UGANDA

CASSAVA SUB-SECTOR ANALYSIS

REPORT OF A LITERATURE REVIEW

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ACRONYMS

ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
NARO	National Agriculture Research Organization
EARRNET	East Africa Root crops Research Network
FoodNet	Post Harvest and Marketing Research Project
IITA	International Institute of Tropical Agriculture
NAARI	Namulonge Agriculture and Animal Research Institute
FAO	Food Agriculture Organization of United Nations
GDP	Gross Domestic Product
ACMD	Africa Cassava Mosaic Disease
CMD	Cassava Mosaic Disease
CGM	Cassava Green Mite
CMB	Cassava Mealy Bug
NRI	Natural Resources Institute
DFID	Department for International Development
IDRC	International Development Research Centre
Mt	Metric ton
Ha	Hectare
NANEC	National Network of Cassava Workers
NADEC	National Forum for Development of Cassava
NCP	National Cassava Programme
UNHS	Uganda National Household Survey
IARCs	International Agricultural Research Centres
COSCA	Collaborative Study for Cassava in Africa

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1 EXECUTIVE SUMMARY

This report presents information on the current status of the cassava sub-sector in Uganda. It is based on information gathered through literature review, interviews with cassava researchers in Uganda and a stakeholder consultative workshop. The purpose of the sub-sector review is to gain an understanding of the status of the cassava industry in the country in order to identify: information gaps (areas that need further investigation), constraints in the sub-sector, opportunities for immediate investment and research programming, technological and policy environment in which the sub-sector operates. The report also provides an analysis of how the different stakeholders have collaborated in the development of the sub-sector.

This study is part of a region wide cassava sub-sector analysis in all the EARRNET member countries (Kenya, Uganda, Madagascar, Rwanda, Burundi and DRC-Congo). It is being undertaken in collaboration with National Cassava programmes.

The objectives of the study are;

- Review and update available information on the sub-sector in consultation with sub-sector stakeholders to provide valid, reliable and timely benchmark information on cassava production–to-consumption system (PCS) for effective implementation of EARRNET activities,
- Study the various components of the PCS, identify constraints, assess needs, determine areas of technological, institutional, organizational and policy opportunities and purpose interventions to enhance food security, income generation and socio-economic growth and development,
- Propose research development programmes, coordinate introduction, adaptation, development and dissemination of end-user preferred market oriented technologies for a more efficient and equitable sub-sector,
- Highlight access, equity, sustainability and gender issues for technical options, assess costs and returns of technologies (existing and new) and the potential for increased cassava trade through increased production, utilization and commercialization.

Cassava was first introduced into Uganda in 1862 and it has since spread to almost all parts of the country, especially in the Eastern and Northern parts of the country where it is a major food crop (Bua, A. and Acola, G., 1998).
The main cassava growing areas are eastern and central region around Soroti and Masindi. Cassava is a small scale crop in Uganda. It is mainly intercropped

with maize, beans, and bananas depending on the region. The crop is rarely grown as a monocrop.

Its spread in the country has been influenced by the following factors:

- Its ability to grow well in marginal lands;
- Its apparent resistance to most diseases and pests;
- Its flexibility in cropping systems, and;
- Its high acceptance by many communities as a food crop
- High yields.

Nationwide cassava is ranked second to matoke/ plantains as the main staple food (Sserunkuuma, D. 1999, Bua A. 1991). Annual production is estimated at 3,400,000 tons from an estimated 374,000 ha (FAOSTAT 2000 Website). The low production is partially due to low yields compared to other EARRNET Countries except Rwanda and Madagascar, which have equally low yields.

In terms of national research for food crops cassava is ranked second under NARO research priority setting. This shows the importance of the crop in the country.

Results from Collaborative Study for Cassava in Africa (COSCA) studies showed that cassava was an important source of income for the producing communities compared to other food crops (Nweke, et. al, 1999). Nweke et. al. report that cassava production for cash income was highest among farmers who had access to mechanized processing technology, or easy access to market centers, or among those who used purchased inputs.

Processing of cassava in Uganda is still at infant stage. Current processing involves peeling, chipping, drying, and flour milling. Roasted cassava, crisps and chips making is also practised. There is no information available on existence of a large processor of cassava in Uganda.

Marketing is still a major challenge for the cassava sub-sector especially for the dried chips. There is no organized marketing system for the commodity and this leads to exploitation of farmers by middlemen.

Utilization of cassava is largely for human consumption in form of direct food. Main recipes made are boiled fresh roots, roasted chips, and Ugali[1].

[1] Some form of hardened porridge eaten with stews or vegetables.

Commercial use of cassava in animal feeds, manufacturing sector, and in food processing is lacking in the country based on reports of studies conducted by Foodnet. One of the studies conducted by Foodnet showed the potential demand for cassava starch for the industrial sector was 369 tons, demand for cassava flour in the industrial sector was estimated at 162 tons and the combined demand of all starches in the industrial sector was 580 tonnes. Projections to the year 2005 were for 708 tonnes of starch. This shows that there may not be a large potential for a cassava starch industry in the country owing to small amounts of demand for the commodity, but potential for high grade cassava flour exists. Other industries in which there is potential for cassava use include; animal feeds industry (19,000 tons of fresh cassava), plywood, paperboard, and textile industries (994 tons of fresh cassava). In the long run (> 5 years) potential exists in the bread and bread manufacturing industries (27,000 tons of fresh cassava).

Results from these studies therefore indicate the potential demand for cassava lies in the food industry and household consumption.

Areas requiring further information on which a field survey should be based are;

- Carry out an impact assessment of post-harvest technologies on cassava, in relation to their contribution towards commercialization of the crop.
- Identify the social and economic factors that are associated with technology adoption.
- Identify necessary policy reforms to elevate the status of the cassava crop from its current poor priority to a level that matches its immense potential to contribute to attainment of domestic food security, income generation, raw material to industry and an export commodity.
- Identify necessary measures to strengthen linkages between research programmes and other public institutions-training, marketing, infrastructure development, and political institutions – in order to provide concerted efforts to poor rural food and cash economies.
- Determine necessary incentives and activities to nature private sector to be motivated to provide basic commercial services, such as planting material, marketing of produce and investment in cassava processing technology and capacity.
- Evaluate the achievements of NADEC in meeting its objectives and its potential in strengthening the contribution of cassava to food security and income generation.

2 INTRODUCTION

2.1 Global Outlook

Cassava (*Manhot esculenta Crantz*) is a native of Brazil and during 16th and 17th century the Portuguese introduced it to tropical and sub-tropical areas of Africa, Asia and Caribbean. It has become a staple food in many tropical countries in Africa and also a major export crop in Asia and Latin America. It provides livelihood to some 500 million people around the world. Its drought and poor soil tolerance makes it a suitable food crop for small holders in Africa living in marginal areas. In Africa cassava is mainly a food crop and provides livelihood to millions of small holders living in humid, sub-humid and marginal lands in the continent. In Asia the crop is grown mainly for export for animal feeds in European countries.

Global production of Cassava is estimated at 160 million tons of which Africa produces 58%, translating into more than 300 calories per day for more than 200 million people. Countries in Africa where cassava is a major food crop include DRC-Congo, Nigeria, Uganda etc. International trade in cassava increased from a mere 2 million tons in 1961 to a record 37.6 million in 1990 before dropping to 13.9 million in 1995. Most of the exports were to European countries where it is used as raw material in the animal feeds industry (see Table 1). This was a result of changes in the Common Agricultural Policy (CAP) in European Union (EU), which resulted in lower prices of locally available feed grains.

Table 1: Regional Cassava Imports (MT Fresh Equivalence)

REGION	**1961**	**1970**	**1980**	**1990**	**1995**
Africa	75	1,744	3,935	10,760	18,926
Asia	45,234	251,119	733,910	7,822,419	4,914,245
Europe	1,493,462	4,467,809	16,499,999	26,012,876	8,651,648
Latin America	4,902	6,106	4,811	199,192	63,575
North America	496,900	376,143	106,148	680,098	193,157
Oceania	15	252	1,104	36,580	48,351
Former USSR	-	-	-	2,815,154	-
TOTALS	2,040,588	5,103,173	17,349,907	37,577,079	13,889,902

Source: *A Global Development Strategy for Cassava: Transforming a Traditional Tropical Root Crop; Plucknett, D. L. et al, Jan. 1998 draft report.*

Although cassava is largely grown as a smallholder crop it can be grown on commercial basis for industrial use, mainly for manufacture of starch and animal feeds. In Thailand, for example, cassava is grown primarily for export to European markets for animal feeds manufacture. In Madagascar cassava was grown on large scale during the colonial era for export to European countries for manufacture of animal feeds.

2.2 Cassava Production in Africa

Cassava is today one of the dominant starchy staples in the diet of people in Sub-Saharan Africa. Although it is grown in every country its cultivation is concentrated in humid tropics.

Africa's production of cassava is projected to grow at 2.9 per cent per year, which will raise production to 114 million tons by the year 2005. The bulk of the increase is expected to come from the Democratic Republic of Congo (DRC), Ghana, Madagascar, Mozambique, Nigeria, Tanzania and Uganda. Demand for direct consumption is expected to reach 85 million tons in the year 2005 with a growth rate of 2.8 per cent. In Table 2 below production estimates for Africa in the last decade are presented. The data shows a steady increase in production, from 79.35 million tons in 1991 to an estimated 92.12 million tons in 1999. The increase is attributable to increase in area under the crop and also improved yields per hectare.

Table 2 Production of Cassava in Africa 1991 – 1999 in MT of Fresh Tuber Equivalent

Year	Area (Ha)	Production (MT)	Yield (Kgs/Ha)
1991	9,882,080	79,348,242	8,030
1992	10,163,363	81,868,845	8,055
1993	10,044,132	82,678,292	8,232
1994	10,323,385	83,816,343	8,119
1995	10,467,699	85,192,286	8,139
1996	10,225,193	84,587,126	8,272
1997	10,117,313	84,760,847	8,378
1998	10,797,101	90,013,262	8,337
1999*	10,823,616	92,119,233	8,511

Source: FAOSTAT Web2000.
Note: Estimate*

With increasing demand for cassava following population growth, changes in food preferences and increase in industrial needs in the continent, sub-sector operators will be confronted with the challenge of increasing production, improving access to good quality cassava products and expanding markets, which will contribute to local, national and regional food security and socio-economic growth.

The use of cassava for animal feeds in the continent is expected to grow at an annual rate of 1.3 per cent to the year 2005 largely due to expansion of processing facilities to meet any potential growth in domestic and export markets. Other uses of cassava (e.g. starch etc.) in Africa are expected to rise at even higher rates: 5 per cent in Benin, Ghana, Kenya, Zambia and Zimbabwe.

Some of the limiting factors for increased cassava production in Africa are:

- Unreliability of supply;
- Uneven quality of products;
- Low producer prices;
- Lack of appropriate storage technologies;
- Labour intensive processing techniques, and;
- Costly marketing structures.

2.3 Cassava Production Trends in the East and Central Africa Region

Agriculture is the most important economic sector of the Eastern and Central Africa countries. It provides livelihood to about 80% of the population in the region; it is the main foreign exchange earner, provides the highest proportion of employment and is the main source of raw material for the largely agro-industrial sector in the region.

Cassava production in the region is estimated at about 24 million metric tones from a combined area of about 3.1 million hectares. Of this DRC produces about 16.5 million tones from an estimated area of 2.1 million hectares.

The production levels of cassava in five EARRNET countries are presented in Table 1 in the appendix. As it can be seen, Rwanda has recorded the lowest level of production in the last 10 years. Of all the countries shown, Uganda is the only country that has shown a significant increase in production after 1997.

Most of the decline in production within the EARRNET countries experienced from 1991 to 1996 has been attributed to cassava mosaic disease impact and civil strife experienced in most of the main producing countries. The production trend of fresh cassava roots in the region is presented in figure 1 below.

The spread of cassava mosaic disease in the lake region was reported in ASARECA's AgriForum in the April 1998. The disease had first been recorded in Uganda in 1989. It spread into western Kenya in 1995, Southern Sudan in 1997 and in DRC in 1998 (ASARECA-Agriforum, April 1999). The mosaic virus has spared none of the countries in the region. Other contributing factors to the decline in production are lack of clean planting material caused by limited capacity to multiply and distribute improved planting cuttings.

In response to this pandemic, a number of programmes mainly donor funded have been initiated in the region to address the cassava mosaic problem and support multiplication and distribution of clean planting material. The East Africa Root crops Research Network (EARRNET) was started in 1993 and its mandate has been in the area of germplasm development, breeding and support for technology development and transfer in the region.

