*
Anchia	*Solanum macroarpon*
Roselle	*Hibiscus sabdariffa*
Waterleaf	*Talinum fruticosum*
Bitterleaf	*Vernonia* spp.
W. African Okra (Okro)	*Abelmoschus caillei*
Uganda:	
Doodo	*Amaranthus cruentus (+ A. dubius)*
Nakati	*Solanum aethiopicum* Shum group
Ntula, Njagi	*Solanum aethiopicum* Gilo group - garden egg
Jjobyo	*Cleome gynandra*
Bbuga	*Amaranthus blitum* + other wild Amaranth species
Sunsa/nsuju	Pumpkin leaves
Timpa	Cocoyam leaves
Nsuga	*Solanum nigrum/* huckleberry group
Gobe	*Cajanus cajan,* Pigeon Pea
Biringanya	(brinjal) eggplant
Kamulali	Green pepper
Saga	*Brassica carinata,* Ethiopian kale
Alaju	*Crotalaria ochroleuca*
Akeyo	*Cleome gynandra*
Amalakwang	*Hibiscus cannabinus*
Otigo	*Corchorus sp.*
Sukuma wiki	*Brassica sp.*, Kale
Nyanya	Tomato
Acuica	Pumpkin leaves
Biringanya	Egg plant
simsim	Sesame

INDIGENOUS VEGETABLES FROM UGANDA

1. ***Amaranthus lividus***

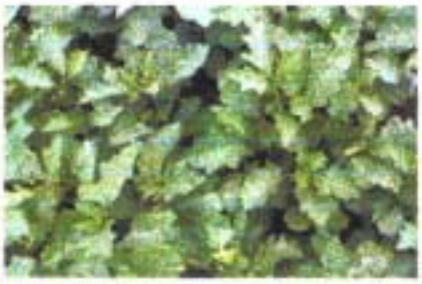
2. ***Cleome*** **or Spider flower**

3. ***Crotallaria***

4. **Ntula or Garden egg**

5. **Nakati with fruits**

6. **Malakwang**



7. **Nakati leaf crop**

A SELECTION OF VEGETABLES FROM CAMEROON

1. *Corchorus*

2. Waterleaf

3. Eru or *Gnetum*

4. *Solanum macrocarpon*

5. Huckleberry

6. Bitterleaf

7. Fluted pumpkin

Introduction

This report summarises the results of market and production surveys carried out in both the dry and wet seasons in Cameroon and Uganda during 1997/98 as part of the DFID funded project, **Opportunities and constraints in the subsistence production and marketing of indigenous vegetables in East and Central Africa (A0699).** The main objective of the study was to establish the socio-economic significance of indigenous vegetables compared to exotic ones. This project is a follow up to the strategy paper on indigenous vegetables and the subsequent workshop held in Limbe, Cameroon.

In Cameroon, three survey areas were chosen to reflect the diversity of agro-ecological conditions in Central Africa:

- Highland humid forest zone - Foumbot , NW Cameroon;
- Lowland humid forest zone - Buea, SW Cameroon;
- Urban/peri-urban area around the capital Yaoundé.

Work in each of the survey areas was conducted in collaboration with a different institute:

- Dschang University of Agriculture for Foumbot coordinated by Dr. Joseph E Berinyuy;
- Institut de la Recherche Agronomique (IRA) for Buea coordinated by Dr. Manfred Besong, Deputy Chief of Centre, Ekona;
- International Institute of Tropical Agriculture (IITA) for Yaoundé coordinated by Dr. Jim Gockowski.

In Uganda, two survey areas were selected:

- Lira district in the northern zone where it is relatively dry;
- Peri-urban Kampala in central Uganda.

The Kampala survey was carried out in collaboration with Makerere University led by Dr Remigius Bukenya-Ziraba, Head of Botany Department, and the Lira district survey with the Kawanda Agricultural Research Institute led by Constance Owori, Post-Harvest technologist.

NRI provided training in survey methods at both Lira and Kampala. Individual reports for each of the study areas were prepared by the collaborating institutes and edited versions included here. The main findings from the five survey areas, over 1,000 interviews in total, are summarised in this report.

Summary

Indigenous vegetables have both subsistence and income value for the poor

In both countries indigenous vegetables were found to play an important role in both income generation and subsistence production. All the surveys provided evidence that indigenous vegetables offered a significant opportunity for the poorest people to earn a living, as producers and/or traders, without requiring large capital investments. Indigenous vegetables are also a very important commodity for poor households because their prices are relatively affordable compared with other food items.

Indigenous vegetables have also provided an important source of employment for those outside the formal sector in peri-urban areas of cities such as Yaoundé because of their relatively short, labour intensive production systems, low levels of purchased input use and high yields. During the economic crisis experienced by Cameroon in the late 1980s the production of these vegetables was increasingly targeted as a livelihood strategy as the level of urban unemployment rose.

The volume of production and trade of indigenous vegetables has increased

A wide range of vegetables, both indigenous and exotic, were found in all the study areas. Although the volume of exotic vegetables is usually greater, especially in the high altitude areas, there are more species of indigenous vegetables being grown.

The volume of production and the number of traders of indigenous vegetables has increased although there are often supply shortages in the dry season. Growing awareness of the profitability of selling vegetables due to the increase in demand has encouraged more farmers to convert more of their land over to horticultural production. In part, the increase in production and marketing is in response to growing urban populations but in Cameroon it may also be a result of the economic crisis which resulted in a strong decline in people's purchasing power, forcing consumers to switch to cheaper alternatives.

Generally exotics are more profitable than indigenous vegetables. For example, the study in Yaoundé found that the sellers of exotics vegetables earned significantly more than sellers of indigenous vegetables. Exotics and a few indigenous vegetables such as huckleberry in Cameroon are considered by farmers as cash crops. Cash crops are more likely to benefit from purchased inputs such as fertiliser, pesticides, and the use of water pumps. Conversely, the lower capital requirements and lack of barriers to entry make the indigenous vegetable market more competitive implying lower profits. However this is not always the case. In the wet season around Kampala farmers reported that nakati was the most profitable vegetable crop. This is partly due to the fact that in comparison to exotic crops nakati requires fewer purchased inputs, matures faster and the harvesting period is longer. In Lira district, Uganda the loss of cattle to rustlers is also believed to have led to a shift in production away from staple crops to horticultural crops as the latter do not require draught power to plough the fields. Also swamp land which was previously used for cattle grazing is now available for vegetable production .

Women have an important role in both production and marketing

Women are key players in the production, processing and marketing (mainly retailing) of vegetables especially indigenous vegetables. Arguably the indigenous vegetable market is one of the few opportunities for poor, unemployed women to earn a living. The Yaoundé study found that in 14 satellite markets around the city about 1,000 women were engaged in selling

indigenous vegetables. For these women and their families the meagre revenues earned are of the utmost importance.

Men were more likely to be involved in the more traditional cash crops although it was observed that where indigenous vegetables were grown on a commercial scale men were more likely to be involved. Where male retailers were present in the markets they were usually selling exotic vegetables. It appears that men are prepared to become involved in the production and marketing of vegetables when they are perceived as cash crops. This implies that if the commercialisation of indigenous vegetables increases so will the participation of men.

Indigenous vegetables remain popular

Despite the growth in exotic vegetable production, indigenous vegetables remain popular especially in rural areas where they are often considered to be more tasty and nutritious than exotic vegetables. Indigenous vegetables often have a ceremonial role and are an essential ingredient in traditional dishes. Tomato and onion are the most popular exotic crops although they are regarded by many as traditional foods.

Similarity in production systems between Cameroon and Uganda

Despite the difference in crops and geographical distance the production systems in the Cameroon and Uganda were found to be very similar. Mixed cropping systems were the norm for all subsistence and semi-subsistence farmers. Most commercial production, especially under irrigation in the dry season, is monocropped.

In both countries, similar vegetables are grown in the dry season as in the wet season but in smaller quantities because dry season cultivation is dependent upon access to water. The harsh dry season climate also affects the quality of vegetables produced. For these reasons vegetables are more expensive during the dry season. Dry season vegetable production is usually in the form of mixed farming with other horticultural crops rather than with staple crops. In the dry season farmers often have to use rented land because their own land does not have access to water.

Marketing chains are well established

The marketing chains for indigenous vegetables are well established especially for the more commercial crops such as huckleberry in Cameroon and Nakati in Uganda. Because of their perishability the vegetables are harvested either the evening before the market day or during the day of the market, quite often through contractual arrangements with wholesalers. Some wholesalers have verbal contracts with their suppliers and often provide them with credit. Others prefer to sell to traders on a first come first served basis or to the highest bidder. These wholesalers meet the farmers in their farms, at their home, in the markets and at supply or assembly centres, where usually bulk buying takes place. In the more sophisticated markets in Lira some traders had developed contacts with farmers whereby they would buy from particular farmers on a regular basis or provide exotic seeds (especially cabbage) to farmers who in turn supply vegetables.

Unit prices tend to fall in the wet season because it is the main production period (the number of retailers also increases in the wet season). Also, most rural households have access to their own vegetable plots and do not need to buy from the market. Retail prices remain constant but the volume in each unit varies between seasons; the size of the bundles are reduced in the dry season. For example during the wet season in the Lira district of Uganda, the supply of

vegetables increases which leads to an increase in the size of the bundles/heap equivalent to a fall in the price per kg. Conversely in the wet season when supplies were scarcer, bundles would often be halved in size, equivalent to a doubling of prices.

Lack of technical advice

Extension officers, where available, were only able to provide advice for exotic vegetables because they had received no training in indigenous vegetable production systems. Generally, improved agronomic packages provided to the farmers are for staple and cash crops and often have little or nothing to do with indigenous vegetables. There is also a lack of published information about indigenous vegetables. There were some reports of extension officers giving advice based on their experience with exotic vegetables but most producers still rely on traditional technologies, which in some cases are not easily adaptable to large scale production. The farmers expressed a need for assistance especially on the choice and use of crop protection chemicals.

Misuse of insecticides and polluted water are common problems

The use of chemical pesticides was widespread although no advice was being given on the dosage and appropriateness of the chemicals being used. Many were originally bought to use on cash crops and the same crop protection chemicals as used on tomatoes are also used on huckleberry. Often insecticides and fungicides were being mixed together on a very ad hoc basis until the mixture was lethal enough to kill any pests that were found on the vegetables.

Most of the problems of vegetable production are associated with pests, such as snails that eat the leaves of *Vernonia*, and black ants that cause the leaves of huckleberry to fold up or to wilt. This has resulted in the misuse of insecticides. In particular, the manufacturers instructions as far as timing of applications is concerned, is often overlooked. The misuse of pesticides has led to some consumers preferring to buy produce which shows evidence of insect damage, thus indicating the absence of toxic chemicals on the leaves.

Around Yaoundé, Cameroon, it was found that the irrigation water comes from small streams that are often used as sewers resulting in uncooked vegetables such as lettuce becoming a health hazard. Consequently, many consumers prefer to buy leafy vegetables that have been produced in remote parts of the country even though they appear less fresh.

Lack of seeds/planting materials

Most farmers grow their own seeds and some sell seedlings in their local markets. Other farmers obtain their seeds from specialists within their village. Farmers frequently expressed a desire to try out other varieties but have no access to a good supply source for seeds. Farm produced seeds are usually only stored from the last year's season. The viability of the seeds are not tested before planting. Farmers tend to reduce the risk of poor seeds by producing as much seed as possible and sowing all of it.

Exotic vegetables replace indigenous vegetables in temperate climates (higher altitude)

In cooler areas found at higher altitudes, many farmers have switched to growing exotic vegetables such as tomato, carrot, onion and potato because the climate is more suitable and they are more profitable than growing indigenous vegetables. Produce from higher areas is often exported to the lowlands where such crops cannot be grown but demand is high. For

example in southwest Uganda farmers prefer to grow Irish potato and cabbage rather than traditional root crops and local leafy vegetables.

Other problems farmers faced included:

a) *Over production.*
Overproduction in the wet season tends to drive prices down.

b) *Market access*
Some farms/villages are far from market centres and often without road infrastructure. This makes it difficult to move produce to the market.

c) *Storage losses*
Producers are often forced to sell at very low prices because produce cannot be kept after maturity.

Follow-up studies are planned

The present survey has generated a wealth of interest from the in-country universities and research institutes reflecting the priority they place on indigenous vegetables. A number of follow-up studies are planned though their financing remains uncertain because of their own financial constraints and a lack of donor interest in non-export crops. In Cameroon, these studies are:

a) A consumption/production survey in Yaoundé (IITA)
This will be based on a stratified random sample of households in Yaoundé.

b) Cost of production study of peri-urban production systems of indigenous vegetables (IITA).

c) Consumption and production survey of households in Yaoundé (Dschang University)
This study will design a household expenditure model of the ingredients used to prepare *la sauce* which includes indigenous vegetables, as well as to determine the value home gardens play in an urban setting. A particular area of interest is to determine wethe indigenous vegetables are inferior goods. If they are considered inferior goods people may turn away from them as their incomes increase. The study will adopt the same methodology as used in the 1982 national household expenditure survey to allow a comparison of how consumer preferences have evolved.

d) Cost of production of peri-urban indigenous vegetable production systems (Dschang University & IRA, Ekona)
The objective of these two studies is to calculate the costs and benefits of producing leafy vegetables in order to understand their role in poverty alleviation.

e) Preferences of producers, traders and consumers (Buea University)
This study aims to establish what people like and dislike about three crops: huckleberry, bitter leaf and fluted gourd. The results of this survey will contribute towards the evaluation of the many different types of landraces of these crops.

f) Constraints and opportunities in post-harvest management of leafy vegetables (Buea University)
This study will assess further the marketing problems that were identified in the Buea area survey to include how these problems have arisen and how they could be solved. The study will also include a description of the various forms of processing of foodstuffs sold at the markets.

e) Overview of water leaf production (Dschang University)
This study aims to provide a comprehensive assessment of water leaf (*Talinum fruticosum)* production through interviews with farmers.

Next steps

To stop further genetic erosion of Africa's indigenous vegetables, it is suggested that the following steps are taken:

1. **Collection of germplasm.** It is essential to make extensive collections of germplasm especially from the more isolated areas.

2. **Screening.** The germplasm needs to be screened with the help of producers and consumers to identify desirable characteristics. Selected material should then be purified, leading to the development of uniform varieties.

3. **Seed multiplication.** Multiplication of seed from a number of varieties, allowing farmers to choose which ones suits them most.

4. **Agronomic research.** To identify the major technical constraints facing farmers of indigenous vegetables and to carry out research to overcome these constraints.

