

# State Of Knowledge Report For Boiled And Steamed Cassava. A Case Of Uganda.

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# 1. BACK GROUND OF THE RTBFOODS PROJECT

The RTBfoods project that aims to breed root, tuber and banana products for end users' preference is currently being implemented by National Crops Resources Institute, NaCRRI-Namulonge and CIRAD. The project is structured in five work packages as described in the project document. Work package 1 commenced with documenting state of knowledge (SoK) on the preferred characteristics of the selected product per partner, its socio-cultural context and the demand to build on and contribute to current knowledge. The results will form the building blocks of work package 2 and 5 activities as well as inform the sampling frame and content of fieldwork under work package 1. This is the state of knowledge report for boiled/ steamed cassava. This report is divided into two sections namely: 1. Food science, gender and social cultural context. 2. Demand. Each section constitutes an introduction, study objectives and key findings. A common methodology was used for data collection and analysis.

## 2. METHODOLOGY

This section presents the study design. In particular, the section discusses the sampling methodology, data collection methods, sampling criteria and data management procedures.

### 2.1. Sample Selection and Sample Size

The key informants were targeted for the introductory study who were selected from different institutions with experience in cassava sector development. These included a research organization, an academic institution and nongovernmental partners. These were National Crops Resource Research Institute (NaCRRI), Makerere University, African Innovations Institute (AfrII) and Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), respectively. Each informant was selected based on their experience in aspects of food science, gender, demand and trends of boiled cassava. Those who were experienced in more than one theme, responded to at least one theme.

### 2.2. Data Collection Methods and Tools

The method used was key informant interviews (KII) and document review using a key informant interview and review checklists respectively. The KII checklist was administered in a face-to-face discussion or online self-administered by responding to the guide sent by email. For ethical considerations, each key informant was asked to review and sign a letter of consent before participant was interviewed or answering online self-administered tool.

### 2.3. Data Analysis

Information obtained from the interviews were coded and analyzed using thematic approach to qualitative data analysis.

### 3. FOOD SCIENCE, GENDER AND SOCIAL CULTURAL CONTEXT

#### 3.1. Introduction

Cassava is a starchy root crop that was introduced in Uganda by Arab traders in the late 1800s (Langlands, 1972). Cassava in Uganda ranks second after banana thus its importance in the country (UBOS, 2010). Cassava in Uganda is processed and consumed in different ways. However, there is little information recently documented on cassava processing and cassava products in Uganda at household level. Nevertheless, earlier studies illustrate a variety of products processed from cassava (Ameny, 1995). Accordingly, sweet cassava is eaten raw, boiled, fried, roasted and as a paste after drying and pounding the roots. On the other hand, bitter cassava is heap fermented and eaten as a paste (Alexander, Cyprian, Remco, & Williams, 1995). Other studies have demonstrated that boiled cassava is one of the most common cassava products consumed in Uganda (Obaa, Mawa, & Angudubo, 2014 and Waigumba et al., 2016). This state of knowledge review (SoK) thus aims at establishing what is currently known about the preferred characteristics, the socio-cultural and demand (market) context of boiled cassava in Uganda.

#### 3.2. Objectives of the Study

##### *Research Questions*

- 1 What are the raw material characteristics that will give a good product?
- 2 What are the quality characteristic of raw materials at each step?
- 3 What are the quality characteristics of the final product?
- 4 What are the agronomic practices and norms for cassava growing in Uganda?
- 5 What is the experience of adoption by producers?
- 6 What are the gender based constraints and opportunities experienced with the crop or product

#### 3.3. Key Findings

##### 3.3.1. Food Science

##### *Raw material characteristics that will give a good product.*

Characteristics of fresh cassava that are associated with the quality boiled cassava were based on three senses- taste, sight and feeling. A variety of attributes of fresh cassava were highlighted by KII and the literature however, some preferences were cited more frequently than others. Fresh cassava characteristics are ranked below based on how common a characteristic was among key informants.

1. Sweet cassava- fresh cassava roots are sweet when bitten. This is key for women because they buy and prepare food so they taste before purchasing.
2. High dry matter- roots should not be watery when chewed fresh. They should be easy to chew as this determines dry matter content.
3. Low fiber content of roots on breaking.
4. Long and slender- this attribute is believed to be associated with production of quality boiled cassava.