Figure 1. Comparison of Cassava Production Trends of Five EARRNET Countries 1991 - 1999 (mt)

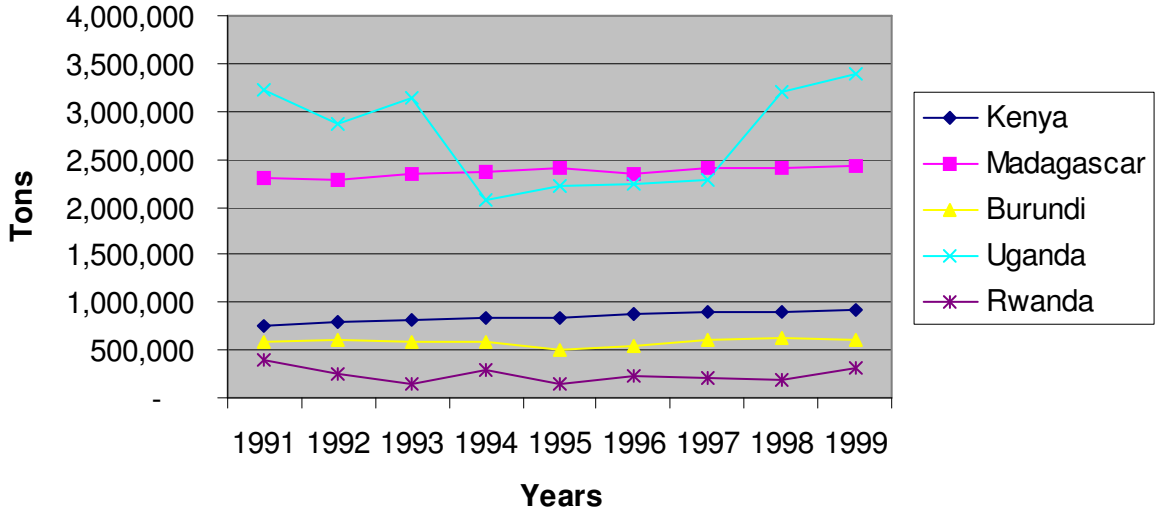
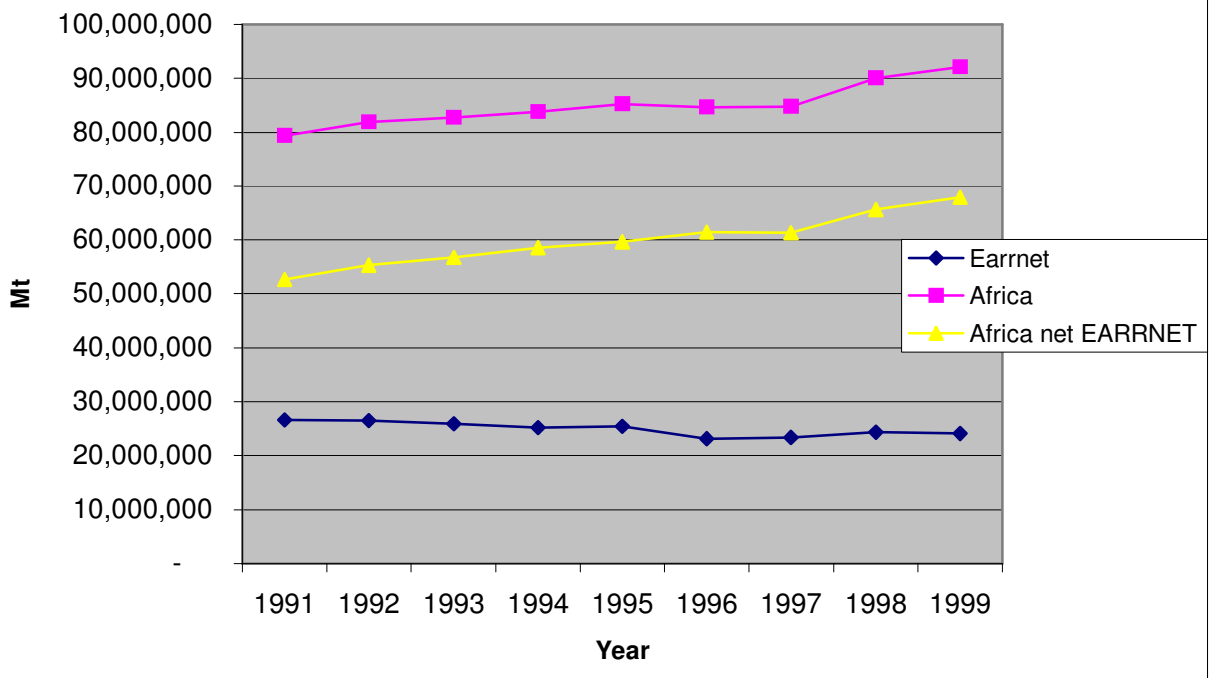


Figure 1 above demonstrates the commodity's vulnerability to pandemics as it happened in Uganda during 1993 – 1997, when the cassava mosaic struck. As it can be seen, between 1993 and 1997 there was a major drop in production of cassava in Uganda associated mainly to cassava mosaic disease.

In figure 2 below a comparison of cassava production in the EARRNET region to that of the entire continent is presented. As it can be seen, the region is an important cassava producer in the continent. However, production levels in the region have declined marginally in the last decade largely due to cassava mosaic disease. The overall production in the continent has however increased within the same period from 80 million tons in 1991 to and estimated 92 million tons in 1998.

Figure 2. Comparison of EARRNET to Africa Cassava Production



The increase in production in the continent can be attributed to advances in improved production techniques and varieties in Western Africa countries.

2.3.1 Sub-sector Advances and Constraints in the Region

EARRNET is one of the networks of ASARECA. It is charged with spearheading the development of the cassava sub-sector in the region in order to contribute to

food self sufficiency and socio-economic development. To achieve this goal the network promotes production, utilization and commercialization of cassava through development of suitable and acceptable technologies for use by the different stakeholders. Its technology development and transfer mission falls under four categories; research, training, information exchange and institutional capacity building.

EARRNET works through national research systems and in collaboration with other international research agencies from which it is able to tap current research breakthroughs, achievements and lessons from other parts of the world for the benefit of the regional cassava programmes. This places the network in a unique position to help in solving most of the problems affecting cassava production and utilization in individual member countries, including pandemics.

Since its inception, the network has worked towards identification of cassava production and utilization constraints and developed approaches to mitigate against them. The African cassava mosaic disease (ACMD), limitation of post-harvest technologies and marketing constraints have been some of the major daunting challenges facing the network. The ACMD has been tackled through development and transfer of mosaic resistant varieties. In this area a new challenge of multiplication and distribution of clean material has also emerged, as the national research institutions do not have the capacity for multiplication and distribution of planting material. The national programmes have tried to address this problem through collaboration with other development agencies within their respective countries.

In the area of post-harvest technologies, processing and storage technologies have posed the biggest challenge. In almost all the network countries cassava is mainly processed using traditional methods. These methods are costly in terms of time, labour and wastage. The quality control of the resulting products is also problematic. The low level of technology also implies that the number of products processed from cassava is also limited at the national level. Storage is a big problem because cassava is highly perishable. To increase cassava shelf life, it has to be processed such that its moisture content is minimized. The available technologies have serious limitations in this area.

Commercialization of cassava in the region is limited. In majority of the countries the share of sales out of the total production rarely exceeds 15%. This means the crop is largely grown for food security reasons. In rare occasions the crop is grown for commercial purposes, such as in the DRC where the leading flour miller has a nucleus estate of cassava from which it grows cassava for milling.

The potential for cassava to contribute to food security in the region is enormous as most of the countries continue to register food deficits and reliance on food relief from international agencies. Opportunities exist to expand production through increase in acreage and improvement in yields. Within the region cassava is primarily a food crop, being a main staple in DRC, second important food staple in Uganda and Madagascar and third important staple in Rwanda and Burundi. In Kenya the crop is an important staple food in the western and coastal areas of the country.

Cassava use in industrial processes is limited in the region but opportunities exist in countries with relatively established industrial base such as Kenya, Uganda and Madagascar. The main industrial potential use of cassava in the region is in livestock feeds, food manufacturing and in paper and textile industries.

Cross border trade in cassava has been reported but not documented between Kenya and Uganda, Rwanda, Uganda and Burundi and between Burundi, Rwanda and DRC. The main traded commodities are cassava chips, planting cuttings, fresh roots and to some extend cassava leaves.

At the policy level, there is no evidence that any of the network countries have an explicit and clear cut policy for the development of the sub-sector. Only in countries where cassava is a principal food crop such as DRC and Uganda is cassava ranked highly in research. Most countries neither have a food security policy, making it impossible to gauge where cassava ranks at the national policy level.

3 WHY SUB-SECTOR ANALYSIS

The International Agricultural Research Centres (IARCs) and NARS initiated COSCA in 1989 with the objective of improving the relevance and impact of agricultural research on cassava in order to realize the potential of the crop in raising food production and incomes. The study covered six countries: Cote D'Ivoire, Ghana, Nigeria, Tanzania, Uganda and the DRC. Later it was expanded to cover Benin, Burundi, Cameroon, Kenya, Malawi, Rwanda and Zambia. The study was done in three phases. The first phase broadly characterized the agro-environment (physical, social, and economic), production, processing, marketing, and consumption situation. The second phase dealt in more detail with yield, land area, crop utilization (sale or home use, processed or fresh use), and input/output relationships. The third phase involved detailed studies on post-

harvest issues such as characterization of processing techniques, product quality assessment (nutrition, toxicity, and quality), marketing, consumption and demand. In Uganda the three phases of COSCA were implemented.

While the COSCA study provided vital information for decision making, it does not provide comprehensive coverage on the cassava PCS continuum and linkages and how they affect the overall performance of the sub-sector. Key information on participants, processes, functions, and outcomes is also lacking in detail.

The study was also carried out in a period in which reforms in the agriculture sector, foreign exchange and overall macro-economic setups were being implemented in all the countries in the region. Hence the outcomes of the study do not represent a normal scenario, as it was done during a period of change and transition. Policy changes are likely to affect macro-and micro economic setups, and the cassava subsector is no exception.

Political instability in the region, which has threatened food production through displacement of farmers and disruption of economic activities, their effect on research work and the emergence and spread of the cassava mosaic disease in the region have also altered cassava production and utilization in the region. The impact of new technologies on production, processing and utilization of cassava, in the last decade may have altered its position as food and commercial crop.

Changes in weather which have seen an increase in the incidence of erratic rains, resulting into failure of grain crops may have stimulated farmers to give more attention to cassava which can withstand adverse weather conditions, in order to mitigate the effects of famine.

Since the COSCA study a number of theme specific studies have been carried out in Uganda in response to research, donor and other stakeholder needs and challenges. These studies have generated important information for decision making and programming. However, there is no comprehensive document or documents that presents the overall cassava sub-sector picture in the country at the moment. Consolidating the existing information in form of a comprehensive status report was therefore considered as a first step in understanding what is known about the sub-sector, identifying the key stakeholders, their expectations and motivations and the critical components and linkages within the sub-sector.

There is therefore need to update information on all aspects of the cassava production-to-utilization system, including stakeholder analysis, major

constraints and opportunities in the sub-sector and more importantly carry further the COSCA work by identifying opportunities for increasing cassava contribution to food security and industrialization (commercialization) in the region.

This first step of the sub-sector analysis was combined with key stakeholder consultations in order to enrich the published information with the more current activities in the sub-sector. The review and key stakeholder consultative information contained in this report is meant to elicit debate, identify critical constraints and opportunities within the sub-sector to contribute to food security and incomes for the rural and urban poor. The analysis will also identify information gaps within the sub-sector which will be a basis for primary data collection and analysis.

4 APPROACH

Two EARRNET steering committee review meetings held in Nairobi 23 – 24th June and July 3rd 2000, respectively endorsed the hiring of a consultant to handle the cassava sub-sector study in collaboration with the NARS and other stakeholders. NARS were asked to form cassava task forces comprising the national programme scientists, other cassava project representatives, NGOs, farmer associations, universities, donors, consumers and other interested parties to guide the sub-sector analysis at the national level. The committee agreed to use a production to consumption systems approach (PCSA) in the sub-sector analysis.

The PCSA is an important tool in sub-sector analysis. It focuses on the identification of the different commodity components and their interactions among themselves and with the environment. It is an important tool to focus and steer commodity research, policy and technological interventions intended to improve the overall performance of a commodity sector. Overall commodity performance is finally assessed in terms of its contribution to food security, employment, income and distributional impact within society at the macro level.

Correctly used PCS is directed to identify strategic points and forms of interventions in order to improve the performance of the commodity system. This objective requires the analysis of the current structure and the behaviour of the system and the understanding of the relations of these to its overall performance and environment. This implies a conceptual decomposition of the

system into its micro level components, featuring the most influential interest groups, and the interactions of these components with each other and with the environment.

Because of its nature, PCS requires the work of interdisciplinary teams that approach and effectively incorporate the participation of intended final beneficiaries and other users of the expected research results.

Literature review and key stakeholder consultations were carried out in order to consolidate the existing information and complement it with current but unpublished information on the activities in the sub-sector. The information gathered through this process forms the basis of this pre-survey report. Additional information was gathered through a stakeholders meeting held in Mukono in February, 2001.

This report outlines the current status of the cassava sub-sector in Uganda and proposes areas with information gaps that need to be filled through a field survey. The report also identifies areas in which opportunities exist for further research and investment. The report also looks at the current policy and technology environment in which the sub-sector operates and proposes areas in which changes may be necessary for policy reforms and technology development.

A draft report indicating areas of opportunities, constraints and potential for cassava commercialization and its contribution to food security will be highlighted. This report will be presented at a regional workshop organized by EARRNET and its partners later in the year. Drafting of the report is a responsibility of the consultant assisted by national research programme.

A stakeholders' workshop was held to discuss the draft report of the literature review and to identify information gaps within the report and recommend other sources of information that could be used to improve the report. Presentations made by other institutions and projects working in the sub-sector also contributed to strengthening of the status report. This report contains information gathered through literature review, informal interviews with stakeholders and information generated at the stakeholders workshop.

Specific papers have been commissioned within the region to collect and analyse information on key areas that required detailed study. Some of the relevant papers for Uganda include a study on cassava in the wider food systems, potential for cassava in the animal feeds industry, potential for cassava in the starch industry, potential for commercialization of planting material

multiplication and distribution, and necessary policy reforms for cassava to make wider contribution to food security and income generation.

This report identifies opportunities and information gaps for further action by stakeholders and key players in the industry and proposes areas for further research and immediate investments. Areas requiring additional data collection have been identified and will be subject to a limited field survey by the NCP staff with assistance from the consultant.

Information gathered from field survey will be consolidated within this report to arrive at a more comprehensive report on the sub-sector.

A five day regional workshop will be organized to cover reporting of the work done, exchange views and sharing information and ideas on the strategies of expanding the sub-sector and building up a regional sub-sector strategy for cassava. Discussion groups covering production, utilization and marketing will discuss relevant subjects in detail and come up with issues of immediate, medium and long-term concern. Ways and means of circumventing these constraints will be mapped out with specific agenda for action and budget implications. Matters requiring immediate corrections by the stakeholders at no cost for the better performance of the sub-sector will be sought before finalization of the strategy document. This report will form part of the resource material to be presented at workshop.

5 RESEARCH AND DEVELOPMENT OF THE CASSAVA SUB-SECTOR IN UGANDA

5.1 Production Setting

The agriculture sector is the dominant source of livelihood for the majority of the population of Uganda. The population is estimated at 22 million of which about 80% live in the rural areas and derive their livelihood from agriculture sector. The sector contributes 42.5% of GDP, while the manufacturing sector contributes only 9%. It contributes 85% of export earnings and nearly all the raw material for the largely agro-based industrial sector.

The total geographical area of Uganda is 241,000 sq. kilometers, of which 75% is suitable for cultivation, pasture or both. The rest consist lakes, swamps and forests. The population is estimated to be growing at 2.2%. Most of the agricultural activities are carried out by an estimated 2.5 million smallholder farmers on less than 2 ha of land each.

Uganda is endowed with a rich agricultural resource base (favorable climate and fertile soils) and thus a good potential for growing a wide range of commodities. Precipitation is fairly reliable and varies from 750 mm p.a. in the drier areas of Northeast to 1,500 mm in high rainfall areas of the shores of lake Victoria, Mt. Elgon in East, Rwenzori, Masindi and Gulu in the North.