5. **Technical package.** Development of appropriate technical advisory packages dealing with agronomic issues (nursery, spacing, fertilisation), pest and disease control and with market and post-harvest related issues. Farmers will also benefit from the provision of reliable market information.

1. CAMEROON

1.1 Socio-economic survey of indigenous vegetables in the Foumbot area.

Dr Joseph Berinyuy, University of Dschang.

METHODOLOGY

Informal interviews were conducted by a team of undergraduate students[1] with assistance from lecturers at the University of Dschang and local agricultural extension officers. Surveys were conducted on-farm and in local markets using semi-structured interviews (See Annex 1 for examples of checklists used).

The market surveys were carried out early in the morning when most vegetables are traded. After first identifying and counting sellers of vegetables, semi-structured interviews were then conducted. The main types of market actors were interviewed including the market masters who are employed by the local council to manage the market. Farm interviews were conducted throughout the day at times convenient for farmers. A total of six villages were surveyed with about thirty farmers in each of the villages. These villages were selected using information from the agricultural extension officers and following contacts made during the market survey.

MARKET SURVEY

The main markets at Foumbot, Kuouptamo, Bafoussam and Dschang were surveyed. Foumbot urban market is situated along the main highway joining Bafoussam and Foumban. This is the main road linking the rest of the country with the north and through it to Central Africa and Chad. Foumbot market starts early. Trading begins as early as 6.00 am. Most of the wholesalers are from Bafoussam, Foumban, Bafang, Mbouda, Ngaoundéré, Yaoundé and Douala. About half of the indigenous vegetables offered at Foumbot market were bought by these wholesalers.

Kouoptamo is a small rural market and only opens on Fridays. It has less variety than Foumbot and virtually no exotic crops. Bafoussam has two main markets (Marché A and Marché B) and a smaller one at the entrance to the town on the road to Mbouda. Vegetables were found in all of these markets.

It costs about CFA100 per day to sell in the markets regardless of the quantity traded. Many of the vegetable traders consider this charge too high. Traders sell from stalls or find an open space on the ground either in or near to the market.

Trader details

Most (about 90%) of the exotic and indigenous vegetable retailers were women. Where male retailers were present they only sold exotic vegetables. Most of the retailers interviewed were also farmers and had brought their vegetables from their farms or bought extra supplies from other farmers from their villages. The traders ranged in age from 25 to 45 years.

---

[1] The students were: Sylvia Mbinglo, Isidore Lenjo, Lucy Ntangti, Isabella Ade, Edmond Langerson and Joycelin.

Product inventory

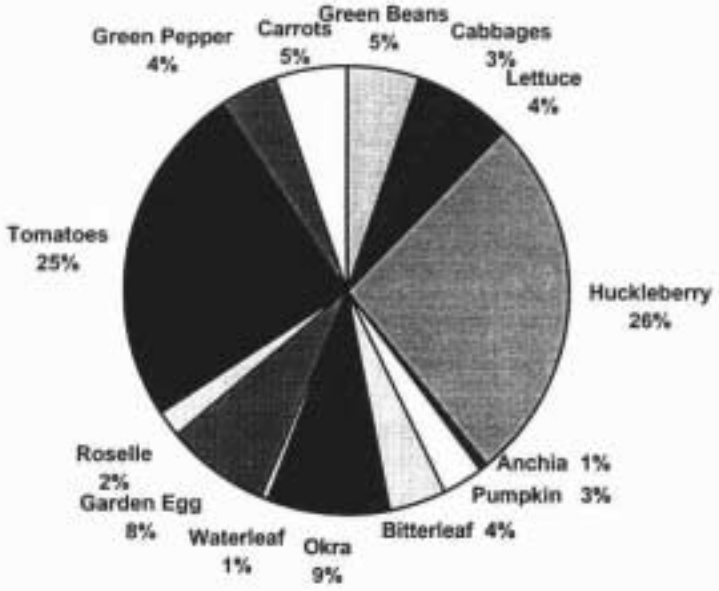


Figure 1. Proportion of sellers by crop in Foumbot market (over three market days in the dry season).

On average about 45% of the vegetable sellers sold indigenous vegetables (Figure 1). Huckleberry and garden egg were present in all the markets with the former being the main indigenous vegetable exported out of the region. Exotic vegetables such as tomato, carrot and cabbage were very prominent in Dschang Market, lending weight to the theory that at high altitudes, exotics tend to replace indigenous vegetables.

History of marketing

There was evidence to suggest that the number of traders and the volumes traded has increased over the years in response to the growing demand from urban areas. Retailers have also increased the range of vegetables they sell in order to reduce the risk of depending upon one type of vegetable.

Consumer Preferences

Consumers prefer fresh green leaves regardless of whether the leaves had holes or not. (Holes on the leaves are often acceptable because this may indicate the absence of toxic chemicals on the leaves).

There were two main varieties of huckleberry: large leaf leaf size (13 cm by 17.5 cm), and small leaf (6.0 cm by 7.0 cm). For cultural reasons in this area the large leaf variety was preferred. The small leaf cultivar also tended to be slightly bitter.

Marketing arrangements

Farmers either bring the vegetables to the market entrance where they meet the traders or more often retail the produce themselves. For the daily markets, farmers bring small quantities only, larger quantities are reserved for the main market day. Generally retailers buy vegetables in

bundles while wholesalers buy in bags (discarded fertiliser or flour bags). A bag may take two to three days to sell. Many of the retailers buy progressively depending on their selling rate. Wholesalers from urban centres tend to buy larger quantities and are therefore attractive to farmers who want to sell their produce as fast as possible and return to their villages.

The vegetables are transported to the markets from the villages by light truck or mini bus. Push carts are also prominent as a means of transport for distances of around 5-10 km. Smaller quantities are carried by head.

Huckleberry together with exotic vegetables are transported by minibus to urban centres such as Bafoussam, Bafang or Mbouda. Often this trade by-passes the markets. For example at Mbantou village, wholesalers arrive in trucks and mini buses and transport the vegetables directly to Bafoussam without taking them to the Foumbot market. The farmers say they get a better return this way because they do not have to pay transport costs and it is more convenient. Even here the farmers do not have any contracts with traders; vegetables are sold on a first come first served basis or to the highest bidder.

Post harvest techniques

No special packaging is used in the handling of vegetables. Leafy vegetables such as huckleberry and amaranth and some spices (such as basil) are first tied into bundles. The bundles are then tied into bales using items of clothing or old sacking.

There are no storage facilities for vegetables. Unsold huckleberry is taken back home, sprinkled with water, placed in a cool corner with stems down and propped against the wall. This method of storage has evolved over the years. Other traders say they spread the unsold vegetables on the floor when they return home. It was occasionally observed that some traders left unsold vegetables covered with old sacking overnight in the market.

Most vegetables are sold fresh but bitterleaf (both types), cowpea and okra are often processed. For cowpea the freshly harvested leaves are boiled, put in a tray or rack and dried in the sun. Processing bitterleaf locally is done as follows. The leaves are plucked off the stalks after harvest or purchase. These are then sliced into thin slices using a knife. The leaves are then boiled in salted water to reduce the bitterness. Some people prefer to pound the leaves in a mortar at this stage. The resulting product is then washed and dried in a rack in the sun. After washing the bitterleaf may be rolled into little bundles and stored in plastic bags in the refrigerator. Selling processed bitterleaf is on the decline because some unscrupulous traders use other plants to increase the volume.

When okra is harvested and left for a few days, it tends to get tough and unsuitable for use. Processing allows these fruits to be used or preserved for later use. The fruits are sliced and dried on a rack or mat in the sun. The dry okra is then put into plastic bags or gourds for storage in a cool dry place in the house.

Seasonality

The same types of vegetable available in the rainy season are also available in the dry season although usually in smaller quantities. *Corchorus* and water-leaf may be completely absent during the heart of the dry season. Other vegetables such as garden eggs and pumpkin leaves are reduced in quantity and quality. Because these are not considered as high value products, they are not cultivated on any scale for the market.

Prices

Table 1 shows the prices for the main vegetables being sold in Foumbot market. Prices tend to be driven down in the wet season because it is the main production period (the number of retailers also increases in the wet season). The price reduction is mainly by means of an increase in the volume rather than in CFA's. Most people had access to vegetables either from their own gardens or through friends and therefore did not need to buy them from the market.

Table 1. Price of vegetables in Foumbot market.

Type of Vegetable	Unit of Sale	Approx. Quantity/Weight	Price (CFA)
Huckleberry (large leaf)	Bundle	16 stems/ 1.2 kg	50 - 100
Amaranth	Bundle	0.72 kg	50
Cabbage	Head	2.5 kg	200
Garden Egg	Heap	5 or 6 (0.45 kg)	50 - 100
Green Pepper	Heap	8/9 (0.83 kg)	200 - 300

Income

This is one area where the traders tend to be very reluctant to release information. However it was very apparent that traders are able to make a profit out of trading in vegetables. Since many of them trade in both exotics and IVs, their risks are fairly spread. It was also observed that the same traders who sell during the rainy season trade in Foumbot market during the dry season.

Table 2: Ranking of vegetables by order of importance as an income earner.

Vegetable	Ranking
Huckleberry	1
Tomato	2
Okra	3
Garden Egg	4
Bitterleaf	5
Pumpkin leaves	5

The relative importance of huckleberry as a commercial crop is again highlighted. The relative importance of tomatoes appears low. This is due to the fact that the ranking was done for all the farmers interviewed many of whom did not sell tomato.

Table 3: Gross margins for some vegetables sold in Foumbot market (dry season)

Product	Unit of Sale	Retail Price (CFA)	Gross Margin (CFA)	% margin
Huckleberry	Bundle	75 - 100	15 - 20	20%
Okra	Big basket	5000	200 - 500	10%
Pumpkin leaf	Bundle	50	15 - 25	50%
Bitterleaf	Bundle	50 - 75	10	13%
Tomatoes	Big Basket	5500 - 6000	1000	17%
Tomatoes	Small Basket	600	300	50%
Green Beans	Basket	500 - 1000	200 - 300	33%

Although estimates, Table 3 shows the general trend that indigenous vegetables are sold in smaller quantities and generate a lower profit than exotics because of this smaller amount sold.

Constraints

The main problems faced by traders were: lack of financial assistance, high market fees, a lack of storage facilities and the high perishability of their crops. Those traders who were also farmers complained about the prohibitive cost of fertilisers and pesticides. Suggest solutions by traders included: reduce market fees, make capital available and provision of financial assistance and training appropriate packaging and storage techniques.

VEGETABLE PRODUCTION

Farmer details and history of production

Women were the main producers of indigenous vegetables, ranging in age from about 26-45 years. Male producers favour growing exotic vegetables. When men are involved in indigenous vegetable production they grow only huckleberry and do so on a larger scale (about ¼ ha monocropped).

Product inventory

Out of the six villages visited huckleberry was found to be the most common (in terms of abundance) vegetable. Commercially (and culturally) huckleberry was ranked the highest. Other indigenous vegetables grown in the area included: pumpkin leaves (*Cucurbita* spp), roselle (*Hibiscus sabdariffa*), garden eggs (*Solanum aethiopicum*), melon seeds (*Cucumis melo*), water leaf (*Talinum fruticosum*), bitter leaf (*Vernonia amygdalina*), amaranth (*Amaranthus cruentus*), kelen kelen (*Corchorus olitorius*), fluted gourd (*Telfairia occidentalis*) and African okra (*Abelmoschus* spp). The most common exotics were found to be: tomato, leeks, celery, carrot, cabbage, parsley, snap bean, water melon, sweet pepper and onion. Similar crops were grown in the dry season but on a smaller scale.

Production details

Although farms varied in size from about 0.25-0.5 ha, most vegetables were produced in small home gardens, but where space was limited, the vegetables were also cultivated in nearby farms in inland valley bottoms and receding swamps. Only high-value vegetables such as tomato and huckleberry are grown on a large scale.

The land is prepared in beds, done not only as a land preparation technique but also to manage water since many of these valleys are swamps in the rainy season. Each bed measures about 1m across and in some cases as high as 80 cm. Where inter-cropping is practiced, herbs and spices such as basilicum and hot pepper and/or exotics are grown on top of the bed and huckleberry is grown on the sides (the slopes). This system of production is common in the villages to the west and north west of Foumbot where herbs and spices are grown extensively. Villages to the south tend to concentrate mainly on tomato and huckleberry with a few farmers growing other crops such as leeks and parsley. The reasons for this cropping pattern vary. Some farmers do so to separate the crops in case some have to be sprayed with chemicals. Others do so to protect the exotics from damage during the harvesting of huckleberry. It appears that huckleberry is more tolerant to excess (water runs in the furrows between the beds). The less tolerant crops are grown higher up, thereby making maximum use of the land.

The planting distance for huckleberry seedlings varies between farmers. While some farmers take 15x15 cm as a standard, others use 20x20cm or 15cm within rows and 20 cm between rows. This spacing has been determined through experience and is not based on any

institutional based experimentation. Farmers who use larger spacing argue that branching is better and crops are healthier.

Many combinations of intercroppings are practiced; huckleberry & maize, huckleberry & parsley -& celery, etc. In the huckleberry & maize combination, a typical density is 32 plants of huckleberry to 8 plants of maize in a 1.5 m^2 area. Plant density and yield are difficult to analyze in cases where multiple cropping is practiced. Many farmers practice intercropping because they find it a secure means of obtaining food. In case where there is an outbreak of pests of one crop, they depend on the companion crops in the system. Many of the components of such a production system are for household consumption rather than for sale. Most bitterleaf shrubs were planted as hedges.

Planting is mainly by seedlings although cases of planting by cutting were observed with huckleberry and waterleaf. Farmers claimed that propagation through cuttings was not as beneficial as through seedlings because yields were lower. Seedlings are produced in a nursery. Two types of nursery planting is practiced. In the first case the seed is drilled in rows. The rows are first traced on beds and the seeds 'bunched' in by hand. Alternatively, the seeds may be broadcast. Planting in rows tended to have a better land use: weeding is easier and the plot is neater. Nurseries that are broadcast are transplanted progressively, starting with the best plants, in a thinning process. Some of the late bloomers may be left in the nursery if they mature too late to be transplanted. A typical schedule for huckleberry is shown in Table 4.

Table 4. Duration of different growth stages of huckleberry in Foumbot area.

