PAPER PRESENTATION FOR 13TH INTERNATIONAL
IFMA CONGRESS OF FARM MANAGEMENT
WAGENINGEN THE NETHERLANDS

JULY 8 – 13 – 2001

THEME:

FEED THE WORLD

TITLE

# CHALLENGES TO MODERNIZATION OF AGRICULTURAL FOOD PRODUCTION USING IMPROVED TECHNOLOGIES

PRESENTED BY:

KENDI MAYENGU THOMAS (AGRICULTURIST)
DIRECTOR FOCPPROMEX LTD, B.P. 54 MUYUKA
REPUBLIC OF CAMEROON
E-mail: kendi_thomas@yahoo.co.uk

## BACKGROUND

Agriculture remains the main stay of most economies in Africa. In Cameroon agriculture employs more than 75% of the active population and accounts for over 50% of the total export. Agriculture in Africa is being considered a culture. It is culture because over 75% - 80% of the population are farmers. They are rural farmers whose farm sizes are small. They used local farm tools and little purchased inputs. Agriculture is old and its activities have existed for thousands of years since mankind gave up hunting and gathering as its main source of food. Because of this long history the rural economy is often referred to a tradition bound. The Institute of Agricultural Research for Development (IRAD) in collaboration with (FOCPPROMEX LTD) Food Crop producer, processors and marketing experts in Cameroon conducts research in order to improve on farmer’s farming practices (production and cultural). This is meant to improve productivity and human resources management.

Cassava originated in Central America where it is grown for export and local consumption and is used as the most important staple and commercial food crop in the South West Province of Cameroon. It is one crop that the challenges of modernization in production and processing into many products are visible. Cassava processing into Garri is usually differentiated by the method of processing. Tradition processing method involves the use of a hand grater, while in the improved (industrial) method machines are used at all stages of processing. Even in Cassava production Cameroon farmers still grow the local varieties whose yield are lower compared to the improved/modern and recommended varieties.
The production and processing of cassava into Garri is being described as observed in past experiences In reply to other part of Cameroon. How well cassava responds to its various processing and production methods may depend on the variety of cassava and moisture content. Cassava can be grown in soils low in fertility, it is a low input user and it serves to poor management. Cassava plant is capable of producing economic yields under areas of the plantation that have been abandoned. Planting and harvesting of cassava are important operations the Cameroonian farmers could ensure any required volume both for consumption for low income earners and for commercial purpose when processed.
Based on the available information on the number of farmers involved in cassava production, the cost of producing a hectare, the sales price of 1Kg of fresh cassava, the cost of producing into other by-products, the local and improved variety being grown, the soil type climate conditions and general growth requirements for cassava, the required quantity and quality of exportable cassava can be obtain locally. This study report therefore was carried out to guide the cassava low resource investors in Cameroon and possibly other part of the world and that the results recommended the production of improved cassava varieties and the use of the semi modern graters for processing cassava into Garri and other bye-products that could feed a large proportion of the world population interested in cassava as a staple food in some parts of the world.

## INTRODUCTION

Cassava (manihot esclenta Crants) being a root and tuber crop is grown on a smaller scale by subsistence farmers or group of farmers for local consumption as well as for experts. The high yields productivity of cassava and its convenience components of farming and food system of many tropical countries including Cameroon.

At harvest, cassava has a high moisture content, which makes it very susceptible to deterioration during storage. The cassava in particular once harvested deteriorates rapidly about 48 hours later which

therefore render the root tuber unpalatable and unfit for consumption any further processing.

Trials of the local varieties are important in deciding which variety to grow; because the local farmer, grow more than one variety at a time. In order to grow the preferred typed the knowledge of what the consumer intent to do with the cassava will also be necessary in order to help the farmer select the variety or varieties to grow, some varieties are for processing while the others are for direct consumption.

In order to obtain the required quantity and quality of cassava, particular attention would have to be paid to planting and harvesting. Planting of the early and late maturing varieties may lead to problems if planted and harvested at the same time.