Other attributes include:

5. Mature roots- 12 to 18 months
6. Soft to break- when it is hard to break, it produces hard cassava after boiling
7. Diseases free- white fresh with no traces of brown streaks
8. Pink cortex- This colour of the cortex was associated with quality roots for boiling and sweet taste.
9. Low HCN- cassava roots should not be bitter.

There was no documentation found on characteristics of raw cassava that make quality boiled cassava. Indeed, (González & Johnson, 2009) describes characteristics of fresh cassava that people consider when purchasing sweet cassava. However, the authors don't define the characteristics of the attribute preferred. For example they describe colour as one of the traits considered, but without identifying exactly which colour is preferred.

### ***Quality characteristic of raw materials at each step***

It was apparent from the key informant interviews that boiled cassava is prepared in two major ways in different regions. Accordingly, cassava roots are either wrapped in banana leaves and steamed (a common practice in central and mid-western Uganda) or immersed in water and boiled (a common practice in eastern Uganda). The characteristics of cassava at each step given by key informants are summarized in the Table 1. The characteristics important at each processing step do not differ irrespective of region, processing method or gender. Steps followed when boiling cassava are described by (Ameny, 1995). However the description given excludes wrapping and steaming cassava as a method of boiling despite central Uganda being one of the study areas considered. (Waigumba et al., 2016) mention steamed cassava as an alternative of fresh cassava consumption although the authors don't mention steps involved or associated attributes. (González & Johnson, 2009) highlights ease of peeling as an attribute for purchasing sweet cassava know for fresh consumption.

**Table 1 (3.1): Characteristics of boiled and steamed cassava at each step**

<b>Step</b>	<b>Characteristic</b>
Immersing in water to boil	
Peeling	Self-retracting peel
Washing	Roots glitter after washing
Slicing	Easy to cut into pieces without uneven breaking
Place roots in sources pan with 1/8 <sup>th</sup> of water. (Some people add salt while others don't).	None
Boil	Quick cooking (30 minutes), nice aroma
Pound	Soft to pound without fibers (only middle fiber).
Steaming	
Peeling	Peel is easily removed
Scraping	None
Washing	Roots glitter after washing
Slice into pieces	Soft (easy to cut into pieces)
Wrapping in banana leaves	None
Steaming	Quick cooking, nice aroma and white in colour

### ***Quality characteristics of the final product – boiled cassava***

Characteristics of a high quality final product of boiled cassava are based on four senses- taste, sight, smell and feeling. A variety of attributes of were highlighted ; however, some were more common among key informants compared to others. Boiled cassava characteristics are ranked below based on how common a characteristic was among key informants.

1. Soft on biting or/ and easy to chew
2. Sweet taste-high free sugar content, increasing sugar content on boiling, feel energetic after eating.
3. Nice aroma or mild aroma
4. White or not so brown after pounding
5. Less fiber- middle fiber only
6. Mealy
7. Friable- fluffy texture when pressed in the hand
8. Doesn't stick in the hand- easily makes a depression when a finger is pushed in ponded cassava
9. Less starch

Several attributes of boiled cassava have been documented in literature. However, these attributes are not disaggregated by preferences by sex or/and age. As such it not possible to know whether there are any differences in preferences by gender or age. Mealiness and sweet taste were a common quality attributes of boiled cassava (Lopez-lavalle and Augusto, 2016, Padonou & Mestres, 2005, Adjei-Nsiah & Issaka, 2013, González & Johnson, 2009 and Bakayoko *et al.*, 2009). Other attributes mentioned by authors include: softness, white colour, friable and less fibrous. In addition (Wossen, Girma, & Abdoulaye, 2017) indicates low HCN and poundability as quality attributes of boiled cassava. Similarly, (Ebah-Djedji, Sahoré, & N'Zué, 2013) evaluated quality characteristics of boiled cassava such as colour, taste, aroma and degree of cooking. However, the authors didn't give in-depth descriptions of the attributes. A key informant highlighted mealiness as an important attribute for women and sweet taste of pounded boiled cassava as important for men. Similarly, (González & Johnson, 2009) found that, taste was important in the semi-arid region while texture was important in the coastal region. In addition, time of cooking was important to the educated while ease of cooking to the less educated.