Plant Stage	Duration (days)
Sowing to Germination	7 - 10
1st transplanting	28 - 30
1st Harvest	50 - 60

Water

In the dry season, where water is available it is supplied via surface canals or using watering cans. Water is also supplied by pumping but this is mainly by farmers who have larger plots (>0.25 ha) and again it is either for exotics or huckleberry. Wells are also used in some cases as a water source but these are shallow wells dug on the farm. The number of times a farmer watered the plants varied. While some water daily, others (with pumps) do so twice a week. Where pumping is practiced, the pump and associated piping are the main high cost items on the farm. Pumping twice a week costs on average CFA40,000 for fuel per hectare. All the farmers interviewed has bought their pumps prior to 1993 or bought second hand. A typical purchase price was CFA130,000 and piping CFA5,000/m.

Land tenure

Most vegetables are grown on the farmers' own plots of land. In the dry season farmers often have to use rented land (more than 50% of the farmers interviewed rent their land). The amount paid varies with location and with the land owner. For example while one farmer was charged CFA5000 per season for a piece of land of 15 x 15m, another paid CFA13,000 per season for 1000 m^2. The cost of land is also affected by the crops grown. Land tends to cost more for exotics than for indigenous vegetables. Some of the small-scale producers (mostly women) rent the land per bed. A 5m bed costs about 500 CFA per season.

Labour

Both men and women grew vegetables although the men preferred producing exotic vegetables because they yielded the highest returns. The larger producers (up to 0.5ha) were also men. Farmers used family labour whenever possible although some hired labour is used during peak harvesting periods by the larger scale farmers. More hired labour is available in the dry season than in the rainy season. Both men and women work as hired help, with women concentrating

on harvesting and cultivation while the men do the irrigation and other production chores. Marketing in some cases is handled by women. The average cost of hired labour is CFA1000 per day but this varies depending on the job required. It is cheapest for activities such as harvesting and most expensive for land preparation.

Access to credit
Generally farmers received little external support. There were no organised farmer groups for marketing vegetables or for purchasing inputs; a necessary precondition for applying for credit.

Inputs
Organic fertilizers are mostly used including household refuse from home gardens and chicken droppings. The most common chemical fertilizers were NPK (20-10-10) and urea. The rate of both organic and inorganic fertilizer application is very variable. Generally, the inorganic fertilizers are used for the production of exotics. In land that has been newly cleared, producers tend to add no nutrients. Since the land is prepared by incorporating the grass and burning, yields are often very good during the first few years with plants benefiting from the ash and organic matter.

The use of chemical pesticides was widespread although no advice was being given on the dosage and appropriateness of the chemicals being used (many were originally bought to use on tree cash crops and the same crop protection chemicals as used on tomatoes are also used on huckleberry). Often insecticides and fungicides were being mixed together on a very ad hoc basis until the mixture was lethal enough to kill any pests that were found on the vegetables.

Seeds
Many farmers produce their own seed. Although some seed can be purchased in the market its viability is often questionable and so the more commercial growers prefer to produce their own seed.

For those farmers who choose to grow their own seeds the process is generally as follows. After the general transplanting, a few healthy plants are selected as seed stock. These may be left unharvested or may be harvested during the first harvest to initiate branching. These are then allowed to grow, flower and produce fruits. A typical huckleberry seed plant may have about 15 clusters with each cluster having 8 fruits. More fruits per plant are possible (up to 300) depending on the number of branches that the plant was permitted to have.

Processing for seed production may follow one of 2 paths:

1. The fruits are squeezed to release the seeds which are then dried in the sun. The dried seeds are winnowed and stored in a cool dry place.
2. The fruits are put in a bag (made from jute fibers), allowed to ferment for 7 days and then washed to separate the seed from the chaff. The seed is then dried in the sun and stored in a cool dry place. Drying depends on the farmer as no standard exists for the final moisture content of the seed. The seed is usually only stored for one season. Viability is not tested before planting. The farmers tend to reduce their risk by producing as much seed as possible and sowing all of it.

Marketing/post-harvest arrangements

Because of their perishability indigenous vegetables are generally harvested the evening before market day either by hand or using a knife. The field may be divided into plots and one plot harvested each week in rotation to give the crops time to regenerate. Farmers choose healthy mature plants to harvest.

For huckleberry about ten harvests are possible where water is not limiting and fertilizers (mainly urea) are applied often. Yields from the first harvest are low but peaks at about the third or fourth harvest. For example, one female farmer in Bandjoun with a total surface area under production of about 800^2, could produce up to 400 bundles of huckleberry by the 3rd harvest. After the seventh harvest the yield drops considerably because the plants are older. Although some farmers did claim that they can continue to harvest even after the 10th harvest if water and fertilizer are available, the yields are likely to be so low at to make the operation unprofitable (Fig. 2).

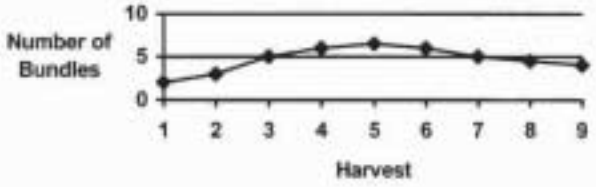


Figure 2. Variation of Huckleberry yield with time for a 10 square metre plot

Harvested leafy vegetables are tied into bundles, which may be further tied into a bale if the harvest is large. Farmers who do not sell all their produce directly from the farm may carry the rest to the market by head or hire a push cart (about CFA400/trip). Leafy indigenous vegetables are retailed in bundles which vary in weight from 900-1050g at the village and sells for CFA 75-100/bundle.

The only indigenous vegetable that is processed to some extent is bitter leaf. It is usually cleaned, sliced and dried. In this state, it can be stored for many months without deteriorating. This method of transformation is also used for okra.

Income

Indigenous vegetables are grown for home consumption and as a source of income. For many selling vegetables is the only way to make money. Many producers consider vegetable production a viable business although the lack of farmer records makes it hard to quantify this. However, all of the producers interviewed claimed that they could make a living from producing and selling vegetables earning at least CFA150,000. In fact in Mbantou village over half of the producers boasted that revenue of more than CFA1m was attainable in a good season of *Solanum scabrum* alone. Because of the harshness of the 1998 dry season, prices and profits were higher than normal.

Table 5. Average weekly income for Huckleberry cultivation in Foumbot area.

Farmer	Land Area (m^2)	Monthly Income
A	225	6,000
B	300	10,000
C	600	5 - 6,000
D	200	6,000
E	2500	40,000

Sources of information

All producers interviewed said they received periodic visits from agricultural extension workers but they only provided advice for exotic vegetables. No assistance was given for indigenous vegetables because of the lack of training and published information. There were some reports of extension officers giving advice about indigenous vegetables based on their experience with exotic vegetables. Most producers still rely on the traditional technologies which in some cases are not easily adaptable to large-scale production. The farmers expressed a need for assistance especially on the choice and use of crop protection chemicals.

Constraints to Production

The main problems faced by farmers included:

- Over-supply in the wet season lowers prices;
- Distance to market/poor road links;
- Lack of appropriate handling and storage technologies;
- Lack of technical packages and support services for indigenous vegetables. Generally improved agronomic packages provided to the farmers were for staple and traditional cash crops and often have little or nothing to do with indigenous vegetables;
- Lack of availability, poor quality and high cost of inputs.
- In the dry season the yellowing of leaves of many of the vegetables grown was mentioned as a major problem in both IV and exotic vegetable production, this problem is probably due to a nutrient deficiency;
- Aphids were identified as the major pests of huckleberry during dry season production. Some insects were also mentioned as being a problem to all leafy vegetables.

Solutions

Farmers considered the provision of frequent and reliable market information combined with greater technical support services to be their main priorities.

Future expectations

Many producers admitted vegetable production was hard work but agreed they would continue with this line of work (producing both exotics and indigenous vegetables) in the future. Some farmers commented that they will continue to produce because that is all they know.

1.2 Socio-economic survey of indigenous vegetables in Southwest Cameroon.

Dr Manfred Besong, IRAD, Ekona

METHODOLOGY

Six markets were selected for the study: three relatively large urban markets and three small rural markets. The six trained enumerators were divided into three groups. In both the dry and wet seasons two rounds of informal interviews were carried out in each of the six markets with an interval of about four weeks.

The production sources of indigenous vegetables were obtained by talking to market administrators and vegetable traders. Seven villages were selected for the production study. The indigenous vegetables sold in the study area were all produced locally whereas most of the exotics came from the more temperate western and northwestern provinces. Although the same markets and villages were surveyed in both the wet and dry seasons different farmers and traders were interviewed.

MARKET SURVEY

The following markets were surveyed: Muea, Ekona, Likomba, Great Soppo, Mutengene and Mile 14/16.

The tax paid for selling vegetables varies according to the total volume marketed. For 6 -10 bundles, the tax is CFA50, for one basin (30kg) the tax is CFA100, for one hand truck (about 100 kg) the tax is CFA200. In some markets such as Likomba, vegetable sellers sold their products along the roadside and not inside the stalls because they could not afford to rent the stalls.

Trader details

Most of the traders interviewed were immigrants from the North West Province while just a handful were locals from South West Province. The traders were mainly mature females with ages ranging from 28-50 years and had been selling vegetables for 1-5 years. The few male retailers generally sold exotic vegetables. Table 6 shows the numbers of sellers during the wet season survey; the proportions were broadly similar in the dry season. About half the retailers were also farmers who sold only what they produced themselves. A small proportion of the farmer-retailers also bought from other farmers to sell. The latter group were more likely to sell beyond their local market. The number of sellers and volume of produce traded has risen over the years due to an increase in demand from Douala. There has been little change in the range of vegetables marketed.

Table 6 Vegetables sellers per market (July and August 1997)

Market	Type of vegetable	Male traders	Female traders
Mile 14/16	Indigenous vegetables only	3	39
	Exotics only	5	7
	IVs & Exotics	0	4
Great Soppo	IVs only	6	93
	Exotics only	10	25
	IVs & Exotics	6	15
Muea	IVs only	14	192
	Exotics only	16	31
	IVs & Exotics	7	28
Ekona	IVs only	12	66
	Exotics only	6	11
	IVs & Exotics	3	6
Mutengene	IVs only	1	88
	Exotics only	17	50
	IVs & Exotics	1	19
Likomba	IVs only	2	36
	Exotics only	22	17
	IVs & Exotics	1	5
% of total	IVs only	4%	60%
	Exotics only	8%	17%
	IVs & Exotics	2%	9%

Product inventory

In terms of abundance the nine most important vegetables in the wet season were estimated as being:

July

1. Tomato
2. Huckleberry
3. Bitter leaf
4. Fluted gourd
5. Onion
6. Amaranth
7. Water leaf
8. Corchorus
9. Garden egg

August

1. Tomato
2. Onion
3. Huckleberry
4. Bitter leaf
5. Fluted gourd
6. Water leaf
7. Garden egg
8. Corchorus
9. Amaranth

During the dry season it was estimated that over 77% of the vegetables being sold were indigenous such as huckleberry, amaranth, bitter leaf, bayangi bitter leaf and big leaf bitter leaf, "anchia", water leaf, kelen kelen, fluted gourd, etc. Although popular, huckleberry does not grow well in the dry season. The most common exotic vegetables included: onion, tomato, ginger, carrot, cabbage, beetroot, cucumber and shallot. Out of all the vegetables, tomato and onion were being sold in the largest quantity.

Table 7. Quantities (in kg) of major vegetables traded in January (dry season)

Vegetable	Muea		Great Soppo		Mutengene		Likomba	
Survey days	1	2	1	2	1	2	1	2
Amaranth	360	120	270	240	210	120	120	60
Bitter leaf	810	480	510	450	330	180	150	90
Huckleberry	330	450	330	360	390	360	180	30
Corchorus	30	30	30	30	-	15	60	15
Fluted gourd	390	270	120	150	150	60	60	90
Garden eggs	50	20	30	50	20	20	10	10
Water leaf	540	240	180	150	450	120	120	120
Tomato	1750	2150	750	800	1000	400	100	150
Onions	1200	1200	800	800	1100	500	150	100

Marketing/Post-harvest arrangements

Wholesalers were observed buying vegetables in bulk during the early hours of the market and these are then transported to Douala and Limbe by truck. The wholesalers usually have contracts with the producers; the producers are given money in advance which acts as a security.

Retailers deal in smaller quantities and sell throughout the day. What is not sold is taken home by the retailers who store the produce for up to 2-3 days during which time further efforts to sell the produce are made. Most sellers sprinkle water on the vegetables to prevent withering.

Most harvesting is done during the late afternoon before a market day. Produce is tied in bundles at home and stored to keep them fresh. For example, bitter leaf is stored by placing the bundles on hedges or grass outside the home. In this way bitter leaf can be preserved for up to a week. In the dry season the indigenous vegetables are watered before putting them outside. Indigenous vegetables are usually carried from the farm to the market by children. Larger quantities are transported by truck.

There is little processing. People from the North West who know how to preserve bitter leaf (through washing and drying) collect the leaves at the end of the market.

In many of the markets unsold produce which had begun to perish was abandoned, creating waste disposal problems. Vegetables, particularly huckleberry, are not washed before sale because water makes them more susceptible to rotting during transportation and retailing. Apart from red chilli pepper most of the vegetables are not processed or preserved before or after sale.

Prices and income

Leafy vegetables are sold in bundles. Although the price remains the same, the size varies between retailers and wholesalers. Generally, one wholesaler bundle is the same size as two retail bundles. Prices do not vary with season but the size of the bundles are reduced in the dry season. During the wet season i.e March - June, there is usually an abundant supply of vegetables. .

The cultivation of vegetables is usually started at the beginning of the wet season i.e. March. Thus, all traders interviewed confirmed that they normally have abundant supply of

vegetables as from mid-March to Mid-June, and a fairly good quantity between September and November. Acute shortage of vegetables is usually experienced from December to February. During this period, vegetables supplied are those cultivated in swamps or under irrigation around the homes. Another period for lower supply is between July and September due to excessive rainfall.

Constraints

Traders complained of excessive rain during August which destroyed many of the vegetables. Insects eating the leaves was a common problem. Interviews with market officials elicited the following problems:
1. Poor hygienic conditions: vegetables are not washed and they are displayed on the floor for sale exposing them to possible contamination.
2. Units of sale for leafy vegetables are not uniform but can vary in weight for the same price.
3. Bulk buyers combine the bundles in huge bales which encourage quick spoilage (encourage heat generation and wilting during transportation).
4. Unsuitable transportation such as hand trucks and passenger vehicles are used to transport the vegetables. The cost of transport was also considered to be too high.
5. Due to heavy rains, mud is splashed on the vegetables displayed directly on the ground (usually on plastic sheets, leaves, mats, etc.)
6. Most of the leafy vegetables are not sorted before sale. This means that up to 50% of the material sold is unusable stalk (bitter leaf, huckleberry) or useless flowers (water leaf). This creates enormous waste disposal problems.
7. Displaying the vegetables under direct sunlight encourages wilting and loss of quality.
8. Lack of storage facilities.
9. Poor roads connecting villages to markets.