The low resource investors in Cameroon in this study have been given the following options for the production and processing of cassava as a source of improvement of their local resources;
(a) Producing cassava and selling the roots.
(b) Producing and processing of cassava root into Garri using local methods of hand grater.
(c) Producing and processing of cassava root into Garri using semi-improved methods of the motorized grater.
(d) Buying cassava roots and processing into Garri using semi-improved method

It will however be of great importance to first of all know the various conditions under which cassava is grown, in order to be able to describe various processing methods involve and access the availability and susbtability of locally grown cassava.

1) CLIMATE
a) Temperature
The ideal temperature range for cassava is 24-35øc, but cassava can grow in a wider temperature range. Temperatures (lower than 16.0øc) delay leaf growth and bulking while high temperatures (40øc) cause increase of growth cycle.

b) Rainfall
Cassava is a plant that can withstand drought for long periods (6 to 8 months) but cassava, like most other plants, need adequate moisture especially during the early part of the growing cycle. An annual average rainfall of 600 mm has been suggested as the least amount for rainfall cassava production. Cassava does better in the humid areas than in drier areas. Cassava can withstand drought conditions better than other crops due to the following mechanism.

- A drooping mechanism which causes the leaves to drop during daily peaks of sunshine.
- An increase in the partitioning of dry matter to the

feeder roots during drought which enhances the plant's exploitation of soil moisture.

- A heliotropic response mechanism which allows the leaves to maximize interception of available sunlight during the early morning and late afternoon when transpirational demands are not high.
- The reduction of the production of new leaves when the dry season begins.

1) Cassava soils

Cassava can grow well on a wide range of soils. Sandy soils will support cassava but the moisture and nutrient levels in such soil are low yields are to be expected from such soils. Heavy clay soils will support cassava but harvesting will be difficult and there will be many cases of broken roots.

Poorly drained soils are also not good for cassava because apart from the restriction in root growth in such soils, root rots are common and will damage the storage roots. Ideally cassava prefers soils which are loamy, deep, well drained and rich in plant nutrients. In such good soils the water holding capacity is high and the plant is able to grow well in the dry season. Also in such good soils the plant grows vigorously and will be better to withstand pest attacks and recover from these when they do occur.

2) Yield potential

The yield potential of the cassava depends on the variety growth, irrespective of the local or improved, the soil type, climatic conditions and the harvest age. Another factor that can improve cassava yields is improved cultural practice like the application of fertilizers. IRA-improved varieties are said to out-yield the local ones, respond better to fertilizer application and resistant/tolerant to several pests and diseases of the cassava.

Average tons per hectare for the local varieties range from 8 – 15 while the improved varieties can go as high as 26 tons/ha. The tuber size varies depending on the varieties and on the soil types.

Besong (1989) also showed that the local cassava yield has an average of 13 tons in Fako soils, South West Province.

3) Cassava varieties

Five major varieties of cassava grown in this area are two local and three improved varieties. The local red is grown for its cooking abilities while the local white is grown for processing.

Farmers have different uses for the varied varieties. Some of the varieties are early maturing while others are late maturing. The two local varieties; the local red and local white are late maturing while the three improved IRA varieties 8017,8034 and 8061 are early maturing.

Varieties also vary with respect to their morphologies. This difference in morphology is usually exploited by the farmer in their cropping systems and the different uses for which the crop is put. The different uses into which the farmers put their harvest had led to the planting of more than one variety of cassava in a farmer's cassava farm/field, the average size of which ranges from 0.4 to 0.6 hectares.

4) Cassava Planting Dates

Most farmers plant their cassava at the onset of rains. (Silva, 1979; Ambe 1987) recommended planting throughout the first eight wet months of the year (March – October) when the rainy season ranges from 1 – 8 months. This timing would also solve the problem of storing planting material and would result in less soil erosion. Early planting of cassava has been reported to reduce mealybug populations in Eastern Nigeria.