Despite the country's high agriculture potential poverty levels are high especially in the rural areas. It is estimated that 44% of Ugandan's are living on less than Ugshs 11,500 (US$ 8.2) per month, the minimum considered necessary to meet minimum food requirements (Sserunkuuma, 1999).

The high incidence of poverty in rural areas is attributed to low agricultural productivity, resulting from depletion of soil fertility, heavy reliance on basic indigenous technology (including the use of unimproved and low-yielding planting material, limited practice of crop protection, high post-harvest losses etc) (Sserunkuuma, 1999).

5.2 Institutional Setting and Research Agenda

Agricultural research in Uganda is spearheaded by NARO; an autonomous Government Organization established in 1992, to address problems in priority areas of planning, organizing and managing research programmes in agriculture. It also disseminates its research outputs to various stakeholders.

The cassava research programme in Uganda was started in 1985 under the auspices of International Development Research Centre (IDRC) (Bua and Acola, 1998). Today the research programme is one of the most important in the agriculture sector.

In terms of national research for food crops cassava is ranked second after Matooke under NARO research priority setting. This shows the importance of the crop in the country's research agenda. Donor support for the research in cassava is also significant.

Initially most of the research activities were located at Serere Research Station, but were later transferred to Namulonge Agriculture and Animal Research Institute (NAARI) in 1987 after prolonged insurgency in the former. Hence when Cassava Mosaic Disease (CMD) broke out in the late 1980's, Uganda research capacity was ill-prepared to handle the emergency. The immediate strategy to deal with CMD through provision of clean planting materials, from existing cultivars under specified phytosanitary conditions proved ineffective to address the epidemic. This failure prompted a strategic shift from short and medium term intervention to a more long-term strategy of development and use of mosaic-resistant varieties. The National Cassava Programme (NCP) which implemented this new strategy managed to contain the epidemic.

The strategic objectives of cassava research are presented as medium to long-term, putting into consideration the urgent need to rapidly cover the remaining parts of the country with available mosaic-resistant varieties. The NCP has institutionalized a National Network of Cassava Workers (NANEC) to facilitate and coordinate the multiplication and dissemination of the mosaic-resistant varieties (Opio Odongo & Otim-Nape-1999). Although the approach has fairly succeeded, it was threatened by coordination difficulties among a multiplicity of stakeholders and its peculiar problems of donor dependency.

The level of technology in the production-to-utilization system for the cassava sub-sector in Uganda is still underdeveloped. Although research work to improve the technology has been on-going for sometime, adoption rates are quite low for a number of factors. Most formal research and extension programmes in the past have concentrated on yield responses and profitability of improved technologies, while relegating socio-economic and biophysical factors (such as cultural attributes to colour and taste preferences; family and farm size and structure, credit availability, market information and accessibility etc) that equally influence and ultimately determine viability for adoption.

At the production level, improved technology use is quite limited. This can be attributed to inefficient extension systems and limited capacity for multiplication and distribution of improved technologies. Hence development of low cost and adaptive technologies could allow for final products that are economically viable. The primary technologies required to add value to the entire crop enterprise include improved management practices, biological control of insect pests, phytosanitary control of diseases and efficient techniques for storage, drying and processing (Bua, A. & Acula, G. 1998). The primary approach to underline these basic production problems is to adopt a demand-driven rather than supply-oriented research and development common under purely academic and donor driven programmes.

In most countries in Eastern and Central Africa cassava is associated with poor communities and therefore given very low priority as a food crop. In the research circles, low priority rating for the crop means very low resources are allocated for its research. In contrast donor and NGO 's support for research and extension in cassava is significant, given their appreciation of the community level development challenges of poverty. In the table below research priority setting by NARO for a number of crops is presented.

As it can be seen, within the roots and tubers crops setting, cassava research is ranked highly. Considering overall ranking nationally, cassava is ranked third after maize and beans. In region one, cassava is ranked third together with maize after millet and sorghum.

Table 3: NARO Research Priority Setting

Commodity	**Region 1**	**Region 2**	**National**	**Priority Ranking**
Banana & Plantain	5.54	7.45	6.5	1
Cereals				
Maize	7.35	7.67	7.51	1
Millet	7.63	5.85	6.74	1
Sorghum	7.58	5.72	6.65	1
Rice	6.20	5.59	5.89	2
Wheat	5.27	5.45	5.36	3
Barley	5.07	5.23	5.15	3

Root & Tubers				
	7.35	6.97	7.16	1
Cassava	7.10	6.67	6.89	1
Sweet Potato	4.93	5.92	5.42	2
Irish Potato	ns	4.32	4.32	3
Yams				
Grain Legumes				
Beans	7.13	7.77	7.45	1
Cowpea	6.98	5.36	6.17	2
Pigeon Peas	6.39	5.01	5.70	2
Grams	5.83	4.77	5.30	3
Field peas		5.54	5.28	3

Priority Ranking: **1** = *high priority*; **2** = *medium priority*; **3** = *low priority*; **ns** = *not significant.*
Region: 1 = Eastern and Northern regions, Region: 2 = Central and Western Regions.
Source: Otim-Nape, G. W. and Bua, A. (ed. 1997). Cassava Development in Uganda: A Uganda Country Study Prepared for Global Cassava Development Strategy.

5.3 Main Cassava Research Challenges in Uganda

The main cassava research challenge in the country is the control of diseases and pests that have cost the country a substantial loss in cassava yields in the past. The cassava mosaic disease in particular has been the most devastating since it was first recorded in the country in 1989. By 1992, the average incidence of CMD in Uganda was 56% and in 1994 it had reached a peak of 97% in the districts of Lira, Apac and Rakai, compared with a national average of 65% (Bua and Acola 1998). It is estimated that annual losses due to the cassava mosaic disease in Uganda were US$60 million between 1992 and 1997. The cassava mealy bug (CMB) and cassava green spider mite (CGSM) are some of pests affecting cassava production in the country (Bua and Acola, 1998).

The research programme has therefore focused on developing mosaic resistant varieties coupled with multiplication and distribution activities with its development partners. Currently the programme is working with a number of other stakeholders, both in Uganda and in the neighbouring countries, to address various constraints that affect cassava production in the country.

Through EARRNET the programme has received improved material from IITA. Linkages with NRI, Foodnet and other agencies have also helped in defining cassava development agenda in the country.

Socio-economic studies conducted under the cassava programme have identified that; in terms of improved varieties, farmers look for early maturing, disease resistant, good underground storability, raw taste, cooked taste and cooking quality attributes. Bua and Acola (1998) estimate the yields from improved cassava cultivars at about 20 mt per hectare compared to 6.7 mt currently realized from local varieties. This means that Uganda can make substantial increases in cassava production by enhancing technology adoption.

5.4 Training and Technology Adoption

The objectives related to technology transfer underline the urgency to widely cover all parts of the country with mosaic-resistant varieties and the promotion of improved on-farm methods of harvesting, storage and processing to meet food security needs (Opio Odango & Otim-Nape; 1999). Little attention has been given to documentation and explanation of farmers' adoption of emerging cassava technologies and their impacts in Uganda. Like in other intensively researched commodities, socio-economic characteristics of farmers and variety attributes have been hypothesized as significant in explaining the adoption decisions of new cassava varieties and technologies. In Uganda, the combined role of farmer specific and variety specific attributes has been found significant (Bua, A. & Acola, G.-1998). The primary farmer-specific factors considered here include family size, farm size, contact with extension, distance from the source of the technology and sex. Cassava attributes of significant importance in Uganda are flour colour, cooked taste and ground storability.

The above complex interplay of factors justifies for a strong interface between research and extension to factor in all the relevant issues in the research programme. Stakeholder collaboration in research and development is important for any commodity system. It ensures a well focused and client led research agenda and avoids duplication of resources and efforts by sub-sector participants. Where there is collaboration, research work will be prioritized based on end user demand. Feedback between researchers and their clients also become more efficient and responsive. This is the basis of modern participatory research methodologies being implemented in Uganda. Participating farmers receive more attention from research and development agents that facilitate their appreciation of the value of new cassava varieties and technologies. For instance adoption rates for farmers participating in on-farm trials and multiplication of

introduced varieties in the 1993-96 period averaged 40%. This may be attributed to easy access to new planting material and information about their performance (Bua, A. &Acola, G. – 1998). Part of this impressive 40% adoption rate denotes the `spill-over' effects from participating farmers (farmer-to-farmer technology transfers).

Despite the above strong correlation, the extension function has been adversely affected by reduced funding and shortage of qualified manpower, more so during the period of public sector mismanagement of the 1970's . Given severe budgetary constraints, the public extension service needs to be re-oriented to provide a mechanism for extension-research-farmer interactions.

The cassava research programme has made a great stride in the development and release of improved cassava varieties with different attributes. In table 4 below varieties that have been tested and released in Uganda including their attributes are presented. As it can be seen most of the varieties are ACMD resistant to tolerant. Other important attributes presented include months to maturity and yields per unit area.

In table 13 farmers appreciation of the different varieties (Nase 1 & 2, Migyera, Aladu, Boa and some local varieties) based on certain criteria's is presented.

Table 4: Improved Varieties Tested and Selected for Use in Uganda

Variety	**Maturity Period (Months)**	**Typical Yield (tons/ha)**	**ACMD Status**
Released Varieties			
Boa	10 – 12	30	Susceptible
Ebwanateraka	10 – 12	30	Susceptible
Nase 1 (TMS 60142)	12 – 14	25	Resistant/ Tolerant
Nase 2 (TMS 30337)	12 – 15	40	Moderately resistant
Migyera (TMS 30572)	10 – 12	45	Resistant/ Tolerant
Awaiting Release			
SS4 (as Nase 4)	12 – 14	55	Resistant/ Tolerant
TMS 4(2)1425 (as Nase 5)	10 – 12	35	Moderately resistant
89/1988-2UYT/PDB			

(as Nase 6)	10 – 12	30	Resistant/ Tolerant
Migyera 81 (as Nase 7)	10 – 12	25	Resistant/ Tolerant
Migyera 16 (as Nase 8)	10 – 12	30	Resistant/ Tolerant

Source:NARO/NRI 1996, Progress in cassava technology transfer in Uganda

6 SUB-SECTOR COMPONENTS

6.1 Production

6.1.1 Farming Systems

Cassava can grow and produce dependable yields in areas where cereals and other crops do not do well. This makes it an ideal crop for addressing food security problems rampant in most sub-saharan Africa countries. In Uganda it is an important crop in the low potential areas of eastern and northern parts of the country.

The 1996 Uganda national household and crops survey found that cassava was the second most important crop after matooke in the food crop production system. The ranking in terms of importance is presented below for main food and cash crops, based on the survey.

- Matoke (food type) 17%
- Cassava 12%
- Sweet potatoes 10%
- Maize 9%
- Beans 8%
- Finger millet 8%
- Coffee 8%
- Sorghum 8%
- Groundnuts 6%

In Uganda cassava is largely grown under smallholder system. The production system is mainly inter-cropping with other food crops such as maize, beans and peas. Other intercrops are, bananas/plantains, sweet potatoes, and sorghum or millet. In some areas cassava is grown as a sole crop. Of the 142 cassava fields surveyed under the COSCA studies in Uganda, only five were planted with cassava as a sole crop, while 77 fields intercropped cassava as the main crop

and in 18 fields cassava was a minor crop with other crops. The reasons for intercropping as explained in another study by Norman (1974), included the need for high aggregate outputs, land shortage, tradition, security and lack of labour.

The COSCA study found that of the surveyed fields 10% were mono-crops, while 90% were intercropped. Cassava was grown as sole or as the major in intercrop more frequently than any other crop other than rice which had a very low number of observations.

Average cassava crop density in Uganda under the COSCA study was 3200 stands/ha, compared to the combined COSCA studies of 8000 stands/ha. Cassava density was low in fields intercropped with beans and peas. Other factors that influenced cassava plant density included, conditions in which the crop was grown[2], and canopy genotype.

Planting of cassava spreads over several months, from the beginning to the end of the rain season. This is because cassava is a versatile crop capable of withstanding harsh weather conditions. Since cassava has a long growth cycle it is not as frequently grown as other food crops.

The choice of cassava varieties grown by farmers in Uganda, from the COSCA reports, was based on a number of factors. Some of the important factors considered are:

- Extended in-ground storability in remote areas.
- High root yield and early maturing in high demographic pressure areas
- Low cyanogen levels because of use in fresh form.
- Diseases/pests tolerance, and
- Good processing and cooking qualities.

Use of improved cultivars is reported to have increased in certain areas of the country. Where the adoption has taken place, yields have increased from 9 tons per hectare to about 20 tons per hectare.

The COSCA study in Uganda found that cassava was produced with purchased inputs as frequently and in some cases more frequently than other staples (Nweke, et al, 1999). The use of hired labour and mechanised transportation was correlated with proximity to market centres. Cassava production in the

[2] Was low if grown on mounds or flat surface and high if grown on ridges

country is however, largely labour based and with no application of commercial fertilizers or mechanized production.

The main pests and diseases experienced in cassava production in the country are cassava green mite (CGM) and African cassava mosaic disease (ACMD). The COSCA study found the diseases were common in areas where cassava was grown under fallow than continuous system and also in areas with intercrop.

Incidence of CGM and ACMD were higher in cassava under intercrop than in sole crop, incidence of CBB was higher under sole crop. Incidence of CBB was higher under sole crop.

6.1.2 Harvesting And Storage of Cassava

The decision to harvest cassava depends on market, and labour availability and household food security needs. Piecemeal harvesting is a major practise among small holders and is generally used as a method of preservation where storage of fresh roots is a big problem (Nweke et al, 1999). It can also be used for price hedging purposes, with harvesting being done only when prices are good. In some communities harvesting for sale is only done to meet immediate financial needs. Farmers' decision to delay harvesting could also be because of lack of labour or its cost.

Most of the harvesting is done between the 7th and 9th month when the crop has reached maturity. In areas experiencing food shortage harvesting is done before the roots are maturely bulk. The crop is however not usually harvested at once and therefore could stay up to 24 months before the root quality starts deteriorating.

Storage of fresh and processed cassava roots is a main constraint in cassava production in Uganda. One of the common methods used for storage in face of lack of alternatives is delayed harvesting. Otim-Nape and Opio-Odongo (1989) pointed out that even when cassava had reached maximum bulking it was sometimes left on the farm as a storage measure. This practice is more common in areas which do not have ready market or appropriate processing technologies. The practice is also found in most other cassava growing areas in the region.

6.1.3 Production trends

In Uganda cassava was introduced in 1862, and it has since spread to most parts of the country. It plays a major role in food security especially in the Eastern part of the country where it is the main staple food. Nationally cassava

is second to Matoke as a staple food, contributing up to 60% of the basic food requirements (Bua et al. 1991).