VEGETABLE PRODUCTION

Farmer details

Vegetable production in this area of Cameroon is undertaken almost solely by women of all ages who are generally immigrants from North West Province; the local residents are more used to producing staple crops. These vegetables are grown mainly on distant farms since productive land near the main roads and villages has been taken up by the Cameroon Development Corporation for the production of export crops such as bananas, rubber, oil palm, cocoa and Robusta coffee.

Product inventory

Regardless of season the most commonly grown vegetables are bitter leaf (*Vernonia hymenolepis* and *V. amygdalina*), several species of the huckleberry group, fluted gourds (*Telfairia occidentalis)*, greens (mainly *Amaranthus cruentus*), water leaf (*Talinum fruticosum)* and African okra (*Abelmoschus caillei*). T he most common exotic vegetable is tomato. The vegetables are usually intercropped with staple crops during the rainy season.

Most farmers thought that the production of indigenous vegetables has increased in recent years. Growing awareness of the profitability of selling vegetables due to increased demand has encouraged more farmers to convert more of their land to horticultural production.

Production details

Vegetable production techniques used are similar for most annual crops. The seedlings are nursed for about two or three weeks. They are then transplanted to prepared ridges. Quite often these vegetables are inter-cropped with cocoyams, maize, cassava, etc. Maturity time and harvesting periods vary with the vegetable crop concerned. Huckleberry and Amaranth have a first harvest after about three weeks, fluted gourd and (sweet) bitter leaf in eight weeks and tomato in about three months. Huckleberry and Amaranth are harvested once a week, bitter leaves once every two weeks, fluted gourd once every three weeks and tomato twice a week.

Huckleberry can be harvested for up to three months, amaranth for two months, Bayangi (sweet) bitter leaf for two to three months, fluted gourd for three years, and bitter leaf which is grown as a hedge near farmers' compounds (*Vernonia amygdalina)* for up to seven years.

The same types of vegetables are grown in both the dry and wet season. Since dry season production is limited to those farmers with access to water, crops are scarce and therefore more expensive during the dry season. Dry season vegetable production is usually in the form of mixed farming with other horticultural crops rather than with staple crops.

Inputs
Generally, vegetable production does not require many inputs. Fertilizers (20-10-10) and pesticides (MOCAP) are applied only on huckleberry.

Labour
Both family and hired labour is used for vegetable production. Hired labour is used in performing specific operations such as bush or land clearing and ridging while family labour is used for harvesting and marketing.

Credit
Because vegetable farming does not require many inputs, farmers generally do not require credit.

History of production

Farmers have been producing indigenous vegetables for many years and the pattern of production has remained the same and the crops grown unchanged. For others because land has become exhausted through overuse the pattern of production has changed; farmers either use fertilizers or have acquired new land.

Subsistence

Traditionally farmers have produced both for subsistence and for income. For subsistence they consume several types of vegetables many times a week, depending on their preference and culture. On average huckleberry is consumed three times a week, amaranth twice a week, fluted gourd, bitter leaf and water leaf (often with eru) once a week, and *Corchorus* only occasionally. These vegetables are eaten with the starchy staples such as cassava, cocoyam, maize and plantains. While urban dwellers consume more exotic vegetables than indigenous it is the reverse situation for rural dwellers.

Sources of income

The main source of income for the farmers interviewed was from the sale of agricultural (non-vegetable) produce such as cocoyam, plantain, cassava and maize. The most important vegetable crops were found to be all indigenous: huckleberry, Amaranth, bitter leaf, fluted gourd and water leaf.

Marketing/ post-harvest arrangements

Harvesting vegetables is a simple process using hands and knives. The produce is taken home in basins where it is tied in bundles for the market. Sometimes the vegetables are sold at the farm. Some farmers have marketing contracts with wholesalers and they meet at regular intervals at home or in their farms.

Most of the indigenous vegetables, except huckleberry, are stored by spreading them out on impermeable surfaces such as fertilizer bags and sprinkling water on them. Huckleberry is stored in a cool dry place with no water since it is very susceptible to rotting.

Constraints

Most of the problems of vegetable production are pest-related such as snails that eat the leaves of *Vernonia* and black ants that cause the leaves of huckleberry to fold up or to wilt. Traditional measures to counteract these pests is to cover the huckleberry plant in wood ash and remove the snails by hand. Diseases can be a major problem for huckleberry.

Expectations

Vegetable production is viewed as a traditional way of life by the farmers and all those interviewed expressed the desire to continue production.

1.3 Socio-economic survey of indigenous vegetables around Yaoundé.[2]

James Gockowski, IITA.

In this report two specific aspects of indigenous vegetables and their role in poverty alleviation are examined:
a) a comparative price analysis of vegetable marketing prior to the onset of the economic crisis in Cameroon and during the economic crisis;
b) an analysis of marketing revenues and employment based on surveys conducted with sellers of indigenous vegetables;

PRICE ANALYSIS OF VEGETABLES IN THE YAOUNDÉ MARKET

The analysis was conducted using nominal monthly and yearly retail prices from 1972 to September 1995 obtained from the Ministry of Planning. The commodities for which prices are available include tomatoes, okra, onions, cassava leaves, *Solanum nigrum/ scabrum (*zom, huckleberry*), Amaranthus cruentus (*folon*),* and *Vernonia* spp. *(*ndolé, bitterleaf*).*

One of our hypotheses is that huckleberry and amaranth are an important source of employment for those outside the formal sector in peri-urban areas and the outlying urban periphery, because of their relatively short, labour–intensive production systems, low levels of purchased input use and high yields. As the level of urban unemployment rose during the economic crisis, the production of these vegetables was increasingly targeted as a livelihood strategy.

If we make the assumption that the impact of the economic crisis on the demand for vegetables was uniformly distributed across all vegetables, then a widening price differential between huckleberry and amaranth vis-à-vis other vegetables would provide evidence in support of a more responsive supply and the hypothesis.

The price differentials between monthly prices from January 1982 through December 1986 were compared to those from December 1993 through September 1995. With the exception of the *Amaranthus*-okra price differential, all monthly price differentials widened and in six of the ten comparisons there was a statistically significant increase. In general the increase in price differentials in general was greater for huckleberry than for amaranth. The results presented in the tables below fails to reject the hypothesis

Table 8. Monthly nominal price differentials between huckleberry and other vegetables, Jan. 1982 - Sept 1995

	Tomatoes	Okra	Onions	*Vernonia*	Cassava	n_i
			CFA/kg			
Mean monthly price differential Jan 82- Dec 86	64.4	-158.5	42.7	177.3	195.3	64
Mean monthly price differential Dec 93-Sep 95	-97.0	-210.7	-142.7	81.2	97.1	22
Student's t statistic	5.74	1.26	4.14	5.84	5.34	
prob	0.000	0.213	0.000	0.000	0.000	

[2] This study was conducted by Juliette Mba'zoa of the University of Dschang and supervised and written up by James Gockowski of IITA.

Table 9. Monthly nominal price differentials between amaranths and other vegetables, Jan. 1982 to Sept 1995.

	Tomatoes	Okra	Onions	*Vernonia*	Cassava	n_i
			CFA kg			
Mean monthly price differential Jan 82- Dec 86	-80.1	-303.0	-101.8	32.8	50.8	64
Mean monthly price differential Dec 93-Sep 95	-149.40	-263.0	-195.0	29.9	44.7	22
Student's t statistic	2.98	-0.977	2.38	0.300	0.481	
prob	0.006	0.33	0.023	0.765	0.632	

The decline in nominal vegetable prices that occurred as a result of the economic crisis (significant for all commodities except onions and tomatoes) is a result of both decreased aggregate demand and an increase in production for those commodities (huckleberry and amaranths) which are produced in the urban periphery (Table 10). The decrease in the prices of leafy vegetables and okra have permitted the urban poor to maintain their nutritional intake of essential vitamins and minerals. As noted the decline in huckleberry was particularly significant. The statistically significant ($p<.01$) decrease in the coefficient of variation for indigenous vegetables provides more evidence of their increased production since the start of the economic crisis. The decline in monthly price variation most likely indicates an increase in the dry season production when price variation from the mean is normally the greatest.

Table 10. A comparison of average monthly retail vegetable prices and price variation in the Yaoundé market prior to and during the economic crisis.

Commodity	period	Mean Price CFA kg^{-1}	Std Deviation	Student's t prob	Bartlett's test for homogeneity of variance[1] prob
tomato	1983-86	247	77		
	1993-95	264	94	0.378	0.256
okra	1983-86	470	255		
	1993-95	378	138	0.038	0.002
onions	1983-86	268	117		
	1993-95	310	170	0.295	0.205
cassava leaves	1983-86	116	89		
	1993-95	71	24	0.020	0.000
Vernonia spp.	1983-86	134	55		
	1993-95	85	30	0.000	0.002
huckleberry	1983-86	311	124		
	1993-95	168	45	0.000	0.000
amaranth	1983-86	167	66		
	1993-95	115	28	0.000	0.000

[1] Chi-square statistic with 1 df.

The data set was used to estimate seasonal multiplicative indices of monthly price variation (Figure 3). Okra, cassava and bitter leaf exhibited the greatest variation with prices highest from January to April. Among the leafy vegetables, huckleberry and amaranth did not vary a great deal reflecting the production of these vegetables during the dry season in the inland valleys of the urban periphery of Yaoundé.

The correlation matrix of deseasonalized monthly time series can provide information on the relationships between commodities and the relative strength of those relationships indicating the degree to which commodities are substitute or complement goods. A priori we would expect the highest coefficients among the leafy vegetables and positive though smaller coefficients

between leafy vegetables and tomatoes and okra indicating weak substitute relationships. Onions which is a complement in the preparation of *la sauce* would be expected to have negative coefficients.

The empirical findings are more or less in alignment with a priori expectations (table 11). The highest correlations were between bitter leaf., huckleberry and amaranth and to a lesser degree cassava leaves, indicating that these vegetables are relatively close substitutes in consumption. Onions had negative coefficients with all variables, except for okra and tomatoes where no significant correlations were noted. Okra which is used to prepare la sauce gombo does not appear to have any close substitutes in consumption on the basis of its insignificant correlations with the other commodities. (Note: There may well be a correlation with kelen kelen (Corchorus olitorius) which is used for the production of a similar sauce but no statistical records over the earlier periods were available for comparison). Tomatoes did have significant positive coefficients with cassava leaves, amaranth and huckleberries, indicating that tomato-based sauce is a substitute for leafy vegetables.

Figure 3. Seasonal indices of monthly retail vegetable prices in the Yaoundé market.

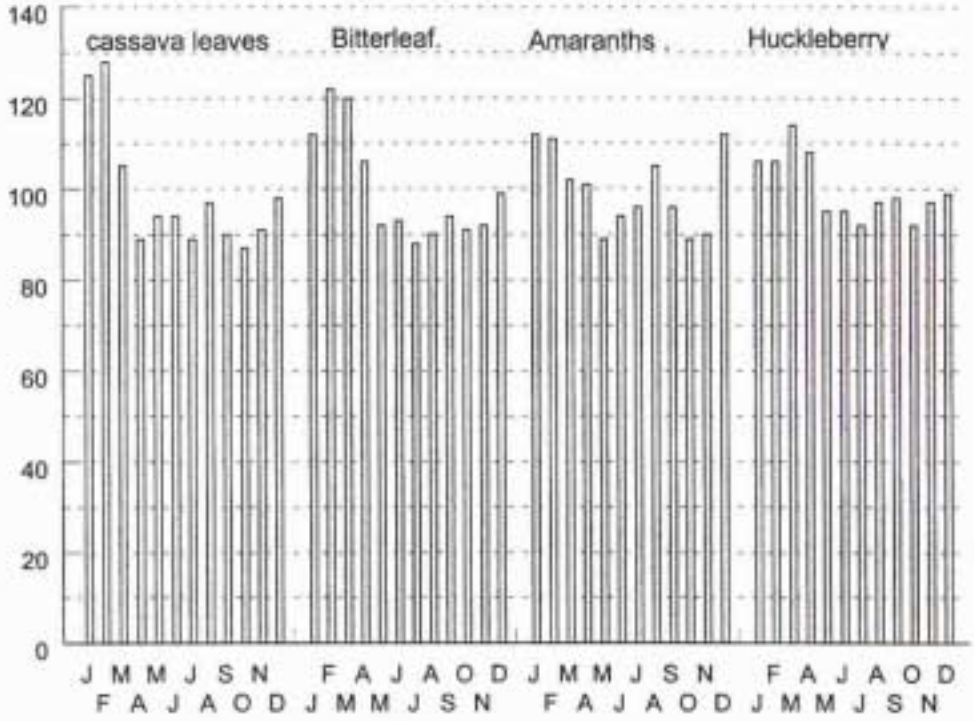


Table 11. Correlation matrix of deseasonalized Yaoundé monthly vegetable price data, 1983-95.

	TOM	OKRA	ONION	CASS	VERN	AMAR	HUCK
TOM	1.000						
OKRA	0.048	1.000					
ONION	0.074	0.069	1.000				
CASS	0.310	-0.024	-0.572	1.000			
VERN	0.177	0.169	-0.342	0.492	1.000		
AMAR	0.471	0.026	-0.235	0.553	0.578	1.000	
HUCK	0.436	0.184	-0.333	0.545	0.719	0.721	1.000

n=84, 1% two-tailed significance level of the correlation coefficient $r = .283$

ANALYSIS OF INDIGENOUS VEGETABLE MARKETS IN YAOUNDÉ

Following a rapid market appraisal in which an approximation of the most important markets and commodities was obtained, the sellers of tomatoes, okra (both indigenous *caillei* and exotic *esculentus*), cabbage, huckleberry, amaranth, bitter leaf and kelen kelen were targeted. Interviews were conducted with 102 market women. For each of these vegetables, gross marketing margins were calculated which were then used to estimate earnings per hour and daily earnings.

The majority of sellers were estimated to fall between the ages of 16 and 50 years. The typical market woman sold 1.7 different products with a mean daily earning of 525 CFA per product, and a total daily earning estimated at 893 CFA ($1.53 at current US$ exchange rate) for an average 12 hour day's work. By groups, sellers of the exotic vegetables (tomatoes, okra and cabbage) earned significantly more ($p<0.001$) than sellers of indigenous vegetables. The estimated daily revenues per product were 645 CFA and a total daily earning of 1028 CFA for sellers of exotics versus 429 CFA and a total daily earning of 817 CFA for indigenous vegetables sellers.