5) Planting densities and weed control

Good weed control is one of the most important factors in obtaining high root yields in cassava. Cassava root yields have been reportedly reduced by 50% due to no weed control (Doll and Piedrahita 1976). Ambe et al (1992) also reported a reduction of more than 90% of fresh root yield of two local cassava cultivars through weed competition.

Cassava is sensitive to weed within the first 8 Weeks After Planting (WAP). Timming and frequencies of weeding depend on plant genotype and environmental factors.

Optimum plant density of cassava is highly dependent on edaphic factors, cassava varieties, soil fertility status, cultural practices, and the final utilization of the roots. CIAT (1976) reported that optimum plant population per unit area depends on the size of the plant.

They found root yield increase with increase plant population. Early weed problems have been checked by fast growing varieties and much branching types that spread quickly to smoother emerging weeds.

Increasing the plant population densities has also been reported to suppress weed growth through increased canopy spread. It was observed too that as plant population increases, the total root yield also increases. However, the number per plant, root size and harvest index decrease while weed control by competition improves (Narasimham and Arjunan 1976; Ambe, 1987).

Fertilizer Application

Cassava fertilization requirements are very dependent on the soil type. To make a general fertilizer programme for all varieties on all soils would be unwise. However, good soil management and the application of organic as well as inorganic fertilizer materials have been known to increase yields and reduce incidences and severity of pest and disease.

Low levels of Potassium have been associated with severe pest attach.
There is no efficient dose of fertilizer for cassava in Cameroon. No work has yet been carried out to advise farmers on how much of each fertilizer should be applied to cassava in the various zones. Fertilizer recommendations are very delicate and it should be noted that each soil type has its own requirements and these differ from zone to zone.

Harvesting
The cassava roots are usually harvested at the farmer's convenience. Harvesting time of cassava also varies with variety, climate and different soil types. Some short cycle varieties would develop root rot if left unharvested for more than twelve months. Other long cycle varieties if kept too long in the field would develop an increase in the fibre content of the fresh roots, which in turn reduces the quality. In general, and depending on the variety, the storage root can be kept underground for 6 – 36 months after planting.

6) Cost of Production
Cassava production involves cost especially labour cost to the farmer. A labour monitoring study conducted by Besong and Bakia (1992) established that the estimated cost of producing a hectare of cassava without fertilizer was about 1860 hours or 310 Mandays, where one manday in this case was 6 hours. The costs of producing a hectare of cassava are given below:

| Description | Amount FCFA |
|---|---|
| Land rent (1 hectare)…….. | 20,000 |
| Planting material, 10,000 cuttings …… | 25,000 |
| Land preparation, 60 Mandays ……. | 60,000 |
| Planting 50 Mandays …… | 50,000 |
| Weeding (3 times) 150 Mandays ……. | 150,000 |
| Harvesting (cutting, roots), 50 Mandays …….. | 50,000 |
| Farm tools (cutlass, hoe, file, etc.) …… | 10,000 |
| Transportation of cassava roots …… | 10,000 |
| Total production cost ……. | 375,000 |

Studies in twelve food crop markets in the South West of Cameroon showed the following mean prices (i.e. FCFA/Kg) and price ranges.

Mean prices an range (FCFA/kg) of cassava root per division in South West of Cameroon between 1988 – 1991.

| Division | Cassava root | Cassava Garri |
|---|---|---|
| Fako | 39 (29 – 49) | 167 (138 – 196) |
| Meme | 27 (25 – 29) | 140 (128 – 159) |
| Manyu | 44 (37 – 51) | 98 (75 – 113) |
| Ndian | 37 (25 – 44 ) | 131 (98 – 160) |
| South West of Cameroon | 37 (29 – 45) | 134 (110 – 155) |

From the above cost of production a hectare of cassava, the sale price of a kilogram of cassava, the average size of a cassava farm, the yield / ha of

improved or local cassava varieties, we can calculate the total number of farmers required to produce a given quantity exportable cassava look local consumption and or the total hectares required.