The production of cassava in the country is estimated at about 3.4 million mts grown in 374,000 ha, implying a national average yield of 6.7 tons/ha. This yield is below the expected yields of 40tns/ha which have been achieved elsewhere. The crop is grown in estimated 1.79 million plots, of an average size of 0.2 ha.

Cassava production in the country has fluctuated considerably in the last 10 years, mainly due to effects of cassava mosaic disease. The production fell from 3.2 million tons in 1993 to about 2 million tons in 1994, before picking up again in 1997 (Table 3 in the Appendix). Other factors that contributed to decline in production included, poor extension services, acute shortages of agricultural inputs, political and socio-economic strife (Bua and Acola, 1998).

Uganda's cassava production can be increased by improving the agronomic practices and adoption of improved varieties to raise yields. Bua and Acola (1998) estimate the yields from improved cassava varieties at about 20 mt per hectare, compared to 6.7 tons per hectare currently realized from local varieties. If the yields of cassava on the estimated 374,000 hectares planted in 1999 could be increased to 20 tons/ha, the total production would be 7,480,000 mt instead of the current 3,400,000 mts. It shows production can be more than doubled without expanding the land acreage under the crop.

Cassava is produced in all districts in the country, although high concentration is found in the drier eastern and northern region districts. In these two regions cassava is the main staple food. In Table 7 in the appendix cassava production in the country by district in the last decade is presented. As it can be seen most of the cassava is produced in the districts in the eastern and northern part of the country. The main cassava producing districts are; Iganga, Mbale, Apac, Arua, Gulu, Kumi, Kitgum and Lira.

Production of cassava in the main growing areas is entirely used as food (see Table 6 in the Appendix). The production of cassava in relation to other important food crops in the country is presented in Table 5 in the appendix. The 1996 national household and crop survey found that the eastern region of the country produced over 50% of the national cassava output. The relative cassava regional production importance is presented below.

- Eastern Region 60%
- Western 19%
- Northern 16%

- Central 4%

6.1.4 Production constraints

The cassava production constraints in the country can be classified as follows;

- Biotic (pests and diseases especially cassava mosaic disease and cassava green mite pests)
- Abiotic (soils, weather etc.)
- Land (Lack of land among some potential farmers). This problem can be addressed through appropriate land tenure reform.
- Labour (especially for harvesting and processing).
- Lack of planting material (this is attributed to inefficient multiplication and distribution systems)
- Cultural attitudes (in Buganda for example rouging is associated with evil. Those who uproot cassava are associated with witchcraft)
- Policy – no explicit government policy on cassava is in place.
- Lack of markets (market access, information)
- Poor extension services,
- Poor agronomic practices (low plant population, poor weed control and insufficient crop mixtures),
- Poor storability of the fresh cassava roots.

Table 5 five below demonstrates the priority importance of some of the above constraints.

Table 5: Cassava Production Constraints and Their Scores and Priority Rankings in Uganda

Category of Constraint	Constraint Particular	Score	Priority
Diseases of Cassava	African Cassava Mosaic	2.38	1
	Nematodes	2.07	1
	Root rot	2.05	2
	Bacterial blight	2.04	2
	Antracnose	1.87	3
	Cercospora leaf spot	1.82	3
Pests of Cassava	Cassava mealybug	2.39	1
	Green spider mite	2.18	1
	Rodents (mole rats)	1.96	2
	Grasshopper	1.79	3
Post Harvest/ Food Technology	Storage systems	2.22	1

	Storage pests	2.20		1
	Limited diversification of products	2.15		1
	Lack of processing technology	2.12		1
Vertical Improvement	Poor quality planting material	2.43		1
(for all roots and tubers)	Lack of low altitude	2.21		1
	Lack of improved varieties (Irish Potato)		2.20	
1				
	Genetic erosion of local germplasm (sweet potato)	2.04		2
Crop Management	Weeds	2.28		1
(for all roots and tubers)	Plant population	2.29		1
	Lack of suitable cropping systems (crop mixture)	2.18		1
Low soil productivity	Nutrient deficiency		2.21	
1				
Socio-economics	Poor marketing	2.18		2
(for all roots and tubers)	Labour shortage	2.09		2
Agricultural engineering	Lack of animal drawn implements	2.00		2
	Lack of improved hand tools	1.92		2

Source: Bua, A. and Acola, G. (1998), adopted from Otim-Nape, G. W. and Bua A. (ed.) (1997). Cassava Development in Uganda. A Uganda Country Case Study Prepared for Global Cassava Development Strategy.

While the main problem facing fresh cassava roots is perishability, dried cassava face a different problem in the form of low productivity which results from use of inefficient husbandry methods, the lack of varieties that are responsive to improved agronomic practices, and damage caused by the pests and diseases (Bua and Acola, 1998). Lack of efficient natural drying methods is also a big problem facing cassava dried chips.

6.2 PROCESSING

Cassava processing is important not only to add value to the product but also to increase its shelf life and reduce its bulkiness for transportation in case of marketing. In Africa cassava roots are used in a wide range of forms of food products which can be grouped into fresh roots (unprocessed), granules, pastes, chips/flour, starches, etc. (processed).

Most of the cassava processing takes place at the household level using simple labour-based technologies. The processing methods used include; chopping, peeling, drying and milling. These lead to high processing costs especially in areas where family labour is scarce and hired labour is in short supply.

The traditional methods used in processing cassava are a combination of the following steps: peeling, crushing, milling, slicing/ or grating, water expressing by pressing, decanting, sun/smoke drying, or frying, fermenting by soaking in water, heaping, stacking, or sedimentation, sieving; and cooking, boiling, or steaming depending in the product being made. The processing steps result in a range of intermediate products. Some of the resulting products are ready to eat/use while others require further cooking before they can be eaten.

Hand chopping, peeling and slicing using kitchen knives leads to major losses and is also highly labour demanding. Quality processing at household level is more pronounced in areas where the end product is meant for market purposes.

IITA scientists have indicated that processing costs of certain cassava products, namely flours, dried chips, etc could be significantly reduced if genotypes which contain less moisture could be developed.

Cassava at the household level is largely used in its unprocessed form. The COSCA study in Uganda showed that of the surveyed villages 70% reported that their most preferred cassava product was unprocessed cassava roots. Other important products were chips/ flour and alcohol (Nweke at al, 1999). Other studies report that sweet cassava varieties are eaten raw, roasted, or boiled.

Investment efforts in processing by private sector and governments in most African countries have failed due to inadequate supply of raw materials or access to sizeable markets at competitive prices.

Some of the underlying difficulties include:

- Inadequate focus on a demand driven approach in research efforts (inadequate tailoring of new varieties to rural family needs);

- Inadequate development and dissemination of appropriate processing technologies for traditional or diversified cassava based products and/ or to actual market requirements; and ;

- Failure to penetrate existing domestic and external market outlets.

In Uganda a number of cassava processing methods are used including; traditional, micro and medium scale level of processing. The range of products resulting from the processing process is however low. A few of these products are briefly described below.

6.2.1 Processing of Granules

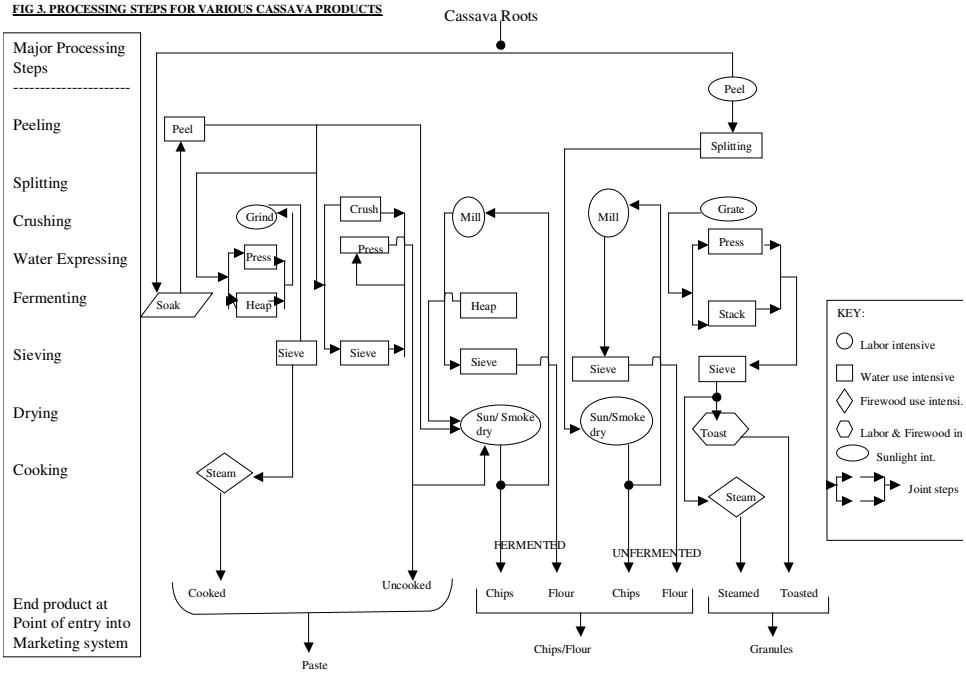
Granules may be toasted or steamed. Toasted granules are made through; peeling, grating, expression of excess liquid through pressing of grated cassava packed in sacks for 3 –4 days while fermenting. Dewatered and fermented pulp is sieved and the resulting fine pulp is fried in a pan. The product can be steamed or fried. Frying extends the shelf life of the product so that it can easily be transported for sale in distant markets or stored for food in the home. This processing method though common in Western Africa states, it is very rare in Uganda.

6.2.2 Processing of Chips and Flour

Chips and flour making is the most common form of cassava processing in the country. In Uganda processed chips or flour are called by various local names such as *moko, moge or unga*. The methods used in making these products are wide. Soaked roots can be converted into chips by sun- or smoke drying, either directly after peeling or after crushing, sieving, pressing, and balling. Chips can also be made directly from fresh roots in one or two ways. Sun drying or smoking of peeled fresh roots is the simplest traditional method but is not effective in eliminating cyanogens if present in roots. The alternative method of making cassava chips involves fermentation by heaping prior to sun- or smoke-drying. The chips made in any of the traditional methods are converted into flour through milling.

In figure 3 below the main cassava processing steps and the resulting products are presented.

FIG 3. PROCESSING STEPS FOR VARIOUS CASSAVA PRODUCTS



6.2.3 Improved Post-Harvest Technologies

The Uganda Post-Harvest Programme has been promoting improved processing technologies for cassava in the country. The available technologies that are being promoted include….. the impact of these technologies in terms of increasing cassava production as it did in Nigeria or improvement in quality or quantity of processed products has not been documented as these efforts are still at initial stages.

The impact and response by stakeholders to the improved technologies need to be assessed. This would give the programme a feedback on areas with potential and shortcomings that need to be addressed.

Some of the improved technologies being promoted include; electric powered

6.3 MARKETING

Cassava in Uganda is planted as a food crop as well as a source of income. Nweke et al (1999) report that of the surveyed villages in Uganda 25% planted cassava purposely for the market. This is however less than what was recorded for the combined COSCA countries, which showed that 40% of the cassava was planted for market purposes.

The proportion of cassava fields planted for marketing during the COSCA study was 50% in Uganda, while 5% of the fields were planted solely for the market. Results from the 1996 households survey however, showed that 61% of the cassava produced was sold (see Table 6 below). This was the highest proportion of sales for food crops, followed by matoke in which 41% of the produce was marketed. This result shows that cassava is an important cash crop in the country.

The factors which influenced decisions to plant cassava for sale were; access to food crop milling machines and the fallow system. Areas with access to milling machines and those with short fallow systems planted more cassava for market. However, villages with access to markets planted little cassava for market. Villages which were distant from markets planted more cassava for which the surplus found itself to the markets (Nweke et al 1999). Within Uganda, the main traded cassava products include fresh roots and cassava chips. Other important products are cassava flour and roasted cassava roots.

In areas where purchased inputs were used, planting of cassava for market was also found to be high. Cassava planting for markets was also correlated with gender in that more fields owned by women were planted with cassava for marketing than those owned by men. For the cassava producing households, COSCA studies found that cassava was more important than any other food crop as a source of cash income. Marketing is carried out by both men and women.

Table 6 Distribution of Crops Production, Sales and Sales Proportions to Production During First Season

Crop	Production (toones)	Sales (tones)	Proportion (%)
Matooke -food type	7,909,000	3,447,000	44
-beer type	1,165,000	176,000	15
-sweet type	384,000	158,000	41
Maize	369,000	51,000	14
Finger Millet	136,000	5,000	4
Sorghum	131,000	8,000	6
Beans	199,000	17,000	9
Groundnuts	94,000	6,000	7
Sweet Potatoes	2,990,000	734,000	25

Cassava	2,746,000	1,683,000	61

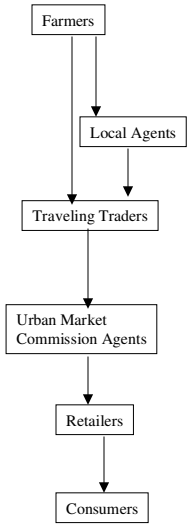
Source: UNHS 1995-1996

6.3.1 Marketing of Fresh Roots

Marketing of fresh roots in Uganda is a dominant activity especially, in the cassava growing areas. The fresh cassava marketing is driven by high perishability of the roots and by the attractive price that consumers are willing to pay for freshness.

The flow of fresh cassava from rural farmers to major consumption markets is dynamic and involves a heavy concentration of marketing services. The marketing chain of fresh cassava roots is presented in figure 4 below. The urban consumers tend to prefer fresh, sweet flavoured, medium sized cassava roots. Many of the cassava mosaic resistant varieties are unpopular because of their bitter taste (Collinson, C. et al, March 2000). From the traders point of view, consumers also prefer roots that do not perish quickly. The traders also point out that there is no significant seasonality change in prices.

Figure 4. Marketing Chain of Fresh Cassava in Uganda



Source: Collison et al, March 2000.

Farmers trade directly with traveling traders or their appointed agents. The agents do not however, take possession of the cassava. Once the traders have identified and negotiated a price for cassava with farmers, they hire labour for harvesting and loading on trucks. Most of the traders negotiate the price for

whole fields hence taking a high risk incase the yields are not good. Some progressive traders only negotiate the price for harvested cassava.

Roots are transported using trucks without bagging, incase of large roots, or bagged before loading, incase of small to medium sized roots. Traders pay a local levy. Once at the Kampala market, the traders hand the responsibility of selling the cassava to commission agents, who negotiate with retailers for prices at a fee. The retailers then sell the roots to consumers, either within the vicinity of the market or other markets.