There are several explanations for this disparity in earnings. Sellers of indigenous vegetables cited a lower marketing loss percentage than exotics (12.8% versus 16.1%, $p< 0.01$). In general we would expect sellers of risky commodities to normally demand a risk premium. The financial risk of selling exotic vegetables also was higher. A mean of 2851 CFA was spent per transaction on purchasing product by retailers in the indigenous vegetable market versus 4927 CFA for exotic vegetables and the average weekly expenditures by retailers for resale was also significantly higher ($p<.05$) for exotic vegetables (13 038 CFA versus 10 878 CFA).

The variation in daily earnings, expenditures, and estimated physical losses across different commodities are presented in Table 12.

Table 12. Estimated daily earnings, weekly expenditures and weekly sales in the vegetable markets of Yaoundé, October 1997.

	daily earnings per product	average expenditure per purchase	weekly average expenditures	weekly average total sales	total estimated physical losses	n_i
	CFA	CFA	CFA	CFA	% of total	
tomato	557	6121	14585	18422	16.7	15
cabbage	1235	7146	18620	26880	16.3	8
okra (exotic)	470	2037	8129	11360	15.0	10
okra (indigenous)	318	3173	18588	20787	14.0	10
amaranth	624	1511	12721	16870	14.0	15
huckleberry	294	1127	4869	6630	10.0	15
kelen kelen	435	5153	8288	11216	12.0	15
bitter leaf	610	1621	10729	14715	14.6	13
Overall Average	525	3812	11836	15393	13.9	101

The low capital requirements for getting into the indigenous vegetable market and the relative lack of barriers means that this is a very competitive market and earnings are in general low. This market offers poor, unemployed women one of their few opportunities for earning a living. Based on a rapid reconnaissance of 14 satellite markets in Yaoundé, we estimate that roughly 1000 women are engaged regularly in selling indigenous vegetables. For these women and their families the meagre revenues earned are of the utmost importance.

2. UGANDA

2.1 Socio-economic survey of indigenous vegetables in Lira District.

Constance Owori, post harvest technologist; Agnes Nayiga, socio-economist and Margaret Nabasirye, biometrician, Kawanda Agricultural Research Institute.

METHODOLOGY.

Three sub-counties in Lira district were selected based on geographical location and local climatic conditions:

1. Adekokwok- situated in the western part of the district. The main urban centre, Lira, is within this sub-county;
2. Omoro- situated in the dryer eastern part of the district;
3. Awelo - situated in the southern part of the district near a lake.

During the wet season survey 30 market participants (market master, retailers and consumers) and 165 farmers were interviewed using participatory appraisal techniques. The interviews were carried out by a team of two district extension staff in each study area supervised by the District Agricultural Officer. A further 161 farmers were interviewed in the dry season.

MARKET SURVEY

Six markets, two in each of the selected sub-counties were surveyed. These were: Lira main, Kakoge, Omoro, Ogowie, Etam and Anyangoga. The markets surveyed in Omoro and Awelo operate twice weekly but those in Adekokwok are open daily because of the larger number of customers. Traders who sell in Omoro and Awelo sell in other local markets such as Inyoge, Oora-aora, Nyamuguru and Amugu in Omoro sub-county, and Kayago, fish landing sites and other informal markets in Awelo sub-county.

Trader details

A total of 23 traders were interviewed from 6 markets. Generally retailers were interviewed but some wholesalers were found in markets in Adekokwok sub-county (Lira main market and Kakoge). The market master reported that wholesalers only sell their produce very early in the morning outside the gates of the main Lira and Kakoge markets. There are no wholesalers in the other markets. Table 13 shows the markets surveyed and the number of retailers in each market at the time of the survey. There were about twice as may exotic vegetable sellers than indigenous vegetable sellers. Few retailers sold both indigenous and exotic vegetables. Most of the exotic vegetable sellers were found in Lira's main market. Many retailers were also farmers.

Table 13. Vegetable sellers per market (two of the three sub-counties only)

Sub-county	market surveyed	No. of IV retailers	No. of EV retailers	No. of both IV and EV retailers	Total No. of retailers
Adekokwok	Lira main	6	60	8	74
	Kakoge	10	3	2	15
Omoro	Omoro	11	9	0	20
	Ogowie	3	2	1	6
	Total	30	74	11	115
	%	26%	64%	10%	100%

Generally there were twice as many women vegetable sellers as men although in Omoro market about 90 % of the vegetable sellers were men. Most traders were aged between 18 and 35 and only had about 1 to 3 years experience of selling vegetables. Respondents indicated that there has been no major change in the type and range of vegetables sold.

The number of vegetable sellers in Lira's main market has decreased in recent years because five new smaller markets have opened in the town. Overall however the number of sellers and volume of sales has increased. The rise is attributed to the growing perception by farmers of the economic value in producing vegetables. The loss of cattle to rustlers is also believed to have led to a shift in production away from staple crops to horticultural crops as the latter do not require draught power to plough the fields. Also swamp land which was previously used for cattle grazing is now available for vegetable production.

Product inventory

Fourteen different types of indigenous and exotic vegetables were being sold in the markets. *Hibiscus cannabinus*, cowpea leaves and *Amaranthus* spp. were the most commonly sold indigenous vegetables in Adekokwok and Omoro (No indigenous vegetables are sold in Awelo markets). For exotics, eggplant, tomato and onion were the most common. Other vegetables on sale were: *Crotalaria ochroleuca, Cleome gynandra, Corchorus* spp, *Solanum aethiopicum, Amaranthus* spp, *Brassica* spp, cabbage, pumpkin leaf and carrot.

Most vegetables are produced within 20 miles of Adekokwok markets and less than six miles for the Omoro markets. Retailers themselves produce a large quantity of vegetables that are sold in Awelo and Omoro markets although retailers in Adekokwok are more likely to purchase supplies from wholesalers or other farmers either at the markets or at their farms.

Consumer preferences

Interviews with consumers revealed that all ate *Cleome gynandra, Amaranthus* spp and tomato. Results also indicate that more consumers ate indigenous vegetables than exotics. Amaranth is the most preferred vegetable followed by *Hibiscus cannabinus* and *Crotalaria ochroleuca*. The least preferred vegetables are egg plant and cowpea. Tomato is the most frequently consumed vegetable followed by onion and *Amaranthus* spp. *Crotalaria ochroleuca* and cabbage are the least frequently consumed vegetables. Consumers interviewed reported that cleanliness and lack of insect damage are the most important qualities required by consumers in both indigenous and exotic vegetables.

Marketing arrangements

There appears to be few contractual arrangements between farmers and traders. Those traders who do not rely on their own production reported that they simply purchase vegetables from any available supplier. In the more sophisticated markets in Lira some traders had developed contacts with farmer whereby they would buy from particular farmers on a regular basis or provide exotic seeds (especially cabbage) to farmers who in turn supply vegetables.

The frequency of vegetable purchases relates to the frequency of the market. In urban Lira, where there are daily markets, produce is bought virtually every day. Because of the problems of storing perishable products usually traders only buy enough to sell in a day. Produce left unsold at the end of the market day is usually taken home and consumed or preserved and sold in a dried form. The main exceptions to this are *Crotalaria ochroleuca* and *Solanum aethiopicum* which can last for up to four days.

Post harvest techniques

After harvesting most indigenous vegetables are washed, trimmed and packed into baskets or sacks. Exotic vegetables are handled in different ways depending on the vegetable.

In Omoro sub-county some indigenous vegetables such as *Hibiscus cannabinus, Crotalaria ochroleuca,* cowpea leaves, *Corchorus* spp and also eggplant were reportedly being sold dehydrated (mainly during the dry season). Reasons given for drying included ease of transportation (dried vegetables are lighter) and ease of storage (they last longer). Only women were reported to be involved in the drying of vegetables but both men and women retailers sold dried vegetables. Vegetables are generally dried by leaving out in the sun for 1-2 days although cowpea leaves were first steamed and then sun-dried for 3-4 days.

Concerning storage, fresh vegetables were stored for 1-3 days and dried ones for 2-5 months. Most respondents stored their vegetables at home except at Lira main market where they stored them at their stalls. The most common storage method involved spreading vegetables on a mat or bag and either covering with a damp cloth or sprinkling with water. Some indigenous vegetables such as cowpea leaves and *Hibiscus cannabinus* are left standing in basins/pans filled with water. Dried vegetables are generally stored in polythene bags or sacks.

Prices

Respondents in all markets sold their vegetables in bundles (indigenous vegetables) and heaps (exotic & indigenous vegetables) of varying weights. In each sub-county, however, the price of the bundle was shs50 and a heap shs 50-100. For purposes of price comparisons, the heaps and bundles in different markets were weighed and average prices determined per kilogram. Table 14 shows the average prices of vegetables at the time of the survey.

Table 14. Average vegetable prices.

Vegetable	Average price (Ug shs) per kg		
	Adekokwok	Awelo	Omoro
Hibiscus cannabinus	1000	-	150
Crotalaria ochroleuca	800	-	50
Cowpea leaves	700	-	50
Cleome gynandra	800	-	100
Corchorus spp	600	-	-
Amaranthus spp	700	-	100
Solanum aethiopicum	500	-	-
Tomato	1000	-	-
Egg plant	500	-	100
Cabbage	500	200	-
Onions	900	500	-
Carrots	800	-	-

Results above show that generally the prices of vegetables in Adekokwok markets are highest. Among the indigenous vegetables, *Hibiscus cannabinus* had the highest selling price per kilo equivalent to that of tomato. Generally there wasn't much difference in prices between indigenous and exotic vegetables in specific markets.

Of the traders who commented on price changes, most claimed that prices had been stable over the past years although prices do vary on a daily basis depending for example on the number of buyers and sellers, the time of day (in the evening the price of vegetable can be reduced to enable the seller to get rid of produce) and the trader's bargaining skills.

Respondents who reported that prices had been stable stated that the size of the bundle/heap varied according to the season. During the wet season (April-September) the supply of vegetables increased and this lead to an increase in the size of the bundles/heap - equivalent to a fall in the price per kg. Conversely in the wet season when suppliers were scarcer bundles would often be halved in size - a doubling of prices. Some traders, however, were convinced that prices had risen in response to the drought which had affected subsistence production.

Income

Almost half of those interviewed ranked selling vegetables as their main source of income followed by selling cotton, cassava, rice and beer. For individual vegetables cowpea leaves, *Crotalaria ochroleuca*, egg plant and *Hibiscus cannabinus* were the most important.

Constraints and solutions.

Farmers and traders (who are often farmers as well) claimed that high market dues was their main constraint followed by high post harvest losses and lack of improved seeds. Other problems included lack of transport to market, poor storage facilities (and knowledge on preservation methods), unhygenic market conditions and high prices in the dry season. **They** suggested a reduction in market dues followed by better provision of good quality seed, training on better storage and processing methods and the provision of loans for solving their constraints.

Future expectations

The majority of traders planned to continue selling the same types of vegetables in the future.

PRODUCTION SURVEY

Farmer details.

A total of 161 farmers selected randomly from Awelo, Adekokwok and Omoro sub-counties were interviewed. Of the interviewed farmers, 106 were indigenous vegetable producers, 14 exotic producers and 41 both indigenous and exotic producers. The majority of the farmers interviewed were women aged between 30 and 45 years old.

Product inventory

Respondents were found producing over 18 types of vegetables. The most commonly produced vegetables in the sub-counties surveyed are shown in Table 15.

Table 15. Types of vegetables grown

	No.of respondents				
Vegetable	Adekokwok	Awelo	Omoro	Total	%
Cowpea	44	50	50	144	89
Hibiscus cannabinus	42	47	46	135	84
Crotalaria ochroleuca	34	8	30	72	45
Cleome gynandra	30	17	17	64	40
Amaranthus ssp	36	9	14	59	37
Pumpkin leaves	17	31	8	56	35
Tomatoes	14	11	15	40	25
Egg plants	15	3	7	25	16
Corchorus ssp	15	4	2	21	13
Cabbage	5	9	5	19	12
Onions	6	5	3	14	9

n=161

Results in the table show that the most popular indigenous vegetables in the three sub-counties are cowpea and *Hibiscus cannabinus*. However, *Amaranthus* sp. and pumpkin leaves are popular in only Adekokwok and Awelo sub-counties respectively. Tomato and eggplant are the most popular exotic vegetables. Other exotic vegetables which were produced by a few respondents but are not shown in the table include spinach, green pepper, cauliflower and carrot.

Production details

Land tenure

Not surprisingly for a rural area, most vegetables are grown on family-owned farms. Farmers interviewed reported that they grew vegetables during the wet season in gardens around the homestead, in the main field either near home (about 100 m) or far from home (about 500m) and in the swampy areas. The gardens in the swampy areas were reported to be used for producing vegetables mainly during the dry season in order to utilise water in the swamps but not everyone has access to these. Other gardens reportedly were used in the wet seasons. Respondents mentioned that *Cleome gynandra* and pumpkin leaves are always grown in gardens around the home stead.

Farming system

There are usually three vegetable production seasons. The first production season is between March and May and corresponds with the first rains. The second production season begins in July to September and corresponds with the second rains. The third production season is in the dry season from November to February. Dry season vegetable cultivation is done in the swampy areas.

Respondents said that they grew vegetables both in pure stands (monocropping) and under intercropping systems. The farming system used depended on the type of vegetable, purpose of the vegetable (subsistence or income) and the season (wet or dry) when it is grown.

Most exotic vegetables produced for income were reported to be grown under a monocropping system whereas most indigenous vegetables grown for subsistence were intercropped. The indigenous vegetables produced for income were reported to be monocropped. Indigenous vegetables produced for income during the dry season were also always monocropped. The reasons given for monocropping included the improvement of crop yield and product quality.

Intercropping of two or more indigenous vegetable species was practiced for *Hibiscus cannabinus, Crotalaria ochroleuca,* cowpea *and Corchorus* ssp. The indigenous vegetables were also intercropped with other crops such as simsim, millet, sorghum, pigeon peas, ground nuts, beans, maize, cotton and cassava.

Inputs

Basic inputs such as hoes, pangas and axes were used for land preparation and weeding in all types of vegetable gardens. Other inputs used included fungicides (dithane M-45) on tomatoes, pesticides (ambush, dursban) on tomatoes and cabbages, and fertilisers mainly on tomatoes. Some respondents from Adekokwok said that they mulched cabbages. Farmyard manure was used for the production of both exotic and indigenous vegetables. All the respondents from Omoro reported that they used farm yard manure on pumpkins.