### 3.3.2. Gender and Social Context

#### ***Agronomic practices and norms for cassava growing in Uganda***

Intercropping and crop rotation were the agronomic practices for cassava production mentioned by key informants. Accordingly, cassava is usually intercropped with short season crops like beans, groundnuts, maize and millet. This practice is particularly under subsistence farming systems because of limited land. In addition intercropping is done to minimize labour requirements because in this way, weeding is done for more than one crop at the same time. Both men and women farmers do subsistence cassava farming although it is women who mainly intercrop. This means that if a woman had her garden separate from the husband, she would intercrop. According to (Mukasa, Kabonesa, and Martin, 2010), sometimes women are allocated land by their husbands to grow their preference crops.

Intercropping is mainly beneficial to women because they don't usually own land thus, they economically utilize the small pieces allocated to them by growing more than one crop at a time (Mukasa *et al.*, 2010). Similarly, literature indicates that intercropping cassava with crops such as sorghum, millet, ground nuts, cow peas, soy bean, banana and sweet potato is a common practice done in Uganda (Mukasa *et al.*, 2010, Mbawika, Whyte, Bua, & Sserunkuma, 2001 and Waigumba *et al.*, 2016). Despite this, cassava is grown as a sole crop in some places in Uganda (Mbawika *et al.*, 2001). This is true according to the key informant in areas where cassava is grown as a major staple like Eastern and Northern Uganda. However, large-scale (commercial) cassava gardens are rarely intercropped because they are market driven.

Crop rotation according to key informants in common agronomic practice done in Uganda and is usually done after planting a cereal because they leave the soil fine thus limited tilling is required. It was noted from key informant interviews that men and women usually have the same cassava garden however, the purpose for harvesting the crop differs. For example, men mainly harvest cassava to sell while women to have food for their family.



### ***Experience of new cassava varieties adoption by producers***

According to key informants, nine cassava varieties have been officially released by NARO in the past 10 years. These include: NASE 13, NASE 14, NASE 15, NASE 16, NASE 17, NASE 18, NASE 19, NAROCAS1 and NAROCAS2. Some of these varieties are mentioned in a publication reviewing eleven years of cassava breeding in Uganda (Kawuki et al., 2016). Adoption of improved varieties in Uganda has been at a rate of 67% (Byamugisha, 2011). Through their observation and field experiences, key informants noted that NASE 14 was highly adopted in Eastern and Northern Uganda, while NAROCAS 1 was widely adopted throughout the country. Reasons given for the wide adoption of these varieties by key informants include:

- NASE 14 and NAROCAS 1 are most predominant due to their attributes such as high yields and superior tolerance to CBSD and CMD.
- NASE 14 has high dry matter, nice taste and makes nice paste.
- NASE 14 has high in ground longevity.
- NASE 17 and NASE 13 were initially preferred in central Uganda while NASE 19 was preferred in northern Uganda. This was because NASE 17 has a pink cortex associated with long self-life and mealiness. In addition, NASE 13 is sweet and NASE 19 makes a nice paste. These varieties however, succumbed to CBSD and were thus dropped by farmers. NASE 13 in particular has low dry matter content besides being susceptible to CBSD. NASE 13 is therefore grown where cassava is processed in to flour.

### ***Gendered experience of adoption***

Literature didn't indicate experiences on gender and adoption of improved varieties however, key informants gave insights on the subject from their experience as follows:

- NAROCAS 1 and NASE 14 were widely adopted by men because they were more marketable in terms of stems.
- Wealthy people in communities initially adopted more improved varieties because stems are expensive. However, with time, government programs such as operation wealth creation (OWC) distributed free stems to farmers thus improved adoption.

### ***Cassava uses, products, practice and participation***

According to key informants, cassava in Uganda is mainly processed for food related products, beverages, textiles and confectionary (Table 3.2). Women are the main actors in processing at all levels and products including boiled cassava, apart from textile-related products (Table 3.2). Although the whole family benefits from food, men are the common beneficiaries at the other levels. Key informants mention that women mainly control small scale household processing aimed at availing food at the table while men control large scale processing for income generation. This is in contrast to the CAVA report on cassava chips processing (Mukasa et al., 2010). According to authors, activities involved in cassava chips processing right from peeling to drying are women's roles.

Recent studies give detail on cassava dishes consumed in terms of percentages in Uganda in the cassava growing regions (Northern, Eastern, central, western and southern) (Table 3.3). Accordingly, boiled cassava is the commonest product consumed in Uganda followed by *kalo* and *katogo*. It is evident from the report that boiled cassava was common in Central and Northern Uganda while *kalo* was common in West Nile, Western and Eastern Uganda. This study didn't disaggregate data as such data is aggregated for both men and women.