The prices of fresh cassava vary on a daily basis, depending on the level of supply on a particular day. This brings complication to traders because the commodity is perishable and no appropriate storage exists that can conserve the roots until prices improve.

Trade in fresh cassava is hampered by lack of information flow, with farmers being in the most disadvantaged position. This lack of information flow can also lead to oversupply of cassava in certain markets on certain days, hence dampening prices. Collinson (2000), however observed that traders usually cooperate to regulate the supply of fresh cassava into Kampala's Kasubi market. The trade is fairly competitive, involving quite a large number of traders.The scale of operation for fresh cassava traders in limited by both perishability and capital availability.

6.3.2 Marketing of Processed Cassava Products

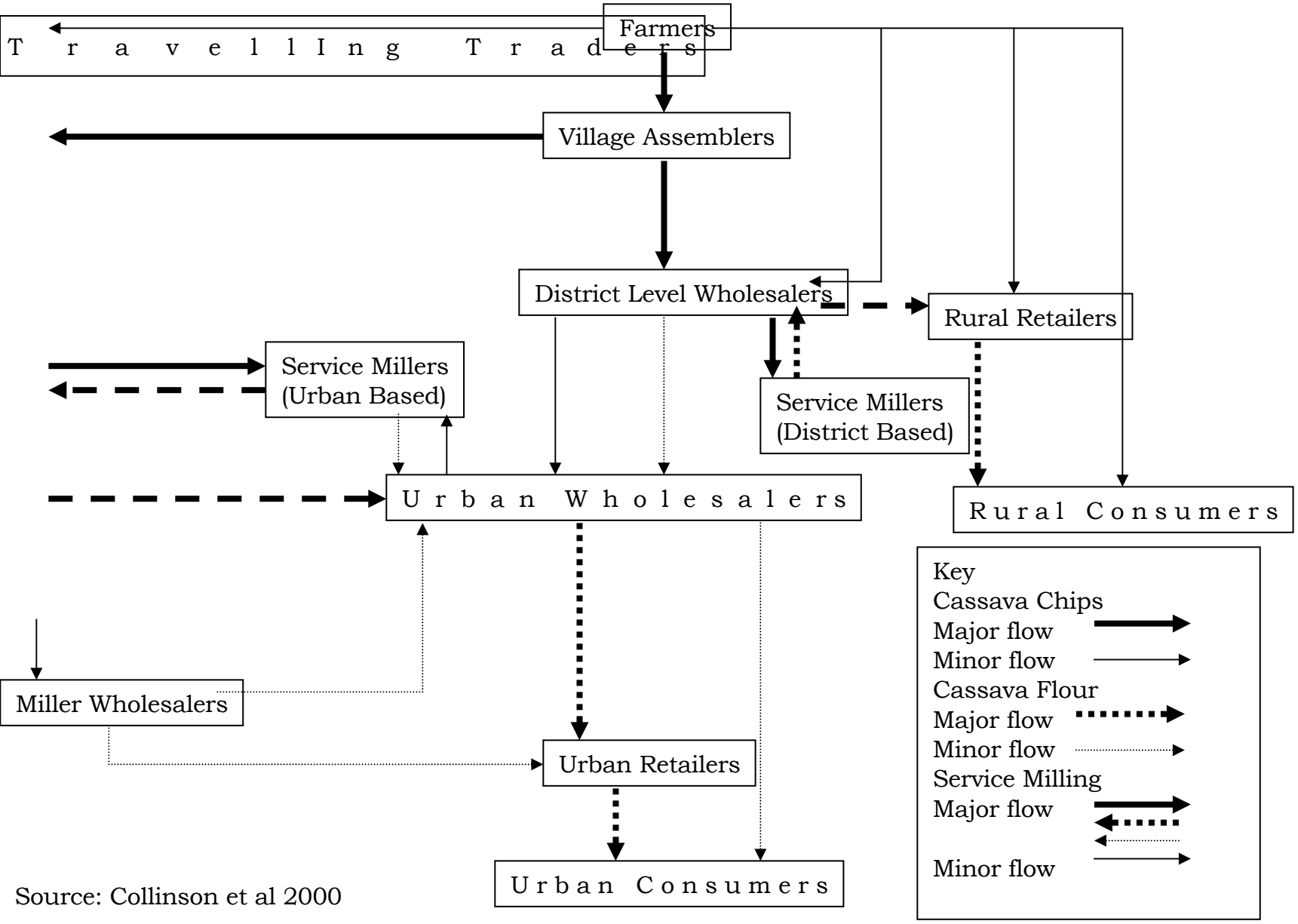
The COSCA study reports that farmers in remote villages who had access to mechanized processing facilities planted more cassava for sale than farmers who had to rely on easy access to fresh cassava market centers (Nweke et al, 1999).

Kampala is the most important trading center for dried cassava. The main sources of cassava sold in Kampala markets include; Apac in the north, and Kumi, Soroti and Palilisa in the east. Hoima also supplies small quantities but of relatively higher quality.

Unlike the trade in fresh cassava roots, trade in processed cassava is more complex, involving a number of intermediaries. From harvest to purchase at the local store of cassava flour, cassava must be; peeled, dried, bulked (assembled into tradable quantities), transported, stored, milled and finally retailed at convenient locations for consumers (Collinson et al 2000).

A summary presentation of the dried cassava transaction chain in Uganda is presented in figure 5 below.

Figure 5 Dried Cassava Marketing Chain in Uganda



Source: Collinson et al 2000

When farmers harvest, peel and dry the cassava roots, they may sell through any of the following channels;

- Direct to rural retailers,
- Rural consumers, or
- To wholesalers if they are near major district level towns,
- Traveling traders, or
- Village assemblers.

The farmers rarely sell their cassava on credit except to traders with whom they have had a long trading relationship. Village assemblers bulk cassava chips from surrounding areas, and in some cases grade them into high quality white and well dried and low quality discoloured grade. Buyers would then place orders with village assemblers.

District level wholesalers serve retailers in their immediate areas and to some extend supply wholesalers in other major urban areas. The main role of the wholesalers is to arrange transformation of cassava chips into flour.

Traveling traders supply most of the cassava flour in main urban centers. In most cases they buy their supplies from village assemblers. Urban wholesalers operate almost like the district level wholesalers, except for differences in the level of scale and location.

Some businesses combine both flour milling and wholesaling. This increases the range of their customers.

Service milling do not usually engage in trade but merely provide the milling service. They use petrol and diesel powered mills and mill a wide range of other commodities including cereals.

6.3.3 Marketing Constraints and Opportunities

- Lack of market information which leads to poor market efficiency and wastage,
- Lack of credit to traders hence stagnating opportunities for enjoying economies of scale,
- Perishability of fresh cassava,
- High transport costs especially from rural areas to main urban centers,
- Lack of adequate and well serviced market facilities,
- Lack of storage facilities especially for fresh and cassava chips.

To improve the cassava trade in Uganda there is need to ensure market efficiency by providing market information (prices, supply and demand situation in main consuming areas). This information can be provided in radio as well as in print media. The MIS project is at the moment collecting

marketing information for various commodities including cassava and relying this information to various stakeholders through different channels. This coverage is however still limited and there plans to expand it to cover more areas.

Credit facilities should also be provided among traders in order to boast their capital base.

Improving the quality of processed products so as to increase consumer base should also be a target by development agencies.

Potential cassava markets such as animal feeds industries, plywoods, textiles, food manufacturing, adhesives, etc have not been fully exploited for a number of reasons and efforts should be made to penetrate these markets by increasing market efficiency and product quality.

6.4 Cassava Utilization

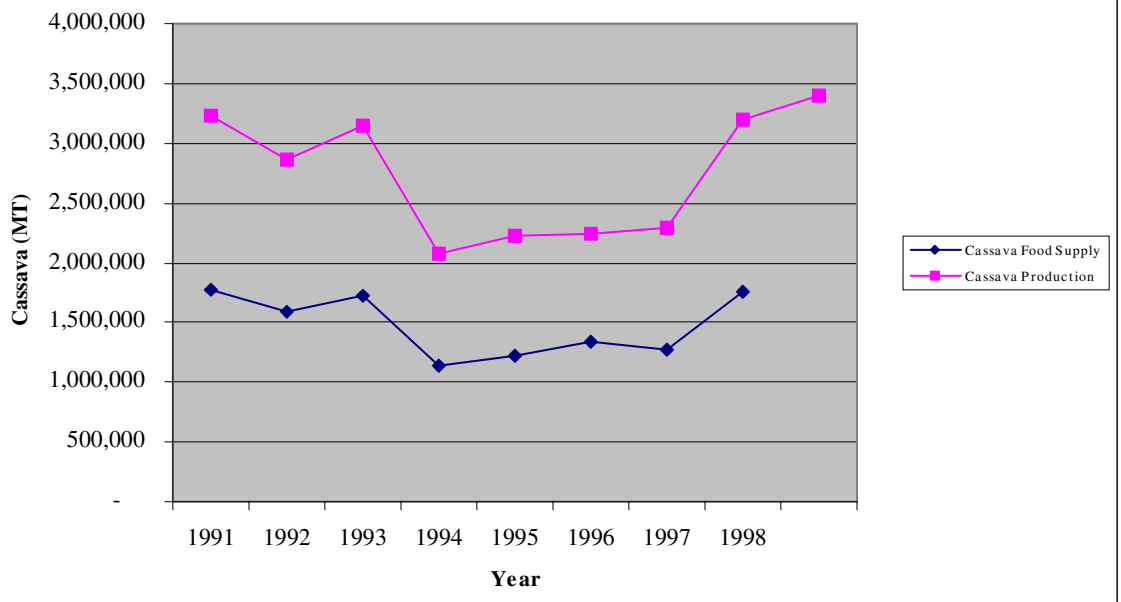
In Uganda cassava is mainly used for human consumption. In the communities to the North and Eastern parts of the country cassava is the staple food crop.

Industrial use of cassava in the country is still limited although potential exists in some sectors. Some of the potential industries based on recent studies include; animal feeds, plywood, paperboard, textiles and bread and biscuits.

In figure 6 below cassava production and proportion used as food in the country in the last decade is presented. The figure shows that more than 50% of production is used as food.

Food supply situation in Uganda, based on 1996/97 – 2000/2001 under the agriculture commercialization programme, shows massive deficits for the supply of cassava. Other main food crops with deficits were; finger millet, wheat, beans, and simsim. The overall food supply situation shows a deficit, most of it contributed by the cassava deficit.

Figure 6. Cassava Production and Food Supply Situation in Uganda 1991 - 1999 (MT)



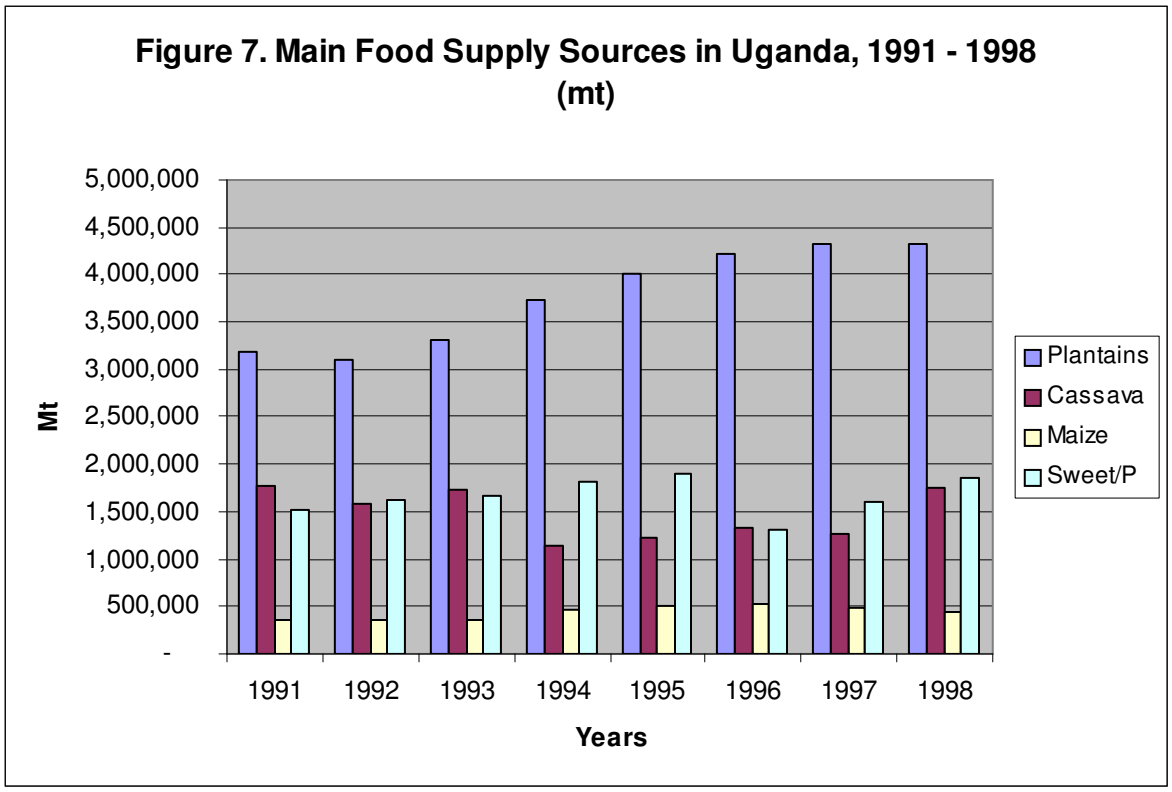
Source: FAOSTAT, Website 2000

6.4.1 Human Utilization

Between 1961 and 1995 the world consumption patterns of cassava had changed with human food consumption becoming dominant in Africa and Asia and as the second most important in Latin America (Plucknett, D. L. et al, 1998). In Africa its use as human food doubled, while in Asia and Latin America it increased by 70% and 50% respectively. In Latin America more than 80% of cassava was consumed in the country of origin in 1961.