About a quarter of the vegetable farmers interviewed did not apply any inputs to their vegetable gardens because the produce was for home consumption only. The most commonly used input used was farm yard manure especially by Adekokwok farmers. The reason given by respondents for wide application of farmyard manure is that it is available at no cost and the yield of vegetables increases when it is applied.

Seed

Most farmers saved their indigenous vegetables' seeds from last year's crop but farmers were more likely to buy exotic vegetable seed such as tomato and cabbage.

Labour

Generally family labour is used although hired labour is used especially for exotic vegetable production. Some women belonged to women's groups who often pooled their labour to work on each others farms.

Access to credit.

Most respondents reported that they had no access to credit for vegetable production. Some farmers had received credit from government schemes.

History of production

The majority of farmers have been growing vegetables for the past 1-10 years. Although the severe drought has led a reduction in vegetable production this dry season the trend over past years was upwards (as more vegetables were being planted in swampy areas). The main reason for this was the growing perception of the income opportunities of selling vegetables.

Sources of information

The most common source of information for vegetable production was family and friends. Advice from the extension service when available was reported to be received mainly for exotic vegetables.

Purpose of production

Most respondents said that they grew vegetables both for subsistence and income reasons. The primary purpose of production was however subsistence. Few farmers reported growing exotic vegetables for subsistence purposes. Cowpea, *Hibiscus cannabinus* and *Crotalaria ochroleuca* are the most important indigenous vegetables for subsistence, while egg plants and tomatoes are important exotic vegetables for subsistence value (Table 16). All the indigenous vegetables produced were found to be a major food component in the daily diet of the farmers. Respondents indicated that they usually prepared one or a combination of two types of vegetable as part of a daily meal.

Table 16. Preference ranking of vegetables.

Vegetable	Rank
Cowpea	1
Hibiscus cannabinus	2
Crotalaria ochroleuca	3
Pumpkin leaves	4
Cleome gynandra	5
Amaranthus ssp	6
Corchorus sp.	7
Egg plants	8
Tomatoes	9
Cabbage	10

Respondents reported that most of the exotic vegetables were grown for income generation purposes. The following indigenous vegetables were identified as being grown for both income and subsistence: *Hibiscus cannabinus, Crotalaria ochroleuca,* cowpea and *Amaranthus* sp. Respondents ranked vegetables in order of importance as a source of income (Table 17)

Table 17. Income ranking of vegetables

Vegetable	Rank
Cowpea	1
Egg plants	2
Hibiscus cannabinus	3
Cabbages	4
Tomatoes	5
Crotalaria ochroleuca	6
Amaranthus sp.	7
Cleome gynandra	8
Corchorus sp.	9

The table shows that the most important vegetables in terms of income generation are cowpea, eggplant and *Hibiscus cannabinus*. The reason given by respondents is that these crops can be produced throughout the year without applying pesticides or fungicides. Both leaves and seeds of cowpea and *cannabinus* sp. are sold to consumers and the leaves of these vegetables are also sold in dried form.

Respondents reported that alternative sources of income include the sale of surplus staple food crops such as millet, cassava, sweet potato and rice, beside the sale of traditional cash crops such as cotton, tobacco and sugar cane as well as domestic animals. Some also sold home produced beer and firewood.

Preparation methods

Various preparation methods for specific vegetables have been summarised in Table 18. The most popular method of preparing vegetables is cooking them with groundnut and/or simsim paste.

Table 18. Vegetable preparation methods.

Preparation method	Vegetable prepared
Cook vegetable with groundnut and or simsim paste	*Hibiscus cannabinus, Crotalaria ochroleuca*, cowpea, *Cleome gynandra, Corchorus ssp, Amaranthus* sp., *Brassica* sp., pumpkin leaves, tomatoes, cabbage, egg plants
Fry vegetable after or without boiling	*Crotalaria ochrolemca*, cowpea, *Cleome gynandra, Corchorus sp., Amaranthus* sp., *Brassica* sp., pumpkin leaves
Cook vegetable with legumes	*Hibiscus cannabinus, Crotalaria ochroleuca, Cleome gynandra, Corchorus* sp., *Brassica* sp., pumpkin leaves, tomatoes
Boil one type or a mixture of vegetables	*Hibiscus cannabinus, Crotalaria ochroleuca*. cowpea, *Cleome gynandra, Amaranthus* sp., pumpkin leaves.
Cook vegetable with animal protein	*Crotalaria ochroleuca, Amaranthus* sp., *Brassica* sp., pumpkin leaves, tomatoes, egg plants, cabbage

POST HARVEST HANDLING DETAILS

Harvesting

Respondents reported that the different types of the vegetables they grew reached harvest maturity at different times. Maturity indicators used by farmers included height of vegetables, presence of branches and age of the plant after germination (Table 19). Once mature, farmers said that they used a number of different methods to harvest indigenous vegetable including uprooting the whole plant and plucking off some of the leaves. The average frequency of harvesting vegetables was found to be once a week for most indigenous vegetables, every day for tomato and once only for cabbage and onion. Respondents indicated that the time of planting till harvesting of vegetables varied depending on climatic conditions and the type of vegetable (Table 20).

Table 19. Time of planting till harvesting.

Vegetable	Harvest maturity (weeks)
Amaranthus sp.	2.3
Gynandra Cleome	2.6
Cowpea	2.8
Hibiscus cannabinus	3.6
Crotalaria ochroleuca	3.8
Spinach	6.0
Pumpkin leaf	10.2
Cabbage	11.8
Green pepper	12.0
Tomato	13.0
Eggplant	13.8
Onions	18.7

Results show that most indigenous vegetables are early maturing whereas exotic vegetables take longer to mature. Respondents said that they harvested vegetables for some time from the same garden.

Table 20. Duration of vegetable harvesting

Vegetable	Harvest duration (months)
Cleome gynandra	1
Cowpea	1.3
Amaranthus sp.	1.4
Hibiscus cannabinus	4.3
Crotalaria ochroleuca	4.6
Pumpkin leaves	6.2
Corchorus sp.	7.2

Preservation methods

Respondents reported that they preserved some indigenous vegetables as well as eggplant by sundrying (Table 21). The major objective of drying vegetables as indicated by farmers is to extend the storage period thereby increasing the availability of the vegetables. Three vegetable drying techniques were identified and are shown in Table 22.

Table 21. Vegetables that are dried

Vegetable	% respondent
Cowpea	*73*
Hibiscus cannabinus	*62*
Crotalaria ochroleuca	*52*
Eggplant	*18*
Amaranthus sp.	*7*
Corchorus sp.	*5*
Garden egg	*3*
Cleome gynandra	*2*
Brassica sp.	*2*

Table 22. Vegetable drying methods.

Drying method	Vegetable	No. of respondents
Spread vegetable with stem or plucked leaves only on a mat and dry in the sun for 3-4 days(dry season) or 6-7 days (wet season)	*Hibiscus cannabinus*	24
	Crotalaria ochroleuca	17
	Cowpea	25
	Eggplant	2
	Total	68
Slice vegetable and sun dry for 3-4 days (dry season) or 6-7 days (wet season)	*Crotalaria ochroleuca*	1
	Eggplant	11
	Total	12
Boil vegetable for a few minutes, drain water and sun dry for 2-4 days	*Hibiscus cannabinus*	1
	Crotalaria ochroleuca	1
	Cowpea	5
	Total	7
Ferment vegetable leaves overnight, boil with salt, dry in the sun for 2-4 days	*Crotalaria ochroleuca*	1
	cowpea leaves	3
	Total	4

Storage methods

Respondents said that they stored their vegetables in fresh and dried forms. Farmers said that they could store the highly perishable vegetables such as *Amaranthus* sp. and *Cleome gynandra* for about three days. The less perishable vegetables such as eggplant and onion can be stored for about eight days. Because of the perishability of the vegetables, respondents indicated that they usually harvest vegetables a day before or on the market/consumption day. A number of problems associated with fresh storage were identified: yellowing of leaves, loss in taste/flavour, rotting, drying and development of mould.

Drying is used by farmers to prolong storage life of vegetables. Respondents said that they can store dried vegetables for as long as three months. Storage containers used include polythene bags, sisal sacks, pots, sauce pans and dishes. A number of problems associated with storage of dried vegetables were reported. These included: rodent attack, change in taste, pest infestation, development of mould and change in colour.

Marketing

Most of the farmers interviewed reported that they did not have any marketing contracts with their buyers. Instead they sold their vegetables to any buyer who was interested. Vegetable buyers were many and they included neighbours, friends, vegetable retailers. Institutions (schools, prisons, etc.), hotels and restaurants. Table 23 shows the different locations at which respondents marketed their vegetables.

Table 23. Vegetable sales points

Location	No. of respondents	%
Main village and urban markets	84	90
Informal village markets	84	90
Farm gate	5	5
Hotels/restaurants	3	3
Institutions	3	3

Most respondents from Awelo reported that they sold their vegetables once a week, Omoro respondents sold twice a week whereas Adekokwok respondents sold their vegetables

throughout the week. It was found that the marketing of vegetables was mainly done by women although some men and children participated.

Respondents sold their vegetables in bundles, heaps, and boxes (exotics only) of various sizes and weights. Each bundle however cost shs 50. Respondents said that the size of the bundles and heaps is changed according to the production season. Bundles are larger in the wet season and smaller in the dry season.

There were differing opinions over recent price movements. The major reason given by respondents for increased vegetable prices was the prolonged drought that occurred in 1997 and caused a shortage in vegetable supply. On the other hand, respondents who reported a decrease in prices said that it was because of increased competition caused by more farmers getting involved in vegetable production.

Constraints and solutions

Production constraints

Respondents identified and ranked problems which they experienced in vegetable production. They also suggested ways in which the problems could be resolved. (Tables 24 and 25)

Table 24. Ranking of farmers vegetable production problems.

Constraint	Rank
Lack of or high cost of inputs (pesticides, seeds)	1
Pest and disease damage	2
Lack of improved/good seed	3
Labour constraint (weeding, harvesting)	4
Drought	5
Lack of capital	6
Lack of transport to market and from garden to home	7
Inadequate knowledge on post-harvest methods	8
Thieves	9
Limited swamp land for dry season cultivation	10
Physical weakness	11
Rodents and other vertebrates	12
Soil infertility	13
Red pepper plants destroying vegetable gardens	14
Preservation of seed is difficult	15

n=140

Table 25. Suggested solutions to production problems

Suggestion	% respondents
Government to provide loan/grants for purchase of production inputs	70
Government to provide pesticides and other inputs at subsidised prices	44
Establish sales system for improved seed	26
Train and educate farmers on improved vegetable production methods	8
Government should increase extension advisory services	3
Safe guard swamps for vegetable production	1
Farmers should intercrop vegetables to reduce land problem	1
Farmers to spray vegetables against pests	1

n=104

Marketing problems

Respondents identified several marketing problems which have been listed in the table 26. A number of solutions to the identified constraints were suggested by the farmers (Table 27).

Table 26. Farmers' marketing problems.

Problem	%
Low vegetable prices (due to market over supply of vegetables and high competition)	57
Lack of transport to the market	53
Lack of packaging materials	22
High market dues	22
Lack of storage facilities	10
Delayed payment by some customers	6
Lack of processing facilities	4
Low product quality caused by pest attack	2
Theft in the market	2

n=49

Table 27. Suggested solutions to vegetable farmers' marketing problems.

Solution	%
Provide credit for purchase of bicycle and packaging material	74
Reduce market dues	13
Provide training on improved vegetable processing methods	4
Farmers form groups/associations to improve marketing	4
Government to provide refrigeration facilities	4

Future expectations

The majority of respondents (69%) expected to continue producing the same types of vegetables as before, some farmers (13%) said that they expected to expand production of indigenous vegetables while others (7%) expected to expand production of exotic vegetables and reduce indigenous vegetable production.

2.2 Socio-economic survey of indigenous vegetables in the peri-urban area of Kampala.

Dr Remigius Bukeny-Ziraba and John Tabuti, Makerere University

METHODOLOGY

The study was divided into two parts: a market survey and a production survey. Enumerators were selected from Makerere University students and these were given training in rapid appraisal techniques by Nicholas Fereday from NRI. Because of the limited budget only six enumerators participated in the survey work although many more benefited from the training course. The enumerators used a number of participatory methods including semi-structured interviews with checklists and ranking exercises (See Annex 1).

The market survey was conducted first, and once a number of market actors were interviewed it became clear that most of the vegetables sold in the Kampala markets came from three districts surrounding Kampala: Mpigi, Mukono and Luweero. All the farmer interviews took place in these three districts. The interviews were carried out by four groups of two enumerators. Market and production surveys were carried out in both the wet and dry seasons. One hundred and sixteen farmers were interviewed in the wet season (44 women) and 70 in the dry season (26 women). Fortytraders were interviewed in the wet season and 30 in the dry season.

Rains fell in the last part of 1997 and continued in January 1998 destroying many crops, followed by a scorching dry spell that stopped farmers from planting.

MARKET SURVEY

Eight markets were surveyed and a general product inventory was recorded in the six main ones. These were: Owino, Kalerwe, Mengo-Bulange, Nakawa, Nateete and Kasubi. All the markets are within 6km of the city centre.

Nakulabye market:

According to the Market Master, Mr Stephen Nsereko, traders began selling leafy vegetables in the 1980s. After the civil wars of the 1980s the population of Kampala increased resulting in an increase in demand for vegetables. The market has 470 stalls, 150 of which sell vegetables. Serious business in this market begins around 1.00 p.m. At the time of the survey there were 40 vegetable sellers, 24 of whom were selling both indigenous vegetables and exotics, and 16 selling exotics only. To get a stall in Nakulabye market, one has to 'buy' goodwill at a cost of between U Shs 150,000 and 1,000,000. Rent for a stall is U Shs 3,450 per month, while market dues per item brought in is U Shs 500.

Kasubi Market:

Kasubi market has both a roadside market and built-up stalls. Men sell from the roadside market and from carts that they push within the Kasubi area. Traditionally, men have not sold vegetables in the market. At the time of the survey there were 51 vegetable sellers, 40 of whom were selling exotics only.

Kalerwe Market:

Kalerwe is a roadside market about 6 Km from Kampala on Gayaza Road. It has a high population of sellers and buyers and is busy the whole day. Both males and females are

involved in the trade. At the time of the survey there were 10 traders selling indigenous vegetables only, 30 selling both and over 100 selling exotics.