Although cassava is commonly processed in Uganda for home consumption (Okello & Akullu, 2017), high quality cassava flour (HQCF) production is becoming a channel to commercialization of high value cassava (Kleih, Phillips, Jagwe, & Kirya, 2012). According to the authors, by 2012 over 800 tonnes of HQCF were sold across commodities such as: biscuits, paper boards, rural bakeries and composite flour. This indicates high potential of using cassava as an industrial raw material in Uganda. Indeed, a report by (Okello & Akullu, 2017) demonstrated an increased demand for cassava in Uganda's institutions such as schools, prisons, manufactures of composite flour and breweries. These institutions may diversify cassava preferences and attributes as such, plant breeders now need to classify endusers beyond those in the household.

**Table 2 (3.2): Cassava uses, products, practice and participation given by key informants**

<b>Uses</b>	<b>Products</b>	<b>Who does what</b>	<b>Who benefits</b>
Food	Paste	All these are produced by women and girl children because of their reproductive responsibility of feeding the family.	Whole family
	Flour		
	Gari		
	Boiled cassava		
	Porridge		
	Fried chips		
	Dry chips		
	Katogo		
	Leaves (sombe)		
	Roasted		
Beverages	Local brew (waragi)	Women in Eastern and Northern Uganda	Men /boys because they control the income
	Beer (Engule)		
Textiles	Starch	Men because processing is organized  Machinery is involved	The male youth
	Paper bags		
	Ethanol		
Confectionary	Bread	Both men and women	Both young men and women
	Biscuits		

**Table 3 (3.3): Cassava dishes consumed**

<b>Dish</b>	<b>Frequency (n=585)</b>	<b>% response</b>
Boiled cassava	437	75
Cassava pate ( <i>kalo</i> )	403	69
<i>Katogo</i>	179	31
Fried cassava chips	48	08
Steamed cassava leaves	18	03
Porridge	16	03
Roasted cassava	15	03
<i>Waragi</i>	13	02
Pancakes	12	02
Mushed cassava	5	01

*Katogo* is a dish composed of a mixture of boiled cassava and a source (offal, beans or meat), *Kalo* is stiff cassava paste, *Waragi* is local alcohol (ethanol) distilled from cassava. Table obtained from (Obaa *et al.*, 2014).

### ***Resources required to grow the crop and produce boiled cassava***

The resources required for production/ processing boiled cassava given by key informants are: land, hoe, fuel (firewood or charcoal), saucepans knives, water labour and banana leaves to cover or grass. Document review highlights land as a key resource for production of cassava the raw material for processing boiled cassava (Mukasa *et al.*, 2010). Apart from (Ameny, 1995) who highlights the procedure for processing boiled cassava in Uganda, the resources required for processing the product are not indicated in literature.

Resources required for production, processing boiled cassava given by key informants

### ***Levels of access to resources***

#### Land

Men have the right to inherit land as dictated by culture yet women and girls don't (Mukasa *et al.*, 2010). Accordingly, male youth have more access because they are prepared by their fathers to take over the land after them than the female youth. Key informants indicated that in some rural settings, widows are not allowed to inherit their late husband's land, its either inherited by the brother to deceased or a male child hence making it hard for women to own land for production. More to that, men dictate what to grow on their land and the women always have to ask for permission or let their husbands know what they are planning to grow on which piece of land. In addition, it's expensive to purchase land so it's easier for men to buy land than women because men control house hold income.

#### Capital

According to key informants, men usually control household financial resources. More to this, men move out of the homestead and go participate in money making ventures yet women are always doing domestic chores in rural settings. As such, men have more access and control to capital as compared to women in the household.

#### Labour

According to key informants, men have more access to labour because they head the households and thus, have authority to assign duties in the home. In addition, men have more access to hired labour

because they can afford to pay for it. Moreover, men can access tractors and ox ploughs yet women don't because they remain at home doing house chores and operating such machinery requires a lot of energy.

#### Utensils for preparing boiled cassava

Key informants mentioned that, women easily access house hold utensils although men buy most them because it is a woman's role to prepare food.

#### Knowledge and information

Key informants indicated that men are more knowledgeable and have access to information about, good planting materials and market than women because they are more mobile.