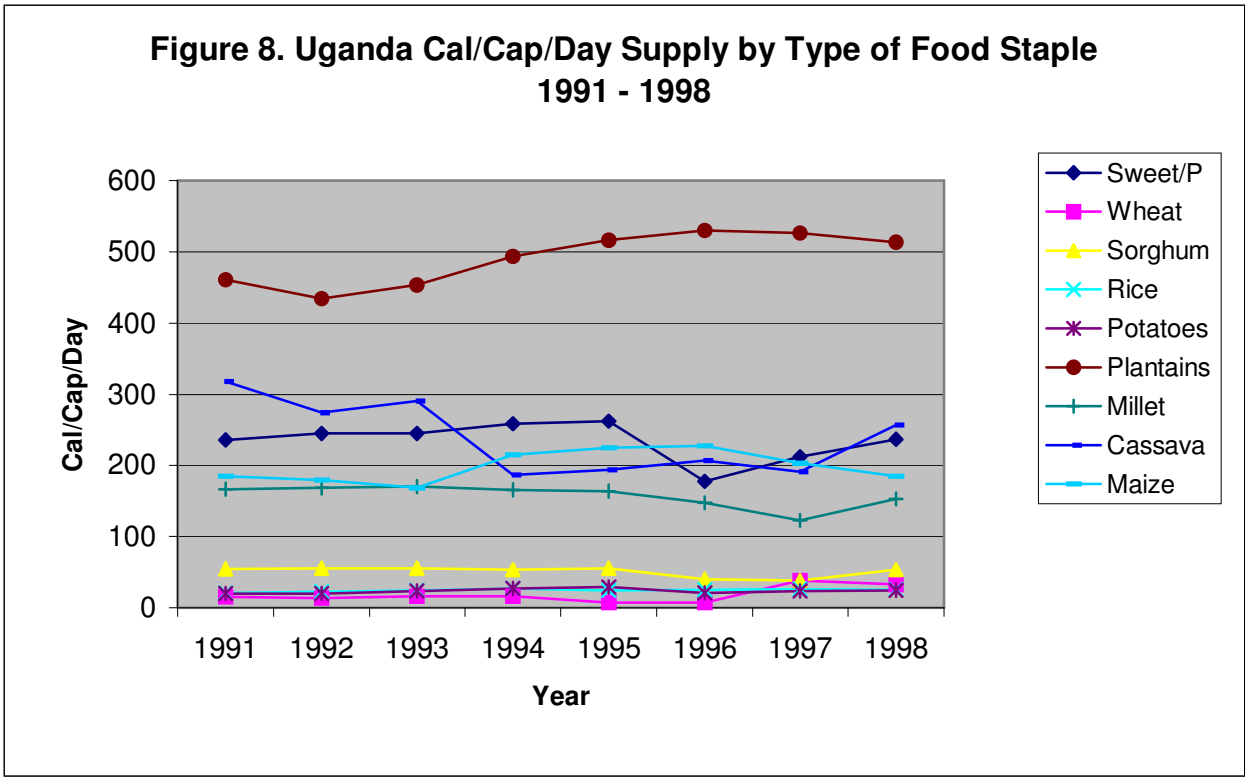
The COSCA study found the range of cassava products used for human consumption in the surveyed countries and especially in Uganda to be narrow. In the report, cassava was predominantly used in fresh form (70% of the surveyed villages) or transformed into a non-convenient food product which could not compete effectively with food grains in the market and therefore did not have many market opportunities (Nweke et al, 1999). Other specific forms in which cassava was used were in flour, chips or alcohol. Roasting and boiling of cassava roots before eating is also common among Ugandan cassava consumers.

As a source of food supply, cassava is ranked second among the main food crops in Uganda after matoke (plantains). In figure 7 Below and table 8 In the appendix it can be shown that cassava is more important than maize as a food crop.



For cassava to contribute to food security and poverty alleviation among the subsistence farmers living in marginal areas where cassava is a potential crop, it is important to understand their food security and nutritional requirements. Actual market requirements for cassava also need to be understood (in terms of quality, quantity and diversity of products).

In the 1970s cassava was estimated to contribute 15% of average daily dietary energy intake per person in Uganda, second after plantains or third if sorghum and millets were combined, while maize came fourth in declining order (FAO, 1970). Otim-Nape and Opio-Odongo (1989) estimate it to be second to plantains and closely followed by sweet potato and finger millet. In figure 8 below the dietary energy contribution per capita from cassava is shown to be second to plantains except for the period between 1994 and 1997 when production was affected by cassava mosaic outbreak. By 1998 cassava had regained its second position in terms of calorie per capita supply.



The use of cassava as a food crop is in Uganda is dependent of the region, with the main producing areas (eastern and northern) having the highest per capita consumption (see Table 7 below).

Table 7: Regional Estimates of Cassava Flour Consumption in Uganda 1997

	Quantity Purchased (tonnes)	**Per-capita quantity purchased (kg)**	**Quantity Consumed from own Production (tonnes)**	**Per-capita consumption from own production (kg)**
Central	14,700	2.55	7,500	1.31
Eastern	34,000	6.61	45,900	8.93
Western	17,500	3.09	26,900	4.77
Northern	21,900	5.64	11,200	2.88
	88,100	4.31	91,500	4.48

Source: Collinson et. Draft report March 2000

Based on the 1996 Uganda National Household Survey, per capita rural consumption of cassava flour stood at 9.66 kgs of which 4.38 was from own

production, while urban per capita utilization of flour stood at 4.22 kilograms of which 0.28 was from own production (see Table 8 below).

Table 8: Rural/Urban Estimates of Cassava Flour Consumption - 1997

	Quantity purchased in 1997 (tonnes)	**Per-capita quantity purchased in (kg)**	**Consumption from own production in (tonnes)**	**Per-capita consumption from own production in (kg)**
Rural	75,200	4.38	90,600	5.28
Urban	12,900	3.94	900	0.28

Source: Estimates from 1996/97 Uganda National Household Survey

Although cassava leaves are of high nutritional value and used extensively in some countries, like the DRC, there is no documented use in Uganda. The use of cassava leaves as a vegetable can increase the nutritional value of cassava foods such as "ugali". A study done by FAO and the US Department of Health Education found very close nutritive values of cassava leaves and cassava roots. In Table 9 protein and energy contents of raw and cooked cassava tubers per 100g dry matter are presented. In Table 10 information on nutritional value of raw cassava leaves is presented on a per 100 g edible portion. As it can be seen, while the calorie value is low in the leaves, it is quite high in the tubers. The protein value in the leaves is significantly higher than in the tubers. This means that cassava tubers and leaves can complement each other to increase the nutritional value of the food. This is an important piece of information for nutritional programmes in high cassava consuming communities where there are deficiencies in protein intake.

Table 9: Protein and energy contents of cassava products prepared traditionally.*

	Raw peeled tuber	**Tuber cooked in water**	**Peeled cooked and washed**
Calories	395	394	395
Proteins	1.51	1.49	1.95

Note: * Per 100g dry matter
Source: Wambugu and Mungai, in Favier, J.C et al. 1971 "La technologie traditionelle du manioc au Camerron: influence sur la valeur nutritive"

Table 10: Proximate composition of cassava leaves per 100g edible portion, fresh weight.

Component	Reference	Calories	Moisture %	Protein g	Fat g	Total carbohydrate g	Fibre G	Ash G
Cassava leaf, raw	A	91	71.7	7.0	1.0	18.3	4.0	2.0
	B	60	81.0	6.9	1.3	9.2	2.1	1.6

Source:Wambugu and Mungai in: (A) Food Composition Table for Use in Africa. FAO and US Dept. of Health Education and Welfare, 1968. (B) Food Composition Table for Use in Africa. FAO and US Dept. of Health Education and Welfare, 1972.

6.4.2 Livestock Utilization

Cassava utilization in the animal feeds industry is a potential source of expanded demand for cassava in the country. The dairy industry in Uganda has grown substantially in the last five years and, with introduction of zero grazing technologies, the use of commercial feeds is expected to increase. The poultry industry in the country is also a potential source of new demand for cassava. A comparative use of cassava as an input in animal feeds in the Cote D'Ivoire is shown in Table 11 below.

Information based on studies conducted by FoodNet and the Uganda Post-Harvest programme show that there is a potential demand of 18,750 tons of fresh cassava tubers equivalent in the animal feeds industry. However, this is a small volume (0.55% of annual cassava production) compared to the overall 3.4 million tons of fresh cassava tubers that are produced in Uganda annually. But it points to a market with potential growth which cannot be ignored. In the past, cassava was used by one of the feed millers in the country, but the supply of the raw material was not reliable and the company had to discontinue its use.

The small volume of projected demand for cassava in the animal feeds industry cannot be used to justify promotion of increased cassava production in the short to medium term, but future potential cannot be ruled out.

Table 11: Composition of Experimental Broiler Rations in Cote D'Ivoire

Raw Materials	Percentage of Cassava in the Ration			
	0%	10%	20%	30%
Ingredients				
Maize	60	50	40	32

Cassava flour	0	10	20	30
Rice flour	14	14	13	10
Cottonseed cake	7	8	7	6
Soybean cake	6	7	7	7
Fish flour	9	9	11	13
Wheat middling	4	0	0	0
Premix (i.e. minerals, etc.)	2	2	2	2
Nutrients				
Energy (kcal ME/kg)	2992	2995	2989	2989
Protein (%)	19.08	19.1	18.96	18.9
Lysine (%)	1.02	1.03	1.07	1.12
Methionine (%)	0.4	0.4	0.42	0.42
Methionine + cystine (%)	0.71	0.7	0.7	0.71
Calcium (%)	1	1	1.12	1.26
Available phosphorus (%)	0.56	0.57	0.61	0.66
Cellulose (%)	3.8	3.7	3.6	3.4

Source: Tiemoko (1992), In Graffham, A. et al NRI, Foodnet, NPP-Uganda, Nov. 2000

6.4.3 Industrial Utilization

Cassava flour and starch can be used in a wide range of industrial applications. However, in Uganda use of either cassava or cassava flour in industrial processing is negligible. Studies by Foodnet and the Post Harvest programme, show that there is potential to promote use of high grade cassava flour in biscuits and bread baking industries. Studies elsewhere have shown that cassava flour can be used to substitute up to 35% of wheat in biscuit making (Graffham, et al, 2000) and up to 10% in bread making. Based on these ratios and industry analysis, the potential for fresh cassava in the bread and biscuits industry in the country is an equivalent of 27,000 tons annually (0.8% of annual cassava production).

Foodnet's study did not however, find any potential in the use of cassava in pharmacy, industrial alcohol or laundry starch. Textiles, plywood and paperboard had a combined potential of 994 tonnes of fresh cassava equivalent. The potential industrial markets for cassava and cassava products in the country are presented below.

Table 12. Potential Industrial Use of Cassava in Uganda

Market Potential

Industry	Cassava Alternative	Existing Market	(Fresh roots equivalent)
Animal feeds	Chips	37,500t carbohydrates	18,750t
Plywood	Flour	72t cassava flour	216t
Paperboard	Starch	223tSBA 54tcassflour	670
Textiles	Flour	36tcass flour	108
Bread	Flour	88,000t wheat	26,400
Biscuits	Flour	2,000t wheat	600
Processed Foods	Flour/Starch	50t NMS	??????
Pharmacy	Starch	198t NMS	None
Industrial Alcohol Alcohol	Cassava derived sugar syrup	1 million litres spirits	None
Laundry Starch	Starch	1t NMS; 0.25t soluble starch	none
	TOTAL		**47,744 (1.4% of 1999 production)**

Assumes 10% replacement of wheat flour with high Grade cassava flour
NMS: Native maize starch

6.4.4 Problems and Constraints In Cassava Utilization

The main problems in cassava utilization in the country relate to low range of processed products from cassava. The high perishability of the fresh roots also contributes to utilization problems as most consumers prefer fresh roots.

Although in some areas with the EARRNET countries cassava is considered a poor man's crop, there is no evidence that this is so in Uganda.

Market inefficiency is also a contributing factor to low use of cassava in the urban areas and more so by the industrial sector. Technological limitations also contribute to low use of cassava.

7 Policy Environment

The agriculture sector is the most important source of livelihood in Uganda, in terms of provision of employment opportunities, foreign exchange earnings and food security. In 1997, Uganda started formulating an Agriculture Commercialization Programme, aimed at increasing the contribution of the largely subsistence agriculture sector into the modern economy.

Prior to independence in1962 Cassava enjoyed a high profile as a famine-reserve crop. Lapse of Local Administration by-laws which enforced the planting of a minimum acreage (0.4 ha) of cassava, for every household for food security has undermined the policy profile of the crop. It is believed that there is apparent marginalization of cassava in discussions about the national food security strategy which have tended to focus mainly on maize and beans, yet cassava is known to be an important food security crop (ibid). It is also believed that bad macro-economic policies contributed to collapse of the starch factory in Lira in 1970s, (Opio Odongo, J.M.A and Otim-Nape, G.W. 1999).

The agriculture sector reforms are contained in the Government "Plan for Modernization of Agriculture (PMA)". Although the current policy agenda in the PMA contains many options for general agricultural development, they lack in addressing the peculiar needs of the cassava sub-sector (PMA; 2000). The PMA's vision is eradication of poverty through a profitable, competitive, sustainable and dynamic agricultural and agro-industrial sector. The underlying Poverty Eradication Plan (PEAP) of 1997 equally underlines several general target objectives that can be dissected to accommodate and apply to the integral role of the cassava sub-sector in the poverty alleviation strategy:

- Increasing the incomes of poor people;
- Improving the standards of the poor; and
- Good governance.

PMA's mission is to eradicate poverty by transforming subsistence agriculture into commercial agriculture". The broad strategies for achieving the above objectives include:

- Deepening decentralization for efficient service delivery;
- Reducing public sector activities and promoting the role of the private sector;
- Supporting the dissemination and adoption of productivity-enhancing technologies;
- Addressing food security through the market, rather than emphasizing self-sufficiency;
- Enhancing and strengthening stakeholder consultation and participation in planning; and
- Designing and implementing gender-balanced programs to improve access of women and youth to productive assets,
- Transform small holders to produce surplus for market,
- Improve competitiveness of Uganda's agricultural export's

All the above policy strategies will have differential impact on cassava depending on how they are interpreted to address the problems. The strategy on gender-balanced programmes will have a far reaching positive impact given the dominant role played by women in the cassava industry. If appropriately implemented, the strategy on market development will solve one of the critical constraints to cassava development: poor markets for surplus cassava and its products. The push for intensified stakeholder consultation and participation will accelerate the effectiveness of collaborative research and extension approach proved highly productive in the past.

At the moment however, the government does not have a comprehensive food security policy. The existing food and nutrition policy, food law and Uganda National Plan of Action for Nutrition (UNPAN) needs revision (PMA final draft report, 2000).

In the absence of an explicit food security policy, the government is considering the following options as interim interventions:

- Supplementary irrigation,
- Publicly held grain reserves,
- Compulsory retention of reserves of designated food crops by farmers.