## Constraints of cassava production

There are several pest and disease that constraints to the production of cassava some are the African cassava mosaic virus, the cassava bacterial blight disease and cassava mealybug.

Cassava also contains cyanoenic fluco sides, which releases hydrocyanic acid (HCN) during hydrolysis. These constraints, together with the limited use of input in traditional farming. Systems, have kept the yield of most Cassava cultivates below their potential.

## OPTION FOR CASSAVA PRODUCTION AND PROCESSING

I) Considering that farming is a business, the questions that merit adequate attention are:
II) Could one invest only in producing and processing cassava into Garri using the local methods hand grater.
III) Both producing and processing into. Garri using semi improved method ( motorized grater)
IV) Buying roots and processing in to Garri using semi improved methods and.
V) At what price should one sell the roots or Garri to make a profit. Both cassava and production and Garri processing involves cost especially labour. In a labour Monitory. Study conducted by Bessong and Kendi (1992). It was, estimated that the actual time spent for producing a hectare of cassava without fertiliser amounted to 1860 hours or 310 Mandays, where one manday in this case is 6 hours. It takes even more time to process a hectare of cassava in to Garri. Reports by the Cameroon National Ports Crop Improvement program in 1986 and on farm research results with farmers of South West of Cameroon (TLU – 1988) indicated that the improved. Cassava varieties of IRAD produced under farmer conditions. Bessong (1989) showed that the local yield of cassava average 13 tons in South West soils of Cameroon. Taking into consideration therefore the local yield of Cassava at 13 tons /ha (52 push truck) and estimating the yield of improved cassava between 26 (104 push truck and 39 tons (156 push truck) Bessong and Bakia (1994) showed that using the local method of processing takes between 1245 – 1864 Mandays to processed one hectare of improved cassava where as the semi improved method of processing takes between 378 – 567 Mandays to process the same quantity of improved cassava. Other production and processing cost items usually considered in addressing the above question are cost of land and capital items (farms tools, processing returns are all targeted around prices of cassava roots and Garri. However, the sales of cassava

cutting is becoming obvious even among small farmers. The price of a 25cm cutting range between 25FCFA and 5FCFA in the South West of Cameroon. Prices of cassava roots and Garri vary regions and market. Processors often rent a motorized grater when needed and payment is either by quantity of cassava or time spent I granting. The activities involved in processing cassava roots into Garri, the capital items and the by products can be summarised in table 1 as follows:

Table 1: The activities, capital items and products involved in cassava processing into Garri.

| ACTIVITY | CAPITAL ITEMS | PRODUCT |
|---|---|---|
| Peeling | Knife, Cutlass, Basin, Bench | Peelings |
| Washing | Basin, Basket, Bench | |
| Grating | Basin, Basket, Knife, Cutlass, Hand grater, bench, motorised grater | Grated dough |
| Dehydration fermentation | Jute bags, ropes, sticks | Fermented dough |
| Sifting | Sifter, Basin, Bench | Sift and Fibre |
| Frying Garification | Frying pan, Palm oil (sometimes), Bench, firewood, kerosene, Stove utensils | Garri |

Other processing returns usually neglected by process including pealing, sifting, and effluent (starch) while peelings are used as livestock feeds, and compound manure, sifting are used for kum – kum and livestock feed. Effluent (starch) is usually used on clothing.

DISCUSSION

OPTIONS FOR A LOW RESOURCE FARMER PRODUCING AND PROCESSING A HECTARE OF IMPROVED CASSAVA INTO GARRI

OPTION 1: Producing cassava and selling the roots.

a) Production cost

= Land, land preparation, cassava cuttings planting, weeding, harvesting, farm tools transportation.

b) Production returns = f (cassava cuttings, cassava roots)

c) Production net benefit = Production returns – Production cost

Example 1: Production costs, revenue and net benefits from one hectare of improved cassava