Mengo Market:

The market is located along Namirembe-Rubaga Road, about 6 Km from Kampala. It is both a retail and wholesale market. The market population is not very high. It has about 70 sellers of both indigenous vegetables and exotics and is dominated by women.

Nakawa Market:

Nakawa market is 5 Km along Kampala-Jinja road and has 30 vegetable sellers 10 of whom are selling both indigenous vegetables and exotics, 15 were selling only exotics and 5 were selling indigenous vegetables only.

Owino market:

Owino market is found in the centre of Kampala. It is the largest market in the country and has recently been refurbished. There are fewer sellers of vegetables now than in previous years because the vegetable traders could not afford the rent of the newly refurbished stalls and were forced out to the roadside market.

Trader details

Most of the retailers were middle aged women who were also farmers. Over half of the retailers observed in the markets were selling exotics only (Table 28).

Table 28. Number of retailers selling different vegetable types (wet season)

	Mengo-Bulange	Nakawa	Nateete	Owino	Kalerwe	Kasubi	Total	%
IVs only	11	7	30	14	100	24	186	22.5
Exotics only	25	4	210	8	180	46	473	57.1
IVs and exotics	3	18	10	8	120	-	169	20.4
Total	39	29	250	30	400 (approx.)	70	828	100

Product inventory

Around 25-30 different types of vegetables are sold in Kampala's markets depending on the season (more are available in the wet season). Tables 29 and 30 show the most common vegetables sold in the wet and dry seasons.

Table 29. Vegetable types sold by different retailers (wet season)

Vegetable type	Number of traders selling
Solanum aethiopicum Shum group	24
Amaranthus lividus	22
Garden egg	14
Eggplant	14
Cleome gynandra	14
Tomato	13
Amaranthus dubius	10
Onion	9
Green pepper	9
Pigeon peas (=indigenous)	7
Solanum anguivi	7
Cabbage	7
Huckleberry	6
Okra (2 types)	6
Hibiscus cannabinus (=malakwang)	5
Corchorus olitorius.	4

Table 30. Vegetable types sold by different retailers (dry season)

Vegetable type	Number of traders
Amaranthus lividus	23
S. aethiopicum (Shum group)	22
Tomato	18
Onion	15
Green pepper	14
S. aethiopicum (Gilo group)	14
Solanum melongena	14
Cleome gynandra	12
Amaranthus dubius	10
Carrot	9
Cabbage	9
Ggobe	6
Cortmilli	6
Solanum nigrum	4
Sukuma week	4
Cucumber	4
Corchorus spp. (Otigo)	4
French bean	3
Ground nuts	2
Hibiscus cannabinus (Malakwang)	2
Spinach	1
Lettuce	1
Okra	1

Vegetables were sourced from within a radius of 40km except for one wholesaler who collected his onions from villages about 400km from Kampala.

History of marketing

The majority of traders have been selling vegetables for a period of 1-5 years. There was no particular preference between exotics and indigenous vegetables in the choice of vegetables a

trader started with. Generally there are more traders now than in previous years because of the retrenchment of civil servants and increase in urban population (consumers).

Marketing arrangements

Retailers bought vegetables early each morning (5.00 - 7.00am) from farmers and wholesalers who travel to the markets. A retailer would generally sell in the same market because of limited capital and transportation costs to other markets. None of the retailers interviewed had contracts with wholesalers. Retailers sell leafy vegetables in small bundles of 4-6 stems and fruits in small heaps.

Post-harvest techniques

Retailers reported that indigenous vegetables could only be stored for 2-3 days and exotics for 4-5 days. The only preservation techniques used by traders on indigenous vegetables was to immerse the roots in water and sprinkle water on the leaves. The vegetables were then covered under plastic sheeting to reduce their transpiration and kept in the shade. Preservation was done only in the dry season as in the wet season the vegetables are already moist. Generally vegetables were washed prior to selling.

Seasonality

Tomato, cabbage and other exotics are more abundant in the dry season whereas indigenous vegetables are more of a wet season crop. There has been an increase in the number of vegetable sellers because of their higher demand of vegetables.

Prices

There has been no significant changes in prices over time. Selling prices in Nakasero market are better because the clientele are more affluent. Periods when customers are generally poor are those when they have many other obligations such as paying for school fees. Some traders were reported to have given up vegetable trading because of the increased number of sellers.

Income

In terms of income ranking indigenous vegetables scored highly. Of the ten most important vegetables from which marketeers derive their income in the wet season, five were indigenous (Table 31). Over half the retailers listed farming as an alternative source of income. The results were very similar in the dry season although vegetables are less abundant.

Table 31. Ranking of traders' income from vegetables (the most important only) - wet season

Vegetable type	Rank
Solanum aethiopicum Shum	1
Tomato	2
Okra	3
Amaranthus spp	4
Solanum anguivi	5
Spinach	5
Garden egg	6
Green pepper	7
Cabbage	8
Lettuce	8
Cleome gynandra	9
Onion	10
eggplant	11
Hibiscus cannabinus	12
Corchorus spp.	13

Prices of vegetables vary with season (Table 32).

Table 32. Seasonal price changes

Vegetable type	Time of Scarcity	Time of Abundance
S. melongena (sack)	20,000 - 25,000	5,000 - 6,000
Gilo group	20,000	4,000 - 10,000
Cabbage (> 80 Kg)	15,000-20,000	
Green Pepper	30,000	10,000
Tomatoes (box) (~80 Kg)	40,000 - 80,000	7,000 - 10,000
Cucurbita sp. (2 Kg)	1,000	500
Cabbage (Sack)	18,000 - 30,000	7,000 - 15,000
Beans (Sack)	15,000 - 30,000	6,000 - 12,000
Cow peas	30,000 - 80,000	15,000 - 30,000
Shum group (30 Kg)	12,000	6,000
A. lividus (30 Kg)	8,000	2,000 -2,500

Table 33. Retail prices of some vegetables and profits obtained

Type	Weight	Buying price	Profit
Tomato	Box	10,000	2,000 - 3,000
S. anguivi	2 Kg	500	200
Cortmilli	2 Kg	700	
Cabbage	1 Kg	500	100
Gilo group	1 - 1.5 Kg	500	
S. melongena	7 pieces	500	500
A. lividus	3 Kg	1,000	500 - 800
Cucumber	1 Kg	1,200	
Carrots	1 Kg	1,500	
Mitisauce	bundle	500	
Lettuce	-	800	
French beans	1 Kg	1,000	
Spinach and salads	bundle	300	
Cortmilli	bundle	300	
A. lividus and *A. dubius*	bundle	200	
Shum group	Small bundle	250	

Table 34. Wholesale prices and retail prices of vegetables

Type	Quantity bought	Wholesale price	Retail price
Shum group	15-20 Kg	6,000	5-7 stems @3-500
Gilo group	Sack (20 Kg)	7,000-10,500	10 fruits 300
Gilo group	1 tin	2,000-3,000	500 heap
Tomatoes	Box (20-35 Kg)	18,000- 25,000	5 fruits 500
S. melongena	Sack (30 Kg)	20,000	3 fruits 200
green pepper	Box (15 Kg)	12,000	3 fruits 500
S. nigrum	bundle (10 Kg)	3,000	6 stems 200
A. dubius	bundle (15 Kg)	5,000	5 stems 200
A. lividus	bundle (15 Kg)	4,500-7,000	5 stems 100-200
G. gyndra	bundle (10 Kg)	3,000	10 stems 100
Onions	20-30 Kg	15,000-18,000	5 fruits 500
Shum group	bundle (15 Kg)	7,000	7 stems 200
Cabbage	Sack	10,000	head 300-400
Cabbage	1 head	100	200 - 300
H. cannabinus	15 Kg	6,000	5 stems 400
C. cajan	20 Kg	8,000	7 stems 200-300
Sukuma week	10 Kg	3,000-5,000	5 stems 500
Chochorus	5 Kg	3,000	6 stems 500

Constraints and solutions

Judging by the frequency a particular problem was mentioned it appears that high prices during the dry season are the major problem (Table 35). High prices deter consumers and make it harder to buy from wholesalers. Other common problems include high market fees, competition from roadside traders (who do no have to pay any market fees) and the high perishability of their products.

Table 35. Problems faced by traders

Problem	Frequency
Increase in price (due to dry weather)	9
Market fees	8
Transport costs	8
Poor market (unstable prices)	8
Lack of proper storage facilities	8
Competition with roadside traders and other traders	7
Surplus (due to wet weather)	7
Perishability (a bigger problem in the wet season)	6
Elements (bad weather)	5
Inadequate capital	5
Labour	3
Bad debtors	2

Future expectations

The majority of the traders expected to continue trading vegetables because they found it profitable.

PRODUCTION SURVEY

Production in the dry season has been lower than expected because of the dry weather which has destroyed many vegetable gardens. Farmers have therefore been discouraged from planting by the harsh dry season.

Farmer details

One hundred and sixteen farmers were interviewed in the wet season (44 women) and 70 in the dry season (26 women). The majority of the farmers were between the ages of 25 and 44. Most farmers were living in the districts of Mpigi, Luweero and Mukono surrounding Kampala.

Product inventory

Table 36. Most popular vegetables grown

Vegetable	Mpigi (Busiiro county)	Mpigi (Kasangati County)	Mukono	Luweero	Total	Percentage
Nakati (=Shum)	26	31	27	25	109	92
Amaranthus cruentus	25	31	17	25	98	83
*Cleome**	19	24	14	7	64*	54
Garden egg	13	12	23	9	57	48
Cabbage	13	8	17	11	49	42
*Amaranthus blitum + A. dubius**	12	9	19	5	45*	38
Tomatoes	8	7	12	9	36	31
Eggplant	6	5	7	8	26	22
Beans	19	-	-	-	19	16
Green pepper	9	2	1	6	18	15
Huckleberry*	4	4	2	2	12*	10

* These vegetables may have been growing in many more farmers' homes. However, since they grow partly as spontaneous crops, many farmers may have ignored them in their answers.

Over 40 different types of vegetables were being grown in the survey area during the wet season. Table 36 shows the most popular ones. Shum and *Amaranthus* are the most popular indigenous vegetables whereas cabbage and tomato are the most popular exotics. Indigenous vegetables are probably more popular because of cultural reasons but also because they are cheaper to propagate in terms of inputs required. The popularity of leafy indigenous vegetables is also due to their ease of preparation which is mainly by steaming and also boiling. Tomatoes are not usually eaten fresh but are used to flavour food and other vegetables. Farmers were found to consume all types of vegetables they grow.

At the time of the survey, production was low. Many farmers had not planted because of the previous dry months and others had just prepared nursery beds of nakati, *Amaranthus lividus*, spider flower, garden egg, egg plant, green pepper, cabbages and tomatoes and did not have crops in their gardens. Farmers with crops were growing the vegetables listed in Table 37 below. The ten most frequently grown vegetables were mostly indigenous vegetables.

Table 37. Number of farmers growing different types of vegetables

S. aethiopicum Nakati (Nakati)	34	Carrots	3
Amaranthus lividus (Bbuga)	29	Spinach	3
Cleome gynandra (Jjobyo)	29	*Capsicum* spp	2
Garden egg (Ntula)	23	Chinese cabbage	2
Tomatoes	18	Okra	2
Cabbage	15	Cucumber	1
Amaranthus. dubius (Doodo)	12	*Brassica carinata* (Ssaaga)	1
Solanum nigrum complex (Nsuga)	11	Beans	1
Onions	8	*Solanum anguivi* (Katunkuma)	1
Egg plant (Biringanya)	7	Leek	1
Cauliflower	6	Hot pepper	1
Green pepper	5	Lettuce	1
French beans	3		

Production details

Most vegetables are grown on family land. Renting is also common and about a quarter of those interviewed admitted squatting on the former King's land (Mailo land) with no land titles. Some rent land for short periods of 1-2 years. Most vegetable gardens were found to be less than 500m from their homes. Vegetable gardens were less than 0.5ha in size although some of the larger commercially orientated farmers had plots up to 4ha. Farmers rent land for about U Shs 5,000-10,000 per acre per season.

Most commercially orientated farmers grew their vegetables in swampy areas because they were less likely to dry out in the dry season, ensuring an all year supply. Most subsistence farmers and others without access to a permanent water source grew indigenous vegetables on well drained soils in the wet season to take advantage of the rains.

The seeds of leafy indigenous vegetables such as nakati, *A. lividus* and *A.dubius* are commonly mixed with soil/sand and broadcast when sowing. Exotic vegetables are first propagated in a nursery bed from where they are transplanted to gardens.

Farmers mainly practice intercropping of the various indigenous vegetables, particularly *Solanum aethiopicum* Shum and *Amaranthus lividus,* or *S. aethiopicum* Shum, *A. lividus* and *Cleome gynandra.* Exotics on the other hand are monocropped and sometimes indigenous vegetables such as spider flower and garden egg. The latter are monocropped because they have large leaves that would shade other crops. Intercropping results in lower individual harvests when compared to monocroping but it is practiced in order to get a double harvest (two crops), to take advantage of inadequate land and to reduce soil erosion due to high crop density.

Labour
Farmers employ both family and hired labour. The hired labour is used to clear land and to harvest vegetables while female labour is often employed for weeding.

Credit
The majority of farmers do not have access to credit facilities but those who do obtain it from friends, government credit schemes and NGOs.

Inputs
Farmers raise their own indigenous vegetable seeds which are therefore much cheaper than exotic seeds which are bought. The farmers of Mukono district who receive advice from extension staff used mainly organic manure when compared with other farmers who mainly use fertilizers. Most farmers apply pesticides, especially on Shum and exotics. The cost of fertilizer

and pesticides is high. Lack of extension services is a major problem. Farmers need advice on pest and disease control, nursery techniques and proper garden management practices.

History of production

The majority of farmers have been growing vegetables for between 1 and 6 years. It was noted that some people had given up farming when they obtained paid employment because vegetable growing was too demanding and not always profitable. Most farmers reported starting vegetable growing by planting indigenous vegetables. Some farmers allegedly abandoned growing exotics to adopt indigenous vegetables because the latter mature faster and require less inputs.

Purpose of production

Most of the farmers grow vegetables as a cash crop and even those who grew for subsistence needs sold the surplus (Table 38).

Table 38. Primary objective of vegetable growing by farmers.

District/County	Number of farmers growing for:		
	Income	Subsistence	Both
Mpigi/Busiiro	22	7	1
Mpigi/Kasangati	14	16	-
Mukono	14	15	1
Luweero	26	1	-
Total	76	39	2
Percentage total	64	34	2

In the wet season farmers reported that Nakati was the most profitable vegetable crop. This is partly due to the fact that in comparison to exotic crops, nakati requires fewer purchased inputs, matures faster, the harvesting period is longer and demand is high (Table12).