8 Technology Development and Transfer

The level of technology in the production-to-utilization system for the cassava sub-sector in Uganda is still underdeveloped. Although research has made major advances in development of improved varieties, which are resistant to most diseases and pests, especially the cassava mosaic disease, and with most of

the other desirable attributes, adoption rates are quite low for a number of factors.

The technologies are developed in response to emerging constraints faced by farming communities. The major underlying factor has been development of varieties that are resistant to diseases and also have other attributes of importance to the farmers.

At the production level, improved technology use is quite limited. This can be attributed to inefficient extension system, and limited capacity for multiplication and distribution of improved technologies.

The processing and storage technologies in the country are largely traditional, although efforts to disseminate improved processing technologies, through the post-harvest programme have been going.

Use of traditional processing methods has a number of limitations. It does not assure quality products, and hence has limitations in market opportunities. Traditional methods do not also enjoy economies of scale. The resulting products are narrow in scope and with limited applications (uses).

8.1 Grappling with the Ravages of the Severe cassava mosaic epidemic: From 1980

- Since 1988, severe epidemic has traversed the country from north to south and caused devastating losses and food shortages

- Annually over 60,000 ha of cassava, equivalent to over 600,000 mt (U.S. $ 60 million) of fresh cassava roots are being lost in this way (Otim-Nape *et al.,* 1997).
- Over 500 local cassava genotypes are threatened with extinction and special measures have been required to protect them
- Annual and seasonal movement of the epidemic and gradients of disease spread from north to south of the country
- Each year since 1988, the epidemic moved in a front southwards, towards Kampala, at a rate of approximately 20-30km per annum

- The front was characterised by high whitefly numbers, both nymphs and adults, and massive whitefly transmitted infections
- The movement stretched from the eastern boarder area of Tororo to the western boarders along Lake Albert, a stretch about 600km wide suggesting that annually the epidemic covered approximately 15,000 sq. km.

Some of the important varieties that have been developed and released which are resistant to cassava mosaic in the country include; nase1 and 2, migyera, Aladu, Boa and SS4.

An assessment of farmers perceptions of local and improved cassava varieties in Uganda revealed that most farmers preferred local varieties. However, in terms of resistance to CMD, the local varieties performed poorly. Aladu however has all the good qualities except in-ground storability and suitability (see Table 12 below).

Table 13: Farmers Perception of Variety Attributes for Local and Improved Cultivars in Uganda

Attributes	Variety																	
	Local			Nase 1			Nase 2			Migyera			Aladu			Boa		
	% FRS	% FRI	No. RESP	% FRS	% FRI	No. RESP	% FRS	% FRI	No. RESP	% FRS	% FRI	No. RESP	% FRS	% FRI	No. RESP	% FRS	% FRI	No. RESP
Yield	27.6	72.4	87	67.9	32.1	56	88.9	11.1	81	88.9	11.1	45	55.6	44.4	36	40.7	59.3	27
CMD Resistance	11.5	88.5	87	85.7	14.3	56	84.0	16.0	81	88.9	11.1	45	41.7	58.3	36	48.2	51.9	27
Suitability	83.9	16.1	87	62.5	37.5	56	27.2	72.8	81	42.2	57.8	45	61.1	38.9	36	51.9	48.2	27
Raw taste	69.0	31.0	87	50.0	50.0	56	35.8	64.2	81	33.3	66.7	45	86.1	13.9	36	55.6	44.4	27
Cooked taste	73.6	26.4	87	46.4	53.6	56	37.0	63.0	81	40.0	60.0	45	80.6	19.4	36	70.4	29.6	27
Cooking quality	72.4	27.6	87	32.1	67.9	56	33.3	66.7	81	44.4	55.6	45	80.6	19.4	36	66.7	33.3	27
Mealiness	69.0	31.0	87	21.4	78.6	56	34.6	65.4	81	51.1	48.9	45	69.4	30.6	36	70.4	29.6	27
Maturity period	34.5	65.5	87	44.6	55.4	56	72.8	27.2	81	62.2	37.8	45	55.6	44.4	36	44.4	55.6	27
Inground storage	64.4	35.6	87	59.0	41.1	56	30.9	69.1	81	51.1	48.9	45	22.2	77.8	36	48.2	51.9	27

Notes:

% FRS: percentage of farmers responding that the attribute is superior

% FRI: percentage of farmers responding that the attribute is inferior

No. RESP: number of respondents

Source: Bua, A and Acola, G. 1998

9 Future strategies for cassava development

- Future cassava development will greatly hinge on technologies that would be rapidly adopted by clients
- Cassava Programme is currently emphasizing a participatory approach whereby clients are involved as equal partners at planning and research level
- The Vvumba farmers in Luwero district are already partners in this respect and have prioritized their constraints of cassava production.
- Formulation of appropriate policies to ensure cassava contributes to food security and agro-industrialization, especially in the already identified potential industries of animal feeds, food manufacturing, textiles, plywood etc.
- Strengthening the cassava marketing system, to assure quality and consistent supplies of required cassava and cassava products.
- Develop and promote appropriate post-harvest technologies to increase the range of available cassava products, improve quality of processed products and the efficiency in processing so as to ensure competitive pricing.
- Develop an export based processing strategy for cassava products that do not have adequate local market.

10 STAKEHOLDER ANALYSIS

The purpose of this chapter is to identify and present an analysis of the various stakeholders in the cassava sub-sector in Uganda and try to identify their interests, expectations, motivations and more importantly their level of collaboration and how it can be strengthened. Their potential contribution to overall performance of the sub-sector is equally important.

10.1 Definition of Stakeholders

A stakeholder for the purpose of this study is an individual, group of individuals or an institution which has a physical or social stake in the sub-sector (financial, food security, material etc.). An example is a farmer who suffers a financial loss or gain depending on the performance of the sub-sector. The other important group under stakeholders is what can be referred as secondary stakeholders or key players. These are individuals, groups of people or institutions whose actions have significant influence and impact on the performance of the sub-sector, but have no financial, material of social stake in the sub-sector. An example could be a policy maker or a public extension agent. These people get paid irrespective of the performance of the sub-sector, but their actions could have profound effect on the sub-sector's performance.

The stakeholders in the cassava sub-sector in Uganda include; farmers, farmer associations, traders, millers, consumers, transporters, researchers, donors, extensionists, policy makers, and development agencies. Different stakeholders have interest in different components of the sub-sector e.g. production, trading or utilization. However, problems within any other components or the environment within which the sub-sector operates could have spiral effects on all other components. Collaboration between stakeholders and those outside the sub-sector but with influence on its performance is therefore critical to its overall performance.

10.2 Stakeholder Collaboration

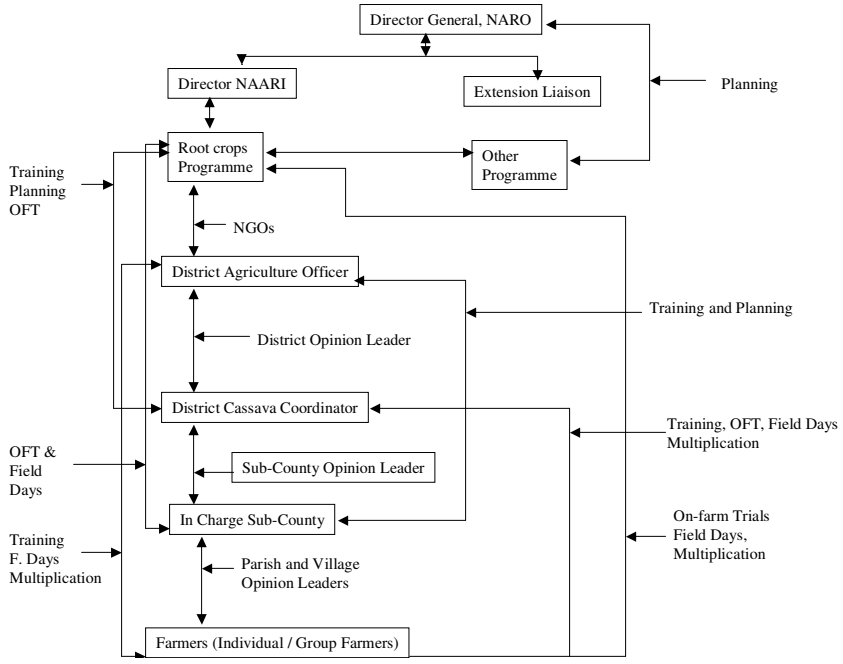
Stakeholder collaboration in research and development is important for any commodity system. It ensures a well focused and client-led research agenda and avoids duplication of resources and efforts by sub-sector participants. Where there is collaboration, research work will be prioritized based on end-user demand. Feedback between researchers and their clients also become more

efficient and responsive. The cassava programme has applied an all inclusive research agenda with emphasis on farm participation in the research process. Involvement of the private sector industry is however limited or non-existent.

In Uganda the level of collaboration between different players in the cassava sub-sector is elicited in the national network for cassava workers (NANEC). This network was set up to facilitate the development and adoption of ACMD control measures and resistant varieties. The network involves all those concerned in technology development, dissemination and adoption. The linkages provide for improved research planning in which technical and non-technical (policy) issues related to cassava and other commodities are prioritized based on national interests and the resources available for research (Otim-Nape et al 1994).

At the research level, however, collaboration between the cassava programme and other national and international agencies has been ongoing. The programme has worked closely with EARRNET, Foodnet, and NRI in the area of cassava research and technology transfer. Most of the focus has been to address the cassava mosaic disease by developing disease and pest resistant varieties. The root-crops programme promotes linkages with other commodity programmes and collaborates with extension staff and NGOs in planning, training, and conducting on-farm trials and multiplication of planting material. Figure 9 below illustrates the functional organization of NANEC

Figure 9. National Network of Cassava Workers in Uganda



While the existing collaboration in the development of the cassava sub-sector initiated by the root crops programme is commendable, it is obvious that more needs to be done to strengthen its composition and impact. The network lacks private sector participation and therefore makes it short of commercial orientation focus. There is need to incorporate private sector participation, such as feed millers, traders and food manufacturers, if the sub-sector is to develop as a commercial crop. As it is now the network appears to be only production oriented and therefore lacking in demand approach.

The agenda for the network is also narrowly focused on the cassava mosaic disease and not the wider aspects of production-to-utilization. The network can be strengthened by expanding its membership and mandate to include all aspects of production to utilization. It should also have a defined agenda, mandate and calendar/workplan.

The Network was also much donor dependent and created many coordination difficulties, including diversion of researchers attention from their core activities. In view of these shortcomings, a stakeholders' review led by NARO, and with support from DfID, was called which came up with a National Cassava Development Strategy and Plan. The plan was developed through a series of stakeholder consultation workshops. This consultation led to formation of a National Forum for Development of Cassava (NADEC) in 1998.

NADEC mandate was to bring to the attention of stakeholders market opportunities for cassava, articulate the needs of cassava industry to the public and decision makers, and catalyse and champion cassava development in the country.

The composition of NADEC include; Director General of NARO, donor and NGOs representatives, Director of Agriculture Extension, Associate Director RELU, Cassava Programme Leader as ex-officio member, representatives of farmers' organizations, representatives of international research organizations working on cassava in Uganda, and representatives of private sector (processors). The forum is supposed to meet twice a year. The NADEC was to have a national cassava desk located at NAARI as an operational node for harmonization of stakeholder activities and a source of technical information for those interested in promoting cassava development.

The stakeholder consultation that recommended formation of NADEC identified the following information gaps for immediate action by NADEC:

Commissioned papers on:

- Profitability of cassava within the various farming systems,
- Sub-sector analysis for product development and market expansion, and
- Sub-sector policy analysis of pricing and taxation systems for agricultural equipment.
- Production of situation reports on the progress achieved in restoring cassava production, and the kinds of priority actions that should be taken in specific districts.
- Assessment of the efficiency and sustainability of the various community based methods of bulking, conservation and dissemination of mosaic-resistant varieties in the short run and the dissemination of other technologies in the medium and long term.
- Establishing the extent to which the infection pressure is reducing and hence the return of hitherto susceptible local cultivars in districts that were the first ones to experience the CMD attack.

There is no evidence that these recommendations by stakeholders have been taken up by the cassava programme or the new look NADEC. Some of the recommendations made if not addressed still remain valid and should be taken up under the sub-sector analysis as specific inquiry areas.

There is also need to review the progress and achievements made so far in operationalising NADEC and if its mandate has been addressed.

11 CONCLUSION

Cassava is an important food crop in Uganda, and is ranked second after matoke in terms of importance. The level of production is estimated at 3.4 million tons a year and based of projections of food demand, the crop has the highest deficit among all food crops in the country.

The most important cassava growing areas are Eastern and Northern parts of the country where it is the staple food.

The level of production has been affected by a number of factors, the main ones being the devastating effects of the cassava mosaic disease which is estimated to have caused losses of up to US$ 60 million a year between 1992 and 1997 (ASARECA, 1999).

Storage, processing and marketing of the crop still posses a great challenge and this is an area that needs immediate attention in order to boast cassava production in the country and to make it available in the deficit areas.

Uganda has a potential to promote cassava as a food crop as there is already a big deficit based on Ministry of Agriculture projections. Industrial use of cassava in the country does not appear to have significant potential at the moment except in animals feed milling. However, a combined thrust to make cassava available for industrial use can stimulate industry interest and therefore provide an important niche in the market. Analysis by FoodNet have shown some potential in food, feed and to some extent textile and plywood industries.

The areas that require further investigation is an update of impact of technology transfer on cassava yields, processing, quality of processed products and commercialization of cassava.

12 RECOMMENDATIONS

Given the devastating impact of diseases on the cassava economy over the last three decades, the bulk of future technological interventions in Uganda will need to concentrate on development of new high yielding and disease resistant cassava varieties. The second block of interventions will focus on developing cost-effective processing technologies to add value to cassava. The last option is development of a well remunerative marketing system, both local and export or

surplus fresh and processed cassava products. Specific recommendations around the above themes are:

- Identify the social and economic factors that are associated with technology adoption.
- Determine necessary policy reforms to elevate the status of the cassava crop from its current poor priority that which matches its immense potential to contribute to attainment of domestic food security, income generation, raw material to industry and an export commodity.
- Identify necessary activities to strengthen linkages between research programmes and other public institutions-training, marketing, infrastructure development, and political institutions – in order to provide concerted efforts to poor rural food and cash economies.
- With declining role of the Government, the private sector will need to be nurtured and motivated to provide basic commercial services, such as planting material, marketing of produce and investment in cassava processing technology and capacity. Determine the necessary incentives and activities that would contribute towards private sector participation in this effort.
- Evaluate the impact of the post-harvest technologies, especially I n relation to their contribution in widening the different cassava products available and contribution to income generation from cassava.
- Evaluate the achievements of NADEC in meeting its objectives and its potential in strengthening the contribution of cassava to food security and income generation.