Assumptions:
i) 1 manday = 1000FCFA
ii) Price of cassava root = 37 FCFA/kg (SWP 1988-91)
iii) Cassava yield = 20 tons/ha (80 push-trucks) i.e. average of 13 tons and 26 tons.
iv) 1 cassava cutting = 2.5 FCFA (25cm)

a)  Production costs

Description Amount FCFA
Land rent (1hectare) ……...Planting material, 10,000 cuttings …….Land preparation, 60 Mandays ……..Planting 50 Mandays ……..Weeding (3 times) 150 Mandays ……..Harvesting (cutting, roots), 50 Mandays ..Farm tools (cutlass, hoe, file, etc) …….Transportation of cassava roots ……
20,00025,00060,00050,000150,00050,00010,00010,000
TOTAL Production Cost  375,000

Production Costs  = 375,000cfa  =576.92euro

b)  Production Returns

Description Amount FCFA
Cassava cutting, 60,000 (1 cassava stem = 6 cutting) ……...Cassava roots, 20 tons ……. …….
150,000740,000
TOTAL Production Returns  890,000

Production Returns  =  890,000FCFA  =  1369.23euro

c)  Production Net Benefits  (b) – (a)  890,000 – 375,000  = 515,000CFA  =  792.30euro

OPTION 2:  Producing and processing cassava into Garri using the local processing method

a)  Production and Processing cost:

=  f (land, land preparation, cassava cuttings, planting, weeding, harvesting, farm tools, transportation of roots, peeling, washing, grating, fermentation and dehydration, frying, sifting, capital items and transportation of Garri)

b)  Production and processing returns  =  f(cassava cutting, Garri)

c)  Production and processing net benefit  =  Returns – Costs

Example 2:  Production and Processing cost, returns and net benefit of 1 hectare of cassava into Garri using the local processing method.

Assumptions:

i)  Price of Garri  =  134 FCFA/kg i.e. South West Price (1988 – 91)
ii)  1 ton of cassava root  =  225 kg Garri (local method)
iii)  1 manday = 1000 FCFA
iv)  Price of cassava root  =  37 FCFA/kg (SWP 1988-91)
v)  Cassava yield  =  20 tons/ha (80 push-trucks) i.e. average of 13 tons and 26 tons.
vi)  1 cassava cutting  =  2.5 FCFA 25cm minimum price.

a)  Production and Processing Cost

(i)  Production Costs

Description Amount FCFA
Land rent (1hectare) ……...Planting material, 10,000 cuttings …….Land preparation, 60 Mandays ……..Planting 50 Mandays …….Weeding (3 times) 150 Mandays ……..Harvesting (cutting, roots), 50 Mandays ..Farm tools (cutlass, hoe, file, etc) …….Transportation of cassava roots ……
20,00025,00060,00050,000150,00050,00010,00010,000
TOTAL Production Cost (i)  375,000

(ii)  Processing cost  (20 tons cassava root)

Description Amount FCFA
Peeling 179 Mandays…….……...Washing  94 Mandays …… …….Grating 249 Mandays
…….……..Fermentation/dehydration 41 Mandays ….Frying and sifting 393 Mandays ..……..Capital items (hand grater, cutlass, basin, firewood, sifters, ropes, sticks, palm oil, jute bags, etc)
……....Transportation of Garri …….…….
179,00094,000249,00041,000393,00030,00010,000
Sub-Total  (ii)  996,000
TOTAL (i) + (ii)  1,371,000

Production and Processing Cost  =  1,371,000FCFA  = 2109.23euro

b)  Production and Processing Returns

Description Amount FCFA
Cassava cuttings, 60,000 ……...Garri, 4,500 kg (20 x 225) …….  150,000603,000
TOTAL  753,000

Production and Processing Returns:  =  753,000 FCFA  =  1158.46euro

c)  Production and Processing Net Benefit:  (b) – (a)
753,000 – 1,371,000  =  -618,000
= - 950.76euro

OPTION 3:  Producing and Processing Cassava into Garri using the semi-improved method

a)  Producing and Processing Cost:

= f (land, land preparation, cassava cuttings, planting, weeding, harvesting, farm tools, transportation of roots, peeling, washing, grating, fermentation and dehydration, frying, sifting, capital items and transportation of Garri)

b) Production and processing returns = f(cassava cutting, Garri)

c) Production and processing net benefit = Returns – Costs

Example 2: Production and Processing cost, returns and net benefit of 1 hectare of cassava into Garri using the semi-improved processing method.