#### Tradeoff between the different uses of cassava

According to key informants, during drought women would rather process cassava into flour instead of having it consumed fresh for food security. Utilization of cassava depends on variety for example, sweet varieties are mostly boiled while bitter ones are processed into flour. In addition, utilization depends on available resources. For example if the resources are few it's prepared for home consumption, but if resources are available it's for industrial use.

### ***Gender based constraints and opportunities experienced with the crop or product***

Women in Uganda are disadvantaged regarding access and control of land which is a major resource required for cassava production. There is a conflict between state and customary law on land inheritance in Uganda (Doss, Truong, Nabanoga, & Namaalwa, 2012). For example the constitution decrees equal rights to land for married men and women however, the right to control of land is usually benefited by men. Nevertheless, literature indicates that, gender relations in the household influence negotiations and decisions regarding women's' access to land (Mukasa et al., 2010). Accordingly, if the relations are cooperative, a woman may be allocated land by her husband to manage her own cassava garden. In addition, women have an opportunity to generate income from boiled cassava. Key informants highlight that some women especially in central Uganda have generated income from boiled cassava because they sell it along the road in the evening.

### ***Laws policies, institutions influencing crop use, participation and benefit from the crop or product.***

Women engage in cassava production however, culture and the household relations deter thier potential participation and benefit of women in cassava production, their involvement in cassava production has been boosted by projects through the government. For example in Nakasongola, women benefited from an initiative by Farm Africa whose aim was to revive cassava production in the district. Accordingly, 38% of the beneficiaries were women during the life time of the project. This initiative through Nakasongola district farmers' association, trained farmers on better cassava produciton practises and provided them with disease free improved cassava varieties. Besides learning and practising better cassava production, women and men reaped financial benefits and were able to support their family financial needs like school fees and health care. Accordingly, land under cassava production increased from 0.55 acres at the beginning of th project to an average of 4.6 acres.

### 3.4. Level of Confidence in the Information Reviewed

The information obtained from key informants is from their experiences and practices with cassava and its products, but specifically boiled cassava. This is reliable information however, its being subjective cannot be completely ruled out. For example, the Information from literature is reliable although it is aggregated. For example, attributes are mentioned without considering gender distinctions in preference or their detailed description. There is need to know the quality distinction between the products from the two methods of preparing boiled cassava. Futhermore, qualities of boiled cassava need to be dissagregated by sex and location (district/ region).

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## 4. DEMAND FOR CASSAVA

### 4.1. Introduction

NaCRRRI conducted an introductory study on boiled cassava as the selected product with the aim to identify the preferred characteristics in Uganda among producers, processors and consumers including other user groups. The study also assessed the state of knowledge on gender and social context and demand for the product. This will offer a platform to build on and contribute to existing knowledge. This section of the study focused on understanding the demand and trends in demand, product purchase and preparation and preferred characteristics associated with demand including product transportation, storage and selling patterns.

### 4.2. Objective of the Study

The objective of the introductory study was to collect information on the demand for boiled cassava, preferred characteristics associated with demand and marketing of the product.

#### ***Research Questions***

1. What is the demand and trends in demand for the product among the consumers who purchase, those who prepare and consume it themselves?
2. Who and where the product is purchased, prepared and consumed, at home or in the market?
3. What are the preferred characteristics of the product associated with the demand?
4. How and by who the product is transported, stored and sold?

### 4.3. Key Findings

#### 4.3.1. Scale of Production of the Crop and Seasonality Associated with the Product

The production of fresh cassava roots is estimated at over 5 million Metric tons from 853,000 hectares (Kilimo Trust, 2012; UBOS, 2016). Apart from Eastern and West Nile regions, the rest of the country consume boiled cassava. Another study estimated production of fresh cassava roots to be about 1.3 million MT of which 309,528 MT is marketed (RTB report; year?). The final EAAPP evaluation report indicated that 90% of the population consume cassava in different forms at least once a day, while the marketing study on cassava products puts the overall consumption of boiled cassava at 61% of the total cassava consumption (EAAPP, 2015). Although, other reports state the consumption of the product could be at 30 -50 % since it is consumed besides other staples, sweet potatoes and cooking banana (EAAPP, 2011).