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14 Appendices

Table A1. Cassava Production in EARRNET Countries and Africa

Kenya			Madagascar			Burundi		
	Area	Production	Yield		Area	Production	Yield		Area	Production	Yield
Year	Ha	(Mt)	(kgs/ha)	Year	Ha	(Mt)	(kgs/ha)	Year	Ha	(Mt)	(kgs/ha)
1991	94,887	761,200	8,022	1991	346,799	2,307,000	6,652	1991	65000	583600	8,978
1992	95,000	790,000	8,316	1992	340,001	2,280,000	6,706	1992	65000	598300	9,205
1993	95,000	810,000	8,526	1993	347,025	2,350,000	6,772	1993	65000	584300	8,989
1994	95,000	830,000	8,737	1994	350,000	2,360,000	6,743	1994	60000	577304	9,622
1995	95,000	840,000	8,842	1995	348,500	2,400,000	6,887	1995	60000	501278	8,355
1996	97,000	880,000	9,072	1996	348,900	2,353,000	6,744	1996	64000	548986	8,578
1997	98,000	900,000	9,184	1997	358,000	2,418,000	6,754	1997	70000	603275	8,618
1998	98,000	910,000	9,286	1998	360,000	2,404,000	6,678	1998	70000	621740	8,882
1999	98,000	920,000	9,388	1999	358,000	2,435,000	6,802	1999	70000	617483	8,821

Uganda				Congo				Rwanda			
	Area	Production	Yield		Area	Production	Yield		Area	Production	Yield
Year	(Ha)	(MT)	(Kgs/Ha)	Year	(Ha)	(MT)	(Kgs/Ha)	Year	(Ha)	(MT)	(Kgs/Ha)
1991	389,000	3,229,000	8,301	1991	2,420,716	19,366,000	8,000	1991	120000	396000	3,300
1992	362,000	2,869,000	7,925	1992	2,471,933	19,779,000	8,001	1992	90000	261000	2,900
1993	369,000	3,139,000	8,507	1993	2,420,075	18,890,390	7,806	1993	60000	150000	2,500

1994	320,000	2,080,000	6,500	1994	2,473,469	19,101,680	7,723	1994	120000	300000	2,500
1995	332,000	2,224,000	6,699	1995	2,500,000	19,378,000	7,751	1995	60000	148000	2,467
1996	335,000	2,245,000	6,701	1996	2,081,132	16,886,772	8,114	1996	80000	220638	2,758
1997	342,000	2,291,000	6,699	1997	2,114,715	16,973,330	8,026	1997	82188	202994	2,470
1998	356,000	3,204,000	9,000	1998	2,148,840	17,060,332	7,939	1998	76314	188182	2,466
1999	374,000	3,400,000	9,091	1999	2,100,000	16,500,000	7,857	1999	118492	306934	2,590

Table A2: Combined Cassava Production Trends for EARRNET Countries 1991 - 1999

Year	Area (ha)	Production (mt)
1991	3,436,402	26,642,800
1992	3,423,934	26,577,300
1993	3,356,100	25,923,690
1994	3,418,469	25,248,984
1995	3,395,500	25,491,278
1996	3,006,032	23,134,396
1997	3,064,903	23,388,599
1998	3,109,154	24,388,254
1999	3,118,492	24,179,417

Source: FAOSTAT Web2000, National Statistics Bureaus

Table A3: Food Production and Supply Balance in Uganda

	1994-6 (base year)			1996/1997			1997/1998			1998/1999			1999/2000			2000/2001		
Commodity	Prod.	Demand	Surplus	Prod.	Dem.	Surp.	Prod.	Dem.	Surp.s	Prod.	Dem.	Surpl.	Prod.	Dem.	Surp.	Prod.	Dem.	Surp.
Cereals																		
Maize	900	749	151	1080	823	257	1296	863	433	1556	904	652	1867	941	926	2054	974	
.Millet	626	650	(24)	654	689	(35)	680	709	(29)	708	730	(22)	736	751	(15)	751	773	
Sorghm	398	348	50	416	370	46	432	381	51	449	392	57	467	404	63	477	416	
Rice	80	87	(7)	96	103	(7)	115	111	4	138	115	23	166	118	48	182	123	
Wheat	9	50	(41)	13	55	(42)	18	57	(39)	25	59	(34)	35	62	(27)	48	64	
Sub-total	**2013**	**1,885**	**128**	**2259**	**2040**	**219**	**2541**	**2121**	**420**	**2876**	**2200**	**676**	**3271**	**2276**	**995**	**3512**	**2350**	
Pulses																		
Beans	390	661	(271)	468	711	(243)	561	742	(181)	673	764	(91)	808	786	22	970	810	
Others	125	44	81	150	47	103	180	48	132	216	50	166	259	51	208	311	53	
Sub-total	**515**	**706**	**(191)**	**618**	**758**	**(140)**	**741**	**790**	**(49)**	**889**	**814**	**75**	**1067**	**837**	**230**	**1281**	**863**	
Oilseeds																		
G/nuts	143	173	(30)	172	187	(15)	206	194	12	248	202	46	297	210	87	357	218	
Simsim	72	93	(23)	86	102	(16)	103	104	(1)	124	105	19	149	107	42	178	110	
S/flower	10		(10)	13		13	17		17	22		22	29		29	37		
Sub-total	**225**	**268**	**(43)**	**271**	**289**	**(18)**	**326**	**298**	**28**	**394**	**307**	**87**	**475**	**317**	**158**	**572**	**328**	
R/crops																		
Cassava	2,223	4,258	(2,035	2312	4514	(2,202	2404	4649	(2245	2500	4787	(2287	2600	4929	(2329	2704	5076	
S/Potoe	2,223	1,939	)	2312	2061	)	2404	2125	)	2500	2191	)	2600	2259	)	2704	2329	
I/Pttoes	388	100	284	466	106	251	559	110	279	670	114	309	805	118	341	965	122	
			288			360			449			556			687			
Sub-total	**4834**	**6296**	**(1462)**	**5090**	**6681**	**(1591)**	**5367**	**6884**	**(1517)**	**1830**	**4673**	**(2843)**	**6005**	**7306**	**(1301)**	**6373**	**7527**	
Plantain	8,870	8,755	115	9269	9298	(29)	9640	9583	57	10026	9877	149	10427	10180	247	10844	10493	
Total	**16457**	**17909**	**(1452)**	**17507**	**19066**	**(1559)**	**18615**	**19676**	**(1061)**	**16015**	**17871**	**(1856)**	**21245**	**20916**	**329**	**22582**	**21561**	

Source: Agriculture Commercialization, Draft Report. MAAF, 1997.

Table A4. Area (ha) under Cassava By District

District	1992	1993	1994	1995	1996	1997	1998	1999
Apac	22,271	22,702	19,687	20,145	20,599	21,030	21,891	23,059
Arua	22,043	22,469	19,485	20,205	20,388	20,184	21,010	22,132
Budibugyo	2,005	2,044	1,773	1,839	1,855	1,894	1,972	2,077
Bushenyi	3,499	3,567	3,093	3,207	3,236	3,304	3,439	3,623
Gulu	18,797	19,160	16,616	17,230	17,386	17,749	18,476	19,462
Hoima	2,687	2,739	2,375	2,463	2,485	2,537	2,641	2,782
Iganga	26,679	27,195	23,584	24,456	24,677	25,192	26,223	27,623
Jinia	2,932	2,989	2,592	2,688	2,712	2,769	2,882	3,036
Kabale	3,061	3,120	2,706	2,806	2,831	2,891	3,009	3,170
Kabarole	15,071	15,362	13,322	13,814	13,939	14,231	14,814	15,604
Kalangala	21,740	22,160	19,217	19,927	20,107	20,528	21,368	22,509
Kampala	-	-	-	-	-	-	-	-
Kamuli	16,993	17,322	15,022	15577	15,718	16,046	16,703	17,594
Kapchorwa	513	523	454	471	475	485	505	532
Kasese	2,910	2,966	2,572	2,667	2,691	2,747	2,859	3,012
Kibaale	2,094	2,134	1,851	1,919	1,937	1,977	2,058	2,168
Kiboga	2,718	2,642	2,569	2,664	2,688	2,744	2,856	3,009
Kitgum	21,346	21,759	18,869	19,566	19,743	20,156	20,981	22,101
Kotido	153	156	135	140	141	144	150	158
Kumi	18,464	18,821	16,322	16,925	17,078	17,435	18,149	19,117
Lira	18,659	19,020	16,494	17,104	17,258	17,619	18,340	19,319
Luwero	3,098	3,158	2,739	2840	2,866	2,926	3,046	3,208
Msaka	3,975	4,052	3,514	3,644	3,677	3,754	3,908	4,116
Masindi	4,443	4,529	3,928	4,073	4,110	4,196	4,368	4,601
Mbale	26,806	27,324	23,695	24,571	24,793	25,311	26,347	27,753
Mbarara	10,018	10,212	8,856	9,183	9,266	9,460	9,847	10,373
Moroto	187	191	166	172	174	177	184	194
Moyo	2,795	2,849	2,471	2,562	2,585	2,640	2,748	2,895
Mpigi	11,373	11,593	10,053	10,425	10,519	10,739	11,179	11,775
Mubende	227	231	200	207	209	214	223	235
Mukono	12,694	12,939	11,221	11,636	11,741	11,986	12,477	13,143
Nebbi	15885	16192	14042	14561	14693	15000	15614	16447
Ntungamo								
Pallisa	16528	16848	14611	15151	15288	15607	16246	17113
Rakai	3862	3937	3414	3540	3572	3647	3796	3999
Rukungiri	966	985	854	886	894	912	949	1000
Soroti	13363	13621	11812	12249	12359	12618	13135	13836
Tororo	11145	11361	9852	10216	10308	10524	10955	11539

Total	**362,000**	**368,872**	**320,166**	**331,729**	**334,998**	**341,373**	**355,348**	**374,314**

Source: Ministry of agriculture Animal Industry and Fisheries

Table A5: Production of Cassava (mt) by District

District	1992	1993	1994	1995	1996	1997	1998	1999
Apac	180,786	195,956	129,847	138,837	140,148	143,019	200,014	304,329
Arua	178,934	193,948	128,516	137,414	138,711	141,553	197,964	301,209
Budibugyo	16,275	17,641	11,689	12,498	12,616	12,875	18,006	27,397
Bushenyi	28,402	30,785	20,399	21,811	22,017	22,468	31,422	47,809
Gulu	152,581	165,384	109,589	117,176	118,283	120,706	168,809	256,849
Hoima	75,089	81390	53,932	57,666	58,210	59,403	83,076	126,403
Iganga	216,572	234,744	155,549	166,318	167,889	171,329	239,606	364,570
Jinja	23,803	25,800	17,096	18,280	18,452	18,830	26,334	40,068
Kabale	24852	26,937	17,849	19,085	19,265	19,660	27,495	41,834
Kabarole	122,337	132,602	87,866	93,949	94,836	96,780	135,348	205,937
Kalangala	23,446	25,413	16,839	18,005	18,175	18,547	25,938	39,466
Kampala	-	-	-	-	-	-	-	-
Kamuli	137,941	149,515	99,073	105,932	106,932	109123	152,610	232,202
Kapchorwa	4,167	4,517	2,993	3,200	3,230	3,297	4,611	7,016
Kasese	23,619	25,601	16,964	18,138	18,310	18,685	26,131	39,760
Kibaale	19,631	21,278	14,099	15,075	15,217	15,529	21,718	33,044
Kiboga	51,255	55,556	36,813	39,362	39,733	40,547	56,706	86,280
Kisoro	-	-	-	-	-	-	-	-
Kitgum	160,492	173,959	115,271	123,252	124,415	126,965	177,563	270,168
Kotido	1,241	1,345	891	983	962	981	1,372	2,087
Kumi	149,879	162,455	107,648	115,101	116,118	118,568	165,819	252,300
Lira	151,454	164,162	108,779	116,310	117,408	119,814	167,562	254,951
Luwero	25,151	27,261	18,064	19,315	19,497	19,896	27,825	42,337
Masaka	54,748	59,342	39,322	42,044	42,441	43,311	60,571	92,161
Mshindi	122,922	133,236	88,286	94,398	95,290	97,242	135,994	206,920
Mbale	217,597	235,855	156,285	167,105	168,683	172,139	240,739	366,293
Mbarara	81,314	88,137	58,402	62,445	63,035	64,327	89,962	136,881
Moroto	1,518	1,645	1,090	1,165	1,176	1,201	1,680	2,556
Moyo	21,012	22,775	15,091	16,136	16,288	16,622	23,246	35,370
Mpigi	92,315	100,061	66,304	70,894	71,564	73,030	102,134	155,400
Mubende	4,271	4,629	3,067	3,279	3,310	3,378	4,724	7,188

Mukono	103,045	111,691	74,010	79,134	79,881	81,518	114,004	173,461
Nebbi	128,950	139,770	92,616	99,028	99,963	102,011	142,664	217,068
Ntungamo	-	-	-	-	-	-	-	-
Pallisa	85,732	92,926	61,576	65,839	66,461	67,823	94,852	144,320
Rakai	31,345	33,975	22,513	24,072	24,299	24,797	34,679	52,765
Rukungiri	7,843	8,501	5,633	6,023	6,080	6,204	8,676	13,201
Soroti	108,475	117,577	77,910	83,304	84,091	85,814	120,012	182,603
Tororo	67,005	72,627	48,125	51,457	51,943	53,007	74,131	112,793
TOTAL	**2,895,999**	**3,138,996**	**2,079,996**	**2,224,030**	**2,244,929**	**2,290,999**	**3,203,997**	**4,874,996**

Source: Ministry of agriculture animal industry and fisheries

Table A6: Uganda Major Food Supply Sources 1991 – 1999

Year	Plantains (mt)	Plantains per/cap	Cassava (Mt)	Cassava per/ca	Maize (mt)	Maize per/ca
1991	3,194,00	189	1,781,750	106	368,464	22
1992	3,093,300	178	1,582,000	91	367,736	21
1993	3,322,100	186	1,724,250	96	356,738	20
1994	3,725,000	202	1,140,000	62	467,655	25
1995	4,006,600	212	1,218,000	64	502,228	27
1996	4,229,200	217	1,333,750	69	523,317	27
1997	4,316,650	216	1,268,250	63	480,707	24
1998	4,324,900	210	1,753,000	85	448,551	22

Source: FAOSTAT, Website 2000