Assumptions:

i) Price of Garri = 134 FCFA/kg i.e. South West Price (1988 – 91)
ii) 1 ton of cassava root = 282.7 kg Garri (semi-improved method)
iii) 1 manday = 1000 FCFA
iv) Price of cassava root = 37 FCFA/kg (SWP 1988-91)
v) Cassava yield = 20 tons/ha (80 push-trucks) i.e. average of 13 tons and 26 tons.
vi) 1 cassava cutting = 2.5 FCFA 25cm minimum price.

i) Production Cost

Description Amount FCFA
Land rent (1hectare) ……...Planting material, 10,000 cuttings …….Land preparation, 60 Mandays ……..Planting 50 Mandays …….Weeding (3 times) 150 Mandays ……..Harvesting (cutting, roots), 50 Mandays ..Farm tools (cutlass, hoe, file, etc) …….Transportation of cassava roots ……
20,00025,00060,00050,000150,00050,00010,00010,000
Sub-Total (i) 375,000

Production Costs = 375000CFA = 576.92euro

(ii) Processing Cost (20 tons cassava root)

| | |
|---|---|
| Peeling 56 Mandays.....…….....| 56,000CFA |
| Washing 18 Mandays.....……..... | 18,000CFA |
| Grating 17 Mandays.....……..... | 17,000CFA |
| Fermentation/dehydration 22 Mandays.……. | 22,000CFA |
| Frying and sifting 178 Mandays …….....| 178,000CFA |
| hiring motorised grater, 100 hours @ 400fCFA.. | 40,000CFA |
| Capital items (knives, sifter, basin, firewood, ropes, jut bags, etc) …… | 30,000CFA |
| Transportation of Garri …….....| 10,000CFA |
| Sub total (ii) | 371,000CFA |

TOTAL (i + ii) 375.000 + 371.000 = 746,000CFA = 1147.69euro

(b) Production and processing returns

Cassava cuttings, 60,000
150,000CFA
Garri, 5,654 kg (20 x 282.7)
757,000CFA

TOTAL 907,636CFA = 1396.36euro

(c) Production and processing net benefit 161,636CFA
= 248.67euro

OPTION 4: Buying cassava roots and processing into Garri using the semi-improved method.

(a) costs = f(cost of roots + processing cost)
(b) Returns revenue from Garri
(c) Net benefit = Returns - cost.

Example 4 Buying and processing cost, returns and net benefit of 1 hectare cassava into Garri using the semi - improved processing method.
Assumptions:

(i) Cassava yield = 20 tons / ha
(ii) Price of cassava root = 37 CFA /kg
(iii) Price of Garri = 134 CFA /kg

Buying and processing cost
Buying cost of roots 740,000CFA = 1138.46euro
Processing cost (20 tons cassava root)

| DESCRIPTION | AMOUNT FCFA |
|---|---|
| Peeling 56 Mandays | 56,000CFA |
| Washing 18 Mandays | 18,000CFA |
| Grating 17 Mandays | 17,000CFA |
| Fermentation/dehydration 22 Mandays | 22,000CFA |
| Frying and sifting 178 Mandays | 178,000CFA |
| hiring motorised grater, 100 hours @ 400fCFA | 40,000CFA |
| Capital items (knives, sifter, basin, firewood, ropes, jut bags, etc) | 30,000CFA |
| Transportation of Garri | 10,000CFA |
| Sub total (ii) | 371,000CFA = 570.76euro |
| TOTAL (i) + (ii) | 1,111,000CFA = 1709.23euro |

b) Returns from sale of Garri (5654 x 134)
757,636CFA = 1165.59euro

c) Net Benefit -353,364CFA =
-543.63euro

Like farmers elsewhere the Cameroonian farmers also

face normal challenges of year modernisation. The above exposure reveal that a farmer investor just producing and selling 1 hectare of cassava roots is better off since he will have a net benefit of 515,000 FCFA (792.30euro) as against one who produces and processes into Garri using either the local or semi-improved processing method. Since processing cassava into Garri is a rule to some farmers while others usually buy roots to process, the methods of processing still merit adequate examination. latter is more efficient in terms of time spent (especially in frying, quantity of Garri obtained and net benefit. Net benefits can however be increased across all the options through the reduction of the cost of production and or processing if the cost of 1 manday of labour is reduced to about 500 FCFA.

The net benefits obtained by either producing and selling or producing and processing cassava roots into Garri greatly depend on the unit prices of cassava roots and Garri and the levels of production. Taking the price ranges of cassava roots between 15-50 FCFA/kg and Garri between 100-450 FCFA / kg at the three possible levels of production of 13 tons, 26 tons and 39 tons, the net benefits from 1 hectare of improved cassava either sold as fresh roots or Garri (processed using the semi-improved method. can be estimated as follows.

Table 3: Net benefits from sales of cuttings and roots at varying prices of roots and production levels from I hectare of improved cassava.

| Cassava Root Prices (FCFA/kg) | Net Benefit (FCFA) at different levels of production | | |
|---|---|---|---|
| | 13 tons | 26 tons | 39 tons |
| 15 | -30000 | 165000 | 360000 |
| 20 | 35000 | 295000 | 555000 |
| 25 | 100000 | 425000 | 750000 |
| 30 | 165000 | 555000 | 945000 |
| 35 | 230000 | 685000 | 1140000 |
| 40 | 295000 | 815000 | 1335000 |
| 45 | 360000 | 945000 | 1530000 |
| 50 | 425000 | 1075000 | 1725000 |

Table 4: Net benefits from sales of cuttings and Garri (processed using the semi-improved method)at varying prices of Garri and production levels from 1 hectare of improved cassava.

| Cassava Garri Prices (FCFA/kg) | Net benefits (FCFA) at different levels of production | | |
|---|---|---|---|
| | 13 tons (3675.1 kg) | 26 tons(7350.2kg) | 39 tons(11025.3kg) |
| 100 | -126490 | 52020 | 230530 |
| 150 | 57625 | 419530 | 781795 |
| 200 | 241020 | 787040 | 1333060 |
| 250 | 424775 | 1154550 | 1884325 |
| 300 | 608530 | 1522060 | 2435590 |
| 350 | 792285 | 1889570 | 2986855 |

| | | | |
|---|---|---|---|
| 400 | 976040 | 2257080 | 3538120 |
| 450 | 1159795 | 2624590 | 4089385 |

Corresponding quantities of Garri at different levels of production

Table 3 and 4 can be used as net benefit indicators by cassava investors. Lower prices of either cassava roots or Garri can only benefit the investor at higher levels of production. For example in Table 3 even at 15 CFA/kg of cassava a farmer with a yield of 35 tons/ha still goes home with 360,000 CFA (553.84euro) while in Table 4 even at 100 CFA/kg of Garri the farmer can make 230,530 CFA (354.66euro) at the same yield level

## RECOMMENDATIONS

1. Since the difference between the local and semi improved cassava processing into Garri methods is the use of a motorized grater, it therefore implies that something must be happening at the grating stage that significantly reduces the frying time in the semi improved method. Further studies should be conducted on this observation by agricultural engineers and food technologists.
2. Cassava processor into Garri should adopt the semi-improved method while the manufacturers of the motorised grater should make extensive publicity.
3. Investors should aim at increase in production since this reduces consumers prices without affecting the farmer’s returns

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