#### ***Variations of boiled cassava products***

The different forms of the product consumed include, whole boiled cassava, mashed cassava and Katogo<sup>1</sup>. The majority consume the whole boiled cassava, it is prepared from harvested roots, peeled, sliced, washed and boiled with or without salt. While some consumers after boiling the cassava smash it to make paste and consume it with a sauce, the consumers prefer boiled cassava from fresh roots of sweet varieties with low levels of cyanide. Some of the preferred varieties for preparing boiled cassava include, NASE 1, NASE 14, TME 14, TME 204, Bukalasa, Bao, Nyaraboke, Gwalanda, NASE 13 and Mufumba-Chai. These are mostly preferred for their sweet taste and ease of cooking (Obaa, Mawa & Angudubo, 2014).

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<sup>1</sup> Katogo is a dish composed of a mixture of boiled cassava and a source (offal, beans or meat)

## ***Status and trends of demand and segments associated with the product***

Boiled cassava for home consumption is mainly for the women and children as a snack since they rarely eat away from home. The boiled cassava supplied in restaurants, food kiosks and roadside points is mostly consumed by men. The men who consume away from home are mainly of low economic status (Appendix 1). Urban areas lead in the consumption of boiled cassava, but daily availability of the fresh cassava roots for preparing the product is challenging as opposed to the rural areas with proximity to the source. Disaggregation of consumption of boiled cassava by primary occupation, indicates that farming households lead other groups with different primary occupations such as civil service. The EAAPP marketing study indicated that boiled cassava was consumed more in male headed households as opposed to their counterparts. Many schools also prepare boiled cassava for their students throughout the terms (AfrII report). Although there are differences in consumption patterns, generally men and women of all ages, ethnicity, socio-economic status as well as boys and girls of varying ages consume boiled cassava in all the major growing regions.

## ***Size and trend of the demand segment associated with the product***

The demand for boiled cassava for home consumption is about 65% and the rest of the portion (35%) is consumed in restaurants, food kiosks, schools and other selling points (street vendors)(B. Obaa, C. Mawa and S. Angudubo, 2015). The trend of demand for boiled cassava is steadily increasing as people substitute other staples such as cooking banana and sweet potato with cassava. Major increases in demand for boiled cassava is attributed to the fact that regions such as central and western that did not grow cassava as one of the main crops in the past, but currently grow and consume cassava large-scale (Obaa, Mawa & Angudubo, 2014). In the central region, for decades cassava was hardly consumed as a staple but the trend is slowly being reversed. A study by African Innovation Institute indicates that consumption of boiled cassava for salad consumed at bars and restaurants stands at 50%, mashed cassava at 10% and boiled cassava consumed at schools is about 30% (AfrII GMarket study).

There is high consumption of boiled cassava from January to April and also between July and August when supplies of cooking banana and sweet potatoes are low and vice versa. However, its consumption is generally low in November and December. Generally, consumers substitute other staples with cassava as their prices rise. Consumption has been increasing over the past decade, current total consumption is estimated at 1.3 million MT with a projected increase of 25% in 2018 (Waigumba et al., 2016).

## ***Geographic and agro-ecological context of demand segments for the product***

Predominantly, it is consumed in the central region part of the Central semi-arid corridor, where 50% of the total cassava production in this region is consumed in boiled form. Also, the Western region including Kigezi area (Rwenzori/ Kazinga semi-arid zone), consume cassava in boiled form. While in the Northern and North Western regions, as well as parts of the Mid-Western where many tribes from the Northern and Eastern have settled, cassava is less consumed as boiled and mashed due to the fact that the ethnicities from these regions mainly consume cassava paste prepared by mixing from flour known as “kwon”, “atapa”, “Kalo” or “enyasa”<sup>2</sup>. In the Northern region, the Lango sub-region situated in the North East Semi-Arid Zone leads in the consumption of the product (Obaa, Mawa, Angudubo & Bua, 2015; Obaa, Mawa & Angudubo ,2014).

## ***Demographics of the demand segments for the product***

The product is mostly consumed by people aged 31 to 45 years (productive age) with a few aged 46 to 60 and above 60 years in most of the cassava growing regions, but in the central region it is mainly consumed by youth (16 -30 years). Boiled cassava is mostly consumed by females in all major growing regions, while the data for the Eastern region indicated that it is equally preferred by both sexes. A large proportion of the

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<sup>2</sup> A stiff paste made by mixing boiled water and cassava flour, sometimes mixed with millet and sorghum flour

population that consumes boiled cassava are married, with little preference among the divorced/ separated, widowed and single (Obaa, Mawa, Angudubo & Bua, 2015).

Preference for mashed cassava varies among middle age consumers and the married. All persons from the ages of 18 to 75 years consume boiled cassava with salad and roasted or fried meat in many semi-urban and urban centres, the mashed cassava consumed by all ages as young as three years of age and boiled cassava is prepared for school students of ages between 3 to 18 years (Afrll quarterly report).

### ***Association of the demand segments with the preferred characteristics of the product***

Consumers in urban areas of Uganda mostly prefer sweet tasting cassava with no difference in preference for white colour of the flesh across the agroecological locations. Both men and women prefer sweet tasting and easily cooked cassava. Although easy to cook is an important trait, it was not further defined by literature. Nonetheless, unmarried people prefer cassava that is easy to cook (softness). Across education levels, consumers prefer cassava that has white flesh, sweet taste and cooks easily as well as across the different occupation categories. Therefore, there is high preference for sweet tasting and easily cooked cassava for boiling across regions while, the bias for white flesh is minimal (Obaa, Mawa, Angudubo & Bua, 2015).

### ***Description of the product chain including processing, transportation, storage and selling***

Harvested fresh cassava for boiling is loaded on trucks or medium sized roots are bagged before loading and transported to predetermined markets. At the point of preparation (home or restaurants), the roots are peeled, sliced and properly washed, then placed in a saucepan. Water and/ or salt and chopped onions are added for flavour. The cassava is then covered with banana leaves or not and then covered with another dish or saucepan. It is left to cook for 30 minutes to 1 hour depending on the type of cassava.

While mashed cassava is made by first boiling the roots following the previous steps of preparing boiled cassava until the cassava is soft and any excessive water is drained. The boiled cassava is then smashed with a pestle or other equipment and pounded in a clean pounding mortar and served in a dish after warming in a saucepan (Obaa, Mawa, Angudubo & Bua, 2015).

Farmers do not have modern storage facilities for boiled cassava, they only harvest and prepare at the household when needed. Any fresh roots left are buried in the soil to keep them fresh for subsequent boiling (EAAPP, 2011). The boiled cassava is left in the cooking saucepan covered with banana leaves or another dish. This is the same practice in the restaurants and food kiosks, but this method only keeps cassava fresh for hours. Street vendors, food kiosks and restaurants keep the saucepan of boiled cassava covered with banana fibre (leaves) on fire with minimal heat to preserve the freshness.

Boiled cassava is mainly sold in restaurants and food kiosks in semi-urban and urban centres as well as vended in the streets. At the food kiosks, depending on price, the pieces are packed in transparent packing bags (polythene), while in the restaurants it is served on plates with other sources of carbohydrates such as cooking banana, sweet potatoes, rice and yams. Increasingly, there is a huge demand at bars in cities, trading centres and other leisure points that prepare roasted or fried meat. It is mainly sold by women (90%) and some men (Middle aged), who are mostly people of middle social and economic status.

The restaurants obtain the raw materials from travelling traders and commission agents who buy from the farm gate. Also, the agents sell the fresh roots to retailers in the market, who sell to consumers within the market or transport the roots to other outlets for the private consumers and restaurants. Most of the retailers are women who sell heaps of roots (3 to 5) which weigh 1.2 to 2.3 Kg with average price of 1,350 UGX/Kg. Others buy and prepare in small hotels, mostly make-shifts (Obaa, Mawa & Angudubo 2014; Waigumba et

al., 2016). Women and female youth vend the boiled cassava on their heads. The male youth vend boiled cassava in covered trolleys across the streets of major towns. The women who prepare large quantities of boiled cassava such as in big saucepans, hire men or male youth to transport it to the market or selling point on wheel barrows, bicycles, motor bikes or other vehicles.

### ***Profitability of the boiled cassava***

Boiled cassava is profitable for women who prepare it in large quantities but the income generated is low. This is due to the fact that small portions of boiled cassava are served for breakfast and the boiled cassava is always served with other carbohydrates on the same plate for meals such as lunch and supper.

**Table 4 (4.1): profitability of boiled cassava based on preparation of a bag of fresh roots**

<b>Description</b>	<b>Number</b>	<b>Unit</b>	<b>Unit price</b>	<b>Amount</b>
Cost of preparation				
Fresh cassava roots	1	Bag	60,000	60,000
Firewood or charcoal	1	Bundle	5,000	5,000
Labor for boiling	1	Person	5,000	5,000
Banana leaves	5	Pieces	500	2,500
Transport	1	Assorted	3,000	3,000
Packing papers	1	Bundle	8,000	8,000
Total cost				83,500
Revenue				
1 bag can contain 60 roots (each root can be sliced into 4 parts)	240	Boiled cassava	500	120,000
Gross margin				36,500
Gross margin %				30

*Source: Estimates by the key informant interviewed*

Table 4.1 shows that boiled cassava business is profitable, however the scale of operation such as selling in big saucepans in restaurants and food kiosks or street vending in small containers may determine the magnitude of the profit margin earned. Also, the cost of acquiring the fresh cassava roots determines the profitability of boiled cassava. Those who purchase the fresh cassava roots cheaply and in bulk would earn higher profits due to reduced costs of preparation.

### ***Note any geographic, ethnic, gender or other variances***

Generally, the ethnic groups in the north, east and north western regions consume cassava products from the flour (cassava paste) with various local names as indicated in section 3.5. Among these groups, some prefer to consume boiled fresh cassava especially in the Lango sub-region and with slight preference among the Madi and Alur in north western. However, many households in these regions consume boiled cassava for breakfast and occasionally as the main meal (lunch and dinner) at times of scarcity of the cassava chips to make flour due to unfavourable weather since the chips are sun dried. In some cases, the boiled cassava is mashed to be consumed with sauce as the main meal. The ethnic groups in the central and western regions as well as near east whose staple is cooking banana prefer to consume boiled cassava to supplement the staples.

#### **4.4. Level of Confidence in the Information Reviewed.**

The finding from the key informant interviews and desk review were valid and reliable, but there is need to use more triangulated approach that includes household individual interviews, focus group discussion, key informant interviews and document reviews. The key informants reached were few to make a generalization or inferences on the demand for boiled cassava in the whole country. An in-depth study using triangulated approaches (which will be conducted through WP1 RTBfoods) would provide a robust basis for inferring the patterns of consumption, demand and trends, preferred characteristics of the product and overall marketing at the national level.

Some of the information can be obtained from interviews with categories such as; market vendors, street sellers and restaurant owners who were not conducted during the introductory study. There is need for deliberate efforts to estimate the size of demand and profitability values for the different consumer segments which is currently scanty for boiled cassava.

#### **4.5. Information Relevant to Other Modules**

There seems to be little difference in consumption of boiled cassava among the gender groups except the consumption across the age groups. There is need to evaluate the preference of the product across different ethnic groups and socio-economic status. Various preparation methods exist such as whole boiled cassava, “Katogo” and mashed cassava and consumers add different ingredients to the different products such as salt, onions, ghee, tomatoes and other vegetables. The food science section should explore various preparation techniques from simple steaming to full scale boiling as indicated in the draft article on culinary patterns of cassava consumption (Obaa, Mawa, Angudubo & Bua, 2015).

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## 4.7. Appendix

**Appendix 1: Overview of Product Demand Segments and preferred characteristics for the product (one for each variation if significantly different)**

<b>Demand segments (producers, processors, traders, consumers who buy the product and people who grow, prepare and consume the product at home)</b>	<b>Characteristic s preferred by demand segment</b>	<b>Size of demand segment</b>	<b>Profitability /value of the product by demand segment</b>	<b>Geographic + agro-ecological location</b>	<b>Description of demographics of demand segment (socio-economic status, gender, age etc).</b>	<b>Areas of growth potential and evidence to support</b>
Consumers who buy the product	White flesh, sweet taste, Softness	24% of total consumption of 1.3 million tonnes	-	Central and western	Men mainly of low economic status	Increased availability of fresh cassava. Better product packaging
People who grow, prepare and consume the product at home	White flesh, high starch content, sweetness, ease of cooking	50 – 61% of the total fresh cassava consumption	-	Central and western regions.  Less demand in north, east and north western	Men, women, young men and women. Ages 31 to 45 years mainly. Low socio-economic status	Introduction of high yielding, sweet, easy to cook and disease tolerant varieties as well as containing low cyanide levels
Traders and processors	White flesh, high starch content, sweetness, ease of cooking	About 15% of the total boiled cassava consumption	About 33% gross margin percentage	Central and western, but majorly all urban and semi-urban centers	90% women of low economic status and 10% men of average income	Increased supply of fresh cassava with customer preferred attributes, sensitization on nutritional benefits of cassava



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