Table 39. Income ranking by farmers (wet season)

Vegetable	Number of farmers	Rank
Nakati	59	1
Cabbage	21	2
Tomatoes	11	3
Amaranth (*A. cruentus)*	53	4
Green pepper	10	5
Garden egg	27	6
Cleome	26	7
Eggplant	12	8
Wild amaranth	10	9

In the dry season of the nine vegetables ranked by farmers as important for income generation, only four are exotics. Nakati is the most important cash crop (Table 40). *A. lividus* also matures fast but has a poor market value.

Table 40. Income ranking of vegetable (dry season)

Vegetable	No. of farmers	Rank	Vegetable	No. of farmers	Rank
Nakati	27	1	Garden egg	13	3
A. lividus	20	2	*A. dubius*	7	4
Tomatoes	13	2	Chinese cabbage	1	4
Green pepper	12	2	Spider flower	17	4
Cabbage	17	2	*S. nigrum*	1	4
Groundnuts	3	3	Lettuce	1	4
Beans	3	3	Onions	2	4
egg plant	8	3	*S. anguivi*	1	5

The other important sources of income for farmers are sale of cash crops and food crops, livestock husbandry and retail shop keeping.

Most farmers have been growing vegetables for a long time (more than 4 years), and they don't expect to change. Many farmers considered themselves as poor but have no better alternative economic activity than vegetable growing. The most important alternative source of income to vegetable growing is food (staple crops or meat) and cash crop growing. Growing indigenous vegetables is considered to be more profitable than pig rearing and other selling food crops. Therefore the primary objective for growing vegetables is mainly for earning an income whilst subsistence is secondary. Amaranth was a popular cash crop because it matures earlier but has to be sold quickly because of its perishability.

Farmers were found to consume all the types of vegetables they grew. *Solanum aethiopicum* Shum and *Amaranthus lividus* are the most popular local vegetables, whereas cabbage, tomato and green pepper are the most popular exotics. Farmers were found to increase their production of vegetables in general. *S. aethiopicum* Shum is the most profitable crop because of its popularity (good taste) by consumers when compared with other vegetables. *Amaranthus dubius, Cleome gynandra* and eggplant are less popular with consumers. *A. dubius* has a reputation to grow in dirty areas for example close to toilets, hence its unpopularity. *Cleome gynandra* and also *Solanum nigrum* and *Solanum anguivi* are not liked because of their bitter taste, while eggplant is unpopular because it has a flat taste and needs frying before consumption. *G. gynandra* and *Solanum anguivi* have a cultural value beside their commercial and subsistence value; they are believed to cure hypertension. *G. gynandra* is also liked by the aged because it is believed to improve sexual potency.

Sources of information

Vegetable farmers reported that they had received advice on vegetable growing from the following sources: family, fellow farmers, schools, extension workers, associations, farm supply shops, seminars and workshops and the media (radio). The majority of the farmers got their knowledge from fellow farmers and to a lesser from extent extension workers. Farmers who receive advice come from Mukono district, close to the District Farm Institute that is frequented by senior government officials including ministers. This may make the extension workers more vigilant and also the staffing level may be better that in other areas.

Marketing/post-harvest arrangements

Farmers used pick-ups, school vans, bicycles, motorcycles and taxis to transport their produce to the markets. Pick-ups are the most favoured mode of transportation to markets more than 20 Km from the gardens. While some accompany the vegetables on the pick-up others go by taxi.

Farmers harvest in the evening. After harvesting, leafy vegetables are tied into big bundles weighing around 30-50kg. The little preservation done on indigenous vegetables is by dipping roots of the vegetables in water in an appropriate vessel, but the leaves must never touch water because of their susceptability to rotting.

Some farmers reported that they stay in the market overnight in order to capture the market very early the next morning. It was important for farmers to sell early in the morning so as to find a buyer. Most farmers do not have contracts with their customers. They sell mainly to wholesalers, retailers and consumers. Most of the farmers sell twice a week in markets.

According to the majority of farmers, vegetable prices have been increasing with time possibly because there are more consumers of vegetables (in urban areas), while according to some prices were falling because many people have joined the vegetable growing business. The Christmas season was identified by some as a good season for selling; the prices are higher.

Vegetable prices are better during the dry season when there is a scarcity of vegetables (Table 41). At this time those growing in swamps benefit from higher prices. For many the wet season is better than the dry season because in the dry season they would not earn anything since the majority do not have irrigation facilities.

Table 41. Selling prices of vegetables in different seasons. Price in Uganda Shs.

Type	Bundles harvested per acre	Bundle Weight of Dry season	Price per bundle Wet season	Price per bundle Dry season
Nakati	60-90	40 Kg	10,000-14,000	5,000-6,000
"	-----	20 Kg	7,000-8,000	2,000-3,000
A. lividus	60-100	40 Kg	8,000-9,000	3,000-4,000
"	-----	20 Kg	5,000-6,000	2,000-3,000
Spider flower	50	20 Kg	3,000-4,000	2,000-2,500
"	----	10 Kg	1,000-2,000	1,000-2,000
Tomatoes		80 Kg(box)	30,000	12,000
Garden egg		50-60 Kg	20,000	4,000-5,000
Green Pepper		55 Kg(sack)	15,000-18,000	5,000
S. melongena		85 Kg(sack)	13,000	3,000
Cabbage		110 kg sack	25,000	6,000-7,000
Cabbage (Denmark)		110 kg sack	30,000	10-13,000

Prices for units smaller than big bundles (15-40 Kg) are higher.

Table 42. Prices of different units of vegetables

Type	Quantity	Price per Bundle	Actor
Nakati	40- 50 Kg	12,000	Wholesaler
"	500 g	1,000	Retailer
"	100 g	100-200	Consumer
A. lividus	40- 50 Kg	9,000	Wholesaler
"	500 g	500-1,000	Retailer
"	100 g	100 -200	Consumer
Spider flower	500 g	500-1,000	Retailer/Consumer
Cabbage	1 head	200-400	Wholesaler/Retailer/Consumer
A. dubius	500 g	500 -1,000	"
Onions	30-40 kg	8,000-9,000	Wholesaler
	500-1,000 Kg	2,000-3,000	Retailer
French bean	1 Kg	1,500	
Capsicum spp. (Hot pepper)	4 kg	1,000-3,000	
A. dubius	30 cm diameter bundle	3,500	
Cauliflower	1 head	800 - 1,000	
Green pepper	5 Kg	1,200/Kg	

The majority of farmers sold vegetables from their homes. It was reported by some farmers that they sell vegetables from their homes during times of scarcity or when roads are impassable. Markets commonly used by farmers are listed in Table 43.

Table 43. Markets in which vegetables are sold

Market	No. of farmers	Market	No. of farmers
Home	30	Roadside market	3
Kalerwe	22	Nakawa	1
Nakawa	13	Kakiri	1
Mukono	12	Zirobwe	1
Owino	9	Namayumba	1
Kasubi	8	Bulamu trading centre	1

Saturday is the busiest market day. In Nakasero market farmers sell mainly exotics. Some farmers sell their vegetables under the association "Zibula Attude association." In this association farmers get 50% of the proceeds and the other 50% remain with the association

Table 44 estimates the costs of production for leafy and fruit indigenous vegetables such as nakati and garden egg.

Table 44. Costs of production

	Leafy IVs	Fruit IVs
Expenditure	Cost	Cost
1. Renting land	5,000-10,000	5,000-10,000
2. Clearing land		
a) Slashing	15,000-30,000	15,000-30,000
b) ploughing	30,000	30,000
3. Fertilising	20,000	40,000
4. Pesticides/fungicides	N/A	N/A
5. Weeding	35,000	35,000
6. Harvesting		
a) Harvesting (200)	12,000-18,000	48,000-56,000
b) tying bundle (100)	6,000-9,000	6,000-9,000
c) transporting to roadside (200)	12,000-18,000	12,000-18,000
7. Transporting to market (550)	33,000-49,500	90,000-105,000
8. Market dues (300)	2,400	5,000
Total	152,400-219,500	286,000-333,000

Constraints and solutions

Farmers listed many problems but the most common was pest and diseases (and the lack of pesticides). Table 45 lists the main problems.

Table 45. Main problems faced by farmers

Problem	times mentioned
Pests and Diseases	90
Inadequate capital /no credit	67
Water logging/ rains /drought	58
Lack of pesticides	53
Poor value of IVs/ poor markets	52
Lack of fertilizers	43
Labour problems	39
Poor transportation facilities	36
Land problems / high rent	32
Lack of equipment	27
Lack of seed	18
No cultivation knowledge	18

Farmers are looking towards the government to solve their problems. The farmers' demand include the following:
1) government should develop the vegetable market and create an export market;
2) government subsidy for farm inputs like fertilizers etc.;
3) government establishes/improves the extension service;
4) government should make soft loans available to farmers;
5) farmers establish farming associations/groups to, for example, improve their marketing. Through associations/groups they may be able to buy vehicles or contract vehicles to transport their vegetables.

Annex 1: Examples of farmer and trader checklists

TRADER CHECKLIST

This checklist details subject areas and possible questions to help you when interviewing traders. Many of the topics may be answered by direct observation or other PRA techniques such as ranking or scoring exercises. Keep in mind that the objective of the study: **to establish the socio-economic value of indigenous vegetables relative to exotic vegetables**. We are only concerned with vegetables (indigenous vegetables and exotics). When taking notes you may find it easier to use the headings in bold as summary headings. Note date, time and location of interview. *Remember you need to collect enough information to be able to write a comprehensive report of the survey area. Don't forget the six helpers:* ***who? what? where? how? when? why?***

Market description. (not everyone has to do this)
Draw a sketch map.. Count the number of sellers of vegetables differentiating between those who sell indigenous vegetables only, exotics only, or both indigenous vegetables and exotics. Try and talk to the market master or mistress. Are there more or less sellers of vegetables (indigenous vegetables and exotics) than in previous years?

Trader details
Market actor (retailer, wholesaler, etc.) Gender / age (approx.). Who is growing these vegetables? Source: name of village.

Product Inventory
What vegetable crops are being sold (IVs and exotic)? Where are they grown: home, near or far garden?

Trader perceptions of consumer preferences
What are the consumer preferences (likes and dislikes? Substitutes? qualities?)

History of marketing
How long have you been selling these crops (IVs and exotic)? Has your choice of crops changed over the years? Are there more or less sellers of these products (IVs and exotics) than in previous years?

Marketing arrangements
What are the marketing arrangements between you and the farmers/wholesalers? Where do you meet? How often? Time and location Do you have contracts with your suppliers? How much do you buy? How long does it take to sell? Which other markets do you sell in? Why don't you sell in other markets? Are the prices different in other markets? What services do retailers/wholesalers provide to farmers such as loans, etc?

Post-harvest techniques
Is the produce sold processed? Who does this? How long can you store the product? Provide details. How do you prepare the produce for market? Estimate of losses?

Seasonality
At what times of the year are the vegetables most/least available? Has supply changed over the years?

Prices
What price do you sell at? Buy at? What is the unit of measurement (buying and selling)? Do prices change between the wet and dry season? Has the price changed over the years?

Income
Is this you main source of income? Ranking/scoring exercise:
- Rank commodities on sale in terms of importance as a source of income
- Rank vegetables (both IVs and exotics together) in order of importance as a source of income.

Constraints and solutions
Ranking/scoring exercise: What are you main problems in the marketing of IVs and exotics? How do you think these problems could be resolved?

Future expectations: Will you continue to sell the same IVs and exotics in the future?

FARMER CHECKLIST

This checklist details subject areas and possible questions to help you when interviewing farmers. Many of the topics may be answered by direct observation or other PRA techniques such as ranking or scoring exercises. Keep in mind that the objective of the study: **to establish the socio-economic value of indigenous vegetables relative to exotic vegetables**. We are only concerned with vegetables (IVs and exotics). When taking notes you may find it easier to use the headings in bold as summary headings. Note date, time and location of interview. *Remember you need to collect enough information to be able to write a comprehensive report of the survey area. Don't forget the six helpers:* ***who? what? where? how? when? why?***

1. Farmer details
Gender / age (approx.)

2. Product Inventory
What vegetable crops are being grown (IVs & exotic)?. Where are they grown - home, near or far garden?
Source: name of village

3. Production details
For IVs describe current productions and harvesting techniques (Indigenous Knowledge). Eg. Details of intercropping/monocropping, duration & frequency of harvesting periods, etc.
- *Inputs*: What types of inputs such as fertiliser and pesticides are used? Source and cost? Does the use of these inputs vary between IVs and exotics or subsistence and cash crops?
- *Land tenure*: (This is a sensitive issues - ask towards end of interview) Is the land owned, rented, being used illegally, borrowed, free access?
- *Labour*: Do the men and women tend to different crops? Is hired labour ever used?
- *Seasonality*: Does the type of IVs and exotics grown depend upon the season? Provide details.
- *Access to credit*: Do you have access to credit (formal and/or informal)?

4. History of production
How long have you been growing these crops (IVs and exotic)? Has production changed over the years?

5. Purpose of production
Why are these crops being grown (subsistence, income, cultural)? Which purpose is the most important?

6. Subsistence (home consumption)
For each vegetable how often is it consumed (daily, x times/week, occasionally, rarely...)? How is the vegetable used/prepared? What are the preferences (likes and dislikes)? *Ranking/scoring*

exercise: Rank IVs and exotics in order of importance in terms of subsistence value. Where possible rank IVs and exotics first separately and then combined.

7. Income
What are the farmer's sources of income (including off-farm income)? Seasonality to the sources of income?
Ranking exercises: 1) Rank sources of income in order of importance. 2) Rank just the vegetables (both IVs & exotics together) in order of importance as a source of income.

8. Sources of information/advice
Do you receive any advice from extension officers, friends, etc. For which crops?

9. Marketing/post-harvest arrangements
Where do you sell these products? Who does this (gender)? How often? Who do you sell to? Contracts? Could you sell more? Describe the chain of events from harvesting to point of sale (include processing, packaging, transportation, storage, and gender details). What are the prices per unit? How does this change between the wet and dry season? Has the price changed over the years? Estimates of losses?

10. Constraints and solutions
Ranking/scoring exercise: What are you main problems in the production and marketing of IVs and exotics? How do you think these problems could be resolved?

11. Future expectations: Will you continue to grow the same IVs and exotics in